

# **Appendix F**

## **Written Comments**

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**COMMENT LETTERS REGARDING APRIL 30, 2004  
MERCURY IN SAN FRANCISCO BAY  
TOTAL MAXIMUM DAILY LOAD (TMDL)  
PROPOSED BASIN PLAN AMENDMENT AND STAFF REPORT**  
(in alphabetical order by organization)

Alameda Countywide Clean Water Program, James Scanlin  
Allen Matkins Leck Gamble & Mallory (for Buckhorn, Inc.), David Cooke  
Applied Ecological Solutions (for Santa Clara County Parks and Recreation Dept.), Adrian del Nevo  
Bay Area Clean Water Agencies, James Kelly  
Bay Area Stormwater Management Agencies Association, Donald Freitas  
Bay Planning Coalition, Ellen Johnck  
California Department of Transportation, David Yam  
Delta Diablo Sanitation District, Gary Darling  
Exponent (for Santa Clara Valley Water District), Gary Bigham  
Fairfield-Suisun Sewer District, Larry Bahr  
Fred Krieger (no affiliation)  
LeBoeuf, Lamb, Greene, & MacRae (for City of Sunnyvale), Robert Thompson  
Livermore, City of, Darren Greenwood  
Morrison and Foerster (for Santa Clara Valley Urban Runoff Pollution Prevention Program), Robert Falk  
Mountain View Sanitary District, David Contreras  
Partnership for Sound Science in Environmental Policy, Craig Johns  
Port of Oakland, Jim McGrath  
San Francisco Baykeeper/Waterkeepers, Sejal Choksi  
San Francisco Public Utilities Commission, Michael Carlin  
San Jose, City of, Carl Mosher  
Santa Clara County Office of Development Services, Steve Homan  
Santa Clara County Parks and Recreation Department, Lisa Killough  
Santa Clara Valley Urban Runoff Pollution Prevention Program, Adam Olivieri  
Santa Clara Valley Water District, David Chesterman  
Save the Bay, David Lewis  
Seyfarth Shaw (for Guadalupe Rubbish Disposal Co.), Todd Maiden  
South Bayside System Authority, James Bewley  
Sunnyvale, City of, Marvin Rose  
U.S. Environmental Protection Agency, Alexis Strauss  
U.S. Environmental Protection Agency, David Smith  
U. S. Geological Survey, Alexander Wood  
URS Corporation (for Santa Clara County Parks and Recreation Dept.), Terrence Cooke  
Western States Petroleum Association, Kevin Buchan



# Alameda Countywide Clean Water Program

A Consortium of Local Agencies

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(510) 670-5543 FAX (510) 670-5262

June 14, 2004

Bill Johnson  
Richard Looker  
California Regional Water Quality Control Board,  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
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and Water  
Conservation  
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Zone 7 of  
the Alameda  
County  
Flood Control  
District

SUBJECT: ACCWP COMMENTS ON MERCURY IN SAN FRANCISCO BAY  
TMDL AND PROPOSED BASIN PLAN AMENDMENT

Dear Bill and Richard:

This letter is submitted on behalf of the Alameda Countywide Clean Water Program (ACCWP) in response the Regional Water Quality Control Board's April 30, 2004 notice of a public hearing on the subject documents.

As I am sure you would agree, the adoption of the mercury TMDL and associated Basin Plan amendment is a very significant action and will likely set precedent for other TMDLs and related Basin Plan amendments that the Regional Water Quality Control Board (Board) will adopt over the next several years. You have done an outstanding job in attempting to grapple with a very difficult issue. As you are well aware, mercury pollution in San Francisco Bay is a very difficult problem to deal with due to factors such as legacy sources, global atmospheric deposition, and methylation. Addressing this problem within the confines of the TMDL regulatory structure while maintaining technical and economic feasibility is at least a difficult and maybe even an impossible task. At least in relation to the allocation to urban runoff, this version of the TMDL project report and proposed Basin Plan amendment, while apparently meeting the requirements of the TMDL regulations, has failed to meet the standard of technical and economic feasibility.

As outlined in the comment letter submitted by BASMAA, the proposed 50% reduction cannot possibly be met by source control efforts alone. Extensive treatment systems would need to be constructed and operated at an estimated cost of several hundred million dollars per year. This is not a feasible approach. The TMDL report and proposed Basin Plan amendment should be revised to provide a reasonable allocation to urban runoff that is based upon estimates of reductions that could be achieved through various actions.

ACCWP supports and concurs with the comments submitted by BASMAA and hereby incorporates BASMAA's comments by reference. We have also attached our letter of July 22, 2003 that was submitted as informal comments on the draft mercury TMDL project report and hereby incorporate those comments by reference. Thank you for your



consideration of our comments. We appreciate Mr. Wolfe's offer to meet with interested parties and look forward to working with you to refine the proposed Basin Plan amendment.

Sincerely,

A handwritten signature in cursive script that reads "James Scanlin". The signature is fluid and elegant, with the first letters of the first and last names being capitalized and prominent.

James Scanlin  
Program Manager

Enclosure: ACCWP comment letter dated 7-22-03

Copy: Bruce Wolfe, SFBRWQCB  
Tom Mumley, SFBRWQCB  
Dale Bowyer, SFBRWQCB  
ACCWP Management Committee Representatives (via email)



# Alameda Countywide Clean Water Program

A Consortium of Local Agencies

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July 22, 2003

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Member  
Agencies:

Alameda

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and Water  
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Zone 7 of  
the Alameda  
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Flood Control  
District

**Re: Mercury in San Francisco Bay  
Total Maximum Daily Load (TMDL) Project Report**

Dear Bill and Richard:

This letter is submitted on behalf of the Alameda Countywide Clean Water Program (ACCWP) in response to Tom Mumley's June 6<sup>th</sup> invitation to submit comments and feedback regarding the TMDL Project Report for Mercury in San Francisco Bay (Report).

I first want to commend the two of you, Tom Mumley, other involved Regional Board staff members, the Regional Monitoring Program, the San Francisco Estuary Institute and the Clean Estuary Partnership for all the work that has gone into finalization of this Report. Although we would like to have had more opportunity for input regarding some of the recent changes in the Project Report, we appreciate Board staff's facilitation of the stakeholder process throughout the various stages of Report development. We anticipate and request that this stakeholder process continue through the Basin Plan amendment preparation, adoption and implementation process.

We are mindful of that fact that mercury concentrations in San Francisco Bay fish are high enough to threaten human health and the sport fishing beneficial use of the Bay. In addition, mercury threatens wildlife and rare and endangered species. We recognize that mercury is a persistent, bio-accumulative, toxic metal that does not degrade in the environment. Consequently, we support reasonable efforts to address controllable water quality factors that cause detrimental mercury concentrations in sediment, aquatic organisms, wildlife and humans.

In addition to our support for the efforts necessary to address the controllable water quality factors, we have significant concerns relating to the Project Report as stated in this letter. These concerns are in the nature of constructive comments in anticipation of clarification and possible changes that may contribute to a more accurate and effective Project Report. It is our understanding that the Report and the responsive comments will form the basis of Basin Plan amendments to be acted upon by the Board later in the year. These concerns are in addition to the comments submitted by BASMAA, which we also support.

As you know, a great many scientific uncertainties and unknowns exist with respect to the measurements of source assessment, establishment of numeric targets, linkage between sources and targets, load allocations and effectiveness of implementation actions. In view of these uncertainties, we feel that it is of utmost importance that the goals and targets are flexible enough to allow for appropriate adjustment and modification as more scientific data becomes available and implementation experience develops. Stated differently, while dischargers can and should be held to implementation of various reasonable methods of controllable mercury reduction, numeric results of such methods and actions cannot be assured. We feel strongly that the process (including the implementing Basin Plan amendment) must be flexible enough to allow for such uncertainties and that the specific scenarios suggested in the BASMAA letter should be incorporated into the staff report.

The following comments are directed at three areas of particular concern: (1) uncertainties and unknowns regarding loads from urban stormwater and the relationship between proposed actions and load reductions; (2) the feasibility of some of the proposed implementation actions; and (3) the allocation places a disproportionate level of reduction for urban runoff programs.

#### **(1) Uncertainties regarding loading and proposed reductions**

The Report states that local urban runoff contributes 160 kg/yr of mercury to San Francisco Bay. This estimate is based on a very limited dataset of mercury concentrations in bedded sediment in local channels and creeks that was collected for a different purpose and was not meant to be used to develop an estimate of loadings. As the Report states, using the same dataset, BASMAA agencies estimated that the annual loading from local urban runoff was 83 kg/yr. The Report should explicitly state the 95% confidence interval surrounding the 160 kg/yr estimate. It is extremely important the uncertainties surrounding the estimate are clearly stated.

A related issue is the uncertainty regarding the relationship between proposed implementation actions and the proposed 80 kg/yr reduction in urban stormwater loads. The Report provides no indication that there is any link between the proposed implementation actions and the expected load reduction. This linkage needs to be made.

#### **(2) Feasibility of storm water implementation plan**

To meet the waste load allocation for urban storm water runoff, the Report provides an Implementation Plan. This plan proposes that storm water dischargers conduct a number of activities including: (1) source control such as promoting the recycling of fluorescent lamps, recycling mercury containing thermometers and other household hazardous waste collection programs; (2) diverting storm water discharges to treatment plants; and (3) treating storm water. Source control programs such as promoting recycling of lamps and thermometers seems reasonable. In fact, the ACCWP has already submitted a Mercury Pollutant Reduction Plan in compliance with Provision C.10.b. of our NPDES permit that takes important steps in this direction. However, diverting flows to treatment plants or treating stormwater to remove mercury may prove infeasible or ineffective.

**Diverting Flows:** As the Report states, mercury loads from urban runoff are associated with sediment. Since dry weather flows contain almost no sediment and hence, little or no mercury, diverting dry weather flows should not significantly reduce mercury loads. Diverting wet-weather flows appears to be infeasible since treatment plants do not have the capacity to accept large wet-weather flows or sediment-laden flows. If such diversions are to be proposed, which we do not recommend, the acceptance of such diversions should be included in the implementation actions for the wastewater plants.

**Treating Stormwater:** The Report suggests that the recently adopted stormwater permit requirements related to new development treatment controls should reduce mercury loads. These permit requirements will address new sources but do little to address existing sources except in cases of redevelopment. In addition, the primary methods used to reduce sediment-associated loading are detention basins or wetland treatment systems. In the case of mercury these methods may exacerbate the problem by creating environments that increase mercury methylation.

### **(3) Disproportionate level of reduction on urban runoff programs**

The allocation scheme the Board has proposed places an unfair disproportionate level of reduction on urban storm water dischargers and the Guadalupe River mine remediation relative to other sources. For example, the Report does not propose a waste load allocation for in-Bay dredged material disposal or for local atmospheric sources.

**Dredged Material Disposal:** The Report states that the average concentration of mercury in dredged material is about 0.37 ppm (p. 25). This is roughly equivalent to the estimated concentration for sediment in urban runoff and about twice as high as the proposed sediment target of 0.2 ppm. The estimated loading from in-Bay disposal is 490 kg/yr (Table 4.5), which is three times as great as the estimated loading from urban runoff. However, the Report seems to indicate that the Regional Board will continue to permit the in-Bay disposal of this contaminated sediment without the imposition of a waste load allocation.

**Local Air Sources:** The Report estimates that local air sources release 500 kg/yr of mercury (p. 59) and suggests that this source of mercury may be much more bio-available than other sources of mercury (p. 75). However, no allocation is established and no actions are undertaken to reduce local air sources. We suggest that the Board address these local air sources.

It should be noted that atmospheric deposition directly to the Bay is described in the Project Report as “uncontrollable.” The Report also notes that of the roughly 180 kg/yr of mercury from storm water (urban and non-urban), as much as 55 kg/yr could result from atmospheric deposition. Thus, a substantial portion of the storm water runoff mercury discharge is from sources deemed by staff to be “uncontrollable.” Consequently, source control and other implementation plans can only apply to a maximum of about 2/3rds of the estimated storm water mercury loading. This results in urban storm water programs being required to actually achieve significantly more than a 50% reduction of controllable sources. We suggest that the 55 kg/yr attributable to indirect air deposition be removed from the load allocation for urban storm water runoff and assigned to a separate indirect air deposition source category.

At a meeting on November 19th, BASMAA representatives advocated assigning at least a small nominal reduction to air deposition and non-urban runoff rather than zero reductions, to keep the

door open to engage those sources in future adaptive implementation. If no reduction is assigned to such sources, it will be much more difficult to include them in the future if needed. Some of the proposed implementation activities for urban runoff may also remove mercury currently assigned to atmospheric deposition or non-urban runoff. Thus, we suggest at least small reductions for air deposition and non-urban runoff. ACCWP supports the allocation system proposed in the BASMAA letter. Adoption of the BASMAA approach would mitigate our concerns regarding the Report's proposed allocation scheme.

### **Adaptive Implementation**

The "Adaptive Implementation" section of the Report provides an important framework for potential future changes in the implementation plan, and describes important management questions still remaining. As previously stated, we believe that in view of the many scientific uncertainties and unknowns relating to this TMDL, it is essential that flexibility be specifically built into the Project Report. While the Report states that the plan will be reviewed every 5 years through the Basin Planning process, it is critical for the Basin Plan amendment and Basin Planning process to outline clear scenarios for how continuing studies will address these management questions, how the future stakeholder involvement would be coordinated and how the TMDL direction can be changed if appropriate.

In conclusion, we appreciate the opportunity to submit these comments. As previously stated, while the ACCWP is fully committed to implementing a reasonable control plan for the control of mercury discharges to waters of the San Francisco Bay, achievement of the numeric targets cannot be assured without a flexible process that allows appropriate adjustments based on further scientific information and analysis of the results of effective implementation. This must be built into the Basin Plan amendment at the outset to avoid potential future legal problems relating to backsliding and anti-degradation. Finally, we specifically request that staff meet with our Program representatives and BASMAA members to discuss these issues further prior to circulation of the draft Basin Plan amendment and staff report for formal public comment.

Sincerely,

A handwritten signature in cursive script that reads "James Scanlin".

James Scanlin  
Management Committee Chair

Copy: Loretta Barsamian, SFBRWQCB  
Tom Mumley, SFBRWQCB  
Dale Bowyer, SFBRWQCB  
ACCWP Management Committee Representatives (via email)

**Allen Matkins Leck Gamble & Mallory LLP**

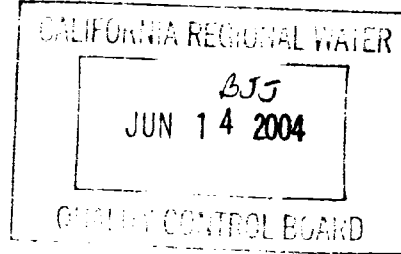
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June 14, 2004

**VIA MESSENGER**

Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Attn: Bill Johnson  
Richard Looker

Re: San Francisco Bay Mercury TMDL/Proposed Basin Plan Amendment

Dear Sirs and Madams:

On behalf of Buckhorn, Inc. ("Buckhorn"), we offer the following brief comments on the draft report entitled "Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report" (hereinafter, "Plan Amendment").

As you probably are aware, in the latter part of the 1990's, Buckhorn and others, including the County of Santa Clara, participated in the remediation, through removal, consolidation, and stabilization, of calcines (waste products of cinnabar processing) in several locations within the Almaden Quicksilver County Park ("AQCP") in Santa Clara County. The AQCP is situated in the Guadalupe River Watershed, and is the site of legacy mining operations that date back to the mid-1800's. This remedial work was performed under the supervision of, and to the satisfaction of, the Department of Toxic Substances Control (DTSC). Reductions in the mass and concentrations of mercury entering surface waters within the watershed, and hence reductions of the mercury-containing sediment loads in the watershed, were among the objectives, and among the results, of this project.

Although Buckhorn is not a discharger and is not and will not be subject to load allocations under any TMDL in this region, it wishes to point out that the Plan Amendment fails to take into account the impact of this remediation project and, more generally, fails to reflect a fair or reasonably accurate estimate of mercury loadings to the Bay from the Guadalupe River Watershed.

The Plan Amendment roughly estimates an "existing load" of 92 kg/year of mining legacy mercury entering San Francisco Bay from the Guadalupe River Watershed. This rough estimate is the product in part of rough estimates of total sediment loading and fractions of

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sediment loading due to urban and non-urban stormwater runoff. The data, assumptions and methods relied upon to form these estimates may, as the Plan Amendment admits, overstate the sediment load discharged to the Bay; indeed, the admittedly flawed total sediment load figure on which the Plan Amendment bases the calculated mercury load (44 M kg/yr) is about 23% higher than the Santa Clara Valley Water District's estimate of the same figure (34 M kg/yr). No justification for using the higher estimate is provided.

The calculated estimate of mercury loading of 92 kg/year from the watershed is further based upon mercury concentrations in sediment samples collected from 1980-89 at a location upstream from the mouth of Guadalupe River. The sampling data on which the loading estimate is based – a mere sixteen samples – is extremely limited, particularly in light of the consequences that flow from the calculation. Such data also fails to take into account the impact of the remediation project, discussed above, which was conducted in the late 1990's. As a result, the data are, by definition, not relevant to a meaningful estimate of current mercury loading from the watershed. Other commenters made this observation at earlier stages of the development of the Plan Amendment, but the Plan Amendment does not fairly address this problem, and instead relegates the issue inadequately to an uncertain later phase of "adaptive implementation." Moreover, the Plan Amendment proposes specifically recognize only those loads avoided resulting from activities implemented after 2001 as counting toward the load reductions consistent with the load allocation. In this way the Plan Amendment would seem to ensure that the benefits and impacts of the DTSC-supervised remediation will be disregarded, a result that cannot be justified. The Plan Amendment should at least acknowledge that the existing load calculation, and hence the reductions needed to meet the 2 kg/year allocation, are subject to revision. So long as the Plan Amendment continues to reflect calculations based on data that predate the DTSC-supervised remediation project, the Plan Amendment should also acknowledge that load reductions accomplished on account of work performed since that data was collected must be taken into account in assessing the adequacy of the Guadalupe Watershed TMDL to accomplish the disproportionately large reduction that the Bay TMDL contemplates for this source category.

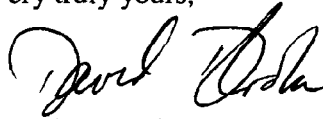
Finally, by definition, and by admission in the Plan Amendment, samples taken from the from U.S. Geological Survey sample station near downtown San Jose could not represent the concentration of mercury in sediments actually entering the Bay, because they reflect neither the impact of tidal actions at the point at which mercury from the watershed may impact the Bay, nor the impact of dredging upstream of that point. In order for the San Francisco Bay TMDL to reflect a reasonably accurate and meaningful existing load estimate for the Guadalupe River Watershed, both of these impacts must be taken into account.

**Allen Matkins Leck Gamble & Mallory LLP**  
*attorneys at law*

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June 14, 2004  
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Thank you for considering these comments.

Very truly yours,

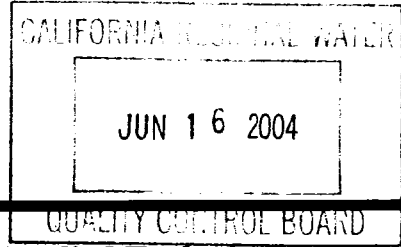
A handwritten signature in black ink, appearing to read "David D. Cooke", written in a cursive style.

David D. Cooke

DDC



# Memorandum



**Applied Ecological Solutions Inc.**

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**Date: June 14, 2004**

**Re: Comments on the San Francisco Bay Mercury TMDL, April 30, 2004.**

## **General Comments**

- 1. Inconclusive/inconsistent use of information on the relative contribution of total mercury versus methylmercury.** The report's commentary on mercury and mercury impacts is frequently vague on this point, and does not always distinguish between the status, distribution and alleged effects associated with total mercury versus methylmercury. This is a critical concern, because methylmercury is the toxic and bioavailable form. The report should clearly state whether data and interpreted effects are associated with total mercury or methylmercury. The appropriate approach to addressing the contamination could vary greatly (in nature, cost and effectiveness) depending on which is the concern. In the absence of a clear recognition of these important distinctions, the existing document fails to provide sufficient information upon which any decision on management of alleged contaminant load could be made.
- 2. Incomplete and inconclusive understanding of past sources of mercury and how these sources may have changed over time.** The document provides scant information on past sources of mercury contamination and inadequately considers the contribution made by other sources, such as road run-off or air contamination. Moreover, the report fails to consider how each and all of these respective sources of mercury may have changed in space and over time and the degree to which they may become available to human or wildlife receptors. The TMDL process is intended to govern load reductions into the future to restore beneficial uses now not available. The absence of a good understanding of current conditions within the Bay significantly affects the credibility of the allocation process, and the ability to make an appropriate selection of effective implementation techniques
- 3. Incomplete and inappropriate consideration of the Bay's water circulation system and the effect this has on the distribution and deposition of different mercury sources with the Bay.** The report inadequately considers the dynamic circulatory system within San Francisco Bay and the effect this may have on the distribution, accumulation, mixing and concentration of sediments and their potential contaminant load. Furthermore, the report inadequately considers the effect of large river surge events (e.g., following periods of substantial flooding along the Sacramento River) and also changes within the Bay

ecosystem following El Nino events, both of which are likely to influence the mobilization of sediments and the subsequent distribution of contaminants. The report also inadequately considers the release of contaminated sediments from major dredging programs within the Bay and the routine dredging at the entrance to the Bay near to the Golden Gate Bridge.

## **Bird-Specific Comments**

- 1. Target level for wildlife based on species with a dramatically different feeding and foraging ecology.** The wildlife target level of 0.5 ppm is based on feeding studies involving a bird species (mallard) that has significantly different foraging behavior and foraging ecology<sup>1</sup> than the species of concern within the Bay.

The report in identifying the Bay as the source of mercury contamination in bird species, inadequately, and in some cases incorrectly, addresses the role of individual and/or species-specific foraging behavior. The report frequently refers to egg data as coming from certain locations within the Bay, but fails to consider the foraging range, foraging behavior, and individual dispersal of many of the species involved. In the absence of an unequivocal link between a mercury source, the take-up of food items exposed to that source, proven contaminant levels within the food, and subsequent contaminant levels in the egg, we believe that the report's assumptions regarding the source and impact of contamination are inappropriate and misleading.

The report fails to mention that the tern species (Caspian tern) that allegedly has the highest mercury contamination is a migratory species and is thus exposed to mercury contamination elsewhere. Additionally, Caspian terns are one of the most deep diving species of the tern family and are most frequently found foraging outside the Bay and in the open ocean<sup>2</sup>. Accordingly, those contaminant levels may be quite unaffected by the proposed TMDL.

To our knowledge the only study of piscivorous birds that has unambiguously determined the source of mercury and other contaminants was conducted on the east coast and involved common terns. In this elegant study<sup>3</sup> the authors examined body feathers of birds during early incubation and then examined the re-grown feathers later in the season. In this way, the authors were able to determine whether the contaminants taken-up in the feathers were from a local source.

In the absence of these types of studies, it is in our view, inappropriate to suggest that the source of mercury contamination in the bird species in the Bay is known. Indeed, the report mistakenly suggests that clapper rails are sedentary species and their exposure to contaminants must be from a local source. While clapper rails are amongst the birds that typically do not migrate, they do however, have a post-breeding dispersal<sup>4</sup>. We know that clapper rails move around, as prospecting birds can be found exploring sites that may have been cleared from predators or were newly created following a habitat restoration project.

2. **The report fails to adequately consider the role played by other contaminants in the Bay and in other parts of a species' foraging area.** The report fails to consider the role played by other contaminants<sup>5</sup> (e.g., PCBs, for which there is also a Bay TMDL) that are known to exist at significant levels in sediment and fish tissue within the Bay and in other areas where the various species may forage. The mere presence of a contaminant does not necessarily mean that it was the source of impaired hatching or death. The absence of an understanding of the relative contribution of different contaminants to the various life cycles of a bird (or other wildlife) precludes the conclusion that any one of those contaminants was the cause of the impairment or death.

Given the acknowledged mix of contaminants within San Francisco Bay, the authors should have considered that the cause of allegedly decreased breeding success might be due to other factors, including other contaminants. Consequently, setting of bird target levels for mercury based on the presence of mercury in the eggs, ignores the contribution/threat from other contaminants and cannot support the expectation that attainment of the target will provide any benefit to a particular species or to wildlife in general.

3. **The TMDL report uses bird egg data for clapper rails that have been derived from an inappropriate study design and is biased in that it only includes non-hatched eggs.** We believe that the use of non-hatched eggs biases the sampling and fails to consider that other factors (contaminants) may have contributed to, or been responsible for, the failed hatching. Consequently, we consider the study design to be seriously flawed and insufficient to support any conclusive findings regarding its subject matter. Additionally, we believe that any TMDL planning and management that is based on the information obtained from the sample eggs is suspect and potentially seriously flawed and misleading.

We recognize that clapper rails are an endangered species and thus there is some sensitivity in collecting eggs for analysis from this species. However there are alternative, and in our view more appropriate, approaches to investigate the rail/mercury issue. Clapper rails lay a large clutch (often 8 eggs), and will lay more than once in a season<sup>4</sup>. Occasionally, they will lay three clutches. With this number of eggs being laid it seems unfortunate that egg data could not be collected from locations within the Bay where the confounding factor of predation – which is the ‘real threat’ to clapper rails -- has been minimized. Alternatively, or additionally, egg data from ecologically similar but non-threatened species could have been collected and provided some insight into the possible contamination levels.

In the absence of the studies we have outlined, we are unable to see how reliable data on clapper rail can be obtained and thereby serve as a basis for TMDL decisions and targets.

4. **The report fails to consider a ‘pathway approach’ to determine whether birds are exposed to mercury contamination, and whether that exposure leads to impairment or subsequent death.** Additionally, the report fails to adequately consider that there can be highly significant differences among species and indeed among individuals within a species, in terms of degree or frequency of exposure, and potential for impairment from exposure. The report relies on a mixture of largely unlinked or logically unrelated data and frequently assumed that mercury in some birds or in their prey correspondingly

means that the predators and/or other levels of the life are affected by the mercury. We believe that the apparent lack of a consistent and logical approach to identify potential contamination to birds is both ecologically and scientifically naïve.

The inconsistencies associated with the design, analysis and interpretation of the raw data and the seemingly poor understanding of the various species' ecology are highly likely to have led the report to erroneous conclusions. It would in our view thus be inappropriate to base any proposed TMDL activities or target levels on the existing information as presented.

5. **The report provides scant information on the feeding ecology of the species that are supposedly exposed to mercury.** The report has provided few data that unequivocally link the prey base of several species to subsequent toxicological effects. In the absence of data that describes how the prey-base may change both within and between seasons, it is not clear how the authors of the report are able to support any conclusion regarding the degree of exposure.
6. **The report inadequately describes the ability of most bird species to limit their exposure to contaminants.** The report fails to consider the physiological aspects of many bird species and their molt cycles and the effect this might have on the contaminant levels. Failure to consider the impact of such factors leads to incorrect assumptions about the likely load within particular species, as well the impact of any proposed implementation strategy on the health of the species.

It is well known that most bird species undergo a pre- and post-breeding feather molt. Mercury taken up by birds is typically confined to certain feather tracts (usually the primary and secondary flight feathers)<sup>6,7</sup>. Thus when a bird molts its feathers, i.e., drops an old feather to enable a new feather to grow in its place, the mercury is lost<sup>6</sup>. Studies of terns and other seabirds have shown that they are constantly molting and that their primary and secondary flight feathers are being replaced year-round<sup>8</sup>. It has been shown that female birds will mate and pair with males that show they are constantly molting. This has been interpreted as a sign of a good quality male, as it takes a lot of energy to do this, (somewhat akin to a male peacock's tail). While the molting pattern of terns and other seabirds may be an adaptive strategy to attract mates, it is also in effect a very efficient method of minimizing contaminant load<sup>6,8</sup>. Given that both males and females are constantly molting it would suggest that adult terns and other seabirds are less likely to have a high mercury load.

**Respectfully submitted:**

**Adrian del Nevo, Ph.D**  
**Applied Ecological Solutions, Inc.**

## REFERENCES

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# **Bay Area Clean Water Agencies**

*Leading the Way to Protect Our Bay*

*A Joint Powers Public Agency*

*P.O. Box 24055, MS 702*

*Oakland, California 94623*

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June 14, 2004

Mr. Bruce Wolfe, Executive Officer  
Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Subject: Comments on Mercury in San Francisco Bay TMDL,  
Proposed Basin Plan Amendment and Staff Report dated  
April 30, 2004**

Dear Mr. Wolfe:

BACWA appreciates the opportunity to continue to work with you and your staff in the development of the Mercury TMDL Basin Plan amendment and supporting documentation. BACWA has worked closely with Regional Board staff on the Mercury TMDL since the beginning of this effort in 1998. We have had numerous meetings and sent a number of letters in the course of our constructive dialog on this topic. The importance of this TMDL lead to the formation of the Clean Estuary Partnership, the collaborative effort of the Regional Water Quality Control Board, the Bay Area Clean Water Agencies, and Bay Area Stormwater Management Agencies Associations, which has supported the preparation of the TMDL. We respectfully request the CEP process be used to address the key concerns we have with changes that have emerged in the April 30 2004 Total Maximum Daily Load, Proposed Basin Plan Amendment and Staff Report, Mercury in San Francisco Bay.-

In brief, these changes are:

1. The pooled allocation for POTWs has been reduced by 18 percent, from 17 to 14 kg/yr. This reduction effectively eliminates any allowance for growth in flows or loads from POTWs over the next 20 years.
2. The averaging period for compliance with the pooled POTW allocation has been reduced from a five-year average to a one-year average.
3. The individual facility "allocations" have been significantly modified in a way that will penalize the communities with the top performing treatment plants.

We respectfully submit that these are unnecessary because:

- POTW loadings to the Bay do not have a significant effect on attainment of TMDL targets or water quality objectives. This is unchallenged in the technical record. A SWRCB scientific peer reviewer has questioned whether it is appropriate to impose a mass cap on the POTW wasteload allocation as a means of attaining TMDL targets (see comments 26 and 27 by professor David L. Sedlak in the administrative record).
- POTWs have agreed to participate in research to address questions regarding the bioaccumulation of mercury from POTW discharges.
- POTWs have implemented and will continue to implement reasonable source control and pollution prevention measures aimed at mercury sources to POTWs.
- Many POTWs currently remove over 95 percent of influent mercury through existing treatment operations.

In addition to the mercury TMDL itself, the April 30 proposals are concerns for future TMDLs because:

- The science does not support a precedent-setting policy to cap all regulated loads in a TMDL, regardless of the magnitude or impact of those loads on the Bay.
- The policy decision to eliminate a growth increment from the mercury wasteload allocation is not supported by the TMDL.

In our comments, we ask for the RWQCB to:

- Maintain the 17 kg/yr pooled allocation amount and associated growth increment from the previous TMDL staff report.
- Restore the 5-year averaging period as was proposed in the previous staff report.
- Eliminate the unnecessary and problematic individual mass "allocations"; the proposed concentration triggers achieve the same purpose in a more effective way.
- Consider and reference previous regional planning documents prepared by RWQCB and draft CEP reports:

- i)i      **The Mercury Source Assessment report (Applied Marine Sciences, 2003).**
- i)ii     The Wastewater Implementation Report (Larry Walker Associates, 2003).
- i)iii    The Inactive Mines Implementation Report (Applied Marine Sciences, 2003).

We have attached our detail comments and full copies of the CEP reports for inclusion in the administrative record.

- B. Through the CEP process, take any steps necessary to make the above CEP draft reports final. Those steps could include consideration by the mercury workgroup, peer review, and consideration by the technical committee.

We request the RWQCB incorporate a model watershed permit into the basin plan amendment. This would allow the regulated community to more fully assess the impact the Mercury TMDL and the basin plan amendment would have on us.

We look forward to working with you resolve the concerns noted herein and to forming a framework to develop subsequent TMDL's.

Sincerely,



James Kelly, Chair  
BACWA

Attachments:

1. **Detailed Comments by BACWA on the April 30, 2004 Regional Board Staff Report and Basin Plan Amendment for the Mercury TMDL for San Francisco Bay**

NOTE: The following Attachments are included in the mail version and will be e-mailed individually in the e-mail version due to file size.

2. Watershed Management of Mercury in the San Francisco Bay Estuary TMDL Report to U. S. EPA, June 30, 2000, California Regional Water Quality Control Board San Francisco Bay Region
3. DRAFT STAFF REPORT, Defining the mercury problem in the northern reaches of the San Francisco Bay and designing appropriate regulatory approaches, June 1998, San Francisco Bay Regional Water Quality Control Board
4. Managing Inactive Mercury Mine Sites in the San Francisco Bay Region, July 22, 2003, Khalil Abu-Saba
5. Mercury Source Assessment for San Francisco Bay, March 3, 2003, Khalil Abu-Saba
6. Talus Lex: Regulatory Approaches to Reducing Mercury Concentrations in San Francisco Bay Fish
7. Mercury Management by Bay Area Wastewater Treatment Plants, September 11, 2003, Clean Estuary Partnership



File 9782-1 Attachment No. 1 to the June 14, 2004 BACWA Comment Letter to the RWQCB, San Francisco Bay Region regarding the Mercury TMDL.

**Detailed Comments by BACWA on the April 30, 2004 Regional Board Staff Report and Basin Plan Amendment for the Mercury TMDL for San Francisco Bay**

The average annual mercury load from POTWs in San Francisco Bay over the past four years is 11.4 kg/yr. The estimated 2003 mercury load to the Bay is 1220 kg/yr and the proposed mercury wasteload allocation is 702 kg/yr. The POTW load is therefore less than one percent of the total current mercury load and less than 2 percent of the proposed wasteload allocation.

The estimated total mass of mercury in the active sediment layer (assumed in the staff report to be the top 0.15 meters of sediment in the Bay) is 63,000 kilograms. The annual POTW load is therefore 0.02 percent of the mass of mercury in the active sediment layer. The cumulative POTW load over the next 20 years will represent less than 0.5 percent of the total amount of mercury in the active sediment layer of the Bay.

The above numbers, which clearly define the magnitude of POTWs as a very minor mercury source in San Francisco Bay, support the approach taken in the staff report and Basin Plan amendment to allow appropriate flexibility in the establishment of the allocation and implementation measures for POTWs. As noted in the staff report, additional expenditures for treatment at POTWs to further reduce the POTW load would not be commensurate with the resulting benefit in the attainment of TMDL targets.

Consistent with the above rationale, BACWA requests the following changes in the subject documents:

**1. Use a 5-year averaging period to assess compliance with the POTW group allocation.** The prior version of the staff report had a five-year averaging period for wastewater sources. The current version of the staff report and Basin Plan amendment has a one-year averaging period for wastewater but a five-year averaging period to account for allocations for Central Valley and Guadalupe River watershed loads. The use of the five year averaging period is to account for inter-annual variability in load due to rainfall-induced flow conditions. BACWA believes the five year averaging period is needed for POTWs to account for inter-annual variability of wastewater flows.

The reaction of the Bay to mercury management measures will be a relatively slow process. The staff report states that the overall time frame for recovery is 120 years. Initial load reduction goals will occur within 10 to 20 years. The proposed time periods for target evaluations for fish tissue and bird eggs is every three years. A five-year average loading value for a minor source such as POTWs is consistent with these time frames. It is also consistent with the calculation method used in the derivation of the current POTW load estimate.

**2. Revise the group allocation to 17 kg/yr.** In prior comments on previous versions of the staff report, BACWA has supported a group allocation to allow for present long-term average loads and an increment to accommodate community

growth and development over the next 20 years. The current version of the staff report recommends a group allocation of 14 kg/yr, based on an annual average POTW mass load estimate of 10.8 kg/yr and an increment of 3.2 kg/yr (through use of a standard error statistic) presumably to address growth and annual variability. As has been discussed with Regional Board staff, the annual average mass load value should be increased to 11.4 kg/yr to correct mathematical errors. This estimate is approximately 1 kg/yr less than the estimate used to develop the 17 kg/yr pooled allocation in the last Regional Board staff report. Given the insignificance of the POTW mass load in the overall Bay mercury budget, BACWA requests that the group allocation for POTWs be set at 17 kg/yr to provide a reasonable growth increment. **BACWA also requests that the staff report and Basin Plan amendment specifically acknowledge that this pooled allocation is intended to address current loads plus a reasonable growth increment.** A similar comment suggesting a specific growth increment allocation was received from one of the independent peer reviewers (Dr. David Sedlak, UC Berkeley) on the TMDL technical report.

Setting the group allocation to 17 kg/yr will not result in the grouped POTW load expanding to 17 kg/yr. On the contrary, one of the BACWA core principles is compliance, so the Water Board can reasonably expect for POTWs to work together to stay well below this maximum.

**3. Eliminate the individual mass “allocations” for POTWs.** The mass “allocation” approach used in the previous version of the staff report relied upon the relative volumes of discharge to the Bay. The “allocations” presented in the April 30 staff report rely on current loadings. This approach is problematic for several reasons. First, it tends to penalize advanced treatment plants that have the lowest loads per volume of discharge and also have less variable loads. Second, it also tends to penalize plants that have stepped forward to implement reclamation or aggressive pollution prevention and have reduced their loadings to the Bay, accordingly. Finally, it penalizes plants that have remaining un-utilized design capacity and gives extra capacity to plants that will never utilize the “allocation”. The prior allocation scheme tended to reward these plants, which is a more equitable approach. However, the prior allocation scheme also caused some jeopardy to some secondary facilities.

For the reasons cited above, BACWA favors elimination of the individual mass load “allocations” (i.e. the mass load element of the proposed triggers). The mass load triggers are unnecessary and, as noted above, are problematic to individual facilities. The mass load from a given facility is controlled by (a) the NPDES permitted design flow (ADWF) and (b) the concentration trigger. Action is only proposed to be triggered based on exceedance of both the mass and concentration triggers by an individual plant. In all cases, the concentration triggers will control this determination. Therefore, the mass load “allocations”/triggers are unnecessary. Reliance on treatment category-based concentration triggers is preferred, since effluent concentration is a better indicator of plant performance than is mass load and top performing plants benefit most from that approach.

**4. Consider and reference previous regional planning documents prepared by Water Board staff.** The Project Background (Section 2) could mislead the reader to believe that the April 30, 2004 final TMDL project report for mercury in the Bay was the first major planning effort initiated by the Water Board in response to concerns expressed by USEPA over mercury concentrations in fish. This is not the case. We recommend adding the following paragraph to the Project Background (Section 2), to accurately convey that this stage represents the next step in a process that has been under way for several years:

“A draft strategy for managing mercury in the northern reach of San Francisco Bay was prepared and submitted to the Water Board as an information item on December 16, 1998 (Taylor, 1998). Stakeholder interest in the draft strategy report led to the formation of the San Francisco Bay Mercury Watershed Council in 1999. A preliminary TMDL project report was prepared using USEPA contract funds and presented to the Water Board as an informational item on June 20, 2000 (Abu-Saba and Tang, 2000). This final project report builds upon the policy and science foundation established by those two planning documents.”

The appropriate references for these two planning documents are

- 1) Taylor, K.A, 1998. Managing the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches. California Environmental Protection Agency - San Francisco Bay Regional Water Quality Control Board. December 16, 1998. Oakland, California.
- 2) Abu-Saba, K.E. and Tang, L.W., 2000. Watershed Management of Mercury in San Francisco Bay: a TMDL report to the USEPA, San Francisco Bay Regional Water Quality Control Board. California Environmental Protection Agency. San Francisco Bay Regional Water Quality Control Board. June 20, 2000, Oakland, California.

We note that both of the above mentioned planning documents acknowledge that mercury mass caps for individual POTWs are not necessary to protect beneficial uses. The draft mercury strategy report (Taylor, 1998) proposed “mass offsets” as a means of accommodating growth within the regulatory constraints imposed by the Bay being over its assimilative capacity for mercury. The preliminary project report (Abu-Saba and Tang, 2000) included individual wasteload allocations that allowed room for growth, and did not require mass offsets, proposing instead that actions such as mine site restoration and investigation of ways to reduce mercury methylation are best undertaken through a partnership approach, rather than being leveraged through mass offsets. The partnership approach proposed in Abu-Saba and Tang (2000) led to the formation of the Clean Estuary Partnership, which has funded over \$200,000 worth of technical projects directly supporting Water Board staff in the development of the mercury TMDL final project report that the Board is considering today.

**5. Consider and reference draft reports that Water Board staff have requested of the CEP and that the CEP has funded and prepared.** Technical

projects sponsored by the CEP have directly contributed to the development of the final TMDL project report, and yet many of the reports produced were not referenced, and the report conclusions have been in some places misrepresented. Proper acknowledgement of information used and relied upon and the CEP's process for internal and external review is essential to make effective use of public intellectual property.

The entirety of Section 3, the Mass Budget Approach, is based on the draft Mercury Source Assessment Report prepared by the CEP. This was one of the first technical projects sponsored by the CEP, and it served as a mechanism for CEP contractors to train Water Board staff who were new to the Mercury TMDL analysis in technical approaches to estimating loads. While Water Board staff have made substantive and original refinements, it is clear that Figure 3.1, Figure 3.2, Equation 1, and essentially all of the calculations and assumptions come directly from that draft report. This needs to be acknowledged. We suggest that the final sentence of the second paragraph in Section 4 (page 18) be amended as follows:

"The estimates are based on available information (Applied Marine Sciences, 2003); more study may allow refinement in the future."

The appropriate reference is:

Applied Marine Sciences 2003. Draft Mercury Source Assessment for San Francisco Bay. Prepared on behalf of the Clean Estuary Partnership. Available at [www.cleanestuary.org](http://www.cleanestuary.org).

Table 4.1 and Figure 4.1 also appear to be based on the draft Mercury Source Assessment Report, with one important difference. The source assessment report stated all load estimates as best estimates with likely ranges, at the specific direction of Water Board staff, and consistent with the loads assessment approach in the preliminary project report (Abu-Saba and Tang, 2000). The error bars representing the ranges have been eliminated from Figure 4.1, and only the best estimates are represented in Table 4.1. This is bad science, as all quantitative statement should include some statement of uncertainty. Bad science could lead to bad policy decisions by creating false expectations about the magnitude of controllable watershed loads. In practice, this uncertainty has been recognized, and is the basis for a recent \$100,000 CEP project to assess the feasibility, costs, and expected benefits of reducing mercury loads in urban stormwater. We request that Figure 4.1 and Table 4.1 be amended to include the uncertainty of each load estimate. Doing so will help the Water Board and the public to understand why the next logical step in implementation for some sources, such as urban stormwater, is to reduce uncertainty.

In August of 2002, Water Board staff made a specific request of the CEP that implementation reports be prepared describing the approach, costs, and expected benefits of TMDL implementation for different source categories. The

Implementation Plan (Section 8) fails to reference the reports produced that describe implementation approaches for wastewater and inactive mines, and as a result omits crucial information.

The Wastewater Implementation Report clearly defines an approach to estimating current mercury loads and predicting future mercury loads from POTWs, and supports the Basin Planning effort by providing cost estimates for different load allocation scenarios. The report also describes, at a conceptual level, the approach to assessing the extent to which mercury discharge from POTWs affects methylmercury in receiving waters. This is all essential information that needs to be considered by the Water Board.

We request that you make the following changes:

In Section 8, under the heading Wastewater, subheading Municipal Discharges (Page 74) make this the opening paragraph:

“Since 2000, when POTWs implemented ultra-clean mercury monitoring at the direction of the Water Board, the estimate for the existing load from POTWs has been reduced from the previous estimate (Abu-Saba and Tang, 2000) of 44 kg/yr (range = 25 – 62 kg/yr) down to 11.4 kg/yr (range = 8.5 – 14.3 kg/yr) (Larry Walker Associates, 2003; Larry Walker Associates, 2004). If POTWs maintain current levels of performance, projected population growth in the Bay Area would increase that load by a total of 2 kg/yr over a twenty-year period. If the Water Board does not allow the long term annual average to increase with population growth, the cost of maintaining the annual average POTW load at current levels is estimated to be between \$8,000,000 and \$25,000,000 per year, depending on the approach. If the Water Board requires reductions in annual average POTW mercury load from current levels, the cost to implement ranges from \$100,000,000 per year to almost \$1,000,000,000 per year, depending on the approach (Larry Walker Associates, 2003).”

Providing the information above in the document will help the Water Board fulfill its duties pursuant to Section 13242 of the California Water Code.

In Section 8, under the heading Wastewater, subheading Municipal Discharges (Page 74) amend the text of the third paragraph as follows:

“The potential availability of wastewater mercury for methylation and biological uptake, and possible local effects of such discharges, is not well understood. We propose that dischargers undertake or otherwise support studies to evaluate local impacts and bioavailability. A recent assessment of methylmercury in receiving waters conducted by the Fairfield-Suisun Sewer District is an example of such a study. That study showed no difference in the production of methylmercury between the receiving slough of the advanced treatment plant and a reference slough. In that study, dissolved oxygen in the receiving waters was a much more important variable than the nature of the mercury source (as summarized in Larry Walker Associates, 2003 and Abu-Saba et al., 2001). Similar information is needed from a variety of treatment plant types and discharge locations, as well as

more direct assessments of the potential for localized increased mercury in the food web (e.g., benthic invertebrates in receiving waters).

If evidence of local effects from wastewater effluents....” (leave the rest of the paragraph as written).

We note the Fairfield-Suisun Sewer District methylmercury assessment was conducted as a special study in compliance with a negotiated provision in their NPDES permit. The methylmercury measurements were made by Dr. Robert P. Mason, a recognized expert in mercury biogeochemical cycling. Dr. Mason also reviewed the results and conclusions of that study, and was a co-author when the results were presented in a special session on mercury at the American Geophysical Union’s annual meeting in December, 2001 (Abu-Saba et al., 2001). Water Board staff currently leading the TMDL unit also attended that session and co-authored that presentation.

The mine site implementation report assessed the status of implementation of the Basin Plan program for inactive mines with respect to mercury mines in the Bay Area. That report summarized the status and priority of mercury mines, proposed next steps to assure full implementation of the mines program, and provided a framework for estimating staff time and contract dollars needed to fully implement the mines program. That information needs to be considered and referenced.

We request you make the following change to Section 8, heading Potential Sources, Subheading Mercury Mines (page 79), second paragraph, first sentence:

“Approximately seven small mercury mines located in the North Bay are not meeting the conditions set forth in the Basin Plan. Priorities and next steps to assure full implementation have been identified (Applied Marine Sciences, 2003).”

It is not clear to us whether Water Board staff have sufficient resources to fulfill the implementation commitment made in this paragraph. If not, that needs to be said, so that those resources can be sought from the legislature, federal grant programs, or funding partnerships.

The appropriate references for the two implementation reports and the AGU presentation discussed above are:

Larry Walker Associates, 2003. Draft report on Mercury Management by Bay Area Wastewater Treatment Plants: approaches, costs, and benefits of alternative scenarios for implementing the San Francisco Bay Mercury TMDL in municipal and industrial National Pollutant Discharge Elimination System permits. Prepared on behalf of the Clean Estuary Partnership, available at [www.cleanestuary.org](http://www.cleanestuary.org).

Applied Marine Sciences, 2003. Draft report on Managing Inactive Mercury Mine Sites in the San Francisco Bay Region: status report on implementation of the Basin Plan mines program. Prepared on behalf of the Clean Estuary Partnership, available at [www.cleanestuary.org](http://www.cleanestuary.org).



Abu-Saba, K.E.; Flegal, A.R.; Ganguli, P.M.; Whyte, D.C.; Mumley, T.E.; Mason, R.P., 2001. Talus Lex: Regulatory Approaches to Reducing Mercury Concentrations in San Francisco Bay Fish. EOS Transactions of the American Geophysical Union, 82(47), Fall Meeting, Supplemental Abstract H52F-08. December 14, 2001, San Francisco, California.

**6. Through the CEP process, take any steps necessary to make the above CEP draft reports final. Those steps could include consideration by the mercury workgroup, peer review, and consideration by the CEP Technical Committee.**

While all of the above reports produced by the CEP are still referred to as drafts, information from each report was selectively used by Water Board staff in the preparation of the Mercury TMDL Final Project Report. The information used by the Water Board is important and needs to be considered in the full context of the reports. The Reports were publicly funded and prepared to support the TMDL effort; the reports need to be recorded in a final form. The CEP has a process for bringing draft reports to final. That process is in the control of the mercury workgroup of the CEP technical committee, which is chaired by Water Board staff. In the interim between the first public hearing of the Mercury TMDL and the hearing to consider adoption, we request that Water Board staff support the CEP process for bringing the draft reports to final products representing the consensus of the partnership. The CEP has an existing budget for workgroup deliberations and external peer review, so this request does not represent an additional burden.

# Watershed Management of Mercury

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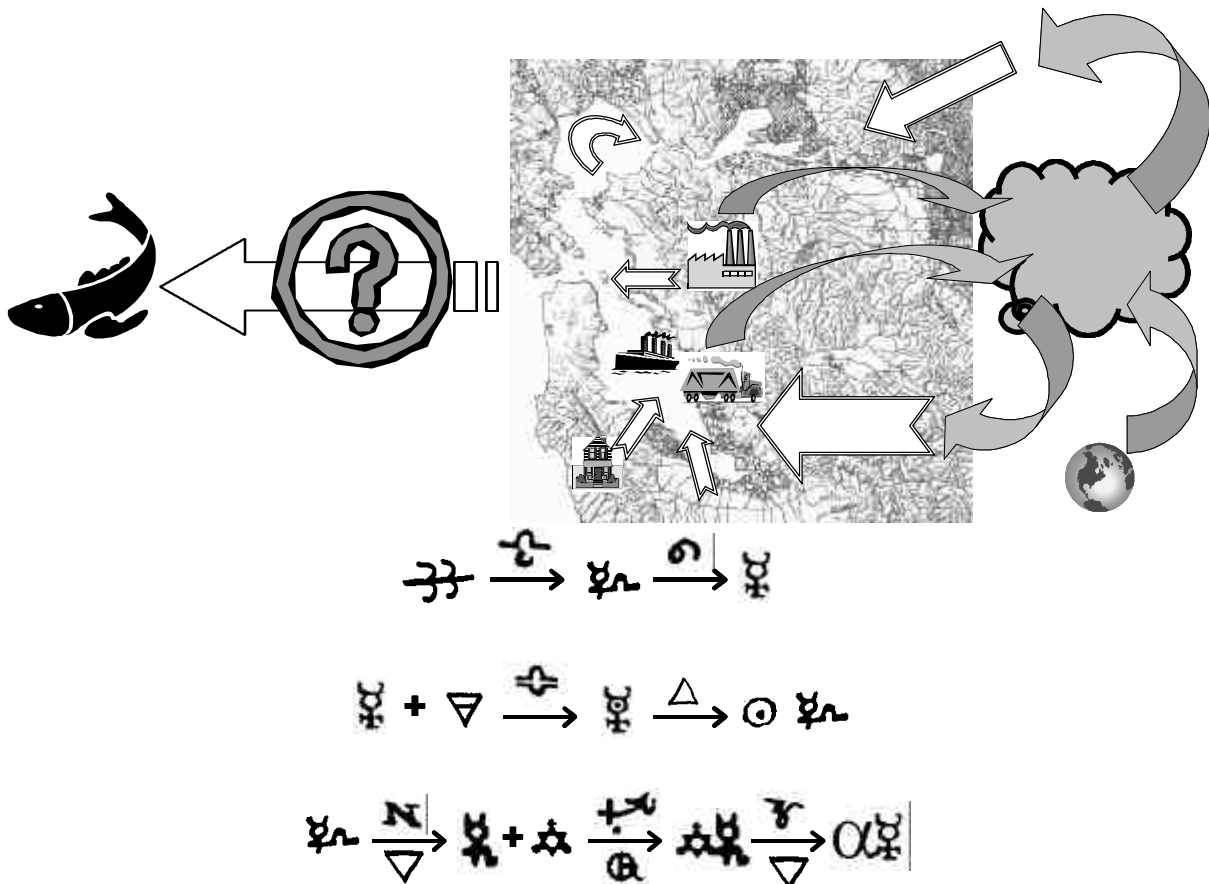
San Francisco Bay Estuary:

Total Maximum Daily Load

Report to U.S. EPA

California Regional Water Quality Control Board  
San Francisco Bay Region

June 30, 2000





## Acknowledgements, Authorship, and Dedications

This report is a synthesis of science, policy, values, and ideas brought forward by a diverse group of stakeholders. Literally hundreds of participants have engaged staff of the California Regional Water Quality Control Board on the subject of mercury in the environment; their interest and participation are greatly appreciated. Many individuals have directly contributed time, thought, and energy into this report and the deliberations leading to it, and should be recognized explicitly. Their names appear on the following two pages.

“Let every man make known what kind of government would command his respect, and that will be one step toward obtaining it.”

Henry Thoreau, *Civil Disobedience*

"And now, let the wild rumpus start!"

Maurice Sendak, *Where the Wild Things Are*

The principal authors and editors of this report are:

Dr. Khalil E. Abu-Saba and Lila W. Tang, PE.

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Cover design by Khalil Abu-Saba. The upper section depicts the numerous pathways conveying mercury into the aquatic ecosystem of the San Francisco Bay estuary, and the uncertainty about how mercury from each pathway is bioaccumulated. The lower section depicts the biogeochemical cycle of mercury, in seventeenth century alchemical symbols, from cinnabar, to quicksilver used in gold amalgamation, to inorganic mercury, to methylmercury in fish.

## Mercury TMDL Report for San Francisco Bay 8/1/00

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San Francisco Bay Mercury Council participants and other contributors. We thank each of these individuals for their assistance, advice and perspectives. The policy guidance contained in this report does not necessarily reflect the views or positions of the agencies and organizations represented.

## Mercury TMDL Report for San Francisco Bay 8/1/00

Name	Representing
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San Francisco Bay Mercury Council participants and other contributors. We thank each of these individuals for their assistance, advice and perspectives. The policy guidance contained in this report does not necessarily reflect the views or positions of the agencies and organizations represented.

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## 6.2 Load and wasteload allocations for Lower South Bay

The assimilative capacity in lower South Bay is estimated to be 29 kilograms per year. That load is allocated among point and nonpoint sources as specified in Table 33. To provide a margin of safety, we have included an unallocated load of 4 kg per year.

Source	Type	Current (kg/yr)	Allocated (kg/yr)
Fremont Bayside	Watershed	2	2
Coyote Creek	Watershed	8	8
Guadalupe River	Watershed	49	4
Palo Alto	Watershed	6	6
Direct Air Deposition	Background	1	1
Unallocated reserve	Background	NA	4
City of Palo Alto	Municipal	0.25	0.6
City of Sunnyvale	Municipal	0.10	0.3
City of San Jose	Municipal	0.80	2.8
FMC Newark	Industrial	?	0.5
Total		67	29

**Table 33: Load and wasteload allocations (kg/yr) for sources in Lower South Bay.**

The burden of reduction is placed upon the most egregious mercury source in Lower South Bay, the Guadalupe River watershed, which drains the New Almaden Mining district. The load reduction for that watershed is predicated on implementation of control measures that reduce the median concentration of mercury in sediments transported from that watershed from their current level of 2.5 µg/g to 0.2 µg/g, comparable to adjacent watersheds. The same level of reduction could also be achieved by reducing sediment loads exported from the watershed. Regardless of how the reduction is achieved, we will require attainment of the sediment target of 0.4 µg/g (normalized to fines) for sediments exported from all watersheds, including the Guadalupe River.

The wasteload allocations for the three municipal dischargers in Lower South Bay assume that the treatment plants can maintain an annual average mercury concentration of 0.007 µg/L or less, and that flows increase to no more than double current levels due to growth. Those wasteload allocations, which allow some increase in wastewater loads, are proposed in accordance with U.S. EPA guidance for the development of phased TMDLs: “the phased approach is required when the TMDL involves both point and nonpoint sources and the point source wasteload allocation is based on a load allocation for which nonpoint source controls need to be implemented.”<sup>84</sup>

In the implementation plan, we will establish a time to review the TMDL, evaluate progress towards attainment of the load reduction from the Guadalupe River watershed, and decide whether additional, more stringent control measures are needed to attain the target.

It is important to quantify the effects, in terms of reduced environmental benefit, that could result from allowing wastewater sources to increase as watershed sources decrease. For example, consider the purely hypothetical case of a discharger that only needs a pound of mercury. How much difference would one more 1 pound, (0.45 kilograms) make, in terms of attaining the target? If the proposed load reduction of 45 kg is attained, then adding another pound of mercury would add another 3 months to the 17 years required to attain the sediment target. The proposed allocations allow a total increase of 3 kg for all wastewater sources. How does this increase affect the time to attain the target?

Figure 43 shows that the answer entirely depends on the load reduction attained from the Guadalupe River watershed. We propose a reduction of 45 kilograms per year from that watershed. Reserving 4 kg per year as a margin of safety makes the net load reduction 41 kg per year. This would lead to attaining the sediment target in 17 years (Scenario A). An additional 3 kg from wastewater discharges would increase the time to attain the target to 18 years. But what if only 20 kilograms per year are reduced from the Guadalupe River, while point sources concurrently increase by 3 kilograms (Scenario B)? In that case, allowing the growth in point sources would cost an extra 6 years in terms of time to attain the target. And if a mere 10 kilograms per year are reduced from the Guadalupe River Watershed (Scenario C), then what would be the effect of an extra 3 kg? Under Scenario C, the extra mercury from the point sources extends the time to attain the target by 30 years.

It is also worth asking what would happen if we completely ignored the Guadalupe River watershed, and focused instead on reducing wastewater sources, which amount to 1.2 kilograms. Reducing mercury loads in Lower South Bay by 1.2 kilograms might lead to attaining the sediment target in 586 years.



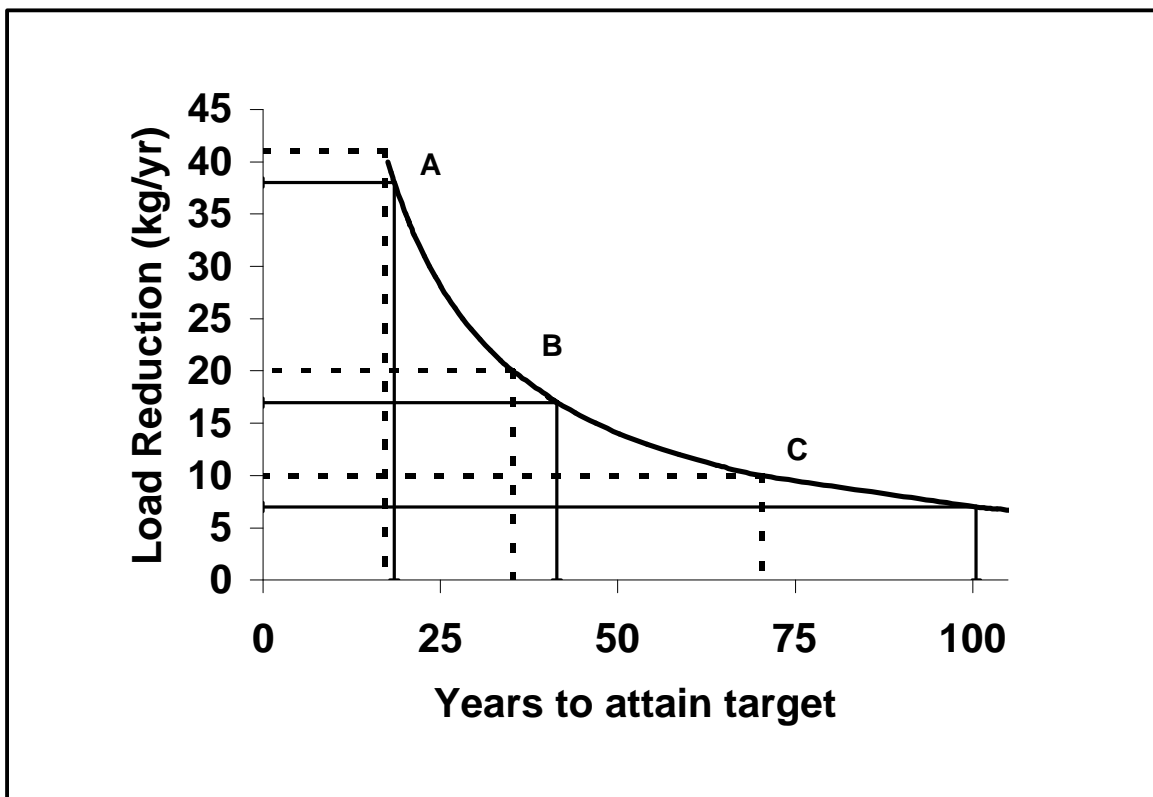


Figure 43: Figure showing the coupling between wasteload allocations for point source discharges in Lower South Bay and the load reduction attained from the Guadalupe River watershed. The dashed horizontal and vertical tie-lines depict load reductions of 41, 20 and 10 kg per year from the Guadalupe River watershed. The solid tie-lines depict the corresponding net load reduction to Lower South Bay if point sources are concurrently allowed to grow by 3 kg.

#### ***6.4 Wasteload allocations for wastewater dischargers in all other Bay segments***

Of all known sources, wastewater dischargers have attained the most substantial mercury reductions over the past three decades, by investing over two billion dollars in construction of wastewater treatment systems. This report shows that in order to protect beneficial uses, we have to focus on watershed sources. Nonetheless, a complete watershed plan must also put reasonable limits on the mass of mercury released from wastewater sources.

In the Bay Area, current wastewater dischargers release between 25 and 63 kg of mercury per year. We have recently required better mercury measurements from all wastewater dischargers, and expect this estimate to be refined to 15-40 kg per year as new data are produced. Even though Bay segments north of the Dumbarton Bridge appear to be below their assimilative capacity, some level of control on point sources is needed to protect beneficial uses.

The sum of wasteload allocations for wastewater should be less than 50 kg in the entire San Francisco Bay watershed. This mass is derived from the sediment budget for San Francisco Bay (Table 15) and the Basin Plan narrative objective for bioaccumulation: “Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.”

Every year, 3.7 billion kilograms of sediment are deposited in San Francisco Bay. If we limit total wastewater mercury loads 50 kg or less, the mercury concentration of bottom sediments would be at most 0.013 mg/kg higher than they would be in the absence of wastewater loads. Thus, the proposed limit for wastewater makes two assumptions:

- 1) Mercury loads from wastewater are entirely adsorbed onto sediments (an environmentally conservative assumption);
- 2) 0.013 mg/kg is not a detrimental increase in the mercury concentration of bottom sediments, which average 0.3 mg/kg in San Francisco Bay.

This proposed load should be allocated to individual sources according to the vulnerability of the receiving waters. Shallow receiving waters have longer residence times, and are more prone to the suboxic conditions that promote mercury methylation. Therefore, shallow water discharges should get proportionally lower wasteload allocations than deep water discharges.

We have also considered technological feasibility in allocating individual loads. A recent study by the Association of Metropolitan Sewage Agencies (AMSA) using modern analytical techniques shows that 90 percent of the effluent mercury values in the dischargers examined were at or below 0.015 µg/L. Therefore, we can reasonably expect that any treatment plants in the Bay Area to maintain an annual average effluent concentration of 0.025 µg/L or less. Plants with shallow water outfalls should show better performance, because their receiving waters are more vulnerable. Based on the AMSA study, we can reasonably expect plants with shallow water outfalls to maintain an annual average effluent concentration of 0.015 µg/L or less.

We have derived individual WLAs using these two performance goals (0.025 µg/L and 0.015 µg/L), and double current flow rates. The sum of these mass limits for all municipal and industrial dischargers is less than 50 kg. This approach limits total masses of mercury released from wastewater discharge to levels very close to current performance, while allowing reasonable room for growth and placing the burden of increased treatment on facilities with the poorest performance. We will continue to investigate possible linkages between wastewater inputs and methylmercury production. As we refine the methylmercury target and gain a better understanding of methylmercury distributions in the estuary, it may be necessary to impose more stringent mass limits on individual wastewater dischargers in the second phase.

Wasteload allocations for municipal dischargers are summarized in Table 34, Figure 44, and Figure 45. Wasteload allocations for industrial dischargers are summarized in Table 33 and Figure 46.

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Facility	Bay Segment	Map Key	Wasteload Allocation (kg/yr)	Best Estimate of annual flow (MGD)	Annual average mercury concentration target (µg/L)
San Jose/Santa Clara WPCP	A	23	2.8	120.1	0.007
East Bay MUD	C	9	6.4	77.3	0.025
EBDA, East Bay Dischargers Authority	B	8	6.4	76.8	0.025
City & Co. of S.F., Southeast	B	21	6.2	75.0	0.025
Central Contra Costa S.D.	E	4	3.8	45.8	0.025
City of Palo Alto	A	19	0.6	25.7	0.007
So. Bayside System Authority	B	29	1.7	20.7	0.025
West County Agency	C	34a	1.4	16.5	0.025
City of Sunnyvale	A	32	0.3	14.6	0.007
Napa S.D.	D	15	0.7	14.2	0.015
Delta Diablo S.D.	E	7	0.7	13.6	0.015
City of San Mateo	B	24	1.1	13.1	0.025
Fairfield Suisun Sewer Dist.	E	10	0.6	12.8	0.015
Vallejo Sanitation & Flood Cont.	D	33	1.0	12.5	0.025
LAVWNMA, Livermore-Amador Valley WMA	B	8a	0.9	11.0	0.025
Central Marin Sanitation A.G.	C	5	0.9	10.9	0.025
So. S.F./ San Bruno WQCP	B	30	0.8	10.2	0.025
City of Petaluma	D	20	0.5	10.1	0.015
West County Wastewater Dist.	C	34b	0.6	6.7	0.025
Novato S.D.	D	17	0.3	6.1	0.015
City of Burlingame	B	2a	0.3	4.1	0.025
Sewerage Agency of So. Marin	C	27	0.3	3.1	0.025
Sonoma Valley County S.D.	D	28	0.1	2.8	0.015
City of Pinole	D	11a	0.2	2.3	0.025
City of Benecia	E	1	0.2	2.3	0.025
City of Millbrae	B	2b	0.2	1.9	0.025
Las Gallinas Valley S.D.	D	12	0.1	1.7	0.015
Mountain View S.D.	E	14	0.1	1.5	0.015
Sausalito-Marín City S.D.	C	25	0.1	1.4	0.025
City & Co. of S.F., Int. Airport	B	2c	0.1	0.9	0.025
Marin Co. S.D. #5	C	13	0.1	0.8	0.025
Rodeo S.D.	D	11b	0.1	0.7	0.025
City of Calistoga	D	3	0.0	0.6	0.015
City of Hercules	D	11c	0.0	0.4	0.025
Town of Yountville	D	35	0.0	0.4	0.015
City of St. Helena	D	31	0.0	0.3	0.015
Contra Costa Co. S.D. No. 5	E	6	0.0	0.0	0.025
Total			40		

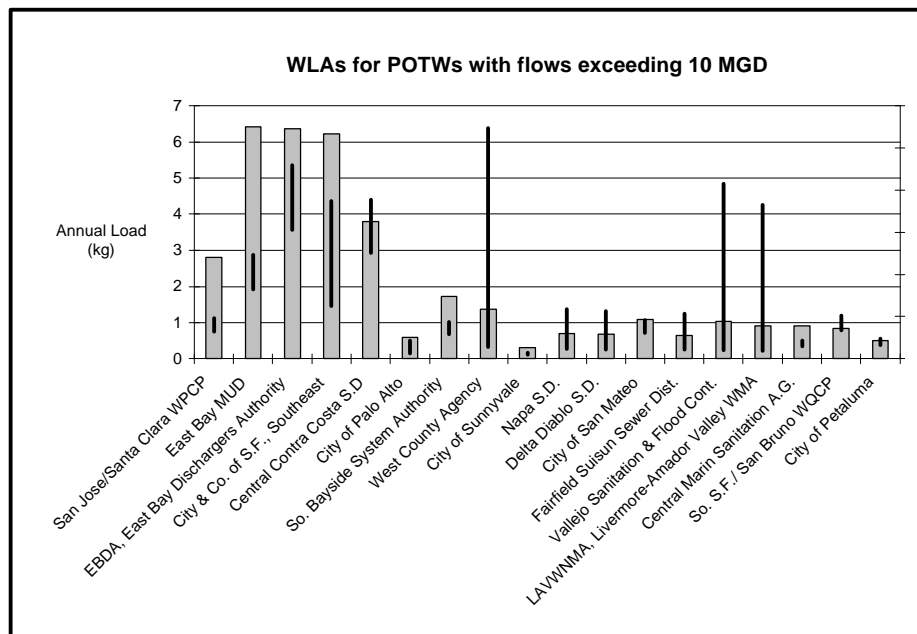
**Table 34: Summary of annual wasteload allocations for municipal dischargers in the San Francisco Bay region.**

# Mercury TMDL Report for San Francisco Bay 8/1/00

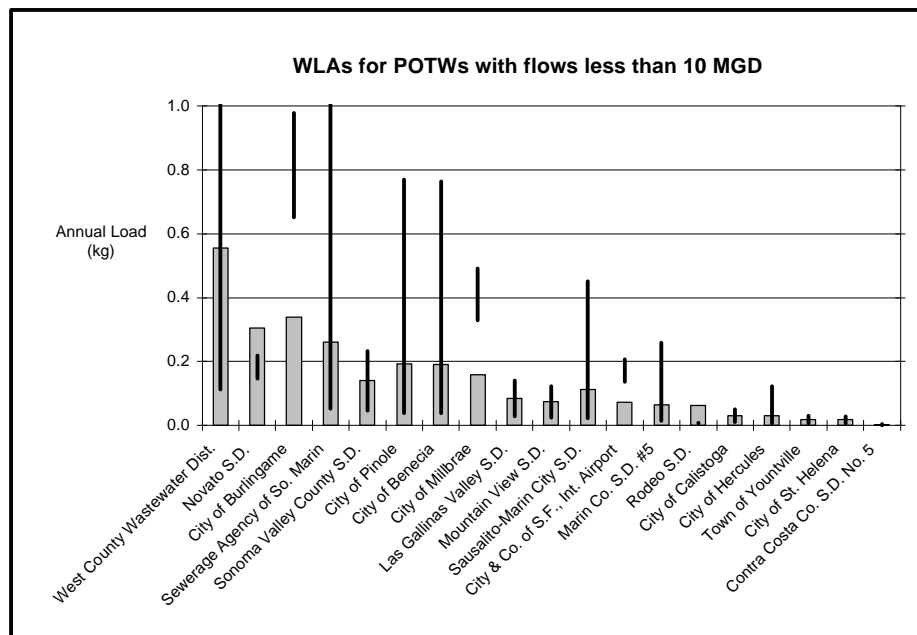
Facility	Bay Seg- ment	Map Key	Wasteload Allocation (kg/yr)	Best Estimate of annual flow (MGD)	Annual average mercury concentration target (µg/L)
C&H Sugar Co.	D	2	2.0	24.5	0.025
Chevron U.S.A.	D	3	0.5	6.0	0.025
Equilon Enterprises LLC.	E	8	0.4	5.3	0.025
Tosco Corp. Avon Refinery	E	11	0.4	4.3	0.025
Dow Chemical Co.	E	4	0.2	2.2	0.025
Exxon	E	5	0.2	1.9	0.025
Tosco Corp. Rodeo Refinery	D	12	0.1	1.6	0.025
San Francisco Int. Airport	B	16	0.1	0.9	0.025
General Chemical Corp. Bay Point Works	E	1	0.0	0.3	0.025
Rhone Poulenc Basic Chemical Co.	E	9			0.025
Zeneca Agricultural Products	C	10			0.025
USS Posco	E	13	0.8	9.1	0.025
FMC Newark	A	6	0.5		
PG&E Portrero Power Plant	B	13	0.1	202.0	0.0002
GWF Power System, Nichols Road Power Plant	E	14	0.0	0.0	0.025
GWF Power System, East Third Street Power Plant	E	15	0.0	0.1	0.025
Total			4.8		

**Table 35: Summary of annual wasteload allocations for industrial dischargers in the San Francisco Bay region.**

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**Figure 44: WLAs (solid Grey bars) and current performance (black vertical lines) of municipal wastewater dischargers with flows exceeding 10 million gallons per day.**



**Figure 45: WLAs (solid Grey bars) and current performance (black vertical lines) of municipal wastewater dischargers with flows less than 10 million gallons per day.**

DRAFT STAFF REPORT

Defining the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches

June, 1998

San Francisco Bay Regional  
Water Quality Control  
Board



This work is the product of many hours of discussions, inquiries, research, data analysis, and writing. Tobi Tyler (ABAG) and Dr. Keith Casey (Sea Grant) compiled technical information and wrote this report. Mark Ruderman, Blair Allen, Katie Hart, Dale Boyer, Greg Walker, and Larry Kolb all contributed by spending time discussing the issue as an internal issue team. Selina Louie contributed her knowledge of the pollution prevention program successes and status. The managers and staff responsible for data management at all of the POTWs discharging upstream of Central Bay contributed by quickly responding to a special data request from the mercury team, sending us electronic copies of their discharge data. Dyan Whyte and Ron Gervason provided critical comments and editing. Kim Taylor directed the project.



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## **I. The Mercury Situation—Executive Summary**

Mercury in the San Francisco Bay (Bay) aquatic system is found in concentrations that exceed standards both in fish and shellfish and periodically in Bay waters themselves. The observed mercury levels in tissue are the end product of historical and ongoing inputs, complex transport mechanisms, biogeochemical process that transform mercury in the water, sediment, and marshes, and uptake of organic mercury into the food chain.

This document presents a proposed policy and regulatory program for mercury in watersheds draining to the northern embayments of the San Francisco Bay Estuary.<sup>1</sup> Staff have developed these proposed Basin Plan amendments in order to achieve full protection of water quality in a manner that emphasizes reductions in the largest, controllable ongoing sources of mercury to the system, considering the rate of natural cleanup processes and existing stocks of mercury in the Bay. This staff report includes:

- A thorough review of mercury levels in the Bay environment (water quality conditions);
- A definition of the environmental problems unique to mercury;
- A review of relationships between environmental conditions and mercury sources and flows in the watershed;
- A review of the current regulatory program;
- An analysis of potential measures for controlling ongoing inputs and long-term remediation;
- Design of a new administrative tool (mass offsets) to promote the use of cost-effective control measures; and
- A set of proposed policy and regulatory program elements (Basin Plan amendments) designed to address and reflect the assessments described above.

### **A. Environmental Conditions and Concerns**

#### **1. Narrative and Numeric Water Quality Objectives**

The Office of Environmental Health Hazard Assessment (OEHHA) has reviewed all available data on health risks associated with consumption of mercury in fish, dietary concentrations, and concentrations in fish caught in the Bay. The first set of reviews was conducted in the early 1970s, after which OEHHA (then DHS) issued a formal health advisory warning against excessive consumption of striped bass in all of the embayments that make up San Francisco Bay. Subsequent reviews of fish tissue data in 1993 and 1997 supported earlier findings.

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<sup>1</sup> This draft staff report and proposed policies were designed to cover Central Bay north of Alcatraz Island, San Pablo Bay, Carquinez Strait, Suisun Bay, the western Delta and tributaries to these waters. We anticipate including loading information on discharges to the Central Bay north of the Hunter's Point-San Leandro line dividing South from Central Bay during the comment period. Additionally, we are seeking comments on whether to extend the policy proposals to include south bay segments as well.

Fish tissue monitoring has been expanded in recent years to better define the extent of the bioaccumulation problem by sampling a broader variety of fish species and the extent of the human health risk by more precisely defining consumption patterns. The latest compilation of fish tissue data indicates that mercury levels in shark, white croaker, and other species are also high enough to warrant public health concerns. The health advisory thus remains in effect, meaning that San Francisco Bay (Bay) is not fully supporting the Water Contact Recreation (Rec-1) and Ocean, Commercial, and Sport Fishing (Comm) beneficial uses or the general narrative standard of “fishable” in the federal Clean Water Act.

In addition to these violations of “narrative” water quality standards, numerical water quality objectives are frequently exceeded in all embayments. Measurements of mercury in Bay waters are frequently above the 0.025 µg/L saltwater and 0.012 µg/L freshwater Basin Plan objectives. Ambient concentrations exceeded objectives in about  $\frac{1}{4}$  of all Regional Monitoring Program (RMP) measurements south of San Bruno shoal (Alameda-Hunters Point) and in about  $\frac{1}{3}$  of all measurements taken in San Pablo Bay and upstream into the Sacramento-San Joaquin Delta system. Although there is a consistent pattern of exceedances, recent data analyses indicate that total mercury in the water column is influenced by suspended sediment concentrations, not increases in Bay mercury. Thus, while exceedances are observed, they do not represent changes in environmental risk.

The second conclusion that can be drawn based on ambient monitoring data is that mercury in the Bay system poses a specific type of risk to beneficial uses. That risk is confined to bioaccumulation. Ambient concentrations are never high enough to warrant concern about short-term mercury-related toxicity. The Bay system is thus in compliance with federal aquatic life criteria.

In summary, many of the existing data sets show a consistent pattern of long-term, mercury bioaccumulation in the Bay environment with the most affected species being long-lived fish, birds, and mammals at the top of the food chain. Mercury tissue concentrations in these types of aquatic organisms are typically above both the formal available endpoints for human health risk (current elements in US EPA’s national mercury criteria) and alternative endpoints being considered as part of a revision of the national criteria. This proposed regional policy and regulatory program thus focuses entirely on the problem of persistent bioaccumulation.

## **2. Mercury in the Bay Environment**

Current mercury concentrations in fish tissue range from a 0.9 ppm average for shark and about 0.3 ppm for white croaker and striped bass, compared to 0.1 ppm average for fish from all US waters. Although bivalves are not very sensitive indicators of mercury bioaccumulation, mean concentrations in transplanted bivalves placed in all San Francisco Bay embayments are about 0.5 ppm—or among the highest 5% of concentrations found statewide in the State Mussel Watch Program and higher than most other west coast sites monitored by NOAA. There is much less information on mercury concentrations in other organisms, but elevated samples have been found in harbor seals, night herons, and clapper rails living in the Bay environment.

Mercury concentrations in Bay waters range from 0.0001 to 0.105 µg/L (total) and less than 0.0001 to 0.00271 µg/L dissolved. Peak total concentrations are observed during wind-, tide-, and



flow-driven sediment suspension; peak dissolved concentrations are expected with first flush/peak flow events in tributary rivers. At these concentrations, no toxicity-related effects are expected.

Mercury concentrations in the upper layer of Bay sediments are relatively homogenous, averaging about 0.35 ppm with slightly higher concentrations in samples with finer particle grains and higher than average amounts of organic material. This upper layer provides habitat for bottom-dwelling organisms that tunnel through and mix sediments and is also subject to resuspension and redeposition—sometimes as frequently as every day. There is a deeper layer of sediment, deposited after the Gold Rush, containing much higher average amounts of mercury (up to 1 ppm) lying in a concentration gradient from the western Delta to the Golden Gate.

Studies to define what chemical forms of mercury are being measured in the Bay system are not yet practical to use in routine monitoring. However, it has been well-established that virtually all of the mercury found in tissue is organic—and that virtually all of the mercury found in ambient waters and sediment is inorganic and bound within or attached to particles. This inorganic, particle-bound material is also likely to be a complex mixture of mineral, “reactive,” and elemental mercury. Bacteria are responsible for transforming “reactive” mercury into bioavailable organic mercury. The key to managing bioaccumulation, then, is understanding how the mixture of particle-bound inorganic mercury becomes methylated, and what human actions influence these processes.

The current state of knowledge about mercury transformation processes can provide a map of what those processes are and the kinds of factors that influence them, but is far from being able to quantifying the net production of methyl mercury given specific information on inorganic inputs. Because of this difficulty, tissue concentrations remain the best indicator of net methylation in aquatic systems.

### ***B. Mercury Inputs to the Sacramento River/San Francisco Bay Watershed***

There are two sources of mercury to the San Francisco Bay system, historic loadings dating from Sierra and Coast Range mercury mining activities during the Gold Rush, and ongoing loadings from a range of sources including: worldwide and local fossil fuel combustion; trace impurities in widely used products; ongoing erosion and drainage from mine sites; and use of the metal. Of these two classes of sources, historic practices account for the vast majority of mercury both in and currently entering the aquatic system—most of this load is associated with sediment particles and flows down the Sacramento River watershed and into the northern embayments. At historic Coast Range mining sites, mercury loadings to the watershed are typically from tailings piles and uncontrolled discharge from abandoned mines. In the Sierra, mercury loadings are much more diffuse and are typically spread through sediments along many miles of river systems downstream from gold mining sites. Locally, historic practices have left isolated sites along the margins of the Bay and local streams with significant areas of contamination. Runoff and erosion from these areas also account for a significant, ongoing mass input to the Bay system. Remediation and containment is currently underway at most local sites where high concentrations of mercury have been found.

The layer of enriched sediment, stretching from the mouth of the Sacramento/San Joaquin Rivers to the Golden Gate, deposited during the Gold Rush is also a significant ongoing source of mercury. Sediment from the deep layer mixes into cleaner surface sediments whenever the Bay

floor erodes; conversely, the layer is buried deeper in areas where sediment deposits. This mixing process is extremely patchy and impossible to predict. Nevertheless, current information suggests that natural sediment flux processes are slowly burying this layer below the biologically active zone.

Ongoing inputs of mercury to the Bay system due to current practices include atmospheric deposition, improper disposal of products such as paint in storm drains, use of products such as bleach containing trace impurities of mercury, and direct use of mercury in thermometers, medical equipment, dental amalgam. These ongoing loadings enter the Bay system through storm drain systems, treatment plants, and direct atmospheric fallout onto the Bay. The total mass of ongoing loadings is small compared to historic sources, but the chemical form of mercury is mostly “reactive” mercury and much more readily converted into bioavailable forms.

The largest inputs to the Bay are from the Sacramento River watershed and the enriched deep sediment layer. Atmospheric deposition onto the upland, urban areas of local watersheds and subsequent discharge through storm drains may be comparable to the riverine and deep sediment inputs. In comparison, estimating loading from local streams, all regulated treatment plant discharges, and direct atmospheric deposition onto Bay waters are all two orders of magnitude less than the largest inputs.

A summary of mercury flows in and out of the northern embayments is presented in Figure 1 below.

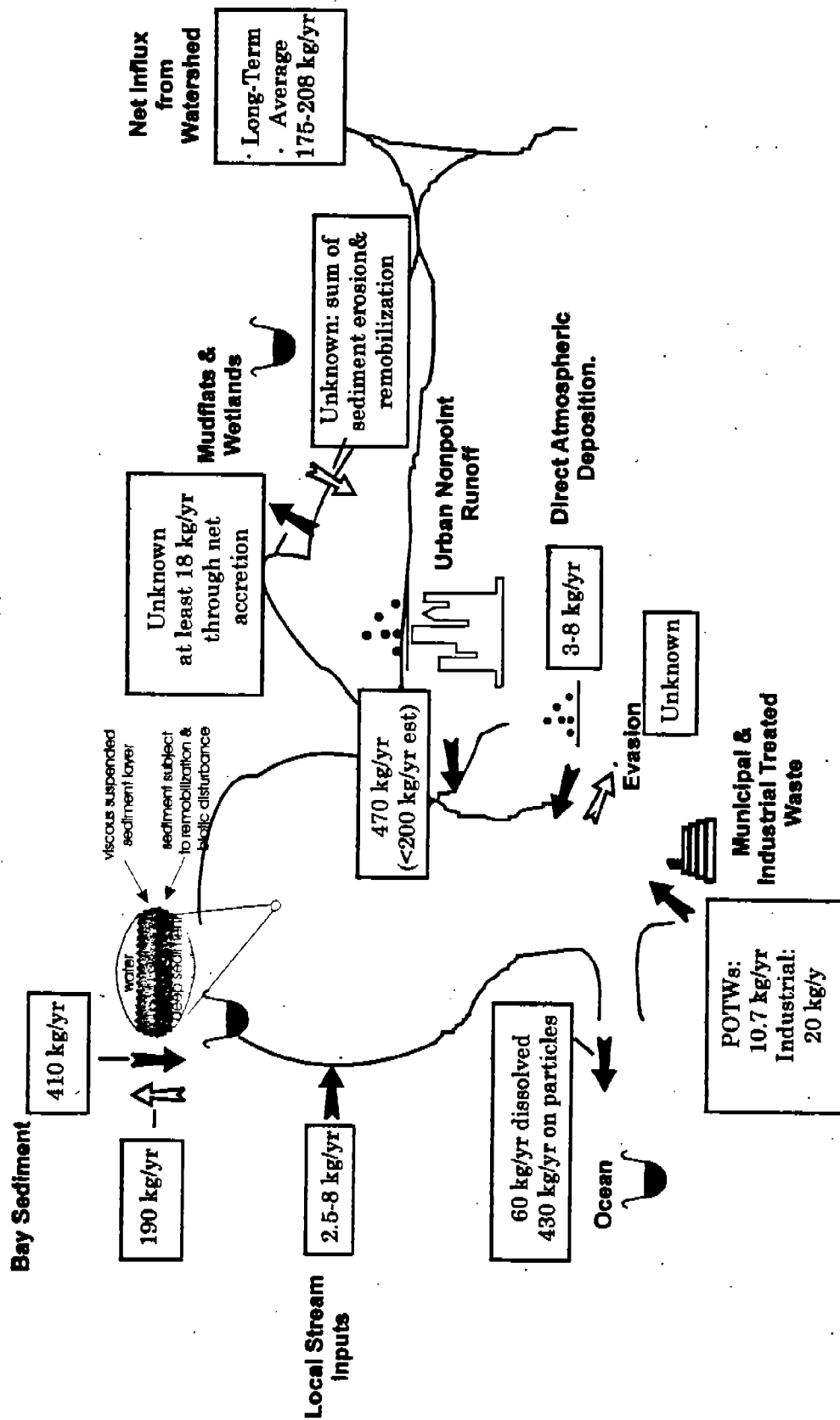


Figure 1. Mercury Budget for the Northern Embayments

### ***C. Conceptual Models of Mercury Inputs, Fate, Transport, and Bioaccumulation Pathways***

Inputs of mercury to the aquatic system alone do not determine where, and to what extent beneficial uses are at risk due to accumulation of mercury in the food chain. Methyl mercury ( $\text{CH}_3\text{Hg}^+$ ), by far the most bioavailable form and the key chemical species of concern, is formed primarily in sediment systems where sulfate-reducing bacteria are present. Methyl mercury, however, can also be formed in the water column and through chemical as well as biological processes. The rate at which methyl mercury is formed in the watershed, and the location where this transformation takes place is the key factor in determining the extent to which beneficial uses are affected.

To understand methyl mercury formation, it is also necessary to understand how the total stock of mercury in a watershed enters, moves through, and leaves the aquatic system—as well as how the prevalent chemical forms are transformed into bioavailable methyl mercury. Figure 2 describes the conceptual model staff have developed that captures the key elements of these processes.

Because the vast majority of mercury in a watershed is associated with sediment particles, fluxes of mercury through a watershed system are largely governed by sediment transport processes. However, the chemical form of mercury is not the same from particle to particle. The four boxes in Figure 2 represent stocks of different kinds of mercury. As you move down the watershed, sediments are eroded, transported down stream systems by flood waters, then settle out in flood plains, riparian wetlands, or other low-energy areas. Later floods start the cycle again, only further downstream. Each time a particle moves to a new location in the stream system, it is subject to new environmental conditions. In places where bacteria thrive, like wetlands or shallow/turbid areas with ample organic material, the mercury on particles can be chemically and biologically transformed. Watershed transformations are cumulative, and slowly change the mixture of inorganic mercury moving down river, increasing the percentage that is easily methylated.

Inputs of mercury are also labeled in Figure 2. Much of the native mercury in geological formations and some mine sites enters the watershed as mineral forms; watershed processes gradually transform some of the mineral into more readily bioavailable forms, creating a natural baseline level of mercury in the food chain. Human activities, including global fossil fuel combustion and local mining and mercury use, have tended to add “reactive” forms of inorganic mercury to the mineral forms already present in the watershed. The cumulative effect of human activities has thus not only added more easily methylable mercury, but increased the rate and total mass loading to aquatic systems. For example in Figure 2, atmospheric deposition and the use of elemental mercury in gold processing adds inorganic forms of mercury that are more easily transformed than mineral forms. Treatment plant effluent, regardless of waste type, adds dissolved mercury to the mixture.

The final key element in Figure 2 is that geography matters. Inputs of mineral mercury at the bottom of a watershed are of much less concern than inputs of dissolved mercury into subenvironments where methylating bacteria thrive. Conversely, the risk of bioaccumulation in any reach in the upper watershed depends on a different balance of factors than the net bioaccumulation at the bottom of the watershed.

## Key Mercury Flux and Transformation Processes

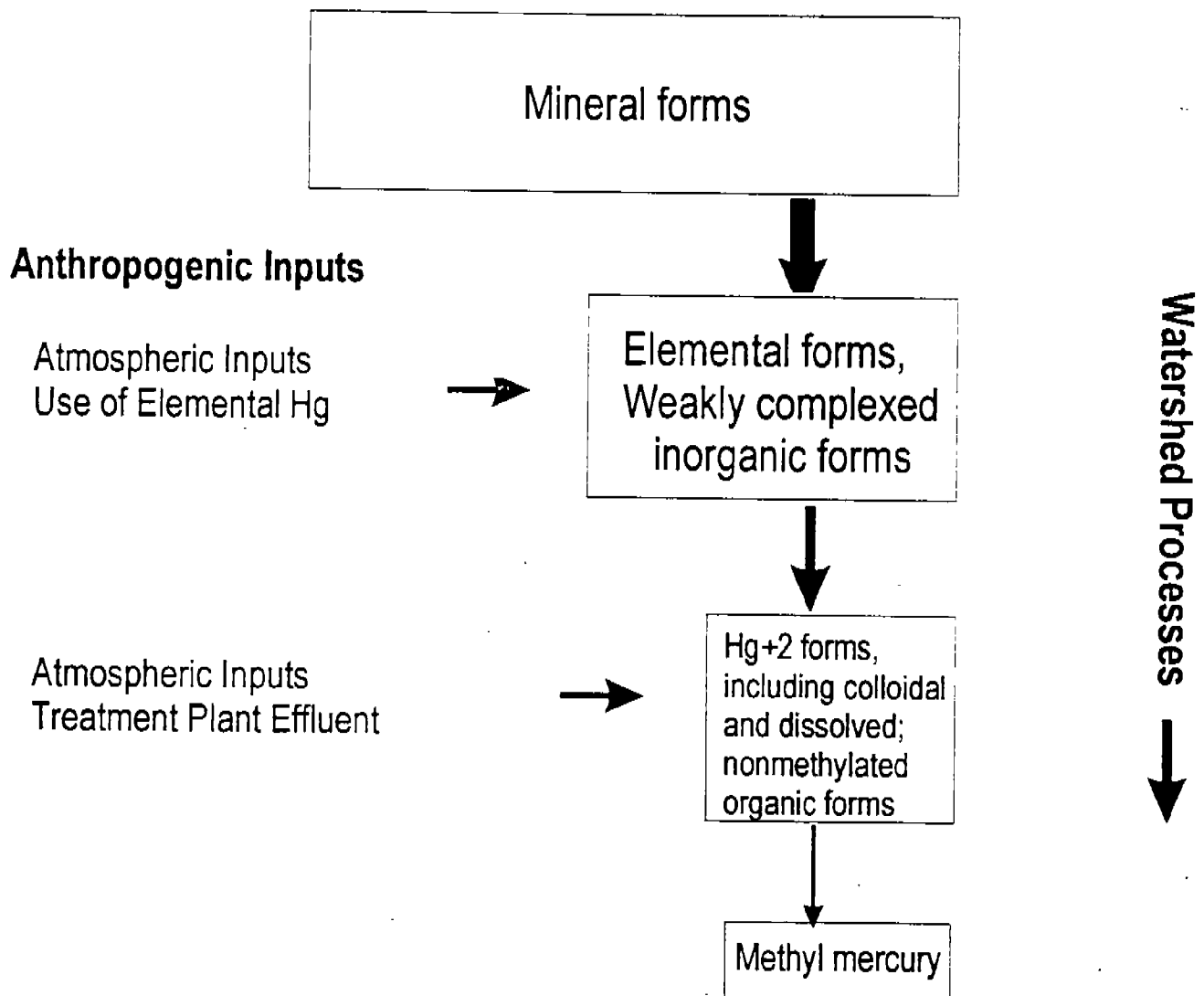


Figure 2. Key Mercury Flux and Transformation Processes

The conceptual model in Figure 2 provides a simple framework for determining the relative risk of different sources of mercury, and the processes that need further characterization in order to fully predict changes in environmental levels of mercury due to changes in inputs and watershed processes.

#### ***D. Status of Current Regulatory Programs***

The Regional Board currently has several regulatory programs and policies aimed at reducing the loading of pollutants like mercury into the Bay system and achieving full protection of beneficial uses within the Region. The three main program areas are waste discharge permits for point sources (including stormwater), pollution prevention programmatic requirements, and contaminated site cleanup and remediation (including mines). For this analysis, staff reviewed each program area to determine whether existing policies, guidelines, and procedures were appropriately addressing the mercury problem. We found that:

- Several changes need to be made in the way point source treatment plant permit limits are developed for mercury;
- Many of the local sewer district pollution prevention programs are successful and these successes should be communicated to all sewer districts and comparable levels of effort expended to achieve load reductions;
- Urban stormwater monitoring programs have not yet focused on mercury sources for BMP development but we expect that the bulk of loading from these systems is due to atmospheric deposition;
- All dischargers and monitoring efforts should use ultra-clean sampling and analytical techniques to characterize fluxes and loadings. These data will be used to confirm effluent quality attainable through pollution prevention and to confirm the atmospheric deposition hypothesis;
- Mine and contaminated site remediation projects within the Region are generally proceeding at a reasonable pace but abandoned mine remediation further up the watershed has stalled due to financial and legal constraints;
- Regional technical studies need to be done to shed light on how classes of activities (i.e., wetland management and stormwater retention basins) may affect the net rate of methylation in the Bay system.

We reached these conclusions by conducting an intensive review of treatment plant discharge data. All wastewater treatment plants in the Region currently have water quality-based effluent limits for mercury. These are derived according to the general provisions in the Basin Plan and site-specific conditions as determined by individual permit writers on a case-by-case basis. In general, shallow water dischargers must currently meet either 0.025 ppb or 0.012 ppb total mercury at the discharge point; deep water dischargers must meet either 0.25 ppb or 0.12 ppb total mercury. These effluent limits follow the standard template for deriving a maximum water column concentration that is protective of beneficial uses such that receiving waters beyond an

initial mixing zone do not exceed this concentration. In the case of mercury, however, beneficial uses are not threatened by water column concentrations, but by system-wide bioaccumulation.

Staff conducted a detailed analysis of treatment plant self-monitoring data to determine mercury mass loading patterns from these sources. Three years of data from all plants discharging to the northern embayments (north of Angel Island in Central Bay) show that:

- concentration-based effluent limits (set at maximum concentrations) do not provide the appropriate link between potential mercury bioaccumulation and discharge;
- there are widespread compliance problems associated with water quality-based effluent limits derived using the standard template;
- allowable mercury inputs are unevenly distributed between shallow and deep water dischargers;
- conventional analytical techniques (and most self-monitoring data) significantly overstate mercury concentrations and loadings from treatment plant effluents.

Staff reviewed the status of pollution prevention programs by gathering reports and audits compiled by sewer districts within the Region and across the country. These reports indicate that:

- controllable inputs generally represent less than 25% of the total mercury entering treatment plants;
- the most significant loading reductions reported for pollution prevention programs occur in cases where there is a single dominant source to a treatment system (i.e. a chlor-alkalai plant) and that source can be reduced through production substitution;
- best management practices that prevent mercury from entering sewer systems, using dry waste disposal, screens, gravity traps, and proper pipe maintenance are cost effective and can significantly reduce controllable inputs; and
- residential and commercial laundries (bleach and dye impurities) and thermometers represent significant fractions of treatment plant inputs and are probably best addressed through product substitution.

During this review, staff also found that the largest sewer districts within the Region have already implemented local pollution prevention measures, although further work to ensure that successful measures are communicated to smaller districts is probably necessary. Aside from ensuring consistency in the level of effort, the Board's programmatic pollution prevention requirements are currently being met. Beyond the BMPs outlined above, further reductions in mercury inputs to treatment plants are probably not practicable in the short-term.

The Regional Board regulates waste discharge from mine sites and staff have been actively involved in ensuring full remediation of all mines posing water quality threats in the Region for several decades. The result of this work is that most of the major mines sites, including those associated with mercury, are currently under cleanup orders. Cleanup of the largest mercury mine, New Almaden, a Superfund site, is ongoing; the status of this cleanup is included in Appendix A.

Site characterization work is currently underway for the Gambonini mine on Walker Creek (Tomales Bay), and staff have recently completed site inspections of all known mine sites in the Region. Those inspections indicate that there are at most two or three mine sites in the Region where mercury may be a slight problem and no site characterization has yet begun.

Mine remediation involves very different approaches than control of mercury inputs from treatment plants or through pollution prevention strategies. Successful remediation hinges partially on extremely thorough site characterization, but also on best professional judgment. The extent of reductions in mercury loading can be estimated before remediation, but is generally not possible to quantify with any degree of accuracy. In addition, the accuracy of estimates varies dramatically from site to site. The regulatory oversight of mine remediation typically specifies the scope and level of detail of site characterization, specific remedial actions, follow-up monitoring to test the effectiveness of those actions, and a general requirement for further action if the follow-up monitoring indicates incomplete work.

While cleanup of the largest mine sites in the Region is underway, mine remediation of new sites in California is virtually at a standstill because of the potential liability to parties or agencies involved in remediation of a site. Under current federal law, a party who engages in cleaning up *some* of an environmental hazard on an abandoned mine site can become liable for removing all of that hazard even if that party had no prior association with the property. This dilemma is commonly referred to as the "good Samaritan" problem. The problem is rooted in how the Clean Water Act and CERCLA laws identify a responsible party (PRP) and their long-term liability for the site. In establishing legal responsibility, the courts use the concepts of "strict" liability and "joint and several" liability. Strict liability means that individuals can be held liable even if negligence is not proven. Joint and several liability means that a single party found liable for damages can be held responsible for all associated costs even if that party's actual contribution to the damages is minimal. The use of such stringent liability standards was intended to save the government from the costly and time-intensive process of proving negligence and in the case of Superfund sites, from determining what portion of remediation costs each PRP must pay. There was also an expectation that the use of joint and several liability would encourage an identified PRP to name all other responsible parties at a given site. Unfortunately, legislators did not make any special liability provisions for voluntary site remediation work where volunteers had no prior association with the site, or for cases where the general public becomes liable for remediation of abandoned sites. The absence of such provisions in federal law presents a major disincentive for environmentally concerned groups to engage in volunteer cleanup work, particularly at abandoned sites. State laws have been amended to provide for good Samaritan mine remediation work. Despite the procedural obstacles standing in the way of reducing inputs from mines, remediation of obvious, large mine sources appears to be the single largest, cost-effective approach to reduce ongoing inputs.

Because several changes in the current approach for regulating mercury inputs to the Bay watershed are warranted, staff expanded the analysis to include a review aimed at identifying cost effective control measures.

### ***E. Potential Control Measures and Costs to Reduce Ongoing Inputs***

The conceptual model for mercury fate and transport in the Bay system presented above encapsulates the current state of knowledge about how ongoing and historical inputs relate to



observed bioaccumulation. However, many factors can not be quantified at this time and there are uncertainties about how much controllable factors, if controlled, can achieve measurable reductions in the net production of methyl mercury in the system and over what time frame these changes are likely to take place. Controllable factors are “those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the state and that may be reasonably controlled.”

We elected to include a detailed analysis of potential control measures in this staff report because of these uncertainties and to provide the basic information to determine whether the following provisions of the Basin Plan are applicable to mercury bioaccumulation in San Francisco Bay:

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, the Regional Board will conduct a case-by-case analysis of the benefits and costs of preventing further degradation. In cases where this analysis indicates that beneficial uses will be adversely impacted by allowing further degradation, then the Regional Board will not allow controllable water quality factors to cause any further degradation of water quality (p.3-1, Water Quality Control Plan)

Potential control measures were identified through an extensive set of interviews, literature searches, and technology reviews, many of which were prepared by consultants for the types of facilities/sites described in this report. The potential control measures listed here, along with ballpark cost estimates for general types of facilities, are those technologies and BMPs that are currently available and most likely to be implemented. High-end and experimental technologies, such as reverse osmosis are not included.<sup>2</sup> Table 1 summarizes the results of this review.

In Table 1, sludge incinerators were identified as one of the local, major sources to the atmosphere. As with fossil fuel combustion, trace levels of mercury in sludge and other wastes can be significant local atmospheric sources. Typically, these local air sources can be controlled with equipment designed to increase particle removal. It is unknown, however, what fraction of local air deposition is due to local air releases—Bay Area mercury probably travels towards the Sierra and is deposited in the upper reaches of the Sacramento watershed or further east.

The combination of pollution prevention programs and specific BMP measures that these programs require are probably the most cost effective approaches for controlling mercury discharges from treatment plants. End-of-the-pipe technologies are both orders of magnitude more expensive and of an unknown reliability. Because low detection limit monitoring data are not available for industrial or stormwater discharges, it is not possible to determine whether similar measures are possible for these systems as well. Mass loading to the Bay from urban runoff, however, could theoretically be controlled with settling basins or polishing wetlands—these techniques can easily backfire, however, because they may serve to transform inorganic mercury in stormwater runoff into bioavailable methyl mercury. While we are not advocating use of these

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<sup>2</sup> A note to parties intending to comment on the issue of cost: the most useful information about cost of control measures includes data for *classes* of facilities and control options. In addition, cost information for specific facilities should be documented and, if possible, set in the context of comparable information from other facilities.

systems, the cost (much higher than pollution prevention) is included for comparative purposes. Finally, a ballpark estimate for mine remediation costs was also developed. Because some of these sites are concentrated sources, rather than the cumulative loading from extremely diffuse, multi-party activities, it is reasonable that the overall remediation cost is less for abandoned mines—even given the technical and procedural difficulties associated with remediation.

Source	Description	Annual Cost (\$)	Est. Load Reduction (g/year)	Avg. Cost (\$/g)
Sludge Incinerators	modifications of wet scrubber system	120,000 <sup>1</sup>	36 <sup>2</sup>	3,300
POTW	source control program	200,000 <sup>3</sup>	90 <sup>4</sup>	
Indirect dischargers subject to source control:				
dentists	gravity traps	2,500 <sup>5</sup>	incl. above	
hospitals	see text	10,000 <sup>6</sup>	incl. above	
labs	see text	5,000 <sup>7</sup>	incl. above	
product subst.		0	incl. above	
laundries	POTW + indirect	265,000	90	3,000
Total costs	discharger BMP			
Direct industrial discharges	?	?	?	?
Urban runoff	?	?	?	>3,500 <sup>8</sup>
Abandoned mines	reclamation	150,000 <sup>9</sup>	1,400 <sup>10</sup>	1,100

Notes:

<sup>1</sup> Based on \$1 million capital cost amortized over 20 years @ 8% = \$100,000 plus \$20,00/year increase in operations and maintenance

<sup>2</sup> Based on an estimated 10% decrease below average north Bay POTW annual mass loading of 360 grams

<sup>3</sup> Based on program cost estimates provided by San Francisco and Western Lake Superior Sanitation Dist.

<sup>4</sup> Based on an estimated 25% decrease below average north Bay POTW annual mass loading of 360 grams

<sup>5</sup> Total cost and load reductions based on theoretical community served by average north Bay POTW with 10 dental offices

<sup>6</sup> Total cost and load reductions based on theoretical community served by average north Bay POTW with 2 hospitals

<sup>7</sup> Total cost and load reductions based on theoretical community served by average north Bay POTW with 4 labs

<sup>8</sup> Total cost and load reductions based on theoretical community served by average north Bay POTW with 4 commercial laundries

<sup>9</sup> Based on \$1 million in reclamation costs amortized over 20 years at 8% = \$100,000 and \$50,000 per year in monitoring studies and maintenance

<sup>10</sup> Based on characterization of Mt. Diablo mine on Marsh Creek (eastern Contra Costa County) with estimated wet flow loading to Marsh Creek of 28g/day over 100 wet flow days and assuming 50% reduction of loadings to creek due to remediation work (figures based on site characterization—CCC, 1996).

Table 1. Cost Information on Potential Mercury Control Measures

### ***F. Design of Proposed Regulatory Policy and Program Elements***

In the spring of 1997, an internal mercury task force was set up at the Regional Board. Members of this task force investigated the environmental and permitting aspects of mercury regulation and developed several solution criteria that any new or alternative regulatory approaches should meet. These criteria served as design parameters for the proposed policy options in this report.

The general environmental solution criteria are that regional policies and regulatory control measures should reflect the following:

- The most affected beneficial use is fishing; in particular, fishing that involves consumption of long-lived fish species at the top of the aquatic food chain. It is also likely that wildlife uses are similarly affected;
- Mercury bioaccumulation is likely to be highest in wetland subenvironments; levels of mercury in these environments should reflect the combination of natural methylation and increases in net methylation due to historic and ongoing anthropogenic activities;
- Mercury flows, fate, and transport are governed by sediment fluxes;
- Additions to, decreases in, and fluxes into wetland habitats are the most likely factors that will control the rate of methyl mercury production in the watershed;
- All ongoing inputs of mercury have the potential to be converted into methyl mercury, but dissolved and colloidal forms typically discharged from treatment systems are far more bioavailable than mineral forms;
- Both historic and ongoing inputs affect the net stock of methyl mercury in the system;
- Ideally, ongoing inputs should be less than natural removal of mercury to deep sediments, nonerosive wetlands, and to the ocean (i.e. inflow is less than outflow).

In addition to the environmental criteria outlined above, the internal task force also recommended a number of social criteria that proposed regulatory policies should also meet. These social criteria are:

- A regional regulatory policy for mercury should be structured so as to bring the Bay system into compliance with the narrative water quality objectives or the antidegradation policy while also taking into account historical loadings to the system;
- Regulatory requirements should emphasize the largest, ongoing sources of mercury to the Bay system;
- Regulatory requirements should implement the general requirement in Porter Cologne to “control controllable sources” and the Basin Plan provision on p. 3-1 in a consistent manner within and between all pollutant control programs (i.e., POTW source control, nonpoint source BMPs, direct discharger treatment requirements, and “hot spot” cleanup);
- Use of dilution credits for bioaccumulative substances should be fair and consistent;

- Water quality based effluent limits for mercury should be designed to hold all parties to an equal level of responsibility;
- Solutions must fit into the constraints and direction of all relevant laws and regulation;
- Effluent limits and permit conditions must reflect the fact that water column toxicity **is not** an environmental concern and that downstream bioaccumulation is an environmental concern.

An ideal regulatory approach for mercury in the Bay system would fully meet all of the solution criteria.

We have reviewed a number of different administrative approaches and, for some, developed a full range of proposed policy and regulatory program elements for public review and Board consideration. The administrative approaches considered were:

- Develop a site-specific objective for mercury that better reflect local conditions and environmental risks;
- Outline an acceptable approach by which point source dischargers could determine and apply for alternate limits;
- Develop a full-fledged Total Maximum Daily Load (TMDL) for mercury for the Sacramento River-San Francisco Bay watershed; and
- Develop a pilot mass-based permit offset system to direct regulatory attention towards the most cost-effective loading reduction measures.

For a variety of reasons, staff chose the last two approaches, namely development of a watershed-based regional policy and regulatory approach equivalent to a phased TMDL and an offset system. The proposed elements of this policy and set of implementation provisions are designed as amendments to the Basin Plan.

### ***G. Proposed Regulatory Policy and Program for Mercury in the San Francisco Bay Region***

The proposed elements of this new regional policy and regulatory program were designed using the solution criteria presented above and based on the findings of this study. Specifically, they are designed to ensure that ongoing, controllable mercury loading to the Bay system is low enough to allow the natural cleanup processes to slowly remove mercury from the biological system. The elements are also designed to ensure that this goal is achieved in a fair manner and to facilitate the implementation of the most cost-effective measures first. To do this, staff are proposing the following changes to the current Basin Plan (indicated by redline/strikeout):

#### **Chapter 3:**

under *Objectives for Specific Chemical Constituents*, p. 3-5:

The Regional 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 Regional Board shall be developed in accordance with the

provisions of the federal Clean Water Act, the State Water Code, State 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 US EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. Copper, ~~mercury~~, PCBs, and selenium will be the highest priorities in this effort.

[this change indicates that a watershed-based policy and regulatory program will be used instead of a site-specific objective process]

under *Table 3-3 Water Quality Objectives for Toxic Pollutants for Surface Waters With Salinities Greater than 5 ppt*, p. 3-9, add the following footnote to "Mercury":

Extensive monitoring of San Francisco Bay embayments indicates that total mercury concentrations in the saline waters within the Region are highly dependent on suspended sediment concentrations and the factors that control them such as wind, tide, and Delta outflows. The Board will implement this objective for mercury using a watershed-based policy and regulatory program (described in Chapter 4) that takes sediment fluxes and other local factors into account.

under *Table 3-4 Water Quality Objectives for Toxic Pollutants for Surface Waters With Salinities Less Than 5 ppt*, p. 3-9, make the following changes to footnote "I":

The US EPA water quality criterion for mercury which was the basis for the objective in this table, was 0.012 µg/L. At the time this objective was adopted, 0.012 µg/L was below the level of detection. The Board elected to set the numeric objective at the level of detection (0.025 µg/L) at that time, noting that 0.012 µg/L was desirable. Since that time, ultra-clean sampling techniques have considerably lowered the level of detection. Extensive monitoring of San Francisco Bay embayments indicates that total mercury concentrations in the freshwater within the Region are highly dependent on suspended sediment concentrations and the factors that control them such as wind, tides, rainfall, and streamflow. The Board will implement this objective for mercury using a watershed-based policy and regulatory program (described in Chapter 4) that takes sediment fluxes and other local factors into account.

~~The US EPA Water Quality Criterion for mercury is 0.012 µg/L, which is below the level of detection of 0.025 µg/L. An objective of 0.012 µg/L is desirable, but attainment can only be determined at the level of detection.~~

[these changes indicate that the underlying water quality standard will not change (i.e. acceptable fish tissue concentration levels), that the established numeric objective is not necessarily the best indicator of whether the standard is being met, and that implementation of the standard will require a unique set of measures]

Insert a new section following “*Toxic Pollutant Accumulation: Mass-Based Strategies*” on p. 4-2 and before “*Scientific Research: Ongoing Refinement of Programs*” on p. 4-3:

### **Watershed-Based Policy and Regulatory Program for Mercury in the Central and Northern Reaches of the San Francisco Bay Estuary**

The Regional Board will implement the numeric objectives for mercury and the narrative objectives in this Plan by regulating ongoing mercury discharges to Richardson Bay, Central San Francisco Bay, San Pablo, Carquinez Strait, Suisun Bay, and the western segment of the Sacramento-San Joaquin Delta on a watershed, mass loading basis. The objective of this strategy is to reduce mercury loading to a level below the rate at which mercury flows out of the biologically active zones of the Bay system (i.e., all parts except the deep sediment layer). Because of the large sink of historic mercury deposits, it is anticipated that the rate of natural cleanup will take on the order of decades. The goal of the regulatory program is to ensure that natural cleanup will occur, and at the fastest practicable rate. As this process takes place, staff anticipate a gradual decline in fish tissue concentrations. These tissue concentrations should be monitored on a periodic basis to provide feedback on how mercury levels change in the system over time.

The Board will implement this policy by identifying and implementing mercury control measures in the order of cost-effectiveness. Specific categories of control measures that have been identified as the most cost effective means of reducing ongoing loadings are: mercury mine site remediation, gravity traps and drain maintenance in facilities where mercury is commonly used, and product substitution in cases where mercury is an impurity or waste and comprises a significant fraction of inflows to treatment plants. In addition, mercury-specific effluent limits for point sources that will implement this policy, as well as designed to facilitate implementation of cost-effective control measures are described in the section on Effluent Limitations later in this chapter.

In addition to these policy-oriented amendments, we have also developed a number of specific implementation proposals to ensure that permitting practices fully implement the proposed policy. These proposed changes are outlined below. Specific Basin Plan language for different permitting options will be developed following the first round of public review and comment on this watershed analysis.

#### **1. General Permit Conditions**

All waste discharge permits that include monitoring provisions for mercury should also require that this monitoring be conducted using ultra-clean sampling and analysis techniques. Much of the data on loadings from large dischargers and stormwater programs indicate extremely high mercury loadings because of poor detection limits.

#### **2. Mass-Based Effluent Limits for Sewage Treatment Plant Discharges**

To fully implement a watershed-based program, including an offset option, mass loading limits based on long-term, average loading (rather than instantaneous concentrations) should be used in

discharge permits. Derivation of allowable mass loads is based on the overall mercury budget for the Bay and the review of potential control measures described above. The options and associated allowable loads for each class of discharger are presented below in Table 2. Staff also recommend that concentration limits be maintained in permits at levels that would protect against chronic *toxicity* in the immediate receiving water. As a result, there would be two permit limits, one to protect against near-field water column toxicity and a second aimed at protecting against long-term bioaccumulative effects downstream in the Bay where sediment is deposited and mercury methylation takes place.

We are proposing three options for setting effluent limits for mercury in NPDES discharges located north of the Bay Bridge. Each is expressed in terms of an annual average daily mass loading, but differ in allowed dilution credits and assumptions about the effectiveness of *new* pollution prevention measures and more accurate sampling analyses.

Under option 1 (Table 2), shallow water effluents would be adjusted to better reflect the overall contribution of these sources to ongoing mass loadings and staff's estimate that 0.02 µg/L is achievable with reasonable pollution prevention investments and use of more accurate analytical techniques. In addition, deep water dischargers would be held to slightly more stringent limits. Under option 2, shallow water dischargers would have the limits as under option 1, but deep water dischargers would be required to meet limits that are about 10 times more stringent as they do now. This option is based on the fact that the primary concern about mercury is mass-based, and the solution criteria that sets a requirement for consistency between classes of dischargers. Option 3 includes the same basis as option 2, but reflects a slightly different assumption about attainability of load reductions.

### **3. Mass-Based Effluent Limits for Industrial Discharges**

Staff are also proposing to add mass-based effluent limits for industrial dischargers, using the same calculation methods and options for dilution credits defined above. However, because self-monitoring data submitted by industrial dischargers are not based on ultra-clean analytical techniques, it is impossible to derive a meaningful assessment about current actual loading and whether the mass limits proposed for POTWs are achievable.

We are requesting public comment on options for setting mass limits for industrial dischargers, for substantiated information on achievability of different mass loading levels, and for summaries of pollution prevention audits and measures that have already been taken specific to mercury.

### **4. Mass-Based Permit Offset System for POTW and Industrial Discharges**

Staff recommend that a pilot offset program be launched as part of the proposed regulatory program with the components outlined below. The purpose of a mass-based offset system is to allow permittees the flexibility to implement the most cost-effective control measures in a watershed, rather than forcing point source discharges to install extremely expensive equipment when much larger ongoing sources have yet to be controlled. A pilot, rather than permanent program, is necessary to further develop the necessary administrative tools to ensure long-term success.



	Option 1	Option 2	Option 3	No Change
<b>Assumptions</b>	<ul style="list-style-type: none"> <li>Maintain 10:1 dilution/mixing zone policy</li> <li>Apply policy to mass limits</li> <li>Average effluent concentration of 0.02 µg/L is achievable<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>Set mass loading policy as equal limits regardless of mixing zone</li> <li>Average effluent concentration of 0.02 µg/L is achievable<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>Set mass loading policy as equal limits regardless of mixing zone</li> <li>Average effluent concentration of 0.05 µg/L is achievable<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>Maintain 10:1 dilution/mixing zone policy</li> <li>Effluent limits set in terms of concentration as per equation in Basin Plan;<sup>2</sup></li> </ul>
<b>Loads</b>				
<b>Shallow Water</b>				
<b>Dischargers</b>				
current load <sup>3</sup>	9.43	9.43	9.43	9.43
allowed load <sup>3</sup>	2.78	2.78	6.96	1.67
difference	+6.14 <sup>4</sup>	+6.14	+3.83	+7.06
<b>Deep Water</b>				
<b>Dischargers</b>				
current load <sup>3</sup>	28.54	28.54	28.54	28.54
allowed load <sup>3</sup>	65.8	7.28	18.2	70.25
difference	-37.26 <sup>4</sup>	-21.26	-10.34	-41.70
<b>Total Allowed Load<sup>3</sup></b>	68.58	10.06	25.16	71.92
<b>Change in Total Allowed Load<sup>3</sup></b>	-3.34	-61.86	-46.76	0

Notes:

<sup>1</sup> Achievable was determined based on past performance, pollution prevention reductions, and improved quantification of mercury at a number of POTWs within the Region. This represents a long-term average concentrations, not instantaneous maximums.

<sup>2</sup> The current allowable loads were calculated assuming effluent limits for shallow water dischargers of 0.012 µg/L (all are freshwater) and for deep water dischargers of 0.214 µg/L with 10:1 dilution credits (except for DDSD—a deep water discharger to freshwater assumed to have limits of 0.048 µg/L).

<sup>3</sup> Load values are annual average grams per day.

<sup>4</sup> Positive differences reflect loads above allowable levels; negative differences reflect compliance.

Table 2. Proposed Effluent Limits for POTWs

Staff recommend the following components of a mercury mass offset pilot program:

- The pilot program should be in effect for 7 years (to allow for a significant fraction of NPDES permit terms);
- The goals of the pilot program are to:
  - define legally binding remediation contracts for each specific project containing the offset program member's or members' financial commitments (more than one program participant may contribute towards remediation of the same site); specific remediation tasks to be completed at the site and subsequent monitoring efforts; and obligations and responsibilities of all private and governmental parties necessary to ensure the adequate completion of remediation and monitoring tasks;
  - determine whether a permanent offset system will successfully control ongoing inputs of mercury to the watershed;
  - and reduce overall mercury loadings during the term of the pilot program.
- The top priority for remediation projects funded through an offset program are those sites where cleanup is, for all practical purposes, a public responsibility. Sites where responsible parties exist who are able to undertake remediation are of a lower priority;
- It is desirable that site characterization and remediation plans be developed before a site is eligible for inclusion in the pilot program. However, because the cost of these plans is a legitimate part of control of ongoing sources, the pilot program may undertake to conduct this work if no appropriate sites are ready for remediation;
- Language will be added to the permits of entities participating in the pilot program to the effect that: "Effective annual average mass loadings must be less than or equal to the annual mass limits specified in this permit. The effective annual average mass loadings equal actual mass loadings less any mass credits purchased through the pilot offset credit program."
- Permit offset ratios for the pilot program are 1 unit in effluent : 3 units as projected by site characterization and remediation plans;
- The Executive Officer would approve mass credits for each participant. The mass credits would specify the total amount of mercury load considered removed from ongoing inputs to the watershed, and the number of years that load reduction would be spread across mass loading requirements in NPDES permits. For example, Discharger A applies to remediate 1 kg of mercury by diverting water around a tailings pile at an abandoned mine site and requests that the 1 kg be applied as 200 g credits in each year of the five-year NPDES permit. After review of the proposed remediation and legal agreements, the Executive Officer could approve this offset. Should the remediation not be completed as specified in tasks outlined in remediation plans, the Board can initiate enforcement proceedings against the party responsible for carrying out the remediation.

We are seeking comments on the proposed pilot offset program and the basic operating principles outlined above. It should be emphasized that the proposal is for the design and testing of a **pilot** program, and not a final system.

### **5. Permit Conditions for Stormwater Sources**

The findings of this analysis indicate that the predominant ongoing source of mercury to stormwater is likely to be atmospheric deposition. The permit conditions appropriate for stormwater dischargers are (a) improved loadings characterization using low detection limits and ultra-clean sampling techniques better characterize loadings and test this working hypothesis, (b) identification of conditions where stormwater flows of mercury may be contributing to the overall flux of mercury into methylating subenvironments, (c) if conditions are identified under (b), identification and implementation of BMPs to minimize methylation.

### **6. Net Mercury Methylation Rates—Human Influences and Research Priorities**

The policy and regulatory program measures outlined above all address overall mercury loadings to the Bay system. Net bioaccumulation, however, also depends on the rate at which stocks of mercury in the Bay are transformed into methyl mercury by bacteria. These processes and the pathways by which particle-bound mercury move into methylating subenvironments are not well-understood.

Based on this watershed analysis, staff believe that the highest research priorities for mercury are the following:

- characterization of the **links** between physical sediment transport processes in the Bay, the overall movement and biogeochemistry of mercury between the main embayments and subenvironments where methylation occurs;
- net methylation rates in these subenvironments;
- food chain bioaccumulation models linked to net methyl mercury production in these subenvironments; and
- identification of human actions that may significantly influence the net transfer of mercury into methylating environments and net methylation rates.

Until information from research outlined above is available, we recommend a basic policy addition to the Basin Plan in a new section on mercury in Chapter 4:

Classes of activities which have been shown to significantly increase the net rate of mercury methylation will be reviewed by the Regional Board under its authority to regulate impacts on aquatic beneficial uses. Whenever possible, these activities should be limited or conducted in a way that will minimize increases in net methyl mercury production.

## **7. Additional Measures**

All of the measures described above are focused on regulatory provisions for discharges to surface water within the San Francisco Bay Region. The nature of the mercury problem, however, is somewhat broader. For example, mercury loading is a significant problem in the Delta and Sacramento watershed, both of which are under the Central Valley Regional Board's jurisdiction. To address these broader issues, staff will draft proposed Board resolutions requesting:

- That the Office of Environmental Health Hazard Assessment conduct (or publish existing) reviews of mercury consumption rates and doses to consumers of Bay fish, specifically comparing mercury levels in Bay fish to levels in fish from other areas, identifying the subpopulation at the greatest risk due to consumption of local fish, and development of a risk communication strategy to mitigate the risk posed to the identified subpopulation;
- Coordination with the Central Valley Regional Board to identify and remediate abandoned mercury mines in the Sacramento River watershed, make the proposed pilot program available to discharges in the Central Valley Region, and to discuss consistency between regulatory programs; and
- Coordination with the Bay Area Air Quality Management District regarding local, stationary sources of atmospheric mercury and water quality impacts associated with those sources.

## **8. Intermediate-Term Measures**

The elements of the proposed watershed-based mercury program include a list of immediate actions and long-term goals. It is also appropriate to identify intermediate-term research needs and analyses that will serve as an ongoing check on the overall program. They are as follows:

- Test numeric targets for mercury concentrations in fish tissue, suspended sediment particles, and dissolved water column levels against local technical data to determine if these targets would serve as appropriate indicators of system-wide changes;
- Encourage research on understanding net methylation rates;
- Encourage research on understanding of system inflows, outflows, and methylation potential; and
- Track changes in fish tissue concentrations at expected rate of change.

When this technical information becomes available, the mercury budget model, permitted mass loads, and pilot offset program goals, and the existing water quality objectives can be revisited and, if appropriate, revised in light of the new information.

## **H. TMDL Summary**

Together, the proposed regional policy and program elements comprise a TMDL for mercury as defined under the Clean Water Act and in federal regulations. Under federal law, a TMDL is required for specific water bodies when they fail to meet water quality standards and local control programs are not sufficient to bring the water body into compliance. Because numeric and

narrative objectives for mercury are being exceeded, the Regional Board is obliged to develop a regulatory strategy that will ultimately result in compliance. The following is a summary of how the program elements correspond to TMDL elements.

### **Problem Statement**

The problem statement consists of sections I.A.1-2, “Environmental Conditions and Concerns” in the Executive Summary.

### **Numerical and Qualitative Targets**

A numerical target that will represent water quality when a specific water body is in compliance with standards is required as part of a TMDL. Because of the problems associated with the use of water column concentrations as indicators of mercury-related impairment (both dissolved and total) discussed in detail in section II.2, we are defining the numerical target at 1.0 ppm wet weight in shark. This numerical target has been previously established as part of the existing Basin Plan water quality objectives for fresh and salt water. Meeting the target thus automatically ensures meeting the standard.

Two additional targets will be established if these proposed policies are adopted that will, over time, cause the first target to be met. Neither one, however, can be quantified at this time. The first qualitative target is for the rate of ongoing inputs of mercury to be controlled to a point where they are less than the rate of outflow of mercury from the biologically active part of the Bay system (see section IV). The second qualitative target is for a general avoidance of human activities that significantly contribute to the net methylation of mercury already in the Bay system (section VII.C.h). A precise definition of classes of activities and the effects these activities have on mercury methylation will require a significant amount of original research and at least five years to carry it out. However, the proposed amendments contain a policy for avoidance, minimization, and mitigation of classes of activities when this information becomes available. Thus, the regulatory direction can be established now.

We anticipate that it will take several decades for the historical sink of mercury in the Bay to be buried in deep sediments or flushed out and for fish tissue levels to change. During that period of time, the numerical target of mercury levels in fish tissue defined above may change based on a revision of health effects thresholds or through a more complete and thorough analysis of global fish tissue concentrations. If the current local water quality objective is changed in the future through a standard setting process, the success and appropriateness of this TMDL will be reevaluated using the new standard.

### **Sources Causing Impairment**

A thorough assessment of existing stocks and ongoing loadings of mercury to the Bay system is presented in sections II.B. The mechanisms by which these sources of mercury contribute to the defined bioaccumulation problem are described in detail in section III. The general conclusion of these technical reviews is that *all* contributions to the total stock of mercury in the Bay are linked to the observed bioaccumulation problem. The link between the stock of inorganic mercury and the process and rate of methylation that converts that inorganic stock can not be modeled at this

time. Because the total stock of mercury in the Bay is a controlling factor for net methylation, it is appropriate to regulate the inputs of all chemical forms of mercury entering the watershed to achieve the long-term goal.

The largest sources of mercury to the Bay aquatic system are sediments contaminated by historic mining. These sediments include material flushed down local and Sacramento River watersheds during the Gold Rush, and material contaminated in the past by mining that still flows into the Bay with riverine inputs. Gold Rush-era sediments re-enter the biologically active zone of San Francisco Bay through wind, flow, and tide-driven forces. These mixing processes can not be controlled, nor can the diffuse, buried mercury-enriched layer of sediment be removed. Of the ongoing inflows of sediment contaminated during the mining area, only inputs from concentrated mining areas still draining into the watershed are controllable. Attempts to remove diffuse layers from riverine and riparian areas would cause extensive habitat damage, require a significant number of new landfills, and consume large amounts of energy.

A number of sources of mercury make up the remainder of the ongoing inputs to the Bay system. Combined, these remaining inputs are at least one order of magnitude lower than the major sources described above.

By far the largest of these secondary sources is atmospheric deposition (this accounting includes estimated loads from urban runoff). Virtually all of the mercury deposited via atmospheric processes in the Bay area is due to global fuel consumption superimposed on preindustrial background levels of mercury. A small fraction of this load is associated with local fuel consumption and incineration.

The remaining secondary sources are inputs from regulated treatment plants. This report contains an extensive review of mercury inputs to these treatment plants (section VI). The uncontrollable inputs to treatment plants include intake water,<sup>3</sup> and human waste. The controllable inputs from these sources include:

- Product substitution/ manufacturing changes for common consumer products (such as reducing trace levels of mercury in laundry bleach and home use thermometers);
- Improved material handling and waste minimization at facilities and locations where mercury is used in a raw material (such as installation of gravity traps in dental offices, proper drain maintenance in hospitals, and collection of metallic mercury still used in small-scale gold mining); and
- Removal of mercury seals in trickling filters used in treatment plants

### **History of Control Measures Already Taken and Currently Underway**

It is important to note that the Regional Board has instituted a number of control requirements before preparing this TMDL. In addition, local agencies have also initiated changes in treatment

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<sup>3</sup> Even high quality water from San Francisco's Hetch Hetchy system contributes up to 1/3 of the inputs to treatment plants.

plant operation and facilities, and actions within their pollution control programs. In general, the controls have already successfully reduced the amount of ongoing inputs of mercury to the Bay system. If adopted, this TMDL will refine, not initiate, a series of regulatory controls.

A thorough review of the current status of actions that have been taken to control mercury inputs is described in detail in section V. Many of the local districts have already implemented the pollution prevention measures outlined above; all trickling filter seals have been removed. At some facilities, detailed mercury mass balances have been conducted using ultra clean sampling and analytical techniques. In summary, there is a need for a consistent level of effort amongst all pollution prevention programs, but the conclusion of this review is that the maximum amount of total load reductions from treatment plants in the Region is less than 25% of current loads—with smaller reductions possible for systems that have already implemented strict pollution control measures.

In addition, mine remediation activities have already been initiated at most of the mines in the Region (see Appendix A). Accelerated cleanup at the New Almaden Superfund site in the South Bay, and work at some of the smaller mines would serve to reduce ongoing inputs.

### **Load and Wasteload Allocation Methodology**

The Clean Water Act requires that TMDLs contain load allocations for all point source discharges and wasteload allocations for all nonpoint source dischargers. These allocations effectively assign responsibility for remediating the water quality problem. Because of the large contribution of historic practices to the current water quality problem, and because complex sediment dynamic processes govern how much mercury is in the Bay's biologically active zone at any one time, staff have concluded that the most appropriate method for allocating loads is to focus on allocating the responsibility for load *reductions* among classes of controllable, ongoing inputs.

This approach effectively defines the following wasteload allocations:

- Natural background – wasteload allocation set at current levels
- Historic deposit of mercury contaminated sediments – wasteload allocation set at current levels
- Atmospheric deposition – wasteload allocation set at current levels minus very small amount of potential decrease associated with installation of scrubbers on local sewage sludge incinerators (currently under way)
- Local stream inputs (with San Francisco Bay Region) – wasteload allocation set at current levels minus the decrease that will occur as the remaining small upstream mines are remediated
- Sacramento River watershed – wasteload allocation set at current levels *minus*
  - Inputs from ongoing gold mining activities
  - Inputs from mining sites where mercury exists in a concentrated source and effective remediation is practicable
  - Downstream transport of mercury from identified hot spots in the river system

Proposed load allocations based on the review of sources are presented in section VII.C.2. These effectively quantify allowable loads at levels that are achievable with strict pollution prevention programs. Because stormwater loading studies did not use ultraclean sampling techniques, a quantitative allocation of loads from these sources is not possible at this time. However, existing stormwater BMP requirements, combined with the proposed policy for regulating actions that contribute to methylation rates will effectively impose the same pollution prevention requirements on stormwater discharges as are being proposed for treatment plant discharges.

### **Performance Measures and Feedback**

A program is already in place to conduct ongoing monitoring of the Bay environment for the purposes of gauging the effectiveness of regulatory actions and tracking long-term trends of trace substances in the San Francisco Bay Estuary—the Regional Monitoring Program. This program (or comparable study) is specified as a permit requirement for all NPDES permit holders.

The Regional Monitoring Program began the process of monitoring fish tissue for mercury and a number of other pollutants in 1993. Currently, a periodic sampling of a broad array of fish, including those typically caught by local fisherpeople, is being designed and field tested. We expect that fish tissue monitoring will be conducted once every three years for the purpose of tracking long-term trends.

Analysis of the RMP data and review of the regulatory approaches is already established as a regular task. The Regional Board reviews new data and its regulatory approaches through the Triennial Review/ Continuing Planning process. If adopted, this TMDL will be no exception.



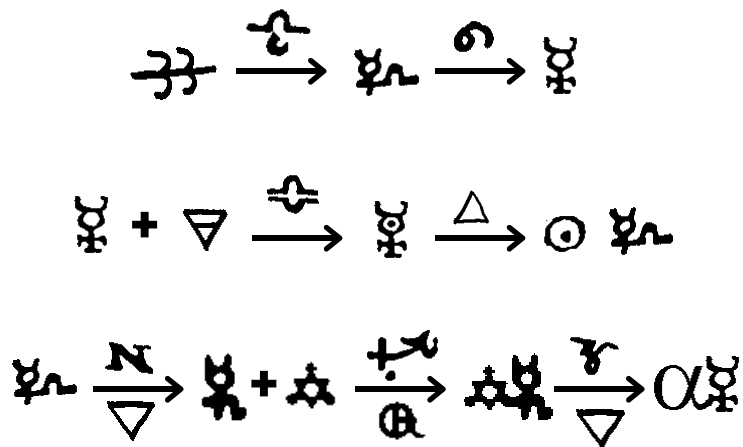
# Managing Inactive Mercury Mine Sites in the San Francisco Bay Region

Status report on implementation of the Basin Plan Mines Program

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## ***1. Introduction***

This report has been prepared in support of the development and adoption of a total maximum daily load (TMDL) for mercury in San Francisco Bay. California produced significant amounts of mercury from coast range mines during and after the gold rush. Many of these mine sites are located within the San Francisco Bay Region, including the New Almaden Mercury mine, which was at one time the largest producer of mercury in North America. Production at these sites ranged from a few hundred kilograms to more than 35 million kilograms of mercury produced at the New Almaden mines.

While mercury is no longer actively mined in the Bay Area, waste produced from these mining operations persists at the some of the sites, potentially affecting downstream water quality. The objectives of this report are to:

- 1) Summarize known mine sites, including their current status with respect to compliance with the existing Mines Program in the Basin Plan;
- 2) Describe an approach to assessing and managing impacts from known mine sites; and
- 3) Summarize options for remediating mine sites found to be significant sources.

## ***2. The Basin Plan Mines Program***

### **2.1 Framework**

The San Francisco Bay Region's Water Quality Control Plan (the Basin Plan) contains a section in the Implementation Plan describing the Regional Board's program for managing active an inactive mining operations (pages 4-47 – 4-49). The goal of the Mines Program is to "restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities."

Inactive sites are managed by identifying Best Management Practices necessary to protect water quality. The U.S. Natural Resource Conservation Service (NRCS) has developed a Resource Management System for Surface Mined Areas which references practices and treatment systems that address the following elements:

- 1) Erosion Control Practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind and water to within acceptable limits;
- 2) Maintenance of adequate water quality and quantity for planned uses and to meet

- federal, state and local requirements;
- 3) Pollution control to meet federal, state, and local regulations; and
- 4) A system of planned access and / or conveyance that is within local regulations and meets the needs for the intended use.

Best management practices (BMPs) at inactive mine sites include diverting stormwater runoff around contaminated areas, re-grading, capping, and re-vegetating exposed soil with elevated mercury concentrations, and other measures necessary to reduce erosive discharge of mercury. Implementation of these practices has resulted in substantial water quality improvements at inactive mercury mine sites such as the Gambonini Mine in Marin County and the New Almaden mine sites in Santa Clara County.

In 1980 the Regional Board negotiated a memorandum of understanding with the Council of Bay Area Resource Conservation Districts. The goal of this MOU was to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems. It was agreed that local units of government should have the lead role in controlling land use activities that cause erosion.

The current framework of the Mines Program is that the Regional Board determines what information is needed to assess the potential for water quality impacts from inactive mine sites. Board staff work cooperatively with landowners, resource conservation districts, and local government agencies to gather the needed information and use it to guide the implementation of best management practices by the landowner or responsible party. In situations where cooperative approaches are not sufficient to protect water quality, the Regional Board has the authority to compel monitoring and BMP implementation through cleanup and abatement orders, waste discharge requirements, conditional waivers of waste discharge requirements, or national pollutant discharge elimination system permits.

## **2.2 Implementation**

Implementation of the Basin Plan mines program for mercury starts with identifying sites where mercury was mined. Then sites should be inspected to assess the potential for water quality impacts and identify any needed BMP's. The Mines Program calls for landowners or responsible parties to develop and implement a Site Closure Plan to address site restoration and long term maintenance and monitoring, and a Site Management Plan to address stormwater runoff and erosion control BMPs.

Substantial progress has been in implementing the mines program. In 1995 the Basin Plan was amended to include a map and table showing the locations of all known mines and mineral production areas (Figure 4-5 and Table 4-16 of the Basin Plan). The locations and site histories of Bay Area mercury mines are shown in Table 1. In 1998 a report was prepared by Regional Board staff summarizing the results of site inspections for mine sites, including mercury mines (Seward, 1998). Based on that report, the condition and management of mercury mines in the Bay Area are summarized in Table 2.

## 2.3 Next Steps

The “site management tracking” section of Table 2 helps identify next steps in the implementation of the Basin Plan Mines Program. At a minimum, all sites should be completed through steps A – F (the shaded area in Table 2). The process of inspecting sites, identifying and contacting owners, notifying local agencies, and conducting load and risk assessments can very likely be completed through non-regulatory mechanisms. For some sites, it may be necessary for the Regional Board to use its regulatory authority to identify previous owners and operators, issue permits and orders, compel or initiate site cleanup, and conduct follow up monitoring (Steps G – J, unshaded area in Table 2). Possible next steps and priorities for known mine sites in the Bay Area are summarized in Table 3. Mine sites can be tentatively divided into four categories according to priority: low, medium, high, and highest priority. The priorities may change as new information is discovered.

### 2.3.1 Low priority sites

Sites are assigned a low priority if there are no obvious discharges, there is low connectivity to the Bay, and there is no immediate threat to fisheries resources in downstream reservoirs, embayments, or other sensitive habitat areas within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board.

The Silverado Mine in Napa County was inspected in 1997. Moderately elevated mercury concentrations were found in soils and sediments (2-5 ppm), and the mercury concentrations in the lower mine drainage (1.5 µg/L) exceed the statewide numeric objective (0.050 µg/L) by a factor of 30. Mercury loads from this mine are discharged into St. Helena Creek, which flows into the Lake Berryessa Watershed in the Central Valley Region. While the Central Valley Regional Water Quality Control Board will need to consider impacts of this mine on the beneficial uses of St. Helena Creek and downstream waterbodies, this mine is assigned a low priority for the San Francisco Bay mercury TMDL because of its low connectivity to the Bay.

The Chilleno Valley mine site in Marin County was inspected in 1991 and determined to be adequately managed. There was no evidence of tailings or excessive erosion, and so the only action taken was to work cooperatively with the property owners and the local Resource Conservation District to assure long term stability with respect to erosion. Essentially all of the necessary boxes have been checked for this site. For the future, Chilleno Creek may be considered for inclusion as a watershed assessment site through monitoring conducted by Marin County Stormwater Pollution Prevention Program (STOPPP) to verify that no additional BMPs are needed to protect downstream water quality.

According to a 1997 survey, the Challenge Mine site in San Mateo County has no visible impacts to land or waters – in fact, the mine itself cannot be found. Sediments from a drainage adjacent to the mine area have 10 ppm mercury, which probably explains why

the water in that drainage exceeds the statewide numeric objective for mercury (0.050 µg/L) by a factor of 25 (1.2 µg/L). This area likely represents a common situation in coast range drainages, where cinnabar formations, both natural and disturbed, result in elevated mercury concentrations in soils and sediments. The most appropriate action for this location is to include the drainage (Arroyo Ojo De Agua Creek) in watershed assessments conducted by San Mateo County STOPPP in order to determine whether additional BMPs are necessary to protect downstream water quality. Because a children's play area is located in the vicinity, it may also be prudent to prepare a risk communication project, to help local users understand the difference between the risk of mercury exposure through the food chain vs. the relatively low risk posed by direct exposure to naturally occurring mineral formations.

The Silver Creek Mine in Santa Clara County is another area where there is no visual evidence of mine tailings or waste discharging to waters of the State, and low to moderate (2 ppm) concentrations of mercury in sediments near the mine area, according to a 1997 inspection. Silver Creek can be included in watershed assessments conducted by the Santa Clara County Urban Runoff Pollution Prevention Program (the SCVURPPP) to determine if BMPs are needed to protect downstream water quality.

In summary, for the low priority sites, the only actions likely to be necessary to fully implement the Basin Plan Mines Program are:

- 1) Identify property owners;
- 2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
- 3) Include the downstream drainage as part of a rotating watershed assessment within the next ten to twenty years.

### **2.3.2 Medium Priority Sites**

Medium priority sites, like low priority sites, are those which have relatively low connectivity to the Bay, and lack visible evidence of mine waste discharging into state waters. Factors that elevate sites from low to medium include the presence of fishable reservoirs downstream that may be impacted by mercury, or lack of sufficient inspection and monitoring data to downgrade to a low priority site.

The Franciscan Mine and the Cycle Mine in Marin County are in the drainage basin of Soulajule Reservoir. Inspection of the Franciscan mine site in 1997 revealed no identifiable discharges to state waters. The Cycle mine site is presumed to be submerged by Soulajule Reservoir. Because Soulajule Reservoir is fished for crappie and large mouth bass, an assessment of mercury levels in fish and a study of local consumption patterns from this reservoir are the most appropriate actions. This should be coordinated through the Marin County Water District, which owns the reservoir.

The Hastings Mine in Solano County was inspected in 1997. Erosion from the mine area was characterized as minor. Similar to other smaller mine sites, sediments from the

drainage below the mine were found to have 10 ppm mercury, and spring water below the mine area was found to have 0.31 µg/L mercury, exceeding the statewide numeric objective for mercury by approximately six-fold. Drainage from the mine site flows into Lake Herman, which is listed as impaired due to mercury because of elevated mercury levels found in fish. Therefore, the most appropriate action is to work cooperatively with the City of Benecia, which owns Lake Herman, to conduct appropriate risk communication efforts, and to evaluate alternatives for managing the lake and its watershed which can help reduce mercury levels in fish. The current landowner of the Hastings mine site should be identified and contacted as well, and a follow-up visit should be conducted to determine whether additional BMPs are needed at this site.

The St. Johns Mine in Solano County produced considerable amounts of mercury – about 20,000 flasks. Although large hillside scarring and tailings piles greater than 10,000 cubic yards distinguish the site, a 1997 inspection reported that erosive discharges of mine tailings appear to be minimal. The drainage from the site flows through Rindler Creek into Chabot Lake, which is owned by the City of Vallejo. Chabot Lake is used for recreational fishing. Therefore, the most appropriate action is to assess mercury levels in fish from Chabot Lake, and coordinate risk assessment and communication with the City of Vallejo. Like Lake Herman, if mercury levels in fish from Chabot Lake are determined to be a problem, alternatives for managing the lake and its watershed should be developed. The property owner of the St. John's mine site should be identified and contacted, and the downstream drainage should be included in future watershed assessments conducted by the Vallejo Sanitation and Flood Control District to determine if additional BMPs at this site are needed.

The Corda Mine site in Marin County was inspected from an airplane reconnaissance in 1997, when a possible surface excavation was identified near the reported mine coordinates. Access to the site was impeded by private property restrictions, so an inspection on the ground has not been conducted. Therefore, the most appropriate next step is to identify and contact the property owner, conduct an inspection, and include the downstream drainage in watershed assessments conducted by Marin County STOPPP.

In summary, the following steps are likely necessary for most medium priority sites:

- 1) Identify property owners;
- 2) Communicate findings and recommendations to property owners, local RCD, and local stormwater management agency as appropriate;
- 3) Conduct targeted risk assessment and risk communication, in coordination with appropriate local agency;
- 4) Conduct targeted monitoring; and
- 5) Consider special studies to evaluate mercury cycling and bioaccumulation.

### **2.3.3 High Priority Sites**

Mine sites are assigned a high priority because of documented discharges into waters of

the State, high connectivity to the Bay, or obvious threats to downstream habitat.

The Mount Diablo Mercury mine is located in Contra Costa County, in the Marsh Creek drainage. Although the mine and its drainage are located within the Central Valley Regional Water Quality Control Board's jurisdiction, it is included in this report because Marsh Creek discharges into the San Joaquin River just upstream of the jurisdictional boundary of the San Francisco Bay Region, and because the Contra Costa Countywide Clean Water Program is regulated by both the San Francisco Bay and Central Valley Regional Water Quality Control Boards.

The magnitude of mining waste, discharges into Marsh Creek, and impacts to sediments and biota have been well documented (Slotton et al., 1996). Concerns over mercury discharges from Marsh Creek have delayed implementation of planned wetland habitat restoration projects downstream at Big Break, on the San Joaquin River. An important next step is to coordinate with the Central Valley Regional Water Quality Control Board to determine when staff will be assigned to initiate actions necessary to eliminate the discharge of mercury pollution into waters of the State.

The La Joya Mine in Napa County was observed in 1997 to have steeply cut tailings in contact with surface water. Because of the high potential to discharge mining waste into State waters, and because of the relatively high connectivity to the Bay through the Napa River, this is considered to be a high priority site. The next steps are to identify and contact the current property owner, and coordinate with the Napa County RCD to develop and implement a Site Management Plan. Depending on the level of cooperation attained, regulatory action by the Regional Board may or may not be needed to initiate monitoring and remediation.

The Bella Oaks and Borges mine sites in Napa County were inspected in 1997. There was no visible evidence of potential discharge to state waters at either location. However, because of the high connectivity to the Bay, follow-up monitoring and loads assessment should be conducted to determine whether either site represents a significant controllable source of mercury to the Bay. The Borges Mine drains into American Canyon Creek, and so monitoring and loads assessment could be coordinated with the City of American Canyon STOPPP. The Bella Oaks mine is located on private property in unincorporated Napa County, so monitoring and loads assessment may need to be conducted as a special project of the CEP, a proposition 13 proposal, a 319-grant project, or through some other funding mechanism.

#### **2.3.4 The Gambonini Mine**

Considerable progress has been made at the Gambonini mine. Although this site does not discharge into San Francisco Bay, it is included in this report as an example of how high priority mine sites can be managed.

This site was assigned an extremely high priority because of its threat to downstream commercial and recreational fisheries. Because of the high priority and the inability of the



current landowner to pay for remediation, the Regional Board used funds from the State Cleanup and Abatement Account pursuant to section 13304(b) of the Porter-Cologne Water Quality Control Act. In contrast to the liabilities incurred by the State at Penn Mine and Leviathan Mine in the Central Valley, the San Francisco Bay Regional Water Quality Control Board was shielded from liability by allowing the U.S. Environmental Protection Agency to take the lead as an emergency response action.

The property owner has been contacted and was issued a cleanup and abatement order in 1993. Remediation was coordinated with the Marin County RCD. Loads were assessed through monitoring prior to remediation (Whyte and Kirchner, 2000). Waste piles have been stabilized and re-graded, and follow-up monitoring is being conducted to assess the post remediation load and determine the extent of downstream impacts to water quality. The total cost of the cleanup and monitoring to date has been approximately \$2,000,000.

### **2.3.5 The New Almaden Mining District**

New Almaden and its associated mine sites present a unique case, because of the amounts of mercury produced, the size of the affected area, the complex ownership history, and the series of litigation, enforcement, monitoring, and remedial actions that have occurred and are ongoing.

#### *Site History*

New Almaden was at one time the largest producer of mercury in North America (Cargill et al., 1980), yielding over 35 million kilograms of mercury which was used first in gold mining and later in support of defense-related munitions production. It consists of several mercury mines, including New Almaden Mine, America Mine, Providencia Mine, Enriquita Mine, San Antonio Mine, San Mateo Mine, Senator Mine, and Guadalupe Mine. These mine sites are identified in Figure 4-5 and Table 4-16 of the Basin Plan. The discharge of mining waste from these areas has polluted Almaden Reservoir, Guadalupe Reservoir, and Calero Reservoir. Those reservoirs serve as water supply for groundwater recharge in the Santa Clara Basin. Numerous gulleys and small tributaries upstream of the reservoirs have been polluted. Downstream of the reservoirs, Arroyo Calero, Guadalupe Creek, and Alamitos Creek and the Guadalupe River have been polluted. The Guadalupe River conveys mercury-polluted sediments through Alviso Slough into lower South San Francisco Bay, which is part of the San Francisco Bay National Wildlife Refuge.

Mining in the area took place from 1845 until the most of the land was acquired by Santa Clara County in 1975, at which time all mining activity ceased. Persons or companies known to have mined mercury include:

Don Andreas Castellero	(deceased);
Alexander Forbes	(deceased);
George H. Sexton	(deceased);
Quicksilver Mining Company	(bankrupt);
New Almaden Inc.	(defunct);

New Idria Mining and Chemical Company (defunct); and  
Cordero Mining (defunct).

In 1996, litigation over the issue of liability for the cleanup was settled, with financial responsibility divided between Santa Clara County, Myers Industries, Inc. (successor to New Idria Mining and Chemical Co.) and Newson, Inc. (successor to New Almaden, Inc.) (Rogers, 1996). It also is possible that a corporate successor to Cordero Mining exists, although if that information has been discovered it has not been published in a readily available document.

### *Current Status*

Currently, lands and watercourses in and affected by inactive mercury mine sites of the New Almaden district are owned by:

County of Santa Clara	(public agency);
Mid-Penninsula Regional Open Space District	(public agency);
Guadalupe Rubbish Disposal Company Inc.	(private landowner); and
Santa Clara Valley Water District	(public agency);
City of San Jose	(public agency);
Private homeowners	(private landowners).

In 1987 the California Department of Toxic Substances Control (DTSC) ordered Santa Clara County to clean up areas within the County Park to protect human health from direct exposure to mercury. By 1998, remedial actions had been implemented in the park at Mine Hill, the Hacienda Furnace Yard, the Enriquita Mine Retort, the San Mateo Mine Retort, and the Senator Mine. The primary remedial actions undertaken were onsite containment via vegetated soil covers, substantial re-grading on mine hill, and a 1500 foot long rock and wire mesh barrier at the Hacienda Furnace Yard along the banks of Alamos Creek (California Department of Toxic Substances Control, 2002). The total cost of remedial actions completed through this process has been approximately \$4.2 million.

While DTSC has certified that threats to human health through direct contact have been mitigated, monitoring data suggests that additional work is needed to attain water quality standards. Fish collected from Almaden, Calero, and Guadalupe Reservoirs have mercury concentrations exceeding FDA action levels, prompting consumption advisories (Woodward Clyde Consultants, 1992). Stormwater monitoring data submitted by the County Parks indicates that the Basin Plan water quality objective for mercury (0.025 µg/L) is routinely exceeded during storm events. Mercury-polluted sediments have been distributed downstream, with concentrations increasing from 1 - 5 ppm at the base of the watershed to 10 – 50 ppm in the upper stream reaches. When these mercury-polluted sediments accumulate in sub-oxic areas (e.g., behind drop structures and diversion dams), methylmercury is formed at concentrations high enough to pose a substantial risk of bioaccumulation (Thomas et al., 2002).

There are at least seven programs or processes currently related to New Almaden, the Guadalupe River, and its tributaries and watersheds:

- 1) NPDES general industrial stormwater permits cover both the County Parks and the Guadalupe Landfill. These permits require basic stormwater monitoring.
- 2) The SCVWD is permitted to conduct operations and maintenance in streams and tributaries through a Waste Discharge Requirement (WDR).
- 3) There are three flood control projects planned or under way in the Guadalupe River, in its lower, middle, and upper reaches. These projects are subject to WDRs and water quality certifications ("401-certs"), and also require coordination with other resource agencies (e.g., California Department of Fish and Game, United States Fish and Wildlife Service) through the Guadalupe River Flood Control Collaborative.
- 4) The United States Fish and Wildlife Service is discussing the possibility of a Natural Resources Damage Assessment (NRDA) with potentially responsible parties. (Santa Clara Basin Watershed Management Initiative, 2001)
- 5) The Santa Clara Valley Pollution Prevention Program (SCVURPPP) conducts watershed assessment and monitoring through compliance with its NPDES permit regulating the discharge of urban stormwater, as well as through participation in the Clean Estuary Partnership.
- 6) The Clean Estuary Partnership has provided funds to initiate the first year of a multi-year loads assessment on the lower Guadalupe River (Mckee and Leatherbarrow, 2002).
- 7) The South Bay Watershed Management Initiative (SBWMI) has formed a TMDL workgroup for the Guadalupe River. Through that workgroup, a contractor has been selected and a scope of work developed to produce a TMDL for mercury in the Guadalupe River. That TMDL addresses both mercury impairment in the Guadalupe River watershed as well as the Guadalupe River as a source of mercury to Lower South Bay.

#### *Next Steps to Consider in the Guadalupe River Watershed*

The scope of the multi-year loads assessment initiated by the Clean Estuary Partnership overlaps with self-monitoring requirements of WDRs issued to the SCVWD for flood control projects. Therefore, negotiating a funding partnership with the SCVWD or the U.S. Army Corps of engineers to support subsequent monitoring years is a useful next step that Regional Board staff could undertake.

The monitoring requirements of the NPDES general stormwater permits covering the County Park and the Landfill may need to be reviewed and revised. The current approach in the general permit is to sample first flush. This approach may not be appropriate to mining-impacted watersheds, when erosive remobilization may take place after first-flush events. Monitoring should address mercury loads and mercury methylation processes: where are there controllable loads, how do loads respond to BMP implementation, where is mercury converted to methylmercury, and are there any management actions possible that minimize either the transport of mercury into methylating areas or that reduce net

methylation rates?

The framework for answering these questions is best established through development of the Guadalupe River mercury TMDL. During the Fall of 2003, a conceptual model and data collection plan will be prepared and reviewed by the South Bay WMI's Guadalupe River Mercury TMDL workgroup.

In summary, the most important next steps at high priority sites are:

- 1) Locate and contact property owners;
- 2) Conduct responsible party search;
- 3) Issue permits, waivers, or cleanup and abatement orders, as appropriate;
- 4) Identify funding sources (Prop-13, Prop-50, Prop-40, 319-H grants) that could help close funding gaps when responsible parties cannot be identified.
- 5) Coordinate with other State and Federal regulatory and resource agencies, including DTSC, USFWS, and USEPA. DTSC Coordination will be essential in any situations requiring movement of soils having mercury concentrations above hazardous waste guidelines.

### ***3. Summary of Approaches to Managing Mining-Impacted Watersheds***

Watersheds impacted by mining can be subdivided into three general areas: upstream, instream, and downstream. Each area requires a different management approach, and will involve different groups of stakeholders. The following discussion summarizes some general approaches to be considered in each area.

#### **3.1 Upstream management**

Upstream, at the actual mine site(s), the approach is to identify soils, sediments, and waste piles bearing high concentrations (> 10 ppm) of mercury. These should be stabilized to reduce and eliminate the discharge of mercury-polluted sediments into State Waters. Visual cues to identify the need for this kind of action includes piles of waste rock or soil at a high angle of repose or in contact with State waters. Monitoring data needed before and after remediation includes mercury concentrations in soils and sediments, as well as in-stream monitoring of mercury and suspended load during storm events. Examples of this kind of management approach can be found at the New Almaden and Gambonini mine sites.

Some inactive mines may also be discharging acid mine drainage into State waters. In this case, the appropriate management actions are to divert surface water away from mine openings to reduce the water supply into the mines, and to capture and treat any discharges fed by subterranean flow. Visual cues that acid mine drainage is a problem include severely discolored water and total devastation of aquatic life for miles downstream of the discharge. Monitoring data needed before and after remediation includes pH, suspended load, and metals. While there are not any known discharges of acid mine drainage from mercury mine sites in the Bay Area, the New Idria mercury mine site in San

Benito County is an excellent example of how simple visual observations combined with monitoring data can point out obvious ongoing threats to water quality (Ganguli et al., 2000; San Benito County, 2003).

Typically, the responsibility for implementing management actions on mine sites falls to the current landowner and / or any previous land owners or mine operators. Responsibility for monitoring can fall either to the landowner and other responsible parties, or it may be undertaken as part of a regionally coordinated effort through stormwater programs, flood control agencies, or other special districts.

### **3.2 In-stream management**

In-stream management needs to consider two factors: mercury loads and mercury methylation. In watersheds where substantial amounts of mercury have already been transported downstream, the majority of the mercury load may come from stream bed and bank erosion. Severely downcut areas provide important visual cues. Other approaches to assess the role of in-stream remobilization include measuring mercury concentrations in sediments of stream beds and banks, modeling erosion and degradation processes, and combining in-stream continuous monitoring of flow and suspended load with discrete sampling to quantify total water column mercury. Load management actions are typically directed at reducing channel velocity by re-grading channel banks to allow overflow during peak flow periods. In-stream operations and maintenance and construction of new projects should include a soil management plan to minimize the downstream transport of mercury polluted sediments. The recent restoration project conducted at Guadalupe Creek (in the upper Guadalupe River Watershed) by the SCVWD is an example of this kind of in-stream management.

The Guadalupe Creek restoration also shows how projects can consider mercury methylation. Prior to implementing the restoration, the project area was monitored to determine where elevated concentrations of methylmercury existed. The most significant pre-project finding was that mercury methylation was associated with low oxygen conditions. Based on the assessment, the restoration project was deemed by the project proponents to be a net benefit, because by restoring cold water fisheries habitat, the project would minimize stagnant pools and other areas prone to low oxygen conditions (Tetra Tech, 2000).

Responsibility for in-stream management and monitoring typically falls to flood control districts, riparian landowners, and/or project proponents with mitigation requirements attached to stream impacts.

### **3.3 Downstream management**

Downstream, management alternatives for receiving waters will vary greatly with the nature of the waterbody in question. There are at least three downstream management scenarios relevant to the Bay Area that can be considered:

- 1) Lakes and reservoirs;
- 2) Planned wetland projects; and
- 3) Depositional zones at the estuary interface.

### **3.3.1 Lakes and Reservoirs**

Lakes and reservoirs downstream of mine sites tend to act as sediment traps, substantially reducing the mercury load from mine sites to the Bay. Therefore, the management focus for mining-impacted lakes and reservoirs shifts away from loads discharge to the Bay, and towards the beneficial uses of the lakes and reservoirs themselves. Initial monitoring and risk assessment should be directed at the following questions:

- 1) Who fishes the lake or reservoir?
- 2) What fish are being caught for food?
- 3) What is the concentration of mercury in those fish?
- 4) Are consumption advisories needed?
- 5) If risk assessment shows that concentrations of mercury in fish are too high, what management alternatives are available to reduce those concentrations?

After conducting the necessary risk assessment and communication, and controlling all controllable upland mercury sources, lakes and reservoirs that still have consumption advisories could be considered for pilot implementation projects to reduce mercury levels in fish through oxygenation (e.g., Abu-Saba et al., 2003) or manipulation of other water quality factors, such as nutrients or flow. Municipal governments and water suppliers who own fishable reservoirs could consider applying for funding from CALFED or other funding sources to implement such pilot projects.

In the Bay Area, some mining-impacted reservoirs that could be considered for pilot projects include:

Almaden Reservoir (Santa Clara Valley Water District);  
Guadalupe Reservoir (Santa Clara Valley Water District);  
Calero Reservoir (Santa Clara Valley Water District);  
Lake Herman (City of Benecia);  
Chabot Lake (City of Vallejo); and  
Soulajule Reservoir (Marin County Water District).

### **3.3.2 Wetland restoration projects**

Wetlands are the second type of downstream waterbody potentially affected by the discharge of mining waste. Wetlands can potentially be areas of enhanced methylation because of their microbial communities, and enhanced bioaccumulation because of their complex food webs. Adaptive management questions about mercury in wetlands are

discussed in a separate report, and so are only briefly summarized in this report with respect to inactive mine sites.

The central mercury questions about the best approach to designing, constructing, and managing Bay Area wetlands are:

- 1) What mercury concentrations in sediments produce substantial increases in the risk of mercury exposure to humans and wildlife if those sediments are used in wetland projects?
- 2) What are some wetland design features (e.g., channel depth and configuration, covering vegetation, flushing rates) that affect mercury methylation rates?

Some important areas to address these questions include:

- 1) The Montezuma project in the northern reach of the Bay, where dredged Bay sediments (with mercury concentrations predominantly around 0.4 ppm) are being used to restore a tidal wetland;
- 2) The planned Big Break wetland restoration in the northern reach, which is downstream of the Mount Diablo Mercury Mine; and
- 3) The planned restoration of Pond A4 in lower South Bay, where a need exists for substantial amounts of foundation sediment because the pond is so subsided. The nearest source of readily available sediment is the regular dredging of the lower Guadalupe River for maintenance of flood capacity. However, dredged sediments from the Guadalupe River can be expected to have elevated mercury concentrations, so it is important to determine whether the use of these sediments as foundation material increases the risks of methylmercury exposure in the restored wetland habitat.

### **3.3.3 Depositional zones**

One of the complicating factors in evaluating watershed loads is quantifying the transfer of pollutants through depositional zones. Sediments tend to deposit at the estuary interface, where flow velocities slow down and transport shifts from fluvial to tidal mixing (McKee and Newland, 2002). In some cases, these depositional zones are managed by flood control agencies or other special districts. A notable example where the effect of management actions in the depositional zone on mercury loads needs to be evaluated is in lower South Bay. The depositional zone of the lower Guadalupe River is managed by the Santa Clara Valley Water District. Monitoring studies in the region should focus on how much mercury is entering the depositional zone from fluvial transport, how much is removed through maintenance dredging, and what is the resulting net transfer of mercury into lower South Bay.

## **4. Cost-Benefit Analysis**

## **4.1 Framework for predicting implementation costs**

The costs of implementing the Basin Plan Mines Program can be projected by considering what implementation would take in terms of Regional Board staff time, other public agency staff time, and contract dollars to conduct monitoring, risk assessment and communication, and remediation. While there is insufficient information at present to rigorously predict future levels of effort, a framework for predicting costs is presented in Table 4. The table divides implementation into two phases: Phase 1 consists of the inspections, outreach, and risk assessment needed for all sites. Phase 2 represents more focused remediation and management efforts at a more limited subset of mine sites. Based on the assumptions about number of sites, priority, and levels of effort needed presented in Table 4, Phase 1 implementation of the Basin Plan Mines program is expected to cost approximately \$1 million, whereas Phase 2 implementation would cost approximately \$10 million. If fully funded, Phase 1 implementation could reasonably be completed within five years, whereas Phase 2 implementation could take 10 – 20 years before all sites are considered complete.

These estimates do not include costs associated with the Guadalupe River, which is a unique case because of the magnitude of mercury mobilized from the New Almaden mines. The DTSC-ordered remediation at New Almaden cost approximately \$4.2 million. Development of a TMDL for the Guadalupe River to attain water quality standards is expected to cost between \$ 1 million - \$2 million. The implementation cost of that TMDL is unknown at present.

## **4.2 Funding mechanisms and public policy implications**

There are four general revenue streams that could fund the mine site monitoring and remediation projects discussed in this report:

- 1) Federal funds. This includes programs such as the non-point source reduction program (US EPA's "319-h" grants that are administered by the SWRCB), and the U.S. Army Corps of Engineers Rehabilitation of Abandoned Mines (RAMS) program. Use of these funds spreads the costs of implementation among all U.S. taxpayers.
- 2) State Funds. This includes special voter-authorized bonds such as the Costa-Machado a Act (Proposition 13). Use of these programs spreads the cost of implementation among California taxpayers.
- 3) Local Government and Public Agency Funds. This includes property taxes, flood control fees, and sewerage rates. Although use of sewerage rates to remediate mine sites has been proposed as a "mass offset" in other contexts (Taylor, 1998; CVRWQCB, 2000), the legal basis for such an offset program is as yet unresolved. Use of local funds spreads the costs of implementation among local taxpayers and ratepayers.



- 4) Enforcement. In some instances (e.g., New Almaden, New Idria) the economic resources created from mercury exploration and production may be traceable to financially viable responsible parties. Enforcement assigns the cost of cleanup to the revenue stream derived from causing the pollution in the first place.

The particular approach used to fund remediation will vary by site. It is unlikely that any one of the above four revenue streams will take care of all mine sites in need of remediation. When determining who should pay for a project, the Regional Board can consider, among other factors:

- 1) Were the economic benefits of mining private, local, statewide, or national in scope? Mercury produced in California supported the Gold Rush, which underpinned the economic development of the State. Gold produced in California helped the Union win the Civil War. Mercury produced at New Idria helped fight World War I, World War II, the Korean War, and the Vietnam War, and thus was a benefit to the national defense. The profits from that mercury were used to build significant investment portfolios and sizable manufacturing corporations (see for example, report by San Benito County, 2003).
- 2) Will the economic and environmental benefits of remediation be local, statewide, or national? In some instances the main benefits of remediation will be localized to individual stream reaches or small lakes and reservoirs. In other instances, remediation has implications for reducing mercury loads to significant public resources, such as the San Francisco Bay National Wildlife Refuge (downstream of New Almaden), or the Mendota Wildlife Area (downstream of New Idria).
- 3) What funds are available? If Regional Boards are unable or unwilling to pursue enforcement against private responsible parties, costs to the public will increase. Absent enforceable programs, funding partnerships with Federal and State Programs can significantly reduce the fiscal burden on local governments. If the only revenue stream available is from local taxes and fees, the scope and priority of projects will be constrained by other local funding priorities, such as police, fire protection, infrastructure, and social services.

### **4.3 Benefits of implementation**

When evaluating the benefits of implementation, both the benefits to the entire Bay (the TMDL basis) and benefits to the immediate watershed should be considered. Six of the mine sites listed in Table 3, (New Almaden, Mount Diablo, Borges, Bella Oaks, La Joya, and Corda) have relatively straightforward connections to the Bay. Without additional monitoring information, it is difficult to estimate the load reduction to the Bay that might be attained through remediation. Of the six, only the Guadalupe River, downstream of New Almaden has meaningful loads monitoring information.

Loads from the Guadalupe River into the depositional zone at the nexus to the Bay amount to approximately 100 kg/yr, with a likely range of 5-750 kg (Abu-Saba and Tang, 2000;

Clean Estuary Partnership, 2003). Additional questions that need to be answered to quantify the load reduction benefit possible from the Guadalupe River include:

- 1) What is the load removed from the depositional zone due to maintenance of flood control capacity?
- 2) How will the load into the depositional zone respond to upstream BMPs?

But with the available information, it is reasonable to estimate that the load reduction to the Bay that could possibly be attained through watershed management in the Guadalupe River will be smaller than 100 kg/yr. The other five Bay Area mercury mine sites, which were much smaller in production, can be expected to have proportionally smaller loads. Hence, it is unlikely that load reductions attained through mine site remediations will exceed 100 – 200 kg/yr Baywide.

Benefits to local watersheds are more readily identifiable. Stopping the discharge of mercury into potentially fishable lakes and reservoirs (e.g. Almaden Reservoir, Guadalupe Reservoir, Lake Hermann, Lake Chabot) can restore and protect local fisheries resources. Conducting necessary risk assessment and communication targeting such lakes has the immediate benefit of protecting public health and raising public awareness about the problems of and possible solutions to much mercury bioaccumulation in fish. Stream restoration projects (e.g., Guadalupe Creek) that have direct stream habitat benefits also reduce mercury loads, and maintain or decrease mercury methylation rates.

Thus, while the nexus remains uncertain between the Basin Plan Mines Program and the Bay Mercury TMDL targets, there are very likely benefits possible to mining-impacted watersheds themselves. When setting priorities and determining next steps, factors to be considered should include not only “is a proposed project good for the Bay,” but also “will a proposed project improve the immediate watershed.” Such an approach can enhance local support and speed up implementation of remediation projects.

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Mine	Location information			Site History		
	Basin Plan Map Key	Coordinates	Location	Type	Operation dates	Production
<b>Silverado</b>	3	38 deg. 39.13' N; 122 deg. 36.23' W	Napa County. Access is off highway 29 neat Mt. Saint Helena	Underground and open cuts	1872 - 1948	2000 flasks
<b>Chileno Valley</b>	11	37 deg. 10.77' N; 122 deg. 46.94' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco (near Gambonini Mine)	Underground	1955-1970	Unknown
<b>Challenge</b>	29	37 deg. 27.23' N; 122 deg. 15.02' W	San Mateo County. Access is off Farm Hill Rd.	Surface and Underground	1955-1958	Unknown
<b>Silver Creek</b>	31	37 deg. 16.03' N; 121deg. 44.9' W	San Jose, off silver Creek Rd. Main mine located upstream from Silver Creek rd. about 1/2 mile. Santa Clara County.	Surface and Underground	Inactive 1940's	Unknown
<b>Cycle</b>	9	38 deg. 8.80' N; 122 deg. 45.02' W	Marin County. Access through N. entrance to SoulaJule Reservoir	Underground	1970-1971	Unknown
<b>Franciscan</b>	10	38 deg. 8.94' N; 122 deg. 45.20' W	Marin County. Access through N. entrance to SoulaJule Reservoir	Underground	1970-1971	Unknown
<b>Hastings</b>	5	37 deg. 27.23' N; 122 deg. 15.02' W	Solano County. Access is off west side of Sky Valley Rd.	Underground	1870's, intermittantly until 1930	Unknown
<b>St. Johns</b>	6	38 deg. 9.11' N; 122 deg. 11.37' W	Solano County. Mine is visible near eastern ridgeline at highway 80 and American Canyon Rd.	Extensive Underground	1870's, intermittantly until 1909	20,000 flasks
<b>Corda</b>	8	38 deg. 09.57' N; 122 deg. 37.74' W	Marin County. Located off of San Antonio Rd. on Corda Ranch	Surface	1968 - 1971	Unknown
<b>La Joya</b>	4	38 deg. 26.36' N; 122 deg. 28.26' W	Napa County. Access is off Wall Rd.	Underground	1865-1939	2000 flasks
<b>Bella Oaks</b>	NA		Napa County. Access is off Bella Oaks Rd about one mile south of Rutherford	Underground	1872-1910	1800 flasks
<b>Borges</b>	7	38 deg. 9.37' N; 122 deg. 12.98' W	Napa County. Access is off American Canyon Rd.	Underground / Minor Surface	Active August 1969	Unknown
<b>Gambonini</b>	12	38 deg 10.26' N; 122 deg. 46.70 ' W	Northwest Marin County, east of Tomales Bay, 50 miles north of San Francisco.	Surface and Underground	Intermittently 1945 - 1971	
<b>New Almaden District</b>	44-31	37 deg. 13' N ; 121 deg 50' W	Santa Clara County; Almaden Quicksilver County Park and surrounding lands	Surface and Underground	Intermittently 1854 - 1976	1,000,000 flasks

**Table 1: Locations and site histories for inoperative mercury mines in the San Francisco Bay Region**

	Site Condition					Site Management Tracking										
						(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	
						Site inspected from the ground?	Property owner identified?	Property owner contacted?	Other local agencies notified?	Site Management Plan Implemented?	Loads / risk assessment conducted?	Previous PRPs identified?	Permits and orders issued?	Remediation initiated?	Follow-up monitoring initiated?	
Mine	Calcines, Tailings, and Waste Rock	Seds (ppm)	Water (ppb)	Drainage	Nexus to Bay	Date last inspected										
Silverado	<1000 cy	3	1.5	St. Helena Creek	Region 5	9/19/97	X									
Chileno Valley	None visible	NA	NA	Chileno Creek	No	6/15/91	X	X	X	X	X					
Challenge	None visible	10	1.2	Arroyo Ojo De Agua and Tributaries	Redwood Creek	4/28/97	X	X								
Silver Creek	None visible	2.1	0.14	Silver Creek	Coyote Creek	1/23/97	X									
Cycle	None visible	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Franciscan	Small	NA	NA	Soulajule Reservoir	No	10/16/97	X	X								
Hastings	Yes	10	0.31	Sulphur Springs Creek	Lake Herman	9/4/97	X									
St. Johns	>10,000 cy	NA	NA	Rindler Creek	Lake Chabot	9/4/97	X									
Corda	Unknown	NA	NA	San Antonio Creek	Petaluma R.	(by air) 12/11/97										
La Joya	Contact w/ water	NA	0.25	Dry Creek / Napa R.	Napa R.	9/12/97	X									
Bella Oaks	Visible	NA	NA	Seasonal trib to Napa R.	Napa R.	9/12/97	X									
Borges	None visible	2.7		American Canyon Creek	Napa R.	9/4/97	X									
Gambonini	Massives				No	Ongoing	X	X	X	X	X	X	X	x	X	
New Almaden	Massive	10 - 100		Guadalupe River	Alviso Slough	Ongoing	X	X	X	X	In Part	X	X	In part	In part	

**Table 2: Current condition and site management of inoperative mercury mines in the San Francisco Bay region.**

Mine	Possible Next Steps	Priority	Basis for Priority
<b>Silverado</b>	Locate property owner; monitor / assess risk through BASMAA, CEP, or Central Valley RWQCB; coordinate SMP implementation with Napa County RCD, CVRWQCB	Low	Outside SFRWQCB jurisdiction; low connectivity to Bay
<b>Chileno Valley</b>	Follow up with owner, Marin County RCD, to verify SMP implementation; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP.	Low	Basin Plan mines program implemented
<b>Challenge</b>	Monitor / assess risk through San Mateo County STOPPP, BASMAA, or CEP; coordinate SMP implementation and risk communication with San Mateo County Parks.	Low	No visible waste, moderate concentrations of mercury in sediments
<b>Silver Creek</b>	Locate property owner; monitor / assess risk through SCVURPPP, BASMAA, or CEP; coordinate SMP implementation with SBWMI, Guadalupe-Coyote RCD.	Low	No visible waste, relatively low concentrations of mercury in sediments
<b>Cycle</b>	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium	Does not discharge Bayside; mine site likely submerged by reservoir, recreational fishing use.
<b>Franciscan</b>	Coordinate with Marin County Water District to determine if risk assessment / communication needed for fisheries resources in Soulajule Reservoir	Medium	Does not discharge Bayside; no visible waste, low-moderate mercury concentrations in soils; recreational fishing use.
<b>Hastings</b>	Locate property owner; monitor / assess risk through BASMAA or CEP; evaluate mercury cycling in Lake Herman through CALFED or CEP; coordinate risk assessment /communication with city of Benecia; coordinate SMP implementation with Suisun RCD	Medium	Impacts municipal lake used for recreational fishing; low connectivity to Bay
<b>St. Johns</b>	Locate property owner; monitor / assess risk through Vallejo SFCD, BASMAA, or CEP; evaluate mercury cycling in Lake Chabot through CALFED or CEP, coordinate risk communication with City of Vallejo; coordinate SMP implementation with Suisun RCD.	Medium	Impacts municipal lake used for recreational fishing; low connectivity to Bay
<b>Corda</b>	Locate and contact property owner; conduct on the ground inspection; monitor / assess risk through Marin County STOPPP, BASMAA, or CEP; coordinate SMP implementation with Marin County RCD, Marin County STOPPP	Medium	No onsite inspection or monitoring information available, but no visible waste observed from air
<b>Mt. Diablo</b>	Coordinate with CVRWQCB, Contra Costa Countywide CWP, Contra Costa RCD; Locate and Contact property owner; seek funding to complete remediation and restoration.	High	Well-documented unabated discharges that threaten downstream habitat restoration projects planned at Big Break and Marsh Creek
<b>La Joya</b>	Locate property owner; issue permits or waivers as needed to produce site management plan for mine tailings; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD.	High	Observation of "steep cut tailings... tailings in contact with surface waters..." and recommendation in Mines report
<b>Bella Oaks</b>	Locate property owner; monitor / assess risk through BASMAA or CEP; coordinate SMP implementation with Napa County RCD	High	Connectivity to Bay
<b>Borges</b>	Locate property owner, monitor / assess risk through American Canyon STOPPP, BASMAA, or CEP; coordinate SMP implementation with Napa County RCD, American Canyon WTP, American Canyon STOPPP	High	Connectivity to Bay
<b>Gambonini</b>	Remediation initiated, monitoring and watershed assessment under way	Highest	Downstream commercial and recreational fisheries in Tomales Bay
<b>New Almaden District</b>	See Text	Highest	Size of source, presence of unmanaged waste piles discharging into waters of the State

**Table 3: Next steps and priorities for implementing the San Francisco Bay Basin Plan Mines Program**

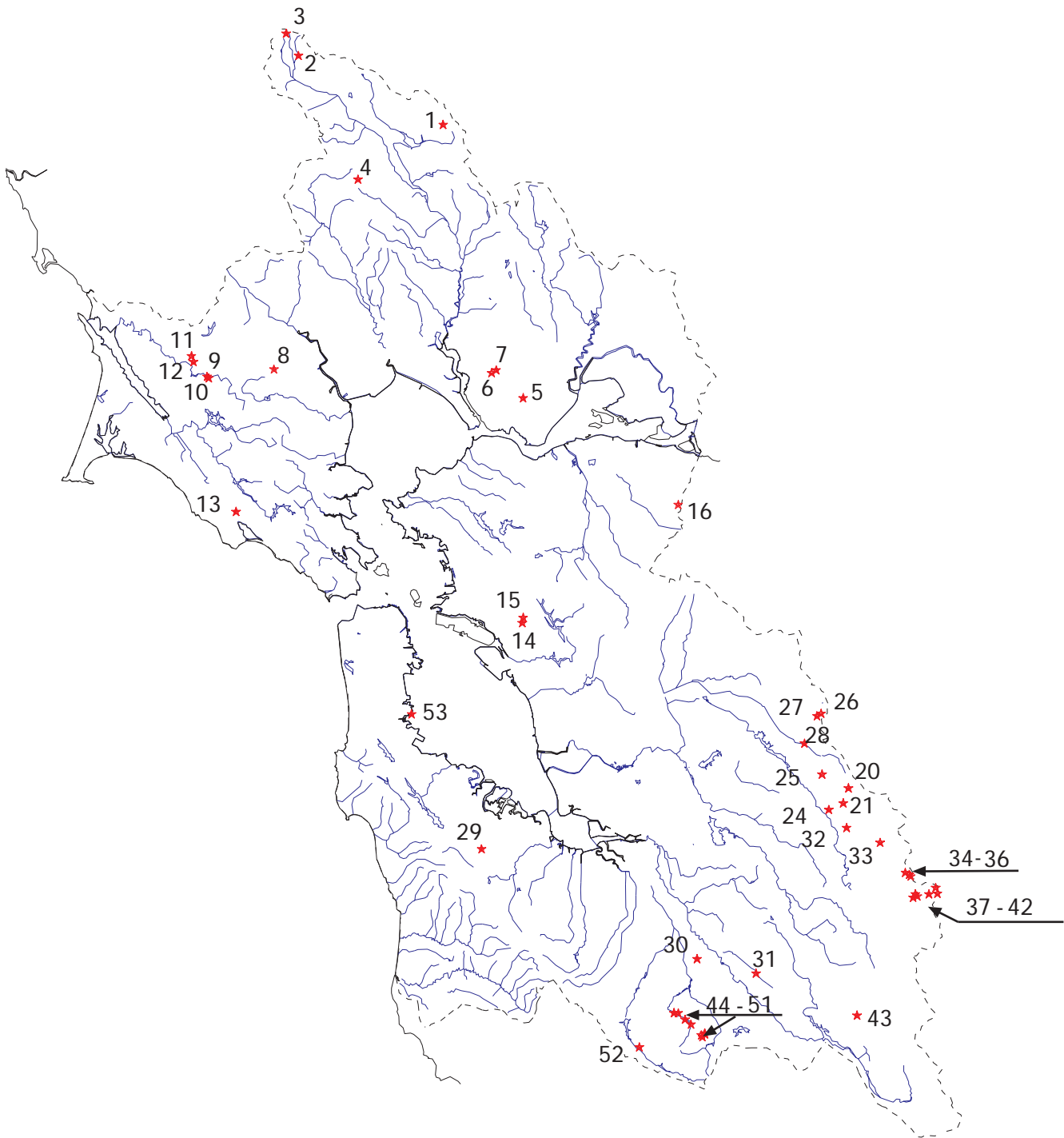
<b>Phase 1 Cost / Site</b>				
Site Priority	Number of Phase-1 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts (\$)
Low	4	0.1	0.1	5,000
Medium	5	0.2	0.2	10,000
High	6	0.2	0.2	50,000
Total	15	2.6	2.6	370,000
Total Cost				890,000

<b>Phase 2 Cost / Site</b>				
Site Priority	Number of Phase-2 Sites	Regional Board Staff Time (FTEs)	Other Agency Staff Time (FTEs)	Contracts (\$)
Low	0			
Medium	2	0.2	0.2	1,000,000
High	4	0.5	0.5	2,000,000
Total	6	2.4	2.4	10,000,000
Total Cost				10,480,000

**Table 4: Framework for projecting costs of implementing the Basin Plan Mines Program. Phase 1 refers to completing steps A-F of Table 2 for all mine sites, Phase 2 refers to completing steps G-J of a more limited subset of mine sites.**



***Appendix A: Excerpts from San Francisco Bay Basin Plan, Chapter 4  
(Implementation Plan), describing the Mines Program***



**Figure 4-5**  
**Inactive Mine Sites**

8. IMPACTS AT DREDGE SITE

The Regional Board may require additional documentation and inspections during dredging activities in order to ensure that dredgers minimize impacts at the dredging location. Water quality certifications or waste discharge requirements may contain additional conditions to address barge overflow and other impacts at the dredging site. Permit conditions may include:

- Special reporting procedures for the hydraulic pumping of dredged material into transport scows prior to disposal (marina slip applications);
- Time limit on the overflow from hopper-type hydraulic dredges in order to obtain an economical load; or
- Precautions to minimize overflow and spillage from the dredging vessel when enroute to the authorized disposal site. (Appreciable loss during transit shall be considered unauthorized disposal, or "short dumping," and such occurrences are subject to enforcement by the Regional Board or other applicable state or federal agencies.)

9. POLICY ON LAND AND OCEAN DISPOSAL

The Regional Board shall continue to encourage land and ocean disposal alternatives whenever practical. Regional Board staff have determined that there should be a high priority placed on disposing of dredged sandy material upland. At a minimum, incentives should be developed to limit disposal of any such material with a market value to upland uses. Staff may condition certifications so as to encourage upland reuse of high value sediments.

10. POLICY ON DREDGED MATERIAL DISPOSAL PERMIT COORDINATION

The Regional Board will implement these measures through its issuance of waste discharge requirements, water quality certification under Section 401 of the Clean Water Act, or other orders. In addition, the Regional Board may require pre- and post-dredge surveys to determine disposal volumes and compliance with permit conditions. In order to better manage data and reduce paper files, Regional Board staff may request, but not require, that applicants submit testing and other project data in a specific electronic format. The Regional Board has been an active participant in efforts to improve the overall dredging permit process and procedures. The

goal of this effort is to provide the public with uniform testing and disposal guidelines, joint permit actions, a streamlined permit application process, and more uniform permit enforcement. Staff are working with other state and federal agencies to implement a combined state-federal dredging permit process. The process is generally based on the Washington State "Dredged Material Management Office," a part of the Puget Sound Dredged Disposal Analysis program (PSDDA), which regulates dredging and disposal in the Seattle and Tacoma regions.

MINES AND MINERAL PRODUCERS

INACTIVE SITES

Over 50 abandoned or inactive mines have been identified within the San Francisco Bay region (Table 4-16 and Figure 4-5). The mineral resources extracted include mercury, magnesite, manganese, coal, copper, silver, and gold. A large percentage of the mining activities took place from 1890-1930, although some areas were mined as recently as 1971. The sizes of these mines vary from relatively small surface mines of less than half an acre to the world's second largest mercury mine, the New Almaden District, located in southern Santa Clara County.

Water quality problems associated with mining activities can be divided into two categories:

- Erosion and sediment discharge from surface mines and ore tailings piles; and
- Acid or otherwise toxic aqueous discharge from underground mines, ore tailings, or other mining processes.

Problems of erosion and sediment discharged from mined areas may be intensified due to the fact that sediment from ore-rich areas typically contains high concentrations of metals. Biological processes that take place in lake and stream-bottom sediments may allow these pollutants to be released in a form that more readily bioaccumulates in the food chain.

Recent water quality and aquatic toxicity monitoring data suggest that the beneficial uses of a number of water supply reservoirs, creeks, and streams in the region have been impacted as a result of past mining activities. Threatened beneficial uses of lakes, streams, bays, and marshes due to mining activities so

far identified in the region include fish migration, fish spawning, shellfish harvesting, wildlife habitat, preservation of rare and endangered species, freshwater fisheries habitat, and water contact recreation. In response to these findings, surveys were conducted by Regional Board staff in order to locate all abandoned and operating mines in the region.

In many cases, the adverse results of previous surface mining activities can be reduced, and in some cases eliminated, through appropriate erosion and sediment control practices. The U.S. Natural Resource Conservation Service (NRCS, formerly Soil Conservation Service) has developed a Resource Management System for Surface Mined Areas. This management system references practices and treatment alternatives needed in order to address the following:

- Erosion control practices that will dispose of surface water runoff at non-erosive velocities and reduce soil movement by wind or water to within acceptable limits;
- Maintenance of adequate water quality and quantity for planned uses and to meet federal, state, and local requirements;
- Pollution control to meet federal, state, and local regulations; and
- A system of planned access and/or conveyance that is within local regulations and meets the needs for the intended use.

In 1980, a memorandum of understanding was negotiated with the Council of Bay Area Resource Conservation Districts in order to provide for assessment and monitoring of potential and existing soil erosion-related water quality problems and identification of control measures. It was agreed that local units of government should have the lead role in controlling land-use activities that cause erosion. Control measures include the implementation of best management practices (BMPs). The Resource Management System for Surface Mined Areas developed by NRCS specifically references BMPs determined to be the most effective and practicable means of preventing or reducing erosion- and sediment-related water quality degradation resulting from surface mining activities.

## ACTIVE SITES

There are approximately 100 active mines and mineral producers within the San Francisco Bay region. The primary mineral commodities produced include clay, salt, sand and gravel, shale, and crushed stone. Water quality problems associated with mineral pro-

duction activities generally consist of erosion and sediment discharge into nearby surface water bodies and wildlife habitat destruction.

Active mining and mineral production activities are in part regulated under the Surface Mining and Reclamation Act of 1975. This act requires all mine operators to submit a reclamation plan to the California Department of Conservation, Division of Mines and Geology, and the recognized lead local agency for the area in which the mining is taking place. Recognized lead local agencies for the San Francisco Bay region include county planning and public works departments. Additionally, some local planning departments regulate mining activities through the issuance of conditional land-use permits. The goal of each reclamation plan is to assure that mined lands are reclaimed to a usable condition that is readily adaptable for alternate land uses and creates no danger to public health and safety. To date, very little emphasis has been placed on the need to protect beneficial uses of surface and groundwaters in the established permitting process.

Under the California Code of Regulations, Title 23, Chapter 15, Article 7, the Regional Board has the authority to regulate mining activities that result in a waste discharge to land through the use of waste discharge requirements. Additionally, the federal NPDES stormwater regulations (40CFR Parts 122, 123, and 124) require active and inactive mining operations to obtain NPDES permit coverage for the discharge of stormwater contaminated by contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products.

## GOAL

The Regional Board's goal is to restore and protect beneficial uses of receiving waters now impaired or threatened with impairment resulting from past or present mining activities.

This goal will be attained by the coordinated effort of the Regional Board, NRCS, the Council of Bay Area Resource Conservation Districts, the California Division of Mines and Geology, and lead local government agencies through the implementation of a mineral production and mining management program.

## PROGRAM

1. The Regional Board intends to continue to work closely with Resource Conservation Districts and NRCS to identify all existing and abandoned mines and mineral production sites in the region. Responsible

parties will be identified, as well as potential funding alternatives for clean-up activities, if needed. Sites will be prioritized based on existing and potential impacts to water quality and size.

2. The Regional Board will require an NPDES permit for the discharge of contaminated stormwater from active and inactive mining operations, as defined in the NPDES stormwater regulations. The Regional Board will consider issuing individual permits or a general permit for such discharges, or will otherwise allow coverage under the State Board general permit for stormwater discharges associated with industrial activity as described in the "Urban Runoff Management, Industrial Activity Control Program" section. Requirements of the notice of intent to be covered under the general permit(s) and the schedule for submittal will be established in the permit(s).
3. The responsible party or operator of each site discharging or potentially discharging waste to land shall be required to submit a Report of Waste Discharge to the Regional Board, pursuant to the California Water Code Section 13267. Requests will be made on a site-by-site basis and based on priority. A Report of Waste Discharge shall consist of a "Site Closure Plan" and an "Operation and Management Plan" for active sites.
  - Each plan shall be designed to ensure short- and long-term protection of beneficial uses of receiving waters.
  - The "Closure Plan" shall address site restoration and long-term maintenance and monitoring.
  - The "Management Plan" shall address stormwater runoff and erosion control measures and practices.
  - Each plan will be evaluated in regard to potential impacts to beneficial uses of receiving waters. Waste Discharge Requirements will be issued or waived at the discretion of the Regional Board based on the threat to water quality and the effectiveness of identified and implemented control measures and the effectiveness of local agency oversight.

## VESSEL WASTES

The discharge of wastes from pleasure, commercial, and military vessels has been a

water quality concern of the Regional Board since 1968 when Resolution No. 665 was adopted, which suggested that the federal government regulate waste discharges from vessels. In 1970, the Regional Board adopted Resolutions 70-1 and 70-65 on vessel wastes. The first urged BCDC to condition marina permits for new or expanded marinas to include pumpout facilities, dockside sewers, and restroom facilities. Resolution 70-65 recommended that vessel wastes be controlled in such a manner through legislative action.

In 1982, the Regional Board conducted a study that found high levels of coliform in the vicinity of several marinas in Marin County's Richardson Bay. Subsequently, the Regional Board adopted a prohibition against discharge of any kind into Richardson Bay. A regional agency was formed to implement and enforce this prohibition.

There is an ongoing effort to construct, renovate, and improve pumpout facilities at marinas and ports around the region. The goal of these efforts is to increase the accessibility of these facilities to boaters and reduce pollution from vessel wastes.

## WETLANDS PROTECTION AND MANAGEMENT

Wetlands and related habitats comprise some of the San Francisco Bay region's most valuable natural resources. Wetlands provide critical habitats for hundreds of species of fish, birds, and other wildlife; offer open space; and provide many recreational opportunities. Wetlands also enhance water quality through such natural functions as flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

The Regional Board will refer to the following for guidance when permitting or otherwise acting on wetlands issues:

- Governor's Executive Order W-59-93 (signed August 23, 1993; also known as the California Wetlands Conservation Policy);
- Senate Concurrent Resolution No. 28; and
- California Water Code Section 13142.5 (applies to coastal marine wetlands).

The goals of the California Wetlands Conservation Policy include ensuring "no overall net loss," achieving a "long-term net gain in the quantity, quality, and permanence of wetlands acreage and values ...", and reducing "procedural complexity in the administra-

# Mercury Source Assessment for San Francisco Bay

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March 3, 2003

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## **1. Executive Summary**

Mercury loads to San Francisco Bay are estimated and incorporated in a mass balance to identify remaining uncertainties. The facts that mercury concentrations in sediments have not changed substantially over the past decade and that sediment outputs from the Bay roughly balance sediment inputs help constrain the mass balance, although the resulting range is relatively large. The best direct estimates of mercury loads to the Bay, including wastewater, stormwater, airborne deposition, and Central Valley runoff, total 640 kg/yr, with a likely range of 430-1350 kg/yr. The major portion of this total comes from Central Valley runoff and local stormwater sources. Mass balance considerations suggest that additional loads of 300 kg/yr enter the Bay, but the range on the additional load is between -2600 kg/yr and 3000 kg/yr. Steps to reduce this uncertainty and the expected outcomes are discussed.

## **2. Background**

A mass balance model for mercury loads to San Francisco Bay is an important component of a mass-based watershed management strategy. This paper summarizes existing knowledge of mercury mass loadings to the Bay in a simple mass balance model that identifies remaining uncertainties and key steps to reducing those uncertainties.

## **3. Approach**

The approach is to initially treat the Bay as the simple, one-box model depicted in Figure 1, and write down what is known about each of the first five terms: the Central Valley load, Bay Area urban stormwater, Bay Area non-urban stormwater, Bay Area wastewater, and direct air deposition onto the Bay. Then the mass balance is evaluated, to put an upper limit on the "additional loads." This is a first order estimate which, in the absence of any other information, would be a reasonable basis for establishing a total maximum daily load for a particle-associated pollutant based on a target concentration in sediment.

Watershed loads (i.e., stormwater runoff from urban areas, non-urban areas, and the entire Central Valley) are estimated as the product of the average mercury concentration in watershed sediments times the average sediment load:

### **Equation 1**

$$\text{Hg Load} = [\text{Hg}]_{\text{sed}} \times \text{Sediment Load}$$

Where (for each source category):

Hg Load = total mercury load (kilograms per year, kg/yr)

$[Hg]_{sed}$  = concentration of mercury in sediment (parts per million, mg/kg)

Sediment Load = sediment entering the bay (millions of kilograms per year, M kg/yr).

Local air deposition and wastewater loads are estimated from direct measurements (i.e., atmospheric deposition rates and mercury concentrations in wastewater).

“Additional loads” includes identified and unidentified mine sites, remobilization of polluted sediments from deeper layers of the bay floor, existing and potential hot spots along the Bay margins, and natural variations of local mineralogy. “Additional loads” also incorporates any missing loss terms, such as burial, offgassing, or biological uptake and removal.

#### **Simplifying assumptions and resultant uncertainties in the overall approach**

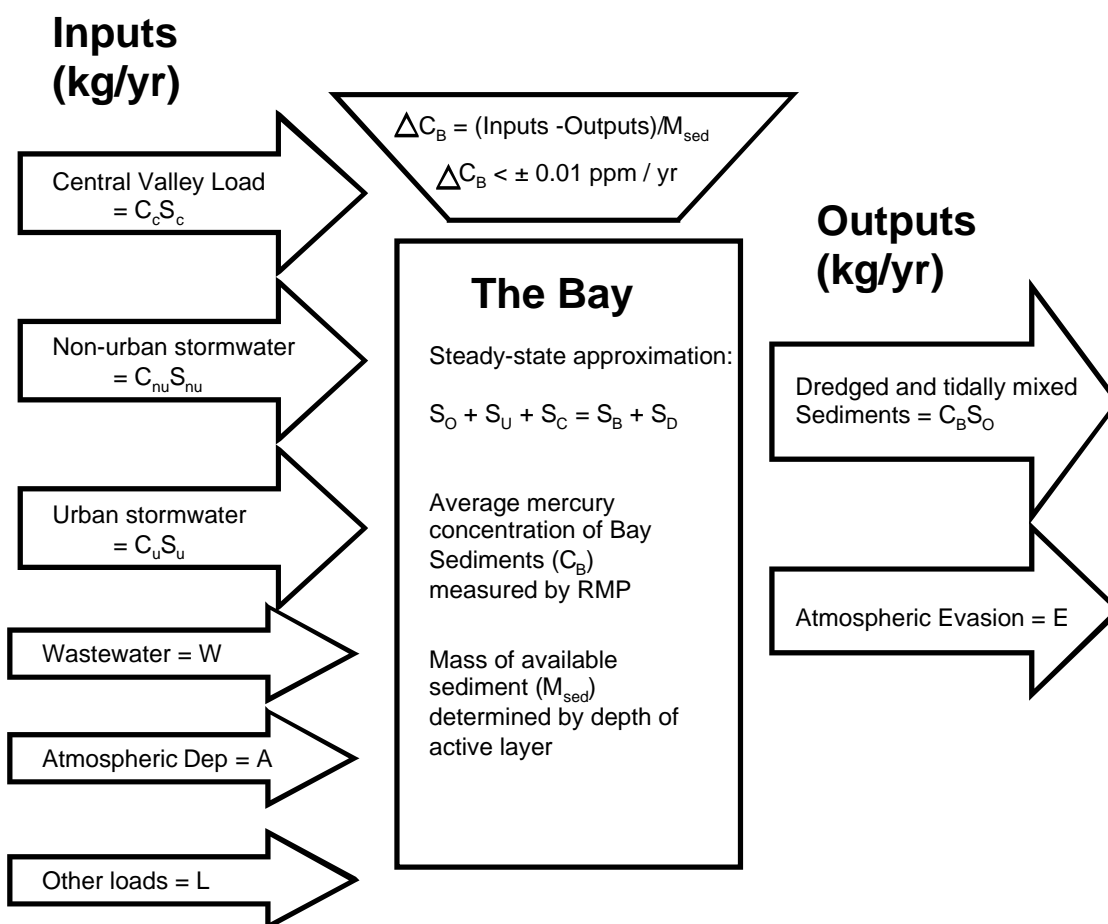
Two fundamental assumptions in developing a mass balance model for mercury in the Bay and its watersheds are that:

- 1) Watershed mercury loads can be estimated as the product of mercury concentrations in watershed sediments and the amount of sediment discharged from a watershed; and
- 2) The Bay can be modeled as a simple, single box of sediment, with all inputs and outputs treated as advective processes.

The first assumption is reasonable, although the methods used to select representative values for mercury concentrations in sediments and mass of sediment discharge can introduce considerable uncertainty. Also, rather than a simple product, a better approach is to model sediment loads and mercury concentrations dynamically, where the data are sufficient to do so. Dynamic modeling means using the relationships between flow, suspended sediments, and mercury concentrations in sediments to estimate loads. This approach has been implemented to estimate the Central Valley watershed load, and recommended for estimation of Bay Area stormwater loads.

The second assumption fails when attempting to describe dredging, tidal outputs, and exposure of old sediments, which are all mixing, rather than advective processes. However, as subsequent sections reveal, this simplified approach is sufficient to describe the overall picture of mercury loads to the Bay, and suggests next steps necessary to reduce uncertainties (i.e., develop a model that accounts for mixing between different segments of the Bay).





**Figure 1: Conceptual illustration of the mercury mass balance for San Francisco Bay.  $C_x$  = mercury concentration in sediments (mg/kg),  $S_x$  = Sediment loading (M kg/yr),  $M_{sed}$  = mass of sediments available for resuspension (M kg),  $\Delta C_B$  = rate of change in the average concentration of mercury in San Francisco Bay sediments.**

#### **4. Initial loads summary**

##### **4.1 The Central Valley Load**

**Hg Loads from the Central Valley = 435 kg/yr (range 240 – 630 kg/yr)**

The best estimate for the average mercury concentration in sediments exported from the Central Valley range is 0.3 ppm, based on measurements at the Sacramento River mouth between March 2000 and October 2001 (McKee and Foe, 2002). Measurements by the RMP confirm that a likely range for this value is 0.2 ppm – 0.4 ppm (Appendix-1). Sediment loads from the Central Valley between 1995 and 2001 ranged from 300 to 2600 M kg/yr, based on continuous monitoring of suspended solids concentration (SSC) and flow (Buchanan and Ganju, 2002; Buchanan and Ruhl, 2000; Buchanan and Ruhl, 2001; Buchanan and Schoellhamer, 1996;

Buchanan and Schoellhamer, 1998; Buchanan and Schoellhamer, 1999). The six-year average discharge of sediments from that study was  $1600 \pm 300$  M kg/yr. Dynamic modeling of sediment discharges and mercury concentrations result in an estimate of  $435 \pm 96$  kg/yr for the mercury load discharged into San Francisco Bay from the Central Valley. These estimates represents six-year means; the uncertainty represents one standard error about the six-year means. The total range on the Hg load estimate (240 – 630) kg/yr represents  $\pm$  two standard errors around the mean.

**Simplifying assumptions and resultant uncertainties  
in the Central Valley loads**

The dynamic modeling approach employed by McKee et al. makes the following assumptions:

- 1) The relationship between TSS and particulate mercury concentrations ([Hg]<sub>p</sub>) measured in 2000 – 2001 represents the typical average mercury concentration in suspended particulate matter exported from the Central Valley.
- 2) Total Suspended Solids (TSS) and Suspended Solids Concentrations (SSC) are equivalent.
- 3) The six-year averaging period represents long-term trends.

The first assumption introduces uncertainty because the [Hg]<sub>p</sub> / TSS ratio may, in fact, vary systematically with flow. This has been observed in other, smaller, mining impacted watersheds. The 2000 – 2001 sampling period represented relatively low-flow conditions. The uncertainty introduced by this assumption can be reduced using long-term monitoring data.

The second assumption introduces uncertainty because the two different analytical methods, TSS and SSC, don't always produce comparable values[Gray, 2000 #61]. The difference between the two methods comes down to subsampling. If a bottle of water is collected and its entire contents filtered to determine the dry mass of particles, the resulting measurement is the SSC. If a subsample of the bottle is filtered, then the measurement is the TSS. Subsampling can lose coarse sediments that settle between agitation and pouring the subsample, so TSS can be systematically lower than SSC, especially in waterbodies transporting large amounts of coarse sands ( $> 63 \mu\text{m}$ ). The data used by [McKee, 2002 #31] to determine mercury concentrations in particles rely upon TSS measurements, whereas the data used to determine particle loads rely upon SSC measurements. In this case, the TSS and SSC measurements are thought to be comparable, because the sediments transported by the Sacramento River have been found to be predominantly fine materials ( $< 12 \mu\text{m}$ ). The uncertainty of this assumption can be reduced in the future by either requiring SSC measurements from monitoring studies (i.e., no subsampling), and / or ultra-clean filtration to directly extract and analyze concentrations of mercury on filtered particles.

The third assumption can be re-evaluated as more sampling years are added. Preliminary results from the 2001 – 2002 water year suggest that the seven-year average mercury load is  $383 \pm 84$  kg / yr. Evaluation of the true, long-term average requires enough monitoring to reproducibly capture the full range of flow conditions, and then application of the observed relationship between flow and loads to the long-term flow history of the Bay.

## 4.2 Stormwater loads

**Hg loads from urban stormwater: = 180 kg/yr (range 60-300 kg/yr)**

**Hg loads from non-urban stormwater = 80 kg/yr (range 20 – 100 kg/yr)**

Stormwater loads are divided into urban and non-urban components. These loads are assessed using the best estimate for sediment loads discharged from urban and non-urban watershed, and the best estimate for the concentration of mercury sediments discharged from urban and non-urban watersheds. Since rigorous assessments of discharged sediments are not available, assessments of bedded sediments in storm drain conveyances are used to make inferences about discharged sediments.

The best estimates for mercury concentrations in bedded sediments from storm drains from urban and non-urban catchments come from (Kinnetic Laboratories Inc., 2001).

Land Use	Average Total mercury (ppm)	Average Percent Fines (%)	Fines-normalized average mercury (ppm)
Urban	0.29	30	1.0
Non-Urban	0.06	30	0.2

**Table 1: Summary of mercury and percent fines data for urban and non-urban land-use types. Data in first two-columns from page 39 of (Kinnetic Laboratories Inc., 2001). Fines-normalized concentrations in third column calculated by dividing the first column by the second column.**

To relate bedded sediments to discharged sediments, this approach assumes that the average concentration of mercury in 100% fine, bedded sediments sets the maximum mercury concentration for mercury in discharged sediments. In other words, the working assumption is that bedded sediments are good predictors of discharged sediments, and the only uncertainty is that we don't know the particle size distribution of discharged sediments. From this, the maximum mercury concentrations in sediments discharged from open spaces is inferred from Table 1 to be 0.2 ppm, and the maximum for urban areas is inferred to be 1.0 ppm.

Following that logic, this approach assumes that the average concentration of mercury in bulk, bedded sediments (i.e., un-normalized concentrations) sets the minimum mercury concentration in discharged sediments. In other words, an additional working assumption is that discharged sediments are at least 30% fine, which is supported by the literature review of [McKee, 2002 #49]. Based on this assumption, the minimum mercury concentration in sediments discharged from open spaces is inferred from Table 1 to be 0.06 ppm, and the minimum for urban areas is inferred to be 0.3 ppm.

The mass of sediments discharged from urban and non-urban watersheds is estimated based on the total amount of sediment produced by local watersheds and estimates of the relative

contributions made each type of land use. Using mass-balance calculations, the total local tributary load of sediments is estimated at 440-970 M kg/yr (Krone, 1979). A more recent literature review places the range at 600 – 1000 M kg/ yr (McKee et al., 2002b), which is the range that will be used in this calculation.

A recent assessment of stormwater sediment loads using the “rational method” suggests that 70% of sediments are discharged from non-urban areas, and 30% from urban areas (Davis et al., 2000). The overall tributary sediment loads from (Davis et al., 2000) are 2-3 times lower than those of (McKee et al., 2002b), because of the data and assumptions used. The “rational” method accounts for the different sediment production rates per unit area for different land uses and topographies, so the assessment by (Davis et al., 2000) provides the best estimate for the fractional contribution from urban and non-urban areas. These fractional contributions are applied to the total tributary sediment load to estimate sediment loads discharged from urban and non-urban land use types.

**Sediment discharged from non-urban areas = 550 M kg / yr (range = 400 – 700 M kg/ yr)**

Minimum = 600 M kg/yr x 70% = 400 M kg / yr (rounding to 1 significant figure).

Maximum = 1000 M kg/ yr x 70% = 700 M kg/yr

**Sediment discharged from urban areas = 250 M kg / yr (range = 200 – 300 M kg/yr)**

Minimum = 600 M kg/yr x 30% = 200 M kg/yr (rounding to 1 significant figure)

Maximum = 1000 M kg/yr x 30% = 300 M kg/yr

**Mercury loads from non-urban areas = 80 kg/yr (range 20 – 100 kg / yr)**

Minimum = 0.06 ppm x 400 M kg/yr = 24 kg Hg / yr ( = 20 kg / yr rounded to 1 significant figure)

Maximum = 0.2 ppm x 700 M kg/yr = 140 kg Hg / yr ( = 100 kg/yr rounded to 1 significant figure)

The best estimate taken at the midpoint of the range (before rounding) = 80 kg/yr.

**Mercury loads from urban areas = 180 kg/yr (range 60 – 360 kg/yr)**

Minimum = 0.3 ppm x 200 M kg/yr = 60 kg Hg/yr

Maximum = 1 ppm x 300 M kg / yr = 300 kg Hg / yr

The best estimate taken at the midpoint of the range (before rounding) = 180 kg/yr.

**Simplifying assumptions and resultant uncertainties  
in stormwater loads**

The estimates of urban and non-urban mercury discharges suggest that while urban areas of the Bay discharge less sediment than open spaces, urban areas may discharge higher mercury loads than open spaces, because the concentrations of mercury in urban sediments are higher than non-urban sediments. That observation is predicated on the following assumptions:

- 1) The only uncertainty in predicting mercury concentrations in discharged sediments from bedded sediments is the particle size distribution of discharged sediments;
- 2) The relative amounts of sediment discharged from urban and non-urban areas have been accurately quantified by the rational method; and
- 3) The average mercury concentration in sediments and the average percent fines are good estimates of the expected values, as opposed to the medians.

The first assumption is not strictly true. Watershed processes introduce additional uncertainties that arise from using bedded sediments to predict the composition of discharged. The topography, land use, pollutant form and distribution, and fluvial geomorphology of a watershed affect the observed concentrations of pollutants in both bedded and discharged sediments. Thus, the observation that bedded sediments from urban storm drains have higher mercury concentrations than non-urban storm drains may be simply an artifact resulting from the type of sediment that deposits in urban storm drains. A monitoring approach to reduce this uncertainty would be to collect composite samples of storm events and directly characterize the mercury concentration and particle size distribution of discharged sediments. This is a labor-intensive approach, so the value of the reduced uncertainty should be carefully weighed against the cost of developing the information. The second assumption can also be tested with targeted watershed monitoring.

The third assumption is best addressed through a more sophisticated modeling approach. Rather than simply multiplying an average concentration times and average sediment load, it is better to develop the information needed to characterize the frequency distribution of mercury concentrations and sediment loads for different watersheds. Both distributions are expected to be log-normal (as with many environmental measurements). If a parameter (e.g., sediment load) varies systematically with flow, then it can be simulated for a long-term flow record to develop load estimates. If a parameter (e.g., concentration) varies randomly according to a log-normal distribution, the distribution can be simulated using a Monte-Carlo approach. The computations to implement such a method are fairly straightforward, but producing the data needed to develop the model is potentially a costly undertaking.

### 4.3 Wastewater Loads

#### **Wastewater loads = 14 kg/yr (range 11 – 17 kg/yr)**

Wastewater loads are measured as flow times annual average concentration, summed up over all dischargers. Best estimates are available in SFRWQCB staff reports that summarize NPDES self-monitoring data (Katen, 2001) (So, 2001). Those estimates have recently been updated [Larry Walker and Associates, 2003 #62]. The total is currently 12.2 kg/yr for municipal pollution control plants, and 2.0 kg/yr for industrial facilities. The overall loading to the Bay from combined municipal and industrial facilities is  $14.2 \pm 3.3$  kg/yr. The range results from uncertainties due to interannual variation and propagated error from summing over thirty terms.

#### **Simplifying assumptions and resultant uncertainties in wastewater loads**

The only simplifying assumption in the calculation of wastewater loads of mercury is that analytical variability in measured mercury concentration is significantly smaller than monthly variability. Thus, the variance about monthly means was used to determine the uncertainty of individual facility load estimates. That sampling variance was propagated in the summation of all facility loads to generate the range for the total wastewater load estimate.

### 4.4 Direct Air Deposition

#### **Direct Air Deposition = 30 kg/yr (range 10 – 50 kg/yr)**

This means mercury deposited directly on the Bay surface. Airborne deposition over the watersheds is incorporated in the watershed loads. This has been measured by the RMP atmospheric deposition pilot study (Tsai and Hoenicke, 2001). The best estimate of direct deposition onto Bay totals 27 kg (=30 kg rounded to 1 significant figure), with likely range of 10-50 kg. The best estimate comes directly from report, and the range is inferred from “two-fold to five-fold” uncertainty stated in report (Tsai and Hoenicke, 2001).

Mercury can rapidly cycle in aquatic ecosystems between inorganic mercury, methylmercury, and dissolved gaseous mercury (discussed in subsequent sections). When dissolved gaseous mercury builds up in surface waters to concentrations above its saturation solubility, it can evade into the atmosphere, making surface waters a source to the atmosphere, rather than a sink. In San Francisco Bay, the atmospheric evasion rate for the entire Bay is estimated at 66 – 260 kg/ yr [Conaway, 2003 #63]. Considering the atmospheric deposition rate of 10 – 50 kg / yr, this means

that the net exchange of mercury between the atmosphere and the Bay is at least a 10 kg loss to the atmosphere, and could be as much as 250 kg per year.

**Simplifying assumptions and resultant uncertainties  
in airborne deposition loads**

The rate of evasion from surface waters of the Bay is the major uncertainty in determining the net flux of mercury to or from Bay waters and the atmosphere. The estimates of mercury evasion rates are not very sensitive to atmospheric mercury concentrations, but are extremely sensitive to concentrations of dissolved gaseous mercury and wind speeds. Therefore, the best way to reduce the uncertainty about atmospheric loads cycling is to obtain more data on dissolved gaseous mercury in Bay waters and to use more detailed models of daily and average wind speeds.

Another major uncertainty is the fate of evaded mercury. How much of the 66 – 260 kg/yr of mercury evaded from the Bay deposits locally, to be cycled back into surface waters via stormwater runoff, how much is transported into the Central Valley, and how much escapes eastward of the Sierra Nevadas?

## **5. Mass Balance**

Referring back to Figure 1, the size of the first five input terms has been estimated. Readily identified mercury inputs to the Bay total 700 kg/yr, with a possible range of 300-1100 kg/yr. To determine what else is missing, we can consider what is known about inputs-outputs and outputs to establish the boundaries of L, the “all other loads.”

### **5.1 Inputs – Outputs**

If mercury inputs to the Bay exceed the outputs, then over time, the concentration of mercury in Bay sediments will be gradually increasing. If inputs are less than outputs, then mercury concentrations will decrease over time (one of the desired outcomes of a watershed management plan for mercury). If inputs are equal to outputs, then concentrations in sediments will remain the same. So we can make some preliminary judgments about the difference between inputs and outputs by asking, “how slowly is the concentration of mercury in Bay sediments changing?”

Year	[Hg] (mg/kg)
1993	0.34
1994	0.33
1995	0.23
1996	0.24
1997	0.31
1998	0.19
1999	0.31
2000	0.29

**Table 2: Mercury concentrations in suspended particles of the northern reach of San Francisco Bay. Concentrations determined by simple linear regression of total recoverable mercury concentrations against TSS, with the intercept forced through zero.**

The concentrations of mercury in suspended sediments of the northern reach over the past eight years are summarized in Table 2. Inspection of Table 2 suggests that the rate of change of mercury concentrations in sediments,  $\Delta C_B$ , is no more than 0.01 mg/kg/yr and no less than -0.01 mg/kg per year. If the concentration of mercury in Bay sediments were changing faster than  $\pm 0.01$  mg/kg/yr, then we would expect a change of  $\pm 0.1$  mg/kg over the past decade; that does not appear to be the case. This qualitative statement can be better quantified through a more rigorous statistical approach, but it is still a useful starting point for constraining the mercury mass balance in San Francisco Bay.

Referring back to Figure 1, knowing that  $-0.01 < \Delta C_B < 0.01$  helps constrain inputs-outputs, according to Equation 2

**Equation 2:**

$$(\text{Inputs} - \text{Outputs}) = \Delta C_B \times M_{\text{sed}}$$

Where  $M_{\text{sed}}$  is the mass of actively resuspended sediments (millions of kg)

The best estimate for the depth of the actively resuspended sediment layer is 0.15 m (Davis, 2002). The area of the Bay is  $930 \times 10^6 \text{ m}^2$  (Conomos, 1979). Assuming that bedded sediments have a density of  $1325 \text{ kg / m}^3$ , this means the mass of active sediments is 184,838 M kg:

$$M_{\text{sed}} = 0.15 \text{ m} \times 930 \text{ M m}^2 \times 1325 \text{ kg / m}^3 = 185,000 \text{ Mkg.}$$

If the average concentration of mercury in Bay sediments is 0.3 ppm, than the mercury mass inventory in the actively resuspended sediment layer is approximately 60,000 kg Hg. If the concentration of mercury in the actively resuspended sediment layer is changing by less than 0.01 ppm, then according to Equation 2 (and rounding to 1 significant figure):



$$- 2000 \text{ kg/yr} < (\text{Inputs} - \text{Outputs}) < 2000 \text{ kg/yr}$$

In other words, from the fact that the concentrations of mercury in Bay sediments are changing by less than 0.01 ppm per year, we infer that the 60,000 kg mercury mass inventory in the Bay is changing by less than 2000 kg/yr, or by less than 3% per year.

With a longer sampling period, the rate of change can be better constrained. For example, data from a 1970 assessment of mercury in the surface of San Francisco Bay sediments suggest that concentrations in surface sediments of the open Bay in 1970 were similar to contemporary concentrations [McCulloch, 1971 #64]. If the average concentration of mercury in Bay sediments has changed by less than 0.1 ppm over the past 33 years, then  $- 0.003 < \Delta C_B < 0.003$ , and therefore the 60,000 kg mercury mass inventory of the Bay would be changing by less than 600 kg/year (i.e., less than 1% per year).

## 5.2 Outputs

The outputs rates are determined by the rate of sediment removal from the Bay, primarily by tidal flushing out the Golden Gate and by disposal of dredged sediments to ocean or upland sites. Removal by burial is considered negligible, because the Bay does not appear to be accreting at a significant rate, and may in fact be eroding slightly (Jaffe et al., 2002) (Note that the erosion rate is still small, <1% compared to the total sediment flux through the Bay, so the steady-state approximation that sediment inputs balance sediment outputs is still valid). The total sediment load to the Bay, including the Central Valley and local tributaries, is between 1600 and 3200 M kg/yr. If the total amount of sediment leaving the Bay is roughly equal to the total amount of sediment entering the Bay, then at least 1600 and as much as 3200 M kg/yr of sediment also exits the Bay. If the average mercury concentration of sediments exiting the Bay is between 0.2 and 0.4 ppm, then the mass of mercury leaving the Bay via sediments is between 320 and 1280 kg/yr, with the best estimate taken at the midpoint (800 kg/yr).

Another possible removal pathway is evasion of dissolved gaseous mercury. As discussed above, this is estimated to be 66 – 260 kg/ yr [Conaway, 2003 #63]. Therefore, the total output rate for mercury in the mass balance model for the Bay is calculated to be between 390 and 1540 kg/yr, with a best estimate of 965 (=1000 kg/yr rounded to 1 significant figure)

## 5.3 Mass Balance

The total inputs inferred from the steady-state conditions of the Bay is calculated from Equation 3:

**Equation 3:**

$$\text{Total inputs} = (\text{inputs} - \text{outputs}) + \text{outputs}$$

Using the values for (inputs-outputs) and outputs calculated above, the best estimate for total mercury inputs to the Bay is 1000 kg/yr, with a likely range of -1600 kg/yr to 3500 kg/yr. This means that the net effect of all processes besides dredging, tidal flushing, and evasion to the atmosphere must be somewhere between an output of 1600 kg per year and an input of 3500 kg/yr, and that the best estimate is a net input of 1000 kg mercury per year to the Bay.

Assuming that all other outputs (burial, offgassing, upstream tidal mixing) are negligible, the implication is that total mercury loads to the Bay amount to 922 kg per year.

In comparison, loads to the Bay calculated from readily available data amount to 700 kg/yr. Therefore, the best estimate for all other loads (L, in Figure 1) is 300 kg/yr, with a likely range of -2700 – 3200 kg/yr. The results of the mass balance calculations (rounded to two significant figures) are summarized in Table 3.

## **6. Discussion of the Mass Balance**

### **6.1 Summary of mass balance calculations**

The results of this mass balance analysis can be summarized in a few intuitive statements that help determine the most important next steps to reducing uncertainties about mercury mass loads to the Bay. The initial approach treats the Bay as a single reservoir consisting of 185,000 M kg of sediment. The concentration of mercury in this sediment reservoir doesn't increase or decrease by more than 0.01 mg/kg per year, and the annual flow of sediment into the reservoir balances the annual flow of sediment out of the reservoir. For this simple system, annual mercury inputs of 940 kg/yr are required to balance the estimated mercury outputs. The sum of all direct estimates of mercury inputs is 640 kg/yr, suggesting that there are an additional 300 kg/yr yet to be accounted for.

However, there is a great deal of uncertainty associated with this estimate. The additional loads could be as much as 3000 kg/yr or as little as -2600 kg/yr (i.e., a net loss), based on a strict assessment of uncertainties associated with the mass balance calculation. The uncertainty comes from the approach – the sediment reservoir is massive ( $1.85 \times 10^{11}$  kg), so limiting the rate of change in mercury concentration to 0.01 mg/kg/yr allows a difference of up to 1850 kg/yr between mercury inputs and mercury outputs.

	Hg Load, Best Estimate (kg/yr)	Hg Load, Possible Range (kg/yr)
<b>Inputs</b>		
Central Valley	400	240 - 630
Urban stormwater	200	60 - 300
Non-urban stormwater	80	20 - 100
Air Deposition	30	10 - 50
Wastewater	14	11 - 17
Total of Calculated Inputs	700	300 - 1100
<b>Outputs</b>		
Sediment loss	800	300 - 1300
Atmospheric Evasion	200	70 - 260
Total Outputs	1000	400 - 1600
Inputs-Outputs	0	(-2000) - 2000
<b>Mass Balance</b>		
Mass Balance Inputs = (Inputs - Outputs) + Outputs	1000	(-1600) - 3500
Additional loads = Mass Balance Inputs - Calculated Inputs	300	(-2600) - 3000

**Table 3: Preliminary Mass Balance Summary for Mercury in San Francisco Bay. Data rounded to two significant figures.**

## 6.2 Approach to reducing uncertainty in the mass balance

Much of this uncertainty can be reduced by just thinking about the system a little more carefully. It is extremely unlikely that total outputs have been underestimated by thousands of kilograms. For that to be true, it would require sediment burial rates, mercury offgassing rates, or biological uptake and removal rates that conflict with our present understanding of the biogeochemical cycle of mercury in the Bay. While this hypothesis should be more carefully reviewed by a science review team, it is worth considering what the more likely range for all other loads is if all other output processes total no more than 300 kg per year.

If the minimum values for all the estimated inputs shown in Table 3 are the true values, and additional output processes (i.e., gaseous evasion, biological uptake and removal, burial, disposal of dredged sediments) amounts to -300 kg, then the “additional loads” term would be no less than -514 kg/yr. On the other extreme, if there are no other significant outputs, the maximum values for all the estimated inputs shown in Table 3 are the true values, and the maximum values for all other possible loads (discussed in section 7 below) are added in, then the “additional loads” term would be no more than 1900 kg/yr.

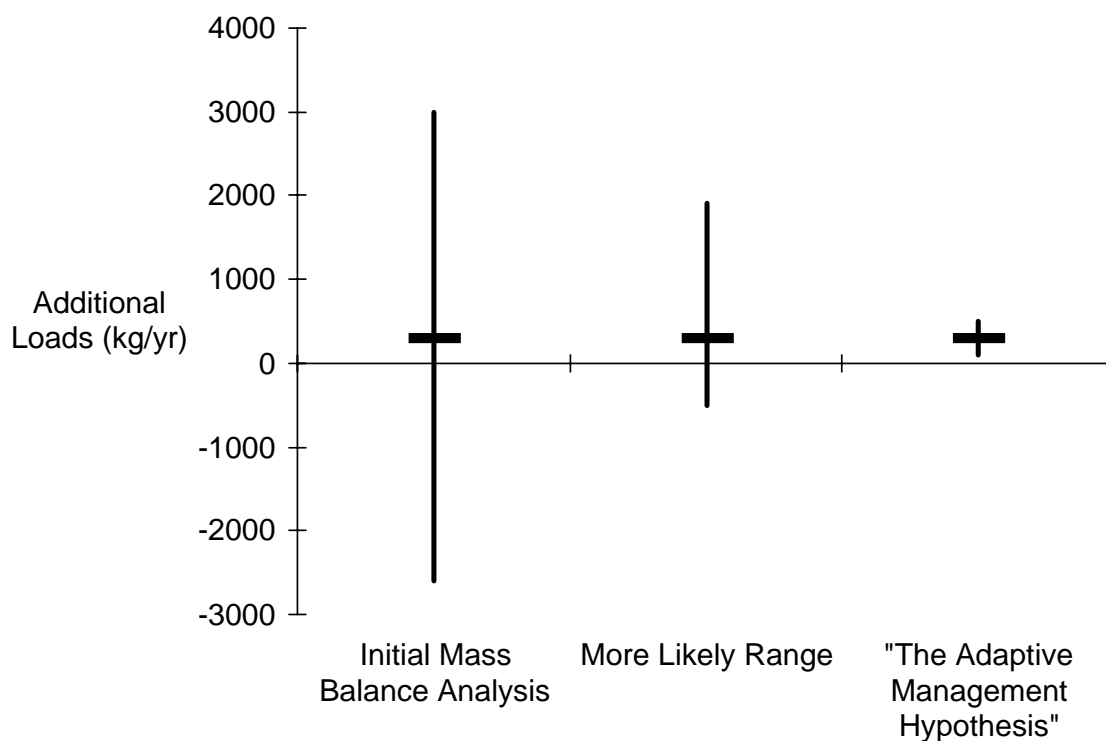
So a more likely range for the “additional loads” term is (-514) – 1900 kg/yr.

Four general approaches are needed to reduce uncertainty in the mass balance:

- 1) *Improve direct estimates of mercury inputs in Table 3*
  - a. The true, long-term annual average concentration of mercury in sediments flushed into the Bay from the Central Valley, including variability during high-flow periods, is a key uncertainty that can be resolved through focused monitoring.
  - b. The amount of sediment discharged from urban and non-urban watersheds and the true, long-term annual average concentration of mercury in those sediments are additional uncertainties.
- 2) *Improve direct estimates of additional mercury loads discussed in section 7 below.*
  - a. Loads from the Guadalupe River are complicated by tidal mixing in the lower reaches of Alviso slough and Lower south Bay. This is a key uncertainty that can be resolved through monitoring and modeling.
  - b. Anomalous storm drain conveyances may contribute additional loads above those calculated using the “urban/non-urban” paradigm. This can be resolved through monitoring.
  - c. Benthic remobilization of polluted sediments deposited in deeper layers of the northern reach may be a substantial source. This can be resolved by collection of more cores throughout the Bay, and by modeling the sediment mixing and erosion dynamics.
- 3) *Refine the estimate for the rate of change in mercury concentrations of Bay sediments.*
  - a. The estimate for the rate of change in mercury concentrations can be improved reasonably soon by simply applying a more rigorous statistical approach to existing monitoring data. Such an approach should account for the heteroskedasticity of the regression analysis discussed in Appendix A.
  - b. Since the rate of change has time in the denominator, the estimate will improve as the time period of the monitoring data set gets longer.
- 4) *Refine the simple, one-box model to a multi-segment box model*
  - a. One key improvement to the mass balance model would be to improve the estimate for concentrations of mercury in sediments of different segments of the Bay. This can be done using data from a random, stratified sampling program, such as the EMAPS data set, or the redesigned approach of the RMP.
  - b. Another improvement is to break the mass balance calculations down into a multiple segment model, to more accurately reflect the segmented nature of San Francisco Bay. Such a model should account for both mixing and advection in the sediment transport dynamics of the Bay. A simple, two-segment conceptual model for the Bay is discussed in Appendix B.

Some preliminary work has been done on a five-segment mass transport box model for the Bay. This work should be peer reviewed and more rigorously tested. Initial results suggest that additional loads to the northern reach of the Bay, after accounting for stormwater, wastewater, airborne deposition, and loads from the Central Valley, amount to 100-500 kg per year, with a best estimate of 300 kg. For now, this range should be considered a working hypothesis, known as “The Adaptive Management Hypothesis.” This working hypothesis is based on Best Professional Judgment resulting from twelve years experience studying trace

metal geochemistry on San Francisco Bay, and two years of discussion with experts from the United State's Geological Survey, the San Francisco Estuary Institute, and the University of California. If greater precision is needed in the mass balance for mercury in San Francisco Bay in order to make key policy decisions, the hypothesis can be tested by addressing the four key uncertainties outlined above.



**Figure 2: Closure on the mass balance (indicated by additional mercury loads) based on this initial mass balance analysis. The more likely range and the Adaptive Management Hypothesis indicate likely outcomes of improved monitoring and modeling efforts. Vertical lines indicate the range, horizontal lines indicate the best estimates.**

## **7. Estimates of additional loads**

### **7.1 Loads from the Guadalupe River**

The mercury mines of the New Almaden mining district left the Guadalupe River watershed with a legacy of mercury-polluted sediments in piles of waste rock, surface soils, and stream sediments. The load resulting from this is calculated based on average mercury concentrations in sediments exported from the Guadalupe River watershed, and average annual sediment loads.

**Hg Load from Guadalupe River = 100 kg/yr (Range 7-700 kg/yr)**

= 5 mg/kg Hg in Guadalupe River Watershed sediments x 20 M kg sediment/yr

**Average Hg concentration in sediments exported from Guadalupe River:** We currently observe 1 mg/kg Hg in sediments at Alviso Slough during high flow (Abu-Saba and Tang, 2000), (Leatherbarrow et al., 2002), from data readily available through RMP annual reports and on SFEI website. However, Alviso slough is a bad place to estimate concentration of mercury in sediments leaving Guadalupe R. watershed because of tidal mixing – watershed sediments are diluted with Bay muds, hence 1 mg/kg is a lower limit. Sediments in the lower Guadalupe River near downtown San Jose have 2-10 mg/kg mercury. A reasonable estimate is 5 mg/kg, midway between 1 and 10. This estimate can be refined and substantiated from the wealth of sediment samples analyzed as part of the lower Guadalupe River flood control project. Kleinfelder Consultants also have an extensive data set from corings taken in conjunction with the Rivermark development project.

**Sediment load from Guadalupe River :** The “rational method” yields an estimate of 7 M kg/yr sediment (URS Greiner Woodward Clyde and Tetra Tech Inc., 1998). The rational method underestimates sediment load by 2-3 fold (Lester Mckee, personal communication). USGS used gauged flow and measured TSS and bed-load estimates to propose 36 – 74 M kg/yr (Porterfield, 1980). The best estimate is 20 M kg/yr, with a likely range of 7-70 M kg/yr.

## 7.2 Additional stormwater loads

Not all drainages within the Bay Area watersheds fit the “urban / non-urban” paradigm used to estimate stormwater loads. Sediments from some storm drain conveyances in the Bay Area have elevated mercury concentrations in the fine sediments compared to more typical urban and non-urban sediments [Gunther, 2001 #23] (**JASP report**). Of the over 200 samples collected for determination of mercury concentrations, 20 showed elevated mercury concentrations which did not fit the “urban / non-urban” paradigm. The average concentration of mercury (normalized to fine sediments) was 9 mg/kg, with a standard error of +/- 2 mg/kg. By making the very rough approximation that these anomalous watersheds represent about 1% of the watershed sediment load to the Bay, and assuming a likely range of 5-13 mg/kg (two times the standard error) for the concentration of mercury in these anomalous stormwater conveyances, the best estimate form mercury loads from other stormwater sources is 78 kg/yr, with a likely range of 22 – 126 kg/yr.

**Sediment load from anomalous stormwater conveyances:**

**Best estimate = 7.1 M kg/yr = 0.01 x 707 M kg/yr (1% of watershed sediment load)**

**Minimum = 4.4 M kg/yr = 0.01 x 440 M kg/yr**

**Maximum = 9.7 M kg/yr = 0.01 x 970 M kg/yr**

**Mercury load from anomalous stormwater conveyances:**

**Best estimate = 9 mg/kg x 7.1 M kg/yr = 64 kg/yr**

**Minimum = 5 mg/kg x 4.4 M kg/yr = 22 kg/yr**

**Maximum = 13 mg/kg x 9.7 M kg/yr = 126 kg/yr**

### 7.3 Loads from undetected local mines in the Northern Reach

There may be additional inoperative mercury mines in the Napa River watershed contributing to the loads for the northern reach. This is suggested by the map of inoperative mines in the 1995 Basin Plan. A reasonable first-order watershed assessment is possible simply by asking “are there possible places where 1-10 M kg/yr of sediment averaging 1-20 mg/kg mercury are discharged downstream?” If so, that could result in 1-200 kg/yr of sediment. Discharge of 5 M kg/yr sediment averaging 5 mg/kg would be 25 kg/yr. So the best estimate is taken as 25 kg/yr, with a likely range of 1-200 kg/yr.

The Gambonini mine in Marin County would be a good “calibration mine” to help think about this in greater detail, as well as site inspections and aerial photographs to identify potential sources of mercury due to erosion and mass wasting of tailings piles.

#### **Mercury load from other mines in the Northern Reach:**

**Best estimate = 5 mg/kg x 5 M kg/yr = 25 kg/yr**

**Minimum = 1 mg/kg x 1 M kg/yr = 1 kg/yr**

**Maximum = 20 mg/kg x 10 M kg/yr = 200 kg/yr**

### 7.4 Loads from sediment pulses from the Central Valley

Pulses of mercury-polluted sediments are transported downstream from mining-impacted watersheds during high-flow periods (Foe and Croyle, 1998; Ganguli et al., 2000; Leatherbarrow et al., 2002; Whyte and Kirschner, 2000). The concentration of mercury in sediments transported from the Central Valley may peak episodically during high-flow events, as a result of flushing from mining-impacted areas, as well as erosive scour of historically deposited sediments from within the Delta. Therefore, treating the observed 0.21 mg/kg concentration of mercury in sediments at Sacramento River mouth as a year-round average may be an underestimate. Even small departures from this average correspond to relatively large mercury loads, because the sediment load is so high during high-flow events.

For example, if 10% of the sediment load from the Central Valley had an average concentration of 0.31 mg/kg instead of 0.21 mg/kg, that would correspond to an excess of 21 kg over loads predicted from an annual average concentration of 0.21 mg/kg:

$$(0.31 - 0.21) \text{ mg/kg} \times (0.1) \times (2100 \text{ M kg/yr}) = 0.1 \text{ mg/kg} \times 210 \text{ M kg/yr} = 21 \text{ kg}.$$

Most of the sediment load from the Central Valley enters during high-flow periods (Foe and Croyle, 1998), so it is reasonable that up to 80% of the sediment load could have higher mercury

concentrations than the typically observed 0.21 mg/kg. This would suggest a maximum load of 168 kg from seasonal pulses out of the Central Valley:

$$(0.31 - 0.21) \text{ mg/kg} \times (0.8) \times (2100 \text{ M kg.yr}) = 0.1 \text{ mg/kg} \times 1680 \text{ M kg/yr} = 168 \text{ kg}.$$

The best estimate is taken at the mid-point, 95 kg/yr.

## 7.5 Loads from benthic remobilization

This is one of the hardest loads to estimate. Benthic remobilization refers to the gradual exposure of mercury – polluted sediments that were deposited over the past 100 years. Deep cores in San Francisco Bay show mercury concentrations up to 1 mg/kg in sediments beneath about 30 cm. The northern reach of San Francisco Bay was filled in up to 2 meters with sediment and debris from hydraulic mining in the late 1800's and early 1900's. Today, dams from the Central Valley Project have cut off considerable amounts of sediment supplied to San Francisco Bay, so the northern reach of the Bay has shifted from a depositional environment to an erosional one (Jaffe et al., 2002; Krone, 1979). As the Bay seeks to restore its natural bathymetry, polluted sediments from deeper layers are gradually mixed upward. This is probably the reason why we observe a concentration gradient between suspended particles and bottom sediments in the northern reach (Appendix 1), and may also explain in part why there is a mercury concentrations in sediments increase by about 0.1 mg/kg between the Sacramento River and San Pablo Bay.

Knowing that the other loads to the Bay add up to at most 284 kg, and that the total loads needed to close the mass balance are less than 1160 kg, it can be said that loads from exposure of polluted sediments are no more than 876 kg/yr.



## **8. Breakdown of the Central Valley Load**

The Central Valley load can be subdivided into the watershed background load, the contribution from atmospheric deposition, mining legacies, and emissions from the urban environment.

### **8.1 Watershed background load**

The concentration of mercury in sediments deposited in the Bay was 0.04 - 0.08 mg/kg in pre-settlement times (Hornberger et al., 1999). This pre-industrial watershed background was caused by mineral weathering and deposition of natural, pre-industrial atmospheric sources. The modern watershed background load has likely increased because the source of sediments has shifted. With the construction of dams and reservoirs, much of the sediment supply from the Sierra Nevadas was cut off from San Francisco Bay, resulting in a shift towards Coast Range sediments as the chief source. Coast range sediments likely have naturally higher average mercury concentrations, so we make the assumption that the modern background load due to mineral weathering is somewhat higher, about 0.06 – 0.10 mg/kg, with a best estimate of 0.08 mg/kg. Applied to the annual sediment load (1800-2400 M kg/yr), this implies a best estimate of 168 kg/yr, with a likely range of 108-240 kg/yr:

**Best estimate = 0.08 mg/kg x 2100 M kg/yr = 168 kg/yr**

**Minimum = 0.06 mg/kg x 1800 M kg/yr = 108 kg/yr**

**Maximum = 0.10 mg/kg x 2400 M kg/yr = 240 kg/yr**

### **8.2 Atmospheric Deposition over the Central Valley**

Atmospheric deposition over the Central Valley probably accounts for between 0.05 and 0.15 mg/kg of the present day concentration of mercury in sediments discharged from the Delta. The upper limit, 0.15 mg/kg, comes from the average of two independent lines of evidence:

- i) Mercury concentrations in the upper layer of sediments collected from Lake Tahoe average around 0.2 mg/kg. Lake Tahoe is an alpine Lake in the Sierra Nevadas (Slotton, 2000). Mercury loads to the lake are essentially all atmospheric in origin – there are no known mercury or gold mines in the Lake Tahoe Basin. In deeper, dated cores, collected from the lake, background concentrations were approximately 0.04 mg/kg. Therefore, the inferred effect from modern atmospheric deposition is 0.16 mg/kg. Deposition rates appear to be much higher in the high Sierras than on the California Coast, and dams downstream trap sediments, so the effect of air deposition on mercury concentrations in Central Valley sediments is probably lower than what we see in the Sierras.
- ii) The median mercury concentration is also around 0.2 mg/kg for surface background sediments collected throughout the Central Valley (Bradford et al., 1996). Since the

natural background of this sediment is 0.06 mg/kg, we infer an effect of 0.14 (=0.2 – 0.06) mg/kg from atmospheric deposition onto the Central Valley.

The best estimate of the lower limit is 0.05 mg/kg. This estimate assumes that since contemporary global atmospheric mercury emissions are 2-3 fold greater than in pre-industrial times, atmospheric deposition must have some effect on the concentration of mercury in surface sediments. Therefore, the lower limit is set by the observation that even in remote areas of the world atmospheric deposition increases mercury concentrations in soils by 0.05 mg/kg (Fitzgerald et al., 1998).

Given these upper and lower limits, atmospheric deposition probably elevates mercury concentrations in Central Valley Sediments by 0.10 +/- 0.05 mg/kg compared to pre-industrial times. Applied to the estimated sediment load from the Central Valley, this suggests a best estimate of 210 kg/yr, with a likely range of 90 – 360 kg/yr.

**Best estimate = 0.10 mg/kg x 2100 M kg/yr = 210 kg/yr**

**Minimum = 0.05 mg/kg x 1800 M kg/yr = 90 kg/yr**

**Maximum = 0.15 mg/kg x 2400 M kg/yr = 360 kg/yr**

### 8.3 All other Central Valley Sources, including inoperative mines

With an estimate of the total mercury load discharged from the Central Valley, and estimates of the amount of that load caused by mineral weathering and atmospheric deposition, the load from all other sources, including inoperative mercury mines, can be estimated by difference. Mineral weathering plus atmospheric deposition account for at least 0.11 mg/kg, and may account for almost all of the 0.21 mg/kg mercury concentration observed in Central Valley sediments. Thus, the impact of discharges from all other Central Valley sources, including inoperative mercury mines, urban runoff, and wastewater, is between 0.01 and 0.10 mg/kg.

This yields a possible range of 18 – 240 kg for all other Central Valley sources:

**Minimum: 0.01 mg/kg x 1800 M kg/yr = 18 kg/yr**

**Maximum: 0.1 mg/kg x 2400 M kg/yr = 240 kg/yr**


**Best estimate: 441 kg/yr (Central Valley Total) – 210 kg/yr (Best estimate for air deposition) – 168 kg/yr (best estimate for mineral weathering) = 68 kg/yr**

	Hg Load, Best Estimate	Hg Load, Possible Range	[Hg]sed	Sediment Flux
Mineral Weathering	168	108 - 240	.06 - .10	1800 - 2400
Air Deposition	210	90 - 360	.1 - .2	1800 - 2400
All other Central Valley Sources, including mines	63	1 - 243		
Total	441			

**Table 4: Breakdown of estimated loads contributing to total Central Valley load.**

## **Appendix A: How we know what we know about mercury concentrations in Bay sediments**

The basis for calculating a Total Maximum Daily Load for mercury in San Francisco Bay is the concentration of mercury in sediments. Like many pollutants, mercury preferentially partitions onto sediments. In the Bay, for every atom of mercury in the dissolved phase, there are about a million mercury atoms stuck to particles<sup>1</sup>. So, even though the Bay is a complex, tidally mixed estuary with multiple mercury sources, we can simplify the mass balance problem by just considering mass transport of mercury in the particulate phase:

$$\begin{array}{ccccc} \text{Hg load} & & & & \text{Sediment load} \\ \text{(kg Hg / yr)} & = & \text{Concentration in} & \times & \text{(M kg sed / yr)} \\ & & \text{sediments (ppm,} & & \\ & & \text{mg Hg / kg sed)} & & \end{array}$$


**Equation 4: Relationship between mercury loads, mercury concentrations in sediments, and sediment load.**

The power of the “view from downstream” is its simplicity. By asking “what causes the contemporary observed concentrations of mercury in receiving water sediments,” we are led to some rather straightforward measurements of mercury concentrations in sediments in different parts of the Bay and its watersheds. The purpose of this memo is to explain how we analyze the thousands of data points from the RMP<sup>1</sup> to quantify the concentration of mercury in Bay sediments.

<sup>1</sup> This is quantitatively expressed as the partition coefficient:

$$K_d = \frac{10^6 \times ([\text{Hg}]_{\text{tot}} - [\text{Hg}]_{\text{diss}})}{[\text{Hg}]_{\text{diss}} \times \text{TSS}} \quad (\text{L/kg})$$

Values for total mercury in water ([Hg]<sub>tot</sub>), dissolved mercury ([Hg]<sub>diss</sub>) and total suspended solids (TSS) are available from the Regional Monitoring Program, at [www.sfei.org](http://www.sfei.org). The K<sub>d</sub> for Mercury in the Bay ranges from 100,000 – 10,000,000 L/kg, and is most commonly on the order of 1,000,000 L/kg.

## A.1 Available Data

The data set for making these determinations comes from the RMP, which archives the data for public access at [www.sfei.org](http://www.sfei.org). Data are available for sampling cruises conducted between 1993 and 2000. Subsequent data have been collected, but have not been reviewed and approved for release yet. Much of the Hg data from later years (1999 and 2000) has been “blank flagged,” indicating they should be considered with caution, because the contracting laboratories reported high blanks (<30% of sample signal)<sup>2</sup> in their analyses that year. The analyses for this study were conducted both by using the full 1993-2000 data set and by deleting “blank-flagged” data. The conclusions are not affected by removing the blank flagged data, so all discussions are based on the full data set.

The United States Environmental Protection Agency has also collected a survey of pollutant concentrations in Bay sediments (their EMAPS program). The EMAPS survey used a random stratified sampling design to choose station locations. When this data becomes available, it will be a useful check as to whether sample design affects the conclusions. Until then, what we know “now” is established by the RMP data set.

There are two types of measurements available in the RMP data set: water column and bottom sediments. This analysis uses both. Water column measurements are collected by pumping water from approximately one meter below the water surface into sample bottles. Samples are analyzed for total recoverable mercury (i.e., the concentration of mercury in an unfiltered water sample after it has been acidified to pH <2). Water column measurements also quantify the total suspended solids (TSS) in a sample. Total recoverable mercury and TSS measurements are combined to make inferences about the concentration of mercury in suspended sediments. Bottom sediment samples are collected by dropping an Eckman dredge overboard to collect a large (about 1 m<sup>3</sup>) chunk of the Bay floor. The top five centimeters of sediments in the dredge are homogenized and analyzed for total mercury and grain size (i.e. the percent fine material, less than 63 microns). Total mercury and percent fines measurements are combined to make inferences about the concentration of mercury in fine bottom sediments.

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<sup>2</sup> The fact that the blank flags went up is a sign that the QC program is working.

## A.2 Data analysis: Basic calculations

Analysis of both the water column and the bottom sediment data relies upon simple linear regression to make scientific inferences about mercury concentrations in Bay sediments. This approach yields not only estimates of mercury concentrations, but also reasonable descriptions of the uncertainty of those estimates. We have to use regression analysis because for both water column data and bottom sediment data, there are gross physical processes that affect observed mercury concentrations. Total mercury in the water column tends to increase with increasing suspended load. Total mercury in bottom sediments tends to increase when sediments have more fine material. We “normalize” water column data to suspended load and bottom sediment data to percent fines in order to detect differences in mercury concentrations that are due to mercury loads.

For the water column data, we plot total recoverable mercury against TSS. The slope of the best fit line gives the average concentration of mercury in the suspended particulate matter, according to .

$$[\text{Hg}]_{\text{sediment}} (\mu\text{g/g, mg/kg}) = [\text{Hg}]_{\text{water}} (\mu\text{g/L}) / [\text{TSS}] \text{ mg/L} \times 1000 (\text{mg/g})$$

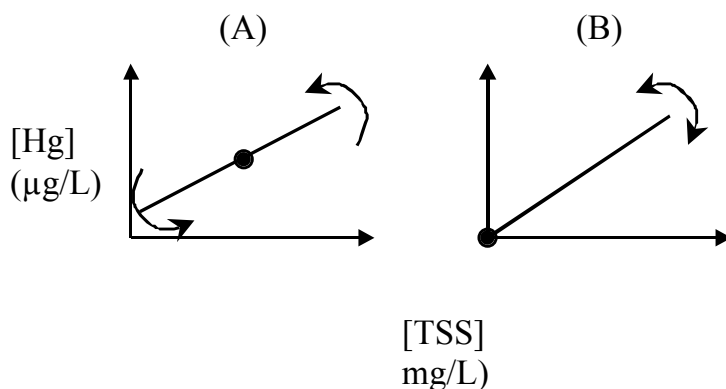
**Equation 5: Water column mercury concentrations ( $[\text{Hg}]_{\text{water}}$ ) as a function of mercury concentrations in sediments ( $[\text{Hg}]_{\text{sediment}}$ ) and suspended load ( $[\text{TSS}]$ ).**

Equation 5 simply expresses the slope of the regression line as the rise over the run, and performs the unit conversion to get the answer in  $\mu\text{g Hg}$  per  $\text{g}$  of suspended sediment. This is the basic calculation to determine mercury concentrations in suspended particles. The complete analysis also considers segmentation of the Bay and uncertainty of the basic calculation, as discussed below. For now, the important point is that for the water column data, we use regression analysis to determine a slope, and that slope has physical meaning. We are looking at a data set and asking, “given the observed relationship between total mercury in the water column and suspended sediment concentration, what does that tell us about the average concentration of mercury in the suspended sediments?”

When using simple linear regression, we can choose to calculate the intercept (Figure 3—A), or to force the intercept through zero (Figure 3-B). Our basic assumption is that essentially all the mercury is in the particulate phase, so the water column mercury should be zero at zero suspended load. This suggests that the best approach for the regression analysis is to force the intercept to zero. This makes use of known information and reduces the effect of high relative uncertainty at low suspended loads. The forced intercept approach (Figure 3-B) is used consistently for all regressions in this analysis, but the results are always compared to the calculated intercept approach (Figure 3-A) to see if the conclusions change with the statistical model selected.

For the bottom sediment data, we plot total recoverable mercury against percent fines, and then calculate mercury concentration where the best fit line crosses the Y axis at 100%. This is slightly different than the approach to the water column data, because we are working in different media. In the case of sediments, we are looking at a data set and asking, “given the observed relationship between mercury in sediments and the percentage of fine material present, what is the inferred concentration of mercury in just the fine sediments?”

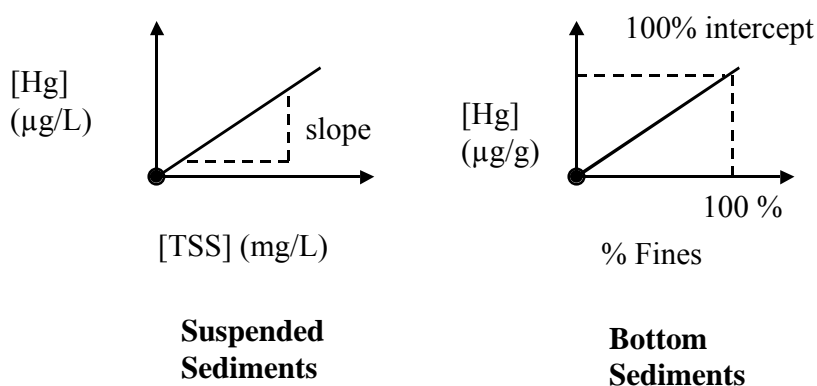
The underlying assumption is that all of the mercury in bottom sediments is stored in the fines, and none in the sandy material. This turns out to be a reasonable assumption for Bay sediments, but not necessarily in the watersheds. The reason the two cases are different is that the watersheds are truly dynamic, whereas Bay sediments are at dynamic equilibrium. Large chunks of cinnabar rolling down the Guadalupe River watershed can substantially elevate mercury concentrations in coarse sediments. But large chunks tend to drop out in the depositional reaches of the lower watershed, where they are ground and weathered into smaller particles that are tidally mixed into the Bay. Within the Bay, mercury is constantly adsorbing to and desorbing from particles – the observed partition coefficient is a dynamic equilibrium. There is statistically a much greater chance that an adsorbing mercury atom will hit the surface of a fine particle than a coarse one, because of surface area to volume ratios. This could be demonstrated using a complex statistical mechanical approach, but it is far simpler to plot mercury concentrations vs. grain size and note that in the Bay, the concentration approaches zero as the percent fines approach zero.



**Figure 3: Regression analysis can either calculate the intercept, in which case the best fit line pivots around the centroid of the data (Case A) or force the intercept, in which case the best fit line pivots around the intercept (Case B).**

As with the water column data, the regression analyses of bottom sediments consistently force the intercepts through zero, but compare the results to the unforced calculations to see if the conclusions change with the statistical model used. The basic calculations used to determine mercury concentrations in suspended and bottom sediments are compared in Figure 4.

Concentrations can be compared between media (suspended and bottom sediments) by making the assumption that suspended sediments are 100% fine (< 63 microns). This is a reasonable assumption, given that coarse sediments tend to rapidly drop out of suspension. Concentrations determined by this method can also be compared to historic concentrations measured in deep cores by the USGS. Sediments from those cores were sieved to less than 63 microns prior to analysis, so the measurements published by Hornberger et al (1999) reflect mercury concentrations in 100% fine sediments.



**Figure 4: Comparison of regression approaches to determine mercury concentrations in suspended sediments and bottom sediments.**

### A.3 Data analysis: Segmentation of the Bay

The next step is to divide the Bay into segments in order to identify whether there are spatial gradients in the concentration of mercury in Bay sediments. The conceptual basis for segmenting the Bay is discussed in Appendix 2). For this discussion, the Bay is divided into four segments: Suisun Bay, San Pablo Bay, Central Bay, and South Bay. South Bay refers to the portion of the Bay between the Dumbarton Bridge and the Bay Bridge. Lower South Bay (south of the Dumbarton Bridge) is a unique environment. Because of the large concentration gradients observed in some contaminants, it is more appropriate for this analysis to regard Lower South Bay as an interfacial region between the South bay watersheds and the Bay, rather than a segment of the Bay. Data from Suisun Bay, San Pablo Bay are also combined to describe a segment called “the northern reach.” The nomenclature for RMP stations makes it possible to quickly sort a data set by station code and divide the data into segments (Table 5).



Segment	RMP Stations
South Bay	BA10, BA20, BA30, BA40, BB15, BB30
Central Bay	BB70, BC10, BC20, BC30, BC41, BC60
San Pablo Bay	BD15, BD20, BD30, BD40, BD50, BD60
Suisun Bay	BF10, BF20, BF30, BF40
Sacramento River	BG20
San Joaquin River	BG30

**Table 5: Segmentation of the San Francisco Bay estuary by RMP station code.**

The Sacramento River station (BG20) is used to make assessments about the concentrations of mercury entering the estuary from the Sacramento – San Joaquin River delta. Because this is a tidally mixed interface region, this assumption needs to be considered with some caution – some of the observed concentrations at BG20 are due to tidal mixing of fluvial sediments with sediments already in the estuary. This is an acknowledged uncertainty that is discussed in greater detail elsewhere (Memo-2). For this analysis, it is sufficient to state that BG20 gives us our best approximation for the concentration of mercury in sediments flushed into the Bay from the Delta.

The San Joaquin River station (BG30), while nominally in the San Joaquin River, doesn't necessarily reflect the nature of sediments entering the Bay from the San Joaquin river basin, because flows through the Delta are extremely complex in this region. BG30 appears to be a depositional region, because the sediments in this region typically have more fine material compared to BG20. This station has some unusual properties that raise some interesting questions about the concentration of mercury in sediments originating from the Delta, but those details are beyond the scope of this discussion.

### *Results*

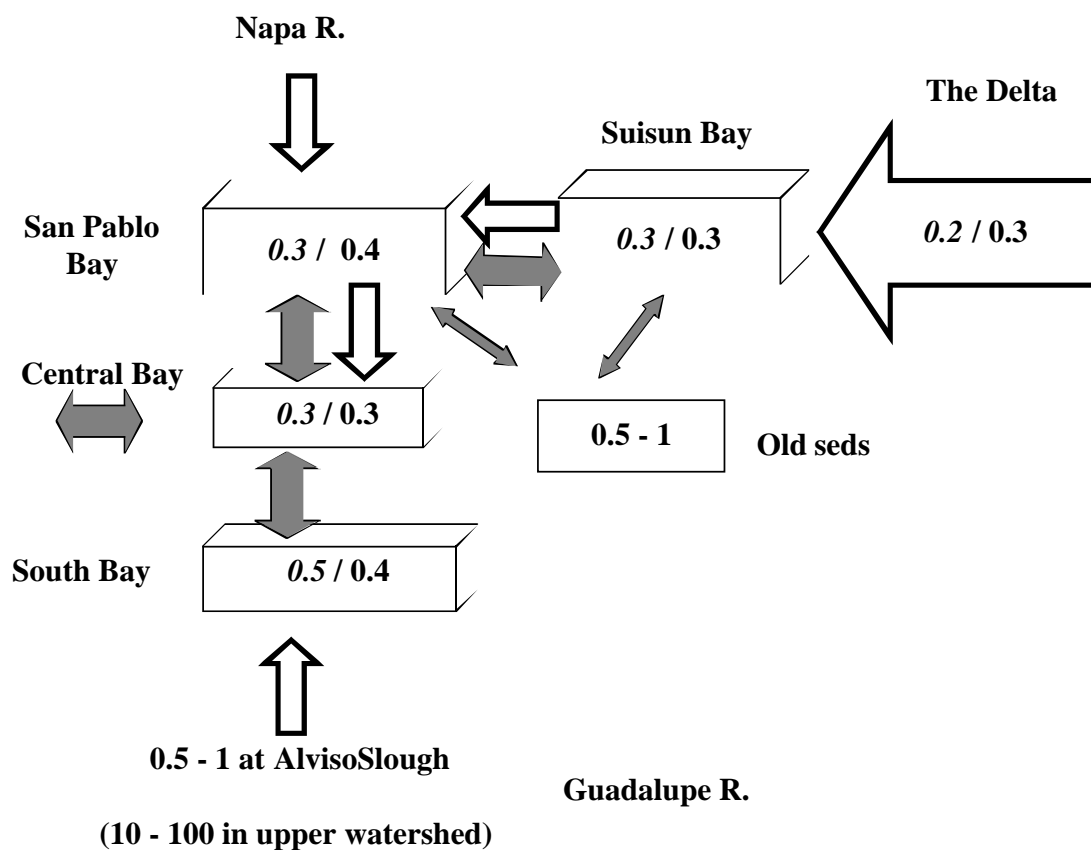
	South Bay	Central Bay	Northern Reach	San Pablo Bay	Suisun Bay	Sac River
<i>(Forced intercept)</i>						
Surface	0.48 +/- 0.02	0.34 +/- 0.01	0.26 +/- 0.01	0.26 +/- 0.01	0.26 +/- 0.01	0.21 +/- 0.01
Bottom	0.37 +/- 0.11	0.32 +/- 0.07	0.36 +/- 0.08	0.37 +/- 0.09	0.31 +/- 0.06	0.34 +/- 0.03
<i>(Calculated Intercept)</i>						
Surface	0.45 +/- 0.02	0.26 +/- 0.01	0.24 +/- 0.01	0.23 +/- 0.01	0.23 +/- 0.02	0.20 +/- 0.02
Bottom	0.34 +/- 0.10	0.30 +/- 0.07	0.35 +/- 0.08	0.36 +/- 0.09	0.31 +/- 0.06	0.30 +/- 0.03

**Table 6: Summary of regression analyses of RMP from San Francisco Bay segments. Surface concentrations refer to the slope of the best fit line for a plot of total water column mercury vs. TSS. Bottom concentrations refer to the 100% intercept of the best fit line. Uncertainties show one standard error. All calculations were done using the LINEST function of Microsoft EXCEL.**

Two general trends emerge from the data analysis (**Table 6**). First, mercury concentrations in surface sediments tend to increase as we move from the Sacramento River mouth, through the northern reach, and into Central and South Bay. This is true regardless of whether or not we do the regression calculations with a forced intercept. Second, mercury concentrations are higher in bottom sediments than in surface sediments in the northern reach, are roughly comparable in the Central Bay, and higher in the surface than at the bottom in the South Bay. This is also true regardless of whether or not the regression calculations force the intercept. *The observed north-south and surface-bottom gradients provide important clues about sediment transport and mercury loads to San Francisco Bay.*

The data from **Table 6** are combined and summarized in a conceptual model (**Figure 5**). One important clue that emerges from the conceptual model is that the concentration of mercury in sediments increases by about 0.1 mg/kg between the Delta and San Pablo Bay. This increased concentration can be used to put an upper limit on the internal loads of mercury to San Francisco Bay.

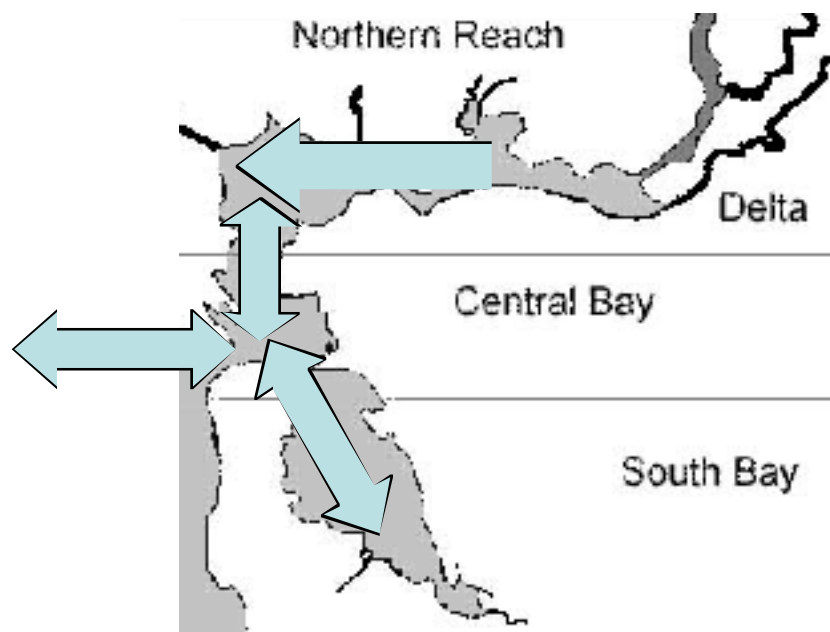
The top-bottom gradient probably reflects the different depositional environments of the northern and southern reaches. In the northern reach, a massive plug of mercury-laden sediment was deposited during and after the gold rush. That plug is being gradually exposed as the Bay seeks to attain its natural bathymetry. The South Bay isn't really erosional or depositional – sediments washed in from surrounding watersheds just slosh back and forth until they are tidally mixed out the Golden Gate. So the insult from the New Almaden mine isn't buried deep in the sediments of South Bay. Past and present mercury loads to South Bay are stored in the active layer, where they are continuously deposited, mixed with deeper, cleaner sediments, and then resuspended. This is most likely the reason that the top-bottom gradient is reversed in South Bay.



**Figure 5: Conceptual model for sediment transport processes affecting the concentration of mercury in San Francisco Bay sediments. Single white arrows indicate advection, double dark arrows indicate mixing. Italicized numbers indicate suspended sediment concentrations, bold-faced numbers indicate bottom sediment concentrations.**

## **Appendix B: Conceptual model for segmenting the Bay**

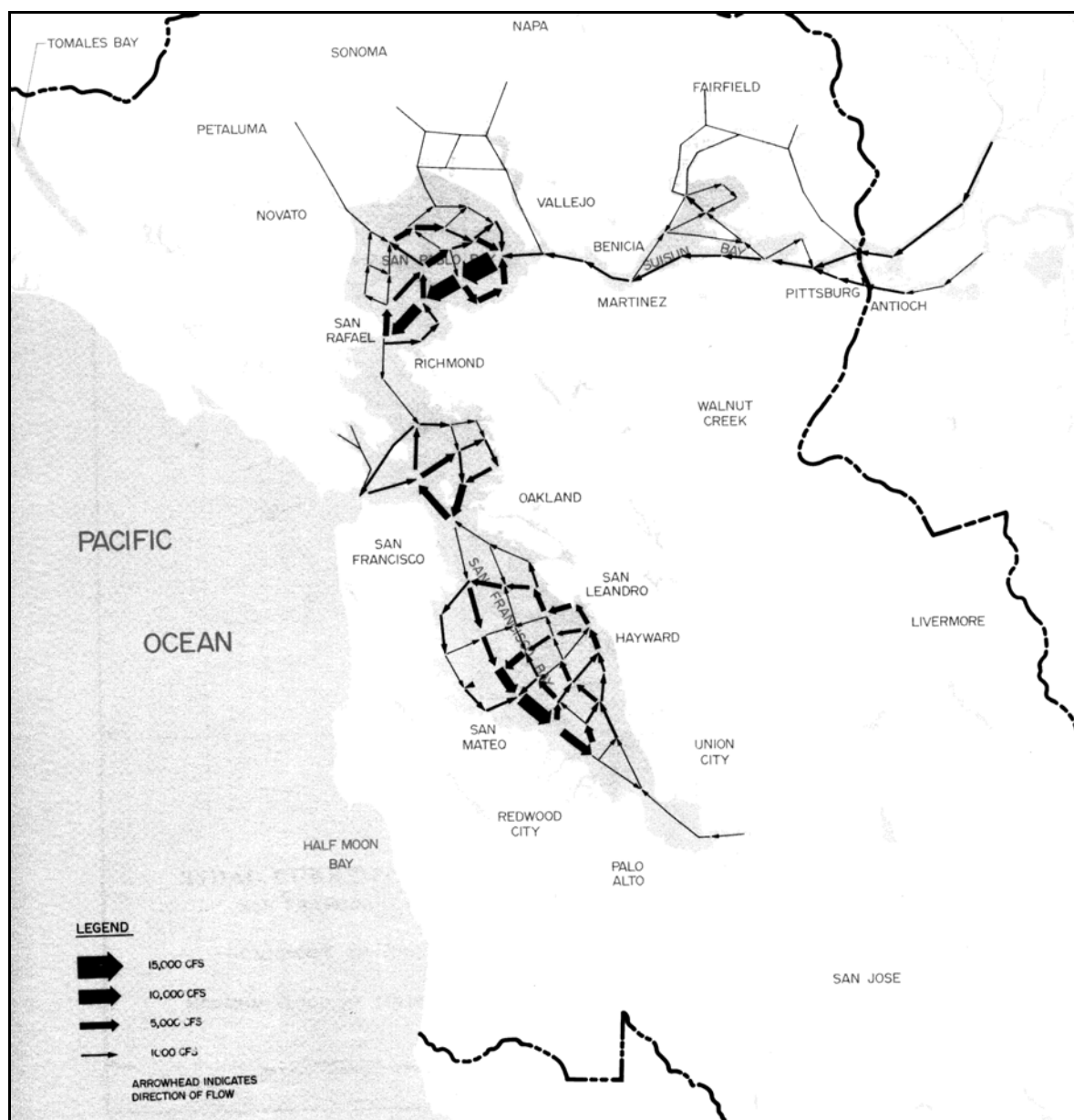
Detailed analysis of Bay loads required breaking the Bay into segments. A good starting point is to consider the Bay as two distinct segments, the northern reach and South Bay, which are joined at Central Bay (Figure 6). This conceptual model is warranted because the hydraulic and sediment transport processes are different in the northern reach compared to South Bay. In the northern reach, the dominant transport mechanism for sediments is river flow. Although tidal action is significant in the Delta, there is still a strong net tidal residual transport in the downstream direction up to the Carquinez straits. From San Pablo Bay to the Golden Gate, the dominant transport mechanism shifts to wind and tidal mixing. Sediment transport out of the South Bay is predominantly by wind and tidal mixing.



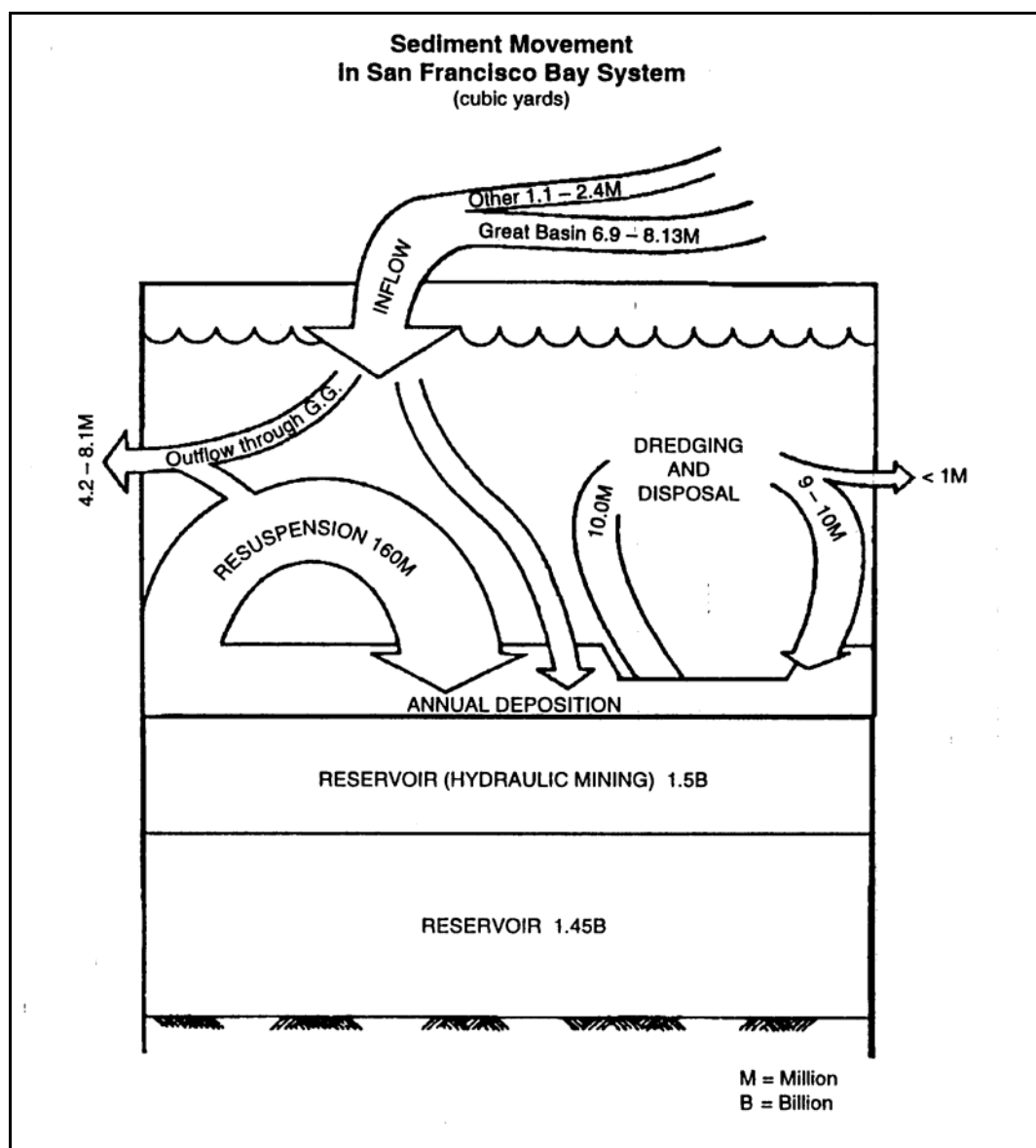
**Figure 6: Conceptual model for sediment transport dynamics in the Bay, treated as a three-segment system. Single arrows indicate sediment transport that is predominantly advective, double arrows indicate sediment transport that is predominantly wind and tidal mixing.**

In summary, the way the Bay works is that sediments are flushed in from the Central Valley, through the Delta, and into San Francisco Bay by predominantly advective forces. In the northern reach, sediments are deposited on the bottom, mixed with deeper sediments, and resuspended. Transport of sediments out of the northern reach is by tidal mixing. In the South Bay, transport is exclusively by wind and tidal mixing. This is an extremely simplified description of a complex superposition of processes, including seasonally variable freshwater outflow, spring-neap variability in suspended load inventories, mixed tidal and fluvial transport,

and wind-driven mixing and circulation. These processes are the focus of ongoing research, all of which has been considered or relied upon to develop this simplified conceptual model (Schoellhamer, 1996 May 15), (Cappiella et al., ; Conomos, 1979; Conomos et al., 1985; Schoellhamer, 2001; Smith, 1987) [U.S. Environmental Protection Agency, April, 1996 #24; Walters, 1985 #25] (Cheng et al., 1993). Although it is a complicated subject, the essential points of the science needed to understand the generalized conceptual model for sediment transport, mixing and dynamics in the Bay illustrated in Figure 6 are captured by Figure 7 and Figure 8.



**Figure 7: Flow and circulation of San Francisco Bay. Figure taken from (San Francisco Bay Regional Water Quality Control Board, 1975).**



**Figure 8: Annual sediment budget for San Francisco Bay. Figure taken from [U.S. Environmental Protection Agency, April, 1996 #24].**

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HR: 15:40h  
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 TI: **Talus Lex: Regulatory Approaches to Reducing Mercury Concentrations in San Francisco Bay Fish.**  
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 AB: The history of mercury in California is recorded in the sediments of San Francisco Bay. The Bay is downstream of 40 percent of the land area of California. Its watershed receives 80 percent of the rainfall in the State, because it rains more in the north. Three billion kilograms of sediments are annually flushed from the Central Valley watershed and deposited in San Francisco Bay. Because mercury preferentially binds to sediments, we calculate mercury loads to the Bay by considering how various sources affect mercury concentrations in Bay sediments. During and after the Gold Rush, over seventy thousand tons of mercury was produced in Coast Range cinnabar mines. Much of this mercury was used as quicksilver to extract gold from placer formations in the Sierra foothills, and later in the production of munitions, electronics, health care and commercial products. Today, we can see the legacy of mining sources, from both remote and local watersheds, superimposed on air deposition, the climate and geography of California, heavily managed water supply and flood control projects, wetland restoration and rehabilitation, urbanization, wastewater discharge and water reclamation. We already regulate wastewater and urban runoff through issuance of permits and waste discharge requirements. We can regulate mercury inputs from inoperative mines by demonstrating the link between mercury-polluted sediments and violation of existing numeric water quality objectives. We can use the same

approach to regulate the disposal of mercury-containing electronic devices. But to reduce mercury levels in fish, we will also have to consider controllable water quality factors that promote mercury methylation in the aquatic ecosystem. Some of these water quality factors are already subject to regulation. For example, we can show that mercury methylation in the northern reach of the Bay increases when dissolved oxygen drops below 6 mg/L; current regulations require dissolved oxygen concentrations of 7 mg/L or more in that region. But many of the processes that influence mercury bioaccumulation, such as microbial assemblage, sulfate concentration, and organic carbon loading, are complex, interacting factors that cannot be expressed as simple numeric limits. The Water Quality Control Plan for San Francisco Bay has a narrative objective for bioaccumulation that states that "controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic substances found in bottom sediments or aquatic life." To effectively implement that objective, we need basic science research to develop sound guidance for the creation, restoration, and management of wetlands and marshes surrounding the Bay.

UR: <http://www.swrcb.ca.gov/rwqcb2>  
DE: 1030 Geochemical cycles (0330)  
DE: 1065 Trace elements (3670)  
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DE: 4251 Marine pollution  
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# Mercury Management by Bay Area Wastewater Treatment Plants

*Approaches, costs, and benefits of alternative scenarios for implementing the San Francisco Bay TMDL mercury in municipal and industrial National Pollutant Discharge Elimination System (NPDES) permits.*

**Prepared by**

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**September 11, 2003**

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## **Executive Summary**

This report summarizes the approaches and feasibility of mercury management strategies for Bay Area wastewater treatment plants. It begins with an assessment of current mercury loads, predicts future (2025 A.D) loads based on population growth, and then evaluates the costs and benefits of different load management strategies. In addition to mercury load management strategies, factors affecting the feasibility of capturing and treating stormwater and managing mercury methylation in shallow waters are also discussed.

The current mercury load to the Bay from wastewater treatment plants is 15 +/- 3 kg/yr, (13 kg from municipal facilities, 2 kg from industries). This amounts to approximately 1 - 2% of the total mercury load entering the Bay (1200 kg / yr). Based on growth projections for the Bay Area, this load is predicted to increase to 17 kg/yr by the year 2025, absent any new mercury load reduction measures.

Implementation of pollution prevention and source control projects could reduce the future load from 17 kg/yr to 11 - 16.5 kg/yr, at a cost of \$8 million - \$25 million/yr. This represents an upper limit for both the costs and expected benefits of pollution prevention and source control, as these programs are already substantially implemented throughout the Bay Area. Combining pollution prevention with limited (Stage 1) increases in water reclamation would limit the future load to 10 - 14 kg/yr, at a cost of \$87 - 104 million/yr. More extensive water reclamation (Stage 2) would limit the future load to 8 - 12 kg/yr, at an annualized cost of \$247 - \$267 million. Upgrading all existing secondary plants (including industrial facilities) to include filtration would constrain the future mercury load to < 7 kg/yr, at a cost of \$167 - \$404 million/yr, and installation of reverse osmosis treatment on all Bay Area wastewater facilities would reduce the future mercury load to < 3 kg/yr at a cost of \$917 - 934 million/yr.

The feasibility of capturing and treating stormwater is very site-specific, depending on the ability to match catchments with highly polluted sediments with nearby excess treatment capacity. For mercury alone, the approach may not produce significant load reductions: in an example from an industrial catchment in Oakland, the projected load reduction for a significant engineering project would amount to 0.1 - 0.4 kg/yr of mercury, while consuming up to 6 mgd of capacity and requiring storage of 2.2 billion gallons. The feasibility of such a project could be enhanced if additional stormwater pollutant loads, such as PCBs or legacy pesticides, were considered. However, there are substantial technical and public policy barriers to blending urban runoff with sewage.

Strategies to reduce conversion of mercury to methylmercury may ultimately be more effective at reducing mercury concentrations in Bay fish. The final section discusses the need for an assessment of which mercury sources are most readily "methylated," how dissolved oxygen management could affect methylation rates, and whether other aspects of treatment plant operation, such as nitrification or the choice of flocculant, can affect mercury methylation in receiving waters.

## **1. Background**

The Clean Estuary Partnership, in support of the Regional Board's development of a Total Maximum Daily Load and Implementation Plan for mercury in San Francisco Bay, has authorized production of this report to answer specific questions regarding mercury management alternatives for municipal and industrial wastewater treatment plants. In order to provide reasonable assurance that wastewater discharges of mercury do not impair beneficial uses such as fishing and wildlife habitat, the Regional Board needs to know:

- 1) What is the current mercury load discharged to the Bay from wastewater?
- 2) In the absence of significant infrastructural and programmatic changes, how much will that load increase as a result of increased effluent flow due to population growth over time?
- 3) What benefit would additional infrastructural and / or programmatic mercury control measures have on the mercury load from wastewater discharges?
- 4) What are the expected costs of infrastructural and programmatic mercury control measures?
- 5) What additional management actions are possible that might reduce the conversion of mercury to methylmercury in receiving waters?

From the initial public review of the draft mercury strategy for managing mercury in the northern reach (Taylor, 1998), to the Mercury TMDL preliminary project report (Abu-Saba and Tang, 2000), to the Mercury TMDL final project report (Looker and Johnson, 2003), two important findings have emerged regarding mercury management alternatives for wastewater. First, it is clear that the mercury load to the Bay is dominated by watershed sources, such as mining-impacted watersheds and atmospheric deposition. The latest assessments quantify mercury loads from wastewater as 14.7 kg/ yr, compared to 1220 kg per year from all sources. Second, mercury management needs to address mercury bioaccumulation, because the beneficial uses impaired by mercury are related to mercury concentrations in fish. For mercury, this means looking for ways to reduce the formation of methylmercury in receiving waters, because this is the form that accumulates in fish. This report discusses management of mercury loads from wastewater in the context of those two findings.

Section 2 documents the approach to calculating wastewater loads from municipal and industrial treatment plants. This information was directly relied upon in the development of the Mercury TMDL final project report. A periodic update of Section 2 would be a useful mechanism for the Regional Board to track individual and aggregate mercury loads over time, providing reasonable assurance that the TMDL load allocation for wastewater is attained.

Section 3 analyzes the effect of population growth on the mercury load from wastewater, in the absence of any new infrastructural or programmatic mercury controls (i.e., the “no-action” alternative). Section 4 combines the information from Sections 2 and 3, along with cost and load reduction estimates, to summarize the costs and expected benefits for different load management scenarios. This analysis is important to fulfill the Porter-Cologne requirement (Sec. 13241 and 13242) to consider the need for communities to grow and develop new housing when the Regional Board adopts plans to implement water quality standards.

Section 5 describes site-specific factors that need to be considered to evaluate the feasibility of routing urban stormwater through municipal pollution control plants in order to control mercury loads. Section 6 describes monitoring and infrastructural approaches to managing mercury methylation in receiving waters.

The last two sections are adaptive management components of TMDL implementation for wastewater treatment plants. While there is a relatively high degree of certainty about current and future mercury loads from wastewater, and the costs associated with managing those loads, there is a great deal of uncertainty as to whether the benefits of treating stormwater are commensurate with the economic and societal costs, and the extent to which decisions about the operation of wastewater treatment plants can affect mercury methylation in receiving waters. Sections 5 and 6 describe some of the key factors to be considered to resolve these questions.

## **2. Updated mercury annual load estimates and annual average effluent concentrations for municipal and industrial wastewater treatment facilities**

### *2.1 Purpose*

Establish current baseline loading from municipal and industrial wastewater point sources for use in the mercury TMDL and wasteload allocation analysis.

### *2.2 Background*

Loads were originally estimated in the Mercury TMDL preliminary project report (Abu-Saba and Tang, 2000). Estimates of mercury load from wastewater treatment facilities as outlined in that report ranged from 25 to 63 kilograms per year. It was acknowledged that those estimates were based on a limited set of reliable mercury effluent concentration data. For a number of the treatment facilities considered in that analysis, available data had been collected using an inadequate USEPA analytical method with a method detection limit of 200 nanograms per liter (ng/l). Such data have been shown to significantly overestimate actual mercury concentrations in treated effluent.

Recognizing this deficiency, the Regional Board required that all Bay area facilities begin collecting mercury data using a newly adopted USEPA analytical method (Method 1631) in January 2000 (SFRWQCB, 1999). The detection limit for the new analytical



method was less than 1 ng/l. A preliminary report and statistical analysis using all available method 1631 mercury data for Bay area treatment plants was compiled by Regional Board staff (SFRWQCB, 2001). In that report, data distributions for secondary and advanced treatment facilities were developed. In support of the mercury TMDL that will be considered by the Regional Board, an updated estimate of mercury annual loadings based on a larger data set of Method 1631 data is desired. Thus, using data provided by the Bay Area pollution control plants and statistical tools developed by Regional Board staff (SFRWQCB, 2001), this type of regional update can be implemented from time to time (i.e., every five years) to provide reasonable assurance that the load allocation for wastewater is attained.

### *2.3 Approach*

Treated wastewater flow data for the period January 1999 through June 2002 and mercury concentration data for the period January 2000 through June 2002 were obtained from the Regional Board electronic reporting database for individual treatment facilities. Those data were used to calculate an updated estimate of annual mercury loads from municipal and industrial treatment facilities. The important assumptions used in making the calculations are as follows:

Monthly mercury measurements were averaged to form a single average mercury concentration for each facility. For those facilities that did not have data, values of 15.3 ng/l, 5.4 ng/l, and 25 ng/l were used for secondary, advanced (tertiary), and industrial treatment plants, respectively. The default value of 15.3 ng/l is derived from the median value of the mercury concentrations in the available January 2000 to June 2002 data set for secondary treatment facilities. The default value of 5.4 ng/l is the mercury concentration for tertiary treatment facilities based on an assumed removal of 65% of the mercury in secondary effluent.

The total monthly flow volumes were summed and divided by the number of days that the flow was monitored to obtain an average daily flow rate. This value was then used to estimate the total annual flow discharged to the Bay from each facility. For treatment facilities that did not have data, the flows from the 2001 Regional Board staff report were used. It is assumed that the flow data reported to the Regional Board reflect the volume of treated wastewater discharged to the Bay.

Most of the data gaps that occurred were for smaller treatment facilities, which have minor impacts on the total mercury load to the Bay. An exception is the C&H Sugar/Crockett-Valona treatment facility, for which reliable flow and mercury concentration data were unavailable.

## 2.4 Results

Using the calculation methods described above, the updated average annual estimates of existing mercury loadings to the Bay from municipal and industrial wastewater treatment facilities are as follows:

Existing annual mercury loading from municipal facilities:	12.7 kg/yr
Existing annual mercury loading from industrial facilities:	2.1 kg/yr
Total existing annual mercury loading from wastewater treatment facilities:	14.8 kg/yr (+/- 3.3)

Spreadsheets showing the data used in the derivation of these estimates are summarized in Table 1 and Table 2.

## 2.5 References

Abu-Saba, K.E., and L.W. Tang, 2000. *Watershed Management of Mercury in San Francisco Bay: a TMDL report to USEPA*. SFRWQCB staff report presented to the Regional Board in a public hearing, June 20, 2000. Available from the SFRWQCB, Oakland, CA. [www.swrcb.ca.gov/rwqbc2](http://www.swrcb.ca.gov/rwqbc2).

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Lam, Johnson, SFRWQCB, personal communication, August 2002. NPDES electronic data summaries.

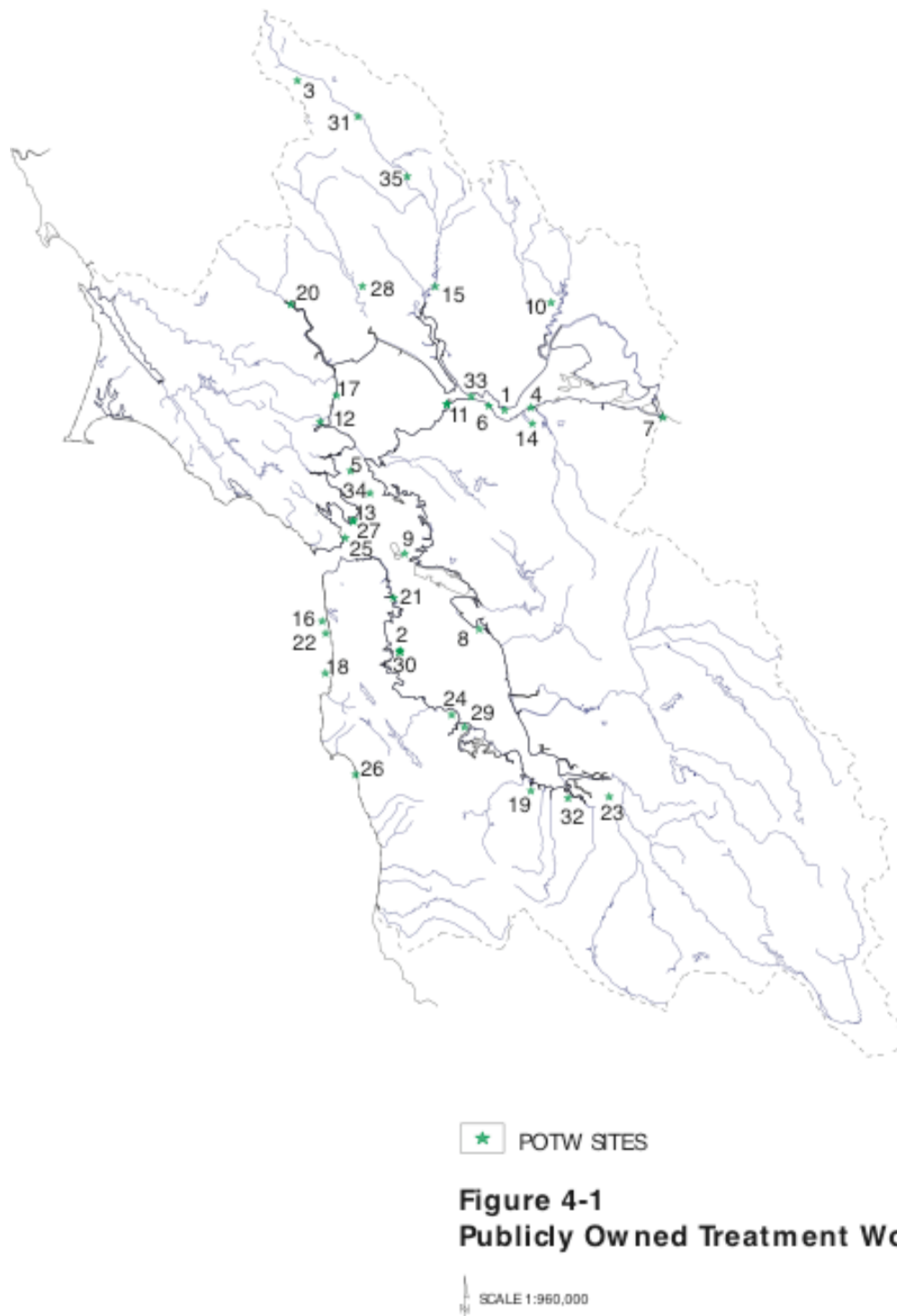
Looker, R.E., and Johnson, B.J. 2003. *Mercury in San Francisco Bay: TMDL project report*. SFRWQCB Draft staff report presented to stakeholders in a public workshop on July 2, 2003. Available at [www.swrcb.ca.gov/rwqbc2](http://www.swrcb.ca.gov/rwqbc2)

SFRWQCB, 1999. August 4, 1999 letter from Lawrence Kolb, acting Executive Officer, to all NPDES permit holders with self-monitoring requirements. Letter invokes Regional Boards authority to require monitoring information as set forth in Section 13267 of the California Water Code.

Taylor, K.A. *Defining the mercury problem in the northern reaches of San Francisco Bay and designing appropriate regulatory approaches*. SFRWQCB draft staff report presented to the SFRWQCB in a public hearing December, 1998.

Facility	Treatment	Annual Effluent flow (L x 10 <sup>9</sup> )	Flow-weighted mean [Hg] (ng/L)	Annual mercury load (kg)
San Jose/Santa Clara WPCP – 23	Advanced	165 +/- 13	3 +/- 1	0.5 +/- 0.1
East Bay MUD – 9	Secondary	107 +/- 24	30 +/- 14	3.2 +/- 1.7
EBDA, East Bay Dischargers Authority – 8	Secondary	106 +/- 10	19 +/- 9	2.0 +/- 0.9
City & Co. of S.F., Southeast – 21	Secondary	109 +/- 26	13 +/- 14	1.4 +/- 1.6
Central Contra Costa S.D – 6	Secondary	62 +/- 8	28 +/- 8	1.7 +/- 0.6
City of Palo Alto – 19	Advanced	37 +/- 3	7 +/- 3	0.2 +/- 0.1
So. Bayside System Authority – 29	Advanced	27 +/- 4	16 +/- 8	0.4 +/- 0.2
West County Agency – 34	Secondary	23 +/- 2	15 +/- 6	0.3 +/- 0.1
City of Sunnyvale – 32	Advanced	22 +/- 13	4 +/- 2	0.1 +/- 0.1
Napa S.D. – 15	Advanced	17 +/- 2	5 +/- 3	0.1 +/- 0.0
Delta Diablo S.D. – 7	Secondary	18 +/- 2	12 +/- 2	0.2 +/- 0.0
City of San Mateo – 24	Advanced	19 +/- 3	13 +/- 12	0.3 +/- 0.2
Fairfield Suisun Sewer Dist. – 10	Advanced	23 +/- 4	7 +/- 6	0.2 +/- 0.1
Vallejo Sanitation & Flood Cont. – 33	Secondary	21 +/- 6	19 +/- 6	0.4 +/- 0.2
City of Livermore (LAVWMA – EBDA)	Secondary	9 +/- 1	8 +/- 8	0.1 +/- 0.1
Dublin-San Ramon (LAVWMA –EBDA)	Secondary	15 +/- 3	32 +/- 45	0.5 +/- 0.7
Central Marin Sanitation A.G. – 5	Secondary	15 +/- 6	6 +/- 3	0.1 +/- 0.1
So. S.F./ San Bruno WQCP – 30	Secondary	14 +/- 1	17 +/- 6	0.2 +/- 0.1
City of Petaluma – 20	Secondary	8 +/- 3	5 +/- 2	0.04 +/- 0.03
Novato S.D. – 17	Advanced	8 +/- 1	5 +/- 6	0.04 +/- 0.05
City of Burlingame – 2	Secondary	6 +/- 1	9 +/- 5	0.05 +/- 0.03
Sewerage Agency of So. Marin – 27	Secondary	5 +/- 2	21 +/- 6	0.10 +/- 0.05
Sonoma Valley County S.D. – 28	Secondary	5 +/- 2	5 +/- 1	0.02 +/- 0.01
City of Pinole-Hercules – 11	Secondary	4 +/- 1	6 +/- 4	0.02 +/- 0.01
City of Benicia – 1	Secondary	4 +/- 1	15 +/- 11	0.07 +/- 0.05
City of Millbrae – 2	Secondary	3 +/- 0	16 +/- 15	0.04 +/- 0.04
Las Gallinas Valley S.D. – 12	Secondary	5 +/- 2	52 +/- 20	0.26 +/- 0.13
Mt. View S.D. – 14	Secondary	3 +/- 1	9 +/- 6	0.03 +/- 0.02
Sausalito-Marin City S.D. – 25	Advanced	2 +/- 1	23 +/- 9	0.05 +/- 0.02
City & Co. of S.F., Int. Airport - 2	Secondary	1 +/- 1	24 +/- 20	0.03 +/- 0.03
Marin Co. S.D. #5/Tiburon – 13	Secondary	1 +/- 0	6 +/- 5	0.01 +/- 0.01
Rodeo S.D. – 11	Secondary	1 +/- 0	16 +/- 27	0.02 +/- 0.03
City of Calistoga – 3	Advanced	1 +/- 0	5 +/- 6	0.01 +/- 0.01
Town of Yountville – 35	Advanced	0 +/- 0	5 +/- 6	0.00 +/- 0.00
City of St. Helena – 31	Secondary	0 +/- 0	15 +/- 6	0.01 +/- 0.00
Total				12.7 +/- 2.7

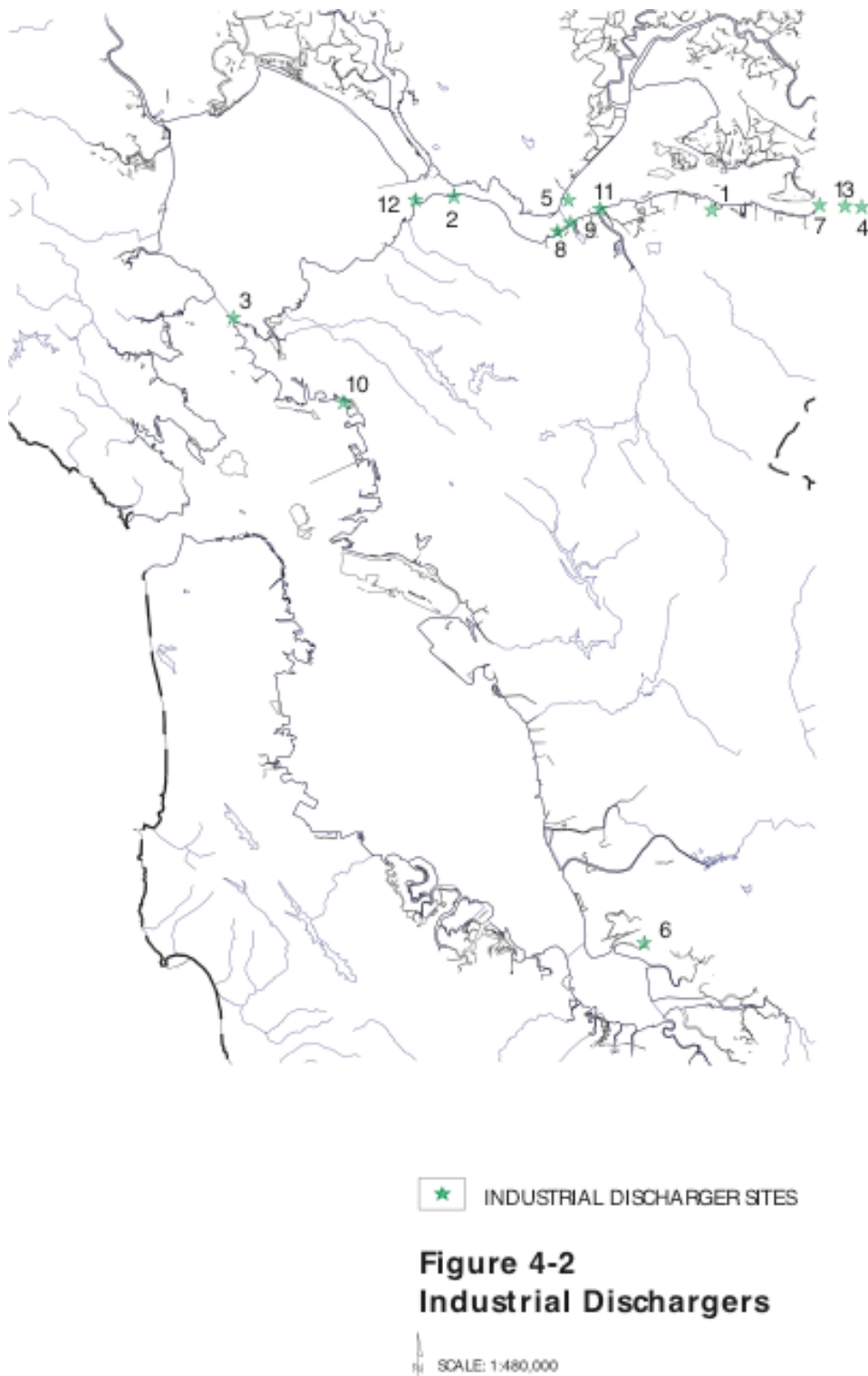
**Table 1: Summary of current flows, concentrations and loads for municipal pollution control plants. Numbers next to each facility name refer to map locations in Basin Plan (Figure 1).**



**Figure 1: Locations of publicly owned treatment works. Figure taken from San Francisco Bay Basin Plan.**

Facility	Treatment	Total Annual Effluent flow (L x 10 <sup>9</sup> )	Flow-weighted average mercury concentration (ng/L)	Annual mercury load (kg)
C&H Sugar Co. – 2	Activated sludge	34 +/- 3	25 +/- 10	0.8 +/- 0.3
Chevron U.S.A. – 3	Activated sludge/wetland	9 +/- 4	66 +/- 43	0.6 +/- 0.5
Equilon Enterprises LLC. – 8	Activated sludge/carbon	8 +/- 1	11 +/- 17	0.1 +/- 0.1
Tosco Corp. Avon Refinery -12 (Tesoro Golden Eagle Refinery)		6 +/- 3	7 +/- 4	0.04 +/- 0.03
Dow Chemical Co. – 4	Neutralization/activated carbon	0 +/- 0	30 +/- 69	0.01 +/- 0.02
Exxon	Activated sludge/carbon	3 +/- 0	13 +/- 8	0.03 +/- 0.02
Tosco Corp. Rodeo Refinery –11	Pond/RBC/carbon	3 +/- 1	30 +/- 34	0.09 +/- 0.10
San Francisco Int. Airport	Physical/chemical	1 +/- 0	18 +/- 15	0.02 +/- 0.02
General Chemical Corp. Bay Point Works – 1	Neutralization/pond	1 +/- 1	335 +/- 279	0.2 +/- 0.3
Rhone Poulenc Basic Chemical Co. – 9	Neutralization/pond	0 +/- 0	48 +/- 90	0.01 +/- 0.01
Zeneca Agricultural Products – 10	Activated carbon/pond	0 +/- 0	25 +/- 10	0.0 +/- 0.0
USS Posco – 13	Physical/chemical	11 +/- 3	3 +/- 3	0.04 +/- 0.04
U.S. Navy Treasure Island		1 +/- 3	23 +/- 11	0.02 +/- 0.06
		Total		2.1 +/- 0.7

**Table 2: Summary of current flows, concentrations, and loads for industrial pollution control plants. Numbers next to facility ID refers to map location in Basin Plan (Figure 2). Loads in this table sum to 2.0 kg/ye, but written in as 2.1 kg/yr to be consistent with TMDL Project Report (Looker and Johnson, 2003).**



**Figure 2: Locations of Industrial Dischargers to San Francisco Bay. Map taken from San Francisco Bay Basin Plan.**

### **3. Effect of growth and development on average annual mercury loads from municipal and industrial wastewater treatment facilities**

#### *3.1 Purpose*

Estimate future treated wastewater flows and associated mercury loadings at Bay area treatment facilities.

#### *3.2 Background*

The existing population of the San Francisco Bay area is approximately 6 million. Projected population growth will occur in communities with available undeveloped land and strong economic foundations. "Smart Growth" plans may also encourage increases in population densities near job and transit centers. Consequently, the magnitude and rate of growth at each Bay area treatment facility will be variable.

Regional population growth estimates are available through the Association of Bay Area Governments (ABAG). These estimates indicate expected population growth in Bay area cities and counties through the year 2025.

#### *3.3 Approach*

The population estimates for individual cities were apportioned to the corresponding individual treatment facilities based on service area information taken from individual NPDES permits. Percentage increases in population to the year 2025 were calculated for each facility. An overall projected growth rate was determined for each treatment facility (Table 3).

The assumed growth rates (expressed as a percentage) were used to estimate future (2025) flow increases at each facility. Projected increases in mercury load were calculated, using the existing mercury concentration and the estimated future flow. A spreadsheet showing these calculations is attached.

#### *3.4 Results*

The existing municipal and industrial treated wastewater flow and mercury loadings to the bay are estimated to be 692 mgd and 14.8 kilograms per year, respectively. Projected future (year 2025) baseline flow and baseline mercury loadings are estimated to be 800 mgd and 16.9 kilograms per year, respectively. Year 2025 flow and load estimates at individual treatment facilities are shown in Table 4. These estimates are used as a baseline for comparison with load reduction alternatives in the next section.

### 3.5 References

Association of Bay Area Governments (ABAG). *Projections 2002: Forecasts for the San Francisco Bay Area to the Year 2025*. Oakland: J.T. Litho (Printer) Dec. 2001. 286 pages.

SFRWQCB, 1998 – Present. Adopted NPDES permits for the treatment facilities considered in this analysis.



**Table 3:**

**Projected population growth, by facility service area. Growth projections are estimates for purposes of projecting future wastewater discharge scenarios in this report. The growth estimates do not imply that local governments have adopted them in their master plans.**

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
<b>City of Benicia (Benicia Wastewater Treatment Plant) –1</b>			
BENICIA	26865	30,000	12%
<b>Total</b>	26865	30,000	11.7%
<b>City of Burlingame (Burlingame Wastewater Treatment Plant) – 2</b>			
BURLINGAME	28158	32,400	15%
OTHER	9000	11,400	27%
<b>Total</b>	37158	43,800	17.9%
<b>City of Calistoga (Dunaweal Wastewater Treatment Plant) –3</b>			
CALISTOGA	5190	6,800	31%
<b>Total</b>	5190	6,800	31.0%
<b>Central Contra Costa SD (Central Contra Costa Wastewater Treatment Plant) –4</b>			
CONCORD	121780	138,500	14%
DANVILLE	41715	45,500	9%
LAFAYETTE	23908	27,100	13%
MORAGA	16290	18,100	11%
ORINDA	17599	19,600	11%
PLEASANT HILL	32837	37,500	14%
WALNUT CREEK	64296	71,800	12%
CLAYTON	10762	13,500	25%
MARTINEZ	11900	13,500	13%
OTHER	80000	107,000	34%
<b>Total</b>	421087	492,100	16.9%
<b>Central Marin Sanitation Agency (San Rafael SD, Sanitary District 1-2, Larkspur) –5</b>			
SAN RAFAEL	56063	65,500	17%
ROSS	2329	2,480	6%
LARKSPUR	12014	13,300	11%
CORTE MADERA	9100	9,900	9%
<b>Total</b>	79506	91,180	14.7%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
<b>Delta Diablo Sanitary District –7</b>			
ANTIOCH	90532	117,500	30%
PITTSBURG	56769	85,100	50%
<b>Total</b>	147301	202,600	37.5%
<b>East Bay Dischargers Authority –8</b>			
HAYWARD	140030	160,300	14%
SAN LEANDRO	79452	87,600	10%
UNION CITY	66869	84,700	27%
NEWARK	42471	53,400	26%
FREMONT	203413	233,200	15%
<b>Total</b>	532235	619,200	16.3%
<b>EBMUD –9</b>			
ALAMEDA	72259	80,600	12%
ALBANY	16444	18,000	9%
BERKELEY	102743	111,600	9%
EMERYVILLE	6882	11,200	63%
OAKLAND	399484	449,500	13%
PIEDMONT	10952	11,300	3%
EL CERRITO	23171	24,700	7%
OTHER	6000	7,400	23%
<b>Total</b>	637935	706,900	10.8%
<b>Fairfield Suisun - 10</b>			
FAIRFIELD	96178	135,700	41%
SUISUN CITY	26118	35,300	35%
<b>Total</b>	122296	171,000	39.8%
<b>Las Gallinas – 11</b>			
OTHER	28000	30700	9.6%
<b>Total</b>	28000	30700	9.6%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
<b>Livermore-Amador Valley Water Management Agency –8</b>			
LIVERMORE	73345	99,400	36%
PLEASANTON	63654	83,600	31%
DUBLIN	29973	63,100	111%
SAN RAMON*	44722	82,500	84%
<b>Total</b>	211694	328,600	55.2%
<b>Millbrae (Water Pollution Control Plant) – 2</b>			
MILLBRAE	20718	23,100	11%
<b>Total</b>	20718	23,100	11.5%
<b>Mt. View Sanitary District – 14</b>			
MARTINEZ	24000	27,200	13%
<b>Total</b>	24000	27,200	13.3%
<b>Napa (Soscol Water Recycling Facility) – 15</b>			
AMERICAN CANYON	9774	14,200	45%
NAPA	72585	98,100	35%
<b>Total</b>	82359	112,300	36.4%
<b>Novato (Novato and Ignacio Plants) – 17</b>			
NOVATO	47630	59,900	26%
<b>Total</b>	47630	59,900	25.8%
<b>Palo Alto (Palo Alto Regional Water Quality Control Plant) - 19</b>			
PALO ALTO	58598	67,500	15%
MOUNTAIN VIEW	70708	80,700	14%
LOS ALTOS	27693	29,700	7%
LOS ALTOS HILLS	7902	8,900	13%
MENLO PARK	30785	33,900	10%
EAST PALO ALTO	29506	38,200	29%
<b>Total</b>	225192	258,900	15.0%

	2000 Census Population 2000 Census	2025 Est. Population 2025 Est.	Growth between 2000 and 2025 Growth between
<b>Petaluma – 20</b>			
PETALUMA	54548	64,200	18%
<b>Total</b>	54548	64,200	17.7%
<b>Pinole Hercules (Pinole-Hercules Water Pollution Control Plant) – 11</b>			
PINOLE	19039	21,400	12%
HERCULES	19488	26,100	34%
<b>Total</b>	38527	47,500	23.3%
<b>Rodeo – 11</b>			
OTHER	8500	11,400	34.1%
<b>Total</b>	8500	11,400	34.1%
<b>St. Helena 31</b>			
ST. HELENA	5950	7,900	33%
<b>Total</b>	5950	7,900	32.8%
<b>SF – SE – 21</b>			
BRISBANE	3597	5,480	52%
SAN FRANCISCO	776733	815,200	5%
<b>Total</b>	780330	820,680	5.2%
<b>SF-Bayside</b>			
<b>Total</b>			
<b>SFO (San Francisco International Airport Water Quality Control Plant) – 2</b>			
<b>Total</b>			
<b>SD No. 5 Marin – 13</b>			
BELVEDERE	2125	2,260	6%
TIBURON	8666	9,200	6%
<b>Total</b>	10791	11,460	6.2%

	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
<b>San Jose (San Jose/Santa Clara Water Pollution Control Plant) - 23</b>			
CAMPBELL	38138	41,700	9%
CUPERTINO	50546	64,500	28%
LOS GATOS	28592	32,500	14%
MILPITAS	62698	86,200	37%
MONTE SERENO	3483	4,400	26%
SAN JOSE	894943	1,096,200	22%
SANTA CLARA	102361	134,000	31%
SARATOGA	29843	33,600	13%
<b>Total</b>	1210604	1,493,100	23.3%
<b>San Mateo (City of San Mateo Water Quality Control Plant) – 24</b>			
SAN MATEO	92482	108,300	17%
FOSTER CITY	28803	33,000	15%
HILLSBOROUGH	10825	11,800	9%
<b>Total</b>	132110	153,100	15.9%
<b>Sausalito Marin 25</b>			
SAUSALITO	7330	7,900	8%
OTHER	11000	12,100	10%
<b>Total</b>	18330	20,000	9.1%
<b>SASM – 27</b>			
MILL VALLEY	13600	14,500	7%
OTHER	12000	13,100	9%
<b>Total</b>	25600	27,600	7.8%
<b>Sonoma Co - 28</b>			
SONOMA	9128	11,900	30%
OTHER	28000	36,900	32%
<b>Total</b>	37128	48,800	31.4%

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	2000 Census Population	2025 Est. Population	Growth between 2000 and 2025
<b>SBSA – 29</b>			
REDWOOD CITY	75402	85,300	13%
BELMONT	25123	28,000	11%
SAN CARLOS	27718	29,700	7%
ATHERTON	7194	8,000	11%
PORTOLA VALLEY	4462	5,300	19%
WOODSIDE	5352	6,000	12%
OTHER	50000	63,400	27%
<b>Total</b>	195251	225,700	15.6%
<b>So SF San Bruno – 30</b>			
SAN BRUNO	40165	44,700	11%
SOUTH SAN FRANCISCO	60552	68,500	13%
<b>Total</b>	100717	113,200	12.4%
<b>Sunnyvale (Sunnyvale Water Pollution Control Plant – 32</b>			
SUNNYVALE	131760	150,100	14%
<b>Total</b>	131760	150,100	13.9%
<b>Vallejo Sanitation and Flood Control - 33</b>			
VALLEJO	116760	143,600	23%
<b>Total</b>	116760	143,600	23.0%
<b>West County Agency – 34</b>			
SAN PABLO	30215	32,200	7%
RICHMOND	99216	112,200	13%
OTHER	20000	26,800	34%
<b>Total</b>	149431	171,200	14.6%
<b>Yountville - 35</b>			
YOUNTVILLE	2916	3,400	17%
<b>Total</b>	2916	3,400	16.6%

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Facility	Treatment	Total Annual Effluent flow (L x 10 <sup>9</sup> )	Flow-weighted average mercury concentration (ng/L)	Annual mercury load (kg)
San Jose/Santa Clara WPCP	Advanced	204 +/- 16	3 +/- 1	0.6 +/- 0.2
East Bay MUD	Secondary	119 +/- 26	30 +/- 14	3.5 +/- 1.9
EBDA, East Bay Dischargers Authority	Secondary	123 +/- 11	19 +/- 9	2.3 +/- 1.1
City & Co. of S.F., Southeast	Secondary	115 +/- 27	13 +/- 14	1.5 +/- 1.6
Central Contra Costa S.D	Secondary	73 +/- 10	28 +/- 8	2.0 +/- 0.7
City of Palo Alto	Advanced	42 +/- 4	7 +/- 3	0.3 +/- 0.1
So. Bayside System Authority	Advanced	31 +/- 5	16 +/- 8	0.5 +/- 0.3
West County Agency	Secondary	26 +/- 3	15 +/- 6	0.4 +/- 0.2
City of Sunnyvale	Advanced	25 +/- 15	4 +/- 2	0.1 +/- 0.1
Napa S.D.	Advanced	22 +/- 3	5 +/- 3	0.1 +/- 0.1
Delta Diablo S.D.	Secondary	25 +/- 3	12 +/- 2	0.3 +/- 0.1
City of San Mateo	Advanced	22 +/- 4	13 +/- 12	0.3 +/- 0.3
Fairfield Suisun Sewer Dist.	Advanced	32 +/- 6	7 +/- 6	0.2 +/- 0.2
Vallejo Sanitation & Flood Cont.	Secondary	26 +/- 7	19 +/- 6	0.5 +/- 0.2
City of Livermore (LAVWMA – EBDA)	Secondary	13 +/- 1	8 +/- 8	0.1 +/- 0.1
Dublin - San Ramon (LAVWMA – EBDA)	Secondary	25 +/- 5	32 +/- 45	0.8 +/- 1.1
Central Marin Sanitation A.G.	Secondary	17 +/- 7	6 +/- 3	0.1 +/- 0.1
So. S.F./ San Bruno WQCP	Secondary	16 +/- 2	17 +/- 6	0.3 +/- 0.1
City of Petaluma	Secondary	10 +/- 4	5 +/- 2	0.0 +/- 0.0
Novato S.D.	Advanced	10 +/- 1	5 +/- 6	0.1 +/- 0.1
City of Burlingame	Secondary	7 +/- 1	9 +/- 5	0.06 +/- 0.03
Sewerage Agency of So. Marin	Secondary	5 +/- 2	21 +/- 6	0.10 +/- 0.05
Sonoma Valley County S.D.	Secondary	7 +/- 3	5 +/- 1	0.03 +/- 0.02
City of Pinole-Hercules	Secondary	5 +/- 1	6 +/- 4	0.03 +/- 0.02
City of Benicia	Secondary	5 +/- 1	15 +/- 11	0.07 +/- 0.05
City of Millbrae	Secondary	3 +/- 1	16 +/- 15	0.05 +/- 0.05
Las Gallinas Valley S.D.	Secondary	6 +/- 2	52 +/- 20	0.29 +/- 0.14
Mt. View S.D.	Secondary	3 +/- 1	9 +/- 6	0.03 +/- 0.02
Sausalito-Marin City S.D.	Advanced	2 +/- 1	23 +/- 9	0.06 +/- 0.03
City & Co. of S.F., Int. Airport	Secondary	1 +/- 1	24 +/- 20	0.03 +/- 0.03
Marin Co. S.D. #5/Tiburon	Secondary	1 +/- 0	6 +/- 5	0.01 +/- 0.01
Rodeo S.D.	Secondary	2 +/- 0	16 +/- 27	0.03 +/- 0.04
City of Calistoga	Advanced	1 +/- 0	5 +/- 6	0.01 +/- 0.01
Town of Yountville	Advanced	1 +/- 0	5 +/- 6	0.00 +/- 0.00
City of St. Helena	Secondary	1 +/- 0	15 +/- 6	0.01 +/- 0.00
Total				14.8 +/- 3.1

**Table 4: Projected POTW mercury loads in 2025 if effluent concentrations remain unchanged.**

#### **4. Technological and programmatic options to manage mercury loads from municipal and industrial wastewater treatment facilities**

##### *4.1 Purpose*

Quantify the costs and benefits of various mercury load management strategies that could be applied to wastewater treatment facilities in the Bay area.

##### *4.2 Background*

As part of the Basin Plan amendment process, the Regional Board considers the economic impact of proposed implementation plans and alternatives to satisfy its obligations under the California Water Code and CEQA. The following analysis has been prepared to provide assistance to Regional Board staff in understanding and quantifying the cost of infrastructural and programmatic approaches to managing mercury loads from wastewater treatment plants.

The range of options for mercury load reduction by wastewater treatment entities considered in this analysis is as follows:

Additional wastewater treatment - Treatment-based load reduction options include (1) filtration at existing secondary treatment plants and (2) reverse osmosis following filtration.

Additional water recycling – Recycling is currently practiced at a number of Bay area municipal facilities. The estimated annual recycled water volume is 20,000 acre-feet (BARWRP, 1999). The estimated avoided mercury load to the Bay due to the existing recycling effort is in the range from 0.1 to 0.4 kilograms per year (based on mercury concentrations ranging from 5.4 ng/l to 15.3 ng/l and an annual volume of 6520 million gallons (=20,000 acre-feet)). Potential future recycling uses include residential irrigation, irrigation of parks, golf courses and cemeteries, commercial and industrial uses, agricultural irrigation, stream flow augmentation, groundwater recharge and potable impoundment augmentation. A major planning study to evaluate future water demands and water recycling opportunities for the Bay area was completed by the San Francisco Bay Area Regional Water Recycling Program (BARWRP) in 1999 (San Francisco Bay Area Water Recycling Program, 1999). That study identified a two-stage program for future water recycling projects in the Bay area region.

Additional pollution prevention/source control - Municipal agencies have implemented pollution prevention and source control programs for mercury. Primary emphasis in those programs has been on dental offices, hospitals/medical clinics and household products. This analysis uses a previous study (AMSA, 2002) to estimate anticipated costs and load reduction benefits of implementing pollution prevention to the maximum extent practicable in the service areas of all Bay Area pollution control plants.



### 4.3 Approach

Cost estimates and load reduction estimates were identified for the above options, where possible. The methods used in deriving these estimates are described below.

Additional wastewater treatment: Unit costs for filtration, reverse osmosis, and filtration plus RO were derived from cost estimates contained in 1993 National Research Council publication titled *Managing Wastewater in Coastal Urban Areas* (NRC 1993). The following annual unit costs (expressed as \$ million per year per mgd) were derived from the information provided in the NRC publication and are used to estimate costs in this analysis:

Filtration	0.18 – 0.65
Filtration plus RO	1.20

These costs are derived from annualized capital and annual operation and maintenance costs and are indexed to a 2001 construction cost index of 6342. The source document for these costs included costs with an estimated 1991 construction cost index of 4835.

These costs were checked against unit costs derived from a recent wastewater master plan report (Carollo, 2001). Carollo estimated the reverse osmosis cost based on the use of microfiltration (MF) rather than dual media filtration ahead of the RO process. The Carollo MF/RO unit cost, adjusted to a cost index of 6342, was \$1.15 million per year per mgd, a close match to the unit cost (1.20) stated above. The Carollo unit cost for filtration was \$0.65 million per year per mgd, significantly higher than the unit cost (0.18) cited in NRC, 1993. The \$0.18 million per year per mgd is considered as the lower bound and \$0.65 million per year per mgd as the upper bound for filtration costs.

The estimated mercury load reductions resulting from the additional treatment options described above are based on assumed removal efficiencies. For filtration, the assumed mercury removal efficiency was calculated from the median effluent concentration values for secondary (13.6 ng/l) versus advanced treatment (4.8 ng/l) taken from the June 2001 Regional Board staff report. Mercury removal efficiencies for reverse osmosis were calculated assuming a final RO effluent concentration of 2 ng/l. Final effluent concentrations were calculated for each facility based on the following assumed treatment efficiencies:

Filtration	65 % removal of Hg from secondary effluent
Reverse Osmosis	60 % removal of Hg from filtered secondary effluent

Additional recycling: The estimated cost for future recycling projects are based on information regarding recycling volumes and recycling costs contained in the San Francisco Bay Area Regional Water Recycling Program (BARWRP) report dated 1999. Costs developed in that report included treatment, distribution and on-site costs at the place of use. Assumed treatment prior to recycling was to meet Title 22 recycled water

requirements (secondary treatment plus filtration and enhanced disinfection) for most uses. In the BARWRP report, where TDS levels in effluent exceed 900 mg/l and recycled use included irrigation of agricultural crops, it was assumed that RO would be required.

The two stages of regional recycling projects identified in the BARWRP report were (1) 125,000 acre-feet per year (consisting primarily of service with Title 22 recycled water to commercial users, industrial users, parks, golf courses and cemeteries) and (2) 240,000 acre-feet per year (serving an expanded list of users and requiring RO treatment for a portion of the volume). The stage 1 program would include recycling projects at 22 municipal treatment facilities discharging to the Bay. The stage 2 program would involve increased recycled water supply from 17 of those 22 facilities. The estimated annual costs for these two stages are \$79 million per year and \$239 million per year, respectively.

The estimated mercury load reduction associated with implementation of these recycled water projects is calculated for each treatment facility based on recycled volume estimates provided in the BARWRP report.

Additional source control: The estimated annual cost range for mercury source control programs at a typical municipal facility is \$250,000 to \$700,000 (AMSA, 2001). This reflects, the staff time to implement programs and the disposal costs of recovered mercury, and the cost of "take-backs." To derive a conservative, upper estimate of the cost of maximizing pollution prevention and source control programs, the AMSA estimate of \$250,000 - \$700,000 per facility was multiplied by the 34 POTWs, resulting in a total cost of \$8 million - \$25 million for pollution prevention and source control.

Over the past ten years in the SF Bay area, waste minimization, pollution prevention and source control programs have been implemented by wastewater agencies for a number of pollutants, including mercury. For mercury, pollution prevention and source control activities have focused on dental offices, hospitals and household products. However, the effectiveness of these efforts in reducing effluent concentrations (and loads) has not been well documented at most facilities. The same can be said at the national level. To address this question, the Association of Metropolitan Sanitation Agencies (AMSA) commissioned a national study of municipal treatment plants that have collected influent and effluent mercury data of sufficient quality and quantity to enable evaluation. In particular, each of the facilities included in the AMSA study has implemented USEPA Method 1631 to achieve suitable low detection limit mercury analysis on effluent.

The AMSA report employed two methods to estimate effluent concentrations as a result of source control. The first method assumed that effluent concentrations would decrease by the same percentage as predicted for influent. That is, by the first method, if source control reduced influent concentrations by 25 percent, it was assumed that effluent concentrations would decrease by 25 percent. This represents the absolute upper bound on the benefit of mercury source control. The second method (a

probability-based approach) used actual data relationships between influent and effluent in predicting effluent concentrations.

Results from the both methods are used to establish a range. If effluent concentrations are directly proportional to influent concentrations, then the expected effluent load reduction due to increased source control and pollution prevention would be 26% – 33 %. On the other hand, based on actual measured plant performance, the AMSA report projects that reductions in effluent load reductions of mercury after implementation of pollution prevention and source control is 2% to 3%. Since this is based on actual data, the best guess is that actual reductions in effluent concentrations will be closer to 2%, rather than 33%.

Additional benefits of pollution prevention and source control include projected influent load reductions of 26% to 33%. This results in a decreased quantity of mercury in the biosolids for the facility, which will result in a decrease in loadings to landfills and may result in a decreased loading to the atmosphere (where incinerators are employed for biosolids volume reduction, depending part on the efficiency of capture of mercury in the air pollution control equipment on the incinerator). The risk reduction benefit of decreased mercury loadings to biosolids, incinerators, and landfills has not been quantified.

For both projected costs and projected load reductions, it should be recognized that pollution prevention and source control have already been substantially implemented throughout the Bay Area. Therefore, new costs may be substantially less than \$8 – 25 million. If so, then the benefit of expected additional load reductions would also be commensurately lower, because the load reductions would have already been realized.

#### *4.4 Results*

Addition of filtration to Bay area municipal facilities which do not currently have filtration is estimated to cost an additional \$80 – 300 million per year to address projected 2025 flows (723 mgd). The addition of filtration would drop the projected annual mercury loading from 14.8 to 6.3 kilograms per year for municipal effluent. For industrial facilities, filtration would cost an additional \$14 – 60 million per year and would reduce the industrial loading from 2.0 to 0.7 kilograms per year. The projected total annual mercury loading from wastewater treatment facilities with filters in place would be 7.0 kilograms per year at an additional annual cost of \$94 - 380 million.

Addition of filtration and reverse osmosis to Bay area municipal facilities would cost an additional \$817 million per year to address projected 2025 flows. The estimated municipal mercury loading following the addition of filtration and RO would be 2.5 kilograms per year. The annual mercury loading from industrial wastewater treated through filters and RO is estimated to be 0.3 kilograms per year, at a cost of \$92 million per year. The projected total annual mercury loading from wastewater after addition of

filters and RO on a Bay-wide basis would be 2.8 kilograms per year. The estimated cost of this treatment would be \$909 million per year.

Implementation of major additional water recycling facilities in the Bay area is estimated to cost between \$79 and \$239 million per year. The reduction in 2025 mercury loading resulting from such recycling efforts would range from 2.2 to 3.6 kilograms per year, depending on the magnitude of the recycling project. Resulting future mercury loadings to the Bay would be approximately 8 to 14 kilograms per year after implementation of the recycling programs. The range reflects the different degrees of recycling (Stage 1 vs. Stage 2) and the uncertainty of the response to pollution prevention programs.

The estimated annual cost for additional mercury pollution prevention and source control activity in the Bay area is in the range from \$8 to \$25 million. Based on an expected reduction of 2% - 33% in effluent concentrations, the future mercury load in 2025 would be 11.3 – 16.6 kg/yr from all wastewater treatment facilities.

The cost and mercury load reduction estimates for treatment of storm water in wastewater treatment facilities require site-specific study, as described in Section 5. A summary matrix of load reduction costs and benefits for the above options is provided in Table 5.

#### *4.5 References*

Association of Metropolitan Sewerage Agencies. 2002. *Mercury Source Control and Pollution Prevention Program Evaluation*. Prepared by Larry Walker Associates for AMSA under USEPA Grant Assistance ID No. CX827577-01-0. March.

National Research Council. 1993. *Managing Wastewater in Coastal Urban Areas*. National Academy Press. Washington, D.C.

San Francisco Bay Regional Water Quality Control Board: adopted NPDES permits for the treatment facilities considered in this analysis (1998 – present).

San Francisco Bay Area Regional Water Recycling Program. 1999. *Recycled Water Master Plan*. December. Available from RMC Engineering, Walnut Creek, CA, [www.rmcengr.com](http://www.rmcengr.com).

Carollo Engineers. 2001. *Sacramento Regional Wastewater Treatment Plant – 2020 Master Plan. Final Draft Summary Report*. Prepared for Sacramento Regional County Sanitation District. November.

Scenario	Total Mercury Load (kg/year)	Additional annualized capital and operating costs over current expenditures (\$ millions)	Additional Benefits, considerations
2002	15 +/- 3	0	Baseline
A: No Action – 2025	17 +/- 3	0	Resources not spent on mercury can be spent on other pollutants. Pollution prevention and source control already substantially implemented.
B: Pollution prevention (P2)	11 – 16.5	8 – 25	Potential benefits of additional P2: further reduction in influent mercury leads to reduction of mercury in sludge, helps move towards overall reduction of anthropogenic mercury use and release.
C1: Pollution Prevention + Reclamation Stage 1	9 – 14	87 - 104	P2 as Scenario B; reduction of other pollutant loads, increased water resources available for water supply, Delta outflow.
C2: Pollution Prevention + Reclamation Stage 2	8 – 12	247 - 264	P2 as Scenario B; reduction of other pollutant loads, increased water resources available for water supply, Delta outflow.
D: Pollution prevention + Reclamation Stage 1 +Tertiary (filtered) Baywide	<7	167 – 404	P2, Reclamation as Scenario C1, 50 to 65 percent reduction of other pollutants associated with particulate phase
E: Reverse Osmosis Baywide	<3	917 - 934	Over 700 mgd of high-quality water available. Significant energy use requirements, treatment and disposal of 140 mgd brine stream

**Table 5: Cost benefit summary of mercury load management alternatives for POTWs**

## **5. Feasibility of using excess treatment capacity to reduce urban runoff mercury loads at strategic locations**

### *5.1 Purpose*

Identify the key factors to be considered in assessing the feasibility of connecting urban runoff facilities to wastewater treatment facilities to reduce mercury (and other pollutant) loading to SF Bay.

### *5.2 Background*

A concept has been identified to connect portions of urban storm drain systems to wastewater treatment plants as a method of reducing mercury loadings to SF Bay. This practice has been employed in Southern California as a method to reduce coliform contamination of beaches. In those examples, the approach has been to route dry weather urban runoff (which contains high coliform levels) to wastewater treatment plants that have available treatment capacity to accommodate those dry season flows. Typically those treatment plants discharge through ocean outfalls that provide dilution in the range from 100 to 200 to one. The NPDES permits for those treatment facilities are written to provide dilution credit for the actual dilution that occurs.

Mercury in urban runoff is primarily associated with suspended sediments. Therefore, highest mercury loads will occur where high mercury concentrations in sediments and high suspended sediment levels occur. Elevated mercury concentrations in sediments must be identified through monitoring at specific locations. Suspended sediment concentrations are typically significantly elevated during early season, first flush storm events. Therefore, as opposed to the treatment of dry season urban runoff flows to control coliform bacteria, treatment of first flush storm flows in areas where mercury sediment levels are high is likely to have the greatest benefit in terms mercury load reduction. Treatment of dry season urban runoff is not expected to reduce significant suspended sediment or mercury quantities.

The connection of urban runoff flows to wastewater treatment plants is an unconventional practice in most Bay Area communities. Wastewater collection and treatment systems have been designed to exclude urban runoff flows in those communities. Excess treatment capacity in existing facilities has been constructed to accommodate future wastewater flows, without consideration of storm-related contributions, aside from allowances for infiltration and inflow to the wastewater collection system. An exception exists in the City of San Francisco, where special conveyance, storage and treatment facilities have been constructed to handle both urban runoff and wastewater flows in a combined sewer system.

Due to the fundamental change in utility design associated with the connection of urban runoff flows to wastewater treatment facilities, a number of complex, site specific factors must be considered prior to implementing this concept, as described below.

### 5.3 Approach

The factors to be considered in a feasibility analysis for this concept should include the following:

The concept of “available excess treatment capacity” in existing wastewater treatment facilities needs to be defined and quantified from the perspective of treating first flush storm flows. Treatment capacity analyses involve the assessment of hydraulic (flow) capacity, as well as treatment (solids removal, solids handling disinfection) capacity. Excess capacity which exists today will ultimately be utilized, i.e. it is a commodity which declines over time, depending on the growth rate in the community. The time required to plan, design and construct the next increment of capacity will influence determination of “available excess capacity” at a given facility.

A table of existing average dry weather flows versus design flows should be developed as a preliminary screening effort to identify candidate Bay area treatment facilities for storm water treatment. Areas with elevated mercury concentrations in suspended storm water sediment should be identified using mercury monitoring data from urban runoff programs or other available sources. The mercury monitoring data should be summarized for each identified area. Monitoring data for other pollutants of concern (e.g. PCBs) should also be summarized.

An analysis of “available excess capacity” should be performed at those treatment facilities which (a) are identified in the initial screening effort as potentially having excess capacity and (b) are located in proximity to an area with elevated mercury concentrations in storm water. The analysis should quantify, for planning purposes, the “available excess capacity” at the selected treatment facilities and the “shelf life” for that capacity. Individual projects should be evaluated at a planning level for each of the identified treatment facilities. Project level analysis include connection facilities between the storm system and the treatment system (storage, pumps, conveyance piping and controls) which is largely a function of distance, operating costs to treat storm flows through the wastewater facility (power, chemicals), and costs to replace the capacity used for storm water treatment. Project level analysis should also include a compliance analysis with the existing NPDES permit for the facility to evaluate the ability to achieve 85 percent removal of BOD and suspended solids, effluent limits for conventional and toxic pollutants, and bypass prohibitions.

The potential benefits of each project should be estimated in terms of mercury (and other pollutant) load reductions. The calculation method for the annual load reduction requires the following information:

- The volume of storm water treated on an annual basis.
- The percent removal of suspended solids through the treatment process (85 percent through secondary, 95 percent removal through filtered secondary)
- The average suspended solids concentration in the storm flow to be treated

- The average mercury (and other pollutant) concentration on suspended sediment in the storm flow.

A funding mechanism and funding arrangements between the wastewater and storm water agencies must be developed and adopted. Agreements must be reached regarding the payment for the front-end costs to perform studies and engineering analysis required for the feasibility assessment.

Finally, while blending urban stormwater with municipal sewage has the potential to reduce multiple pollutant loads (e.g., PCBs and chlorinated pesticides), this could also have the unintended consequence of increasing the pollutant concentrations of biosolids. This is potentially a concern for proper biosolids management (Committee on Toxicants and Pathogens in Biosolids Applied to Land, 2002).

#### *5.4 Results*

The concept only has application on a site-specific basis, where a treatment facility with excess capacity is located near an area with elevated mercury in sediments. The typical project emerging from the original concept would be facilities to connect a storm system to a wastewater treatment facility to treat first flush storm flows. The project would typically include storage, pumps, pipelines and control systems. An alternative would be for the storm water agency to build separate wet weather treatment facilities (e.g. screening, sedimentation, disinfection) to handle storm flows from areas with high mercury concentrations.

Individual projects may have multi-pollutant benefits in special cases where sediments in runoff are elevated for multiple pollutants. Where multi-pollutant benefits would not occur, it is doubtful that the achievable reduction in mercury loading will offset the cost for facilities to implement the concept.

As an example, the hypothetical scenario of an industrialized catchment can be considered. Sediments collected from a catch basin at the Ettie Street pumping station in West Oakland have approximately 1 ppm mercury and 3 ppm PCBs (Gunther et al., 2002). The catchment is estimated to produce between 0.04 and 0.1 million kilograms of sediment per year. Therefore, effectively capturing this sediment could potentially reduce mercury loads to the Bay by 0.04 – 0.1 kg per year, and PCB loads by 0.1 to 0.3 kg per year. If the stormwater carrying this sediment has an average TSS of 10 mg/L, this would mean that approximately  $10^{10}$  liters of water would have to be treated – approximately 2200 million gallons. 2200 million gallons is a significant volume of water to treat – the nearest facility (EBMUD) has a dry-weather capacity of 75 million gallons per day, and less than that during wet weather. Treatment of 2200 million gallons over a month would use 60 million gallons per day of that capacity. Treatment of an extra 2200 million gallons over a period of a year would use an extra 6 million gallons per day of capacity, so the feasibility of treating stormwater would be enhanced by construction of storage facilities. A detailed feasibility assessment for this example should examine the cost of designing and constructing sufficient storage capacity (i.e., up to 2,000,000



gallons), pumps and pipes to transport the water approximately three miles, the cost of permitting and public review, and any changes to the biosolids management plan that might result.

Four general trends in the feasibility of improving water quality by capturing urban stormwater emerge from this example:

- 1) Feasibility of treating urban stormwater increases with increasing pollutant concentrations in sediments;
- 2) Feasibility also increases with increasing TSS levels in stormwater;
- 3) Feasibility decreases with increasing distance to the nearest facility; and
- 4) Feasibility increases with increasing wet-weather capacity.
- 5) Discreet, targeted water quality improvement systems may be more feasible than blending urban runoff with sewage.

## *5.5 References*

Committee on Toxicants and Pathogens in Biosolids Applied to Land, 2002. Biosolids Applied to Land: Advancing Standards and Practices, National Research Council, Washington, D.C.

Gunther, A.J., Salop, P., Abu-Saba, K.E. and Feng, A., 2002. Characterization of PCB, Mercury, PAH, and Chlorinated Pesticide Concentrations in Drainages of Western Alameda County, CA, Livermore, CA.

Orange County Sanitation District, 2003. "Answer to questions about Urban Runoff Diversions." Fact Sheet available at [www.ocsd.com](http://www.ocsd.com).

Personal Communication. 2002. Charles Weir. East Bay Dischargers Authority. August.

Personal Communication. 2002. Khalil Abu-Saba. Applied Marine Sciences. August. Technical memorandum #2, CEP Project # HG-IP-1; 8/28/02.

## **6. Feasibility of managing mercury methylation in receiving waters**

### *6.1 Purpose*

Provide guidance for adaptive approaches to investigate linkages between design and operational choices of pollution control plants and mercury methylation in receiving waters.

### *6.2 Background*

The conversion of mercury to methylmercury (“methylation”) is a key linkage between mercury loads and impairment of beneficial uses. Given that, and the fact that mercury loads from pollution control plants are less than 2% of total loads to the Bay, it is likely that management strategies to reduce methylation rates in the Bay may be more important than management strategies to reduce or control mercury loads from wastewater.

Mercury methylation in receiving waters happens when bacteria, especially sulfate reducing bacteria, assimilate inorganic mercury. Sulfate reducing bacteria thrive under low oxygen conditions, because they use sulfate as a terminal electron acceptor in their respiration of organic matter. Therefore, some typical environmental factors that affect mercury methylation are:

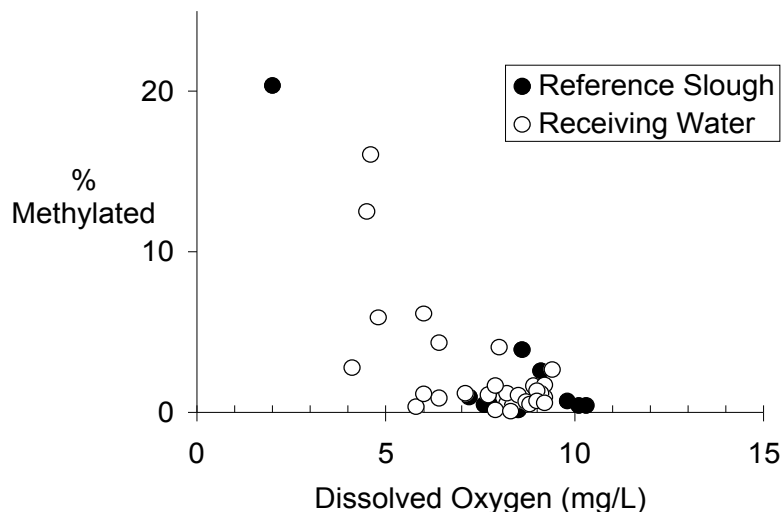
- 1) How readily inorganic mercury is assimilated by bacteria (the “bioavailability”);
- 2) The amount of sulfate available; and
- 3) Dissolved oxygen concentrations.

Pilot projects to evaluate the feasibility of managing mercury methylation should focus on how choices about the operation of wastewater treatment facilities affect these and other factors controlling mercury methylation.

For example, a methylmercury receiving water monitoring study conducted as a provision of the Fairfield-Suisun Sewer District (FSSD) NPDES permit (SFRWQCB, 1998) is an example of one such pilot study. The results from that study showed a linkage between low dissolved oxygen (DO) and enhanced methylation efficiency (Figure 3). Given the ability of sulfate reducing bacteria to thrive under low oxygen conditions, this finding was not surprising. An additional finding was that the linkage was present in both effluent receiving water and reference sloughs, suggesting that in this case, there was no detectable difference in the “bioavailability” of mercury in wastewater compared to ambient mercury.

Depressed DO in the vicinity of FSSD occurs because of decreased flow and the seasonal die-off of vegetation in the surrounding marshes. Discharge from FSSD actually enhances DO in the receiving water+. Thus, planning decisions made for other

reasons have also created a potential benefit for mercury management by reducing mercury methylation rates.



**Figure 3: Fraction of mercury as methylmercury in the surface water of sloughs along the northern reach of San Francisco Bay plotted vs. dissolved oxygen. Note the general trend of increasing mercury methylation with decreasing dissolved oxygen. Data from NPDES receiving water study conducted by Fairfield Suisun Sewer district, courtesy Larry Bahr (Senior Environmental Scientist). Methylmercury measurements made by Dr. R.P. Mason, University of Maryland Chesapeake Biological Laboratories**

### 6.3 Results

Several key questions need to be answered to determine the feasibility of affecting mercury methylation rates in Bay waters through operational decisions at POTWs. A key uncertainty is whether the bioavailability of mercury in POTW effluent is significantly greater or less than mercury in other sources. Knowing the answer to this would help resolve the importance and possible benefits, in terms of reduced mercury risk, to controlling mercury loads under the different scenarios presented in Table 5. As mentioned above, a preliminary study does not show a difference in the methylation efficiency of mercury in effluent receiving waters compared to a reference slough (Figure 3), but this could be explored in more detail and with a more regional scope.

Another question is whether dissolved oxygen management is an effective tool for reducing methylmercury concentrations in water. If so nitrification facilities that reduce ammonia levels in effluent may reduce mercury methylation in specific shallow water discharge situations by increasing DO levels. Assuming a unit cost of \$ 0.2 million / yr /

mgd (NRC, 1993), the cost to provide nitrification facilities serving 44 mgd would be approximately \$7.5 million / yr, and could provide ancillary habitat benefits of elevated DO and reduced ammonia. The validity of this hypothesis and the relative benefit to reducing methylmercury in fish must be ascertained before nitrification is mandated for such purpose.

Noting from the example above that discharge from FSSD helps maintain near-field DO, it is also possible that reclaimed water could be used to maintain flushing of shallow sloughs, thereby maintaining adequate DO levels and reducing mercury methylation rates. This emphasizes the importance of a regionally coordinated approach that combines treatment, reclamation, and receiving water monitoring to provide multiple environmental and resource conservation benefits.

Many treatment plants use alum (potassium aluminum sulfate) as a flocculant. Sulfate is an important factor affecting mercury methylation rates (Henry et al, 1992). In other ecosystems, it has been shown that there is an optimum sulfate concentration for enhanced mercury methylation, corresponding to sulfate concentrations typical of brackish waters. Thus, in effluent dominated freshwater marshes, it is possible that an alternative to alum as a flocculant might be desirable.

Answering these and similar questions involves several steps:

- 1) Development of a conceptual model;
- 2) Framing questions to test the conceptual model;
- 3) Conducting monitoring studies to answer the questions;
- 4) Revising the conceptual model according to the results of the monitoring studies;
- 5) Development and implementation of pilot projects based on the revised conceptual model to test adaptive management hypotheses;
- 6) Monitoring to verify the benefits of the pilot project;
- 7) Full-scale implementation of resulting actions of merit from the pilot projects.

The CEP has established a process for executing steps 1-4 above through development and implementation of its annual work plan. The draft year-two work plan includes resources for refinement of the mercury conceptual model and developing peer-reviewed study plans based on management questions. Resources to answer this kind of basic research question may exceed resources available to Bay Area local governments, so the CEP (or individual agencies that are part of the CEP) may need to seek outside funding to conduct monitoring and implement pilot projects if they desire to pursue management strategies that address mercury methylation.

## *6.4 References*

San Francisco Bay Regional Water Quality Control Board, 1998. NPDES permit adopted for the Fairfield-Suisun Sewer District.

Gilmour, C.C., Henry, E.A., and Mitchel, R. 1992. Sulfate stimulation of mercury methylation in freshwater sediments. *Environmental Science and Technology* 26: 2281 – 2287.



B A S M A A

Alameda Countywide  
Clean Water Program

Contra Costa  
Clean Water Program

Fairfield-Suisun  
Urban Runoff  
Management Program

Marin County  
Stormwater Pollution  
Prevention Program

San Mateo Countywide  
Stormwater Pollution  
Prevention Program

Santa Clara Valley  
Urban Runoff Pollution  
Prevention Program

Vallejo  
Sanitation and Flood  
Control District

June 14, 2004

Mr. Bruce Wolfe

California Regional Water Quality Control Board - San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: Comments on the April 30, 2004 Mercury in San Francisco Bay Total  
Maximum Daily Load (TMDL) Staff Report and Proposed Basin Plan  
Amendment**

Dear Mr. Wolfe:

BASMAA member agencies appreciate this opportunity to comment on the Staff Report and Proposed Basin Plan Amendment (BPA) for the Mercury TMDL, and commend Water Board staff on the hard work put into preparing this document. We would also like to recognize the staff and participants of the San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP) and Clean Estuary Partnership (CEP) for their contributions to this milestone.

BASMAA represents more than 90 Bay Area public agencies, including 79 cities and 7 counties (i.e., the bulk of the watershed immediately surrounding San Francisco Bay) on municipal stormwater-related (i.e., urban runoff) issues. BASMAA member agencies remain committed to addressing impairments to beneficial uses of San Francisco Bay Area water bodies impacted by urban stormwater runoff. We agree that reducing impairment of the Bay's beneficial uses by mercury should be a high priority to all Bay Area public agencies and citizens. Accordingly, municipal stormwater programs have redirected a portion of our limited public resources over the past few years toward investigating the extent of mercury in urban stormwater runoff and identifying sources and control measures. BASMAA member agencies also continue to allocate scarce resources toward regional collaborations such as the RMP and CEP, which are designed to help collect scientific information necessary to develop cost-effective measures to improve water quality in the San Francisco Estuary. As public agencies we recognize the importance of this task, and therefore seek a fair, objective and transparent Mercury TMDL. A process based on the best available information, sound science, feasibility, and cost-effectiveness will help establish the legitimacy and legality of the TMDL and the public's confidence.

Over the past five years BASMAA member agencies have attempted to collaborate with Water Board staff on developing information relevant to the mercury TMDL that is based on sound science. This collaborative approach is evident in BASMAA's active participation in the Mercury Watershed Council and more recently in the Clean Estuary Partnership. Unfortunately, Water Board staff has not fully and consistently embraced this collaborative approach. As you know, we have been greatly disappointed by this and have communicated this to you on several occasions. So, we appreciated the opportunity to meet with you recently and hope and expect that our recent discussions are the beginning of a working relationship with you and your staff where we can work through these issues constructively and collaboratively.

Bay Area

Stormwater Management

Agencies Association

1515 Clay Street

Suite 1400

Oakland, CA 94612

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Our most fundamental comment on the Staff Report and Proposed BPA is that both the urban runoff load of 160 kilograms/year, as well as the proposed urban runoff reduction of 78 kg/yr is too large and not supported technically, scientifically, or economically. Below are our significant comments that support that fundamental concern. For each comment we provide the basis for the issue and suggested changes.

#### Technical Issues

- Based on available information, loading estimates from largest source of mercury to the Bay (i.e., bed erosion) are substantially underestimated, which may have great consequences on the estimated recovery time of the Bay and necessary load reductions assigned to other source categories (i.e., urban stormwater runoff);
- The load reduction proposed in the Staff Report and BPA for urban stormwater runoff, which was developed to meet the proposed sediment target (0.2 mg/kg), is calculated based on inaccurate assumptions and not grounded in sound science; and,
- The assumption regarding the linkage between mercury in sediment and methylmercury in fish is not supported by science so the implications of the assumption are too significant to justify the proposed allocation scheme and implementation schedule; and

#### Policy Issues

- A significant portion of the estimated current urban stormwater load is likely attributable to an uncontrollable source – indirect air deposition and should be removed from the urban stormwater runoff load estimate and waste-load allocation (WLA) to be consistent with the Water Board's treatment of direct air deposition;
- The proposed requirements and WLA for urban stormwater runoff are technically infeasible to meet, go beyond the maximum extent practicable (MEP) standard and would place an undue burden on urban runoff management programs;
- The WLA for urban stormwater runoff does not factor in projected population growth in the Bay Area, which will increase mercury loads in the future; and
- The proposed Basin Plan Amendment language regarding achievement of the urban runoff allocation needs substantial revision to be acceptable to urban runoff management agencies.

As you know, the proposed BPA has many new proposed requirements that BASMAA member agencies may be required to implement. From our estimates, many of these requirements will be technically infeasible, extremely costly and go beyond the MEP standard. Considering this, suggested improvements contained within this comment letter should be seriously considered and incorporated into a revised BPA and Staff Report. We believe that not doing so will most definitely place an undue burden on public agencies in the Bay Area by requiring implementation actions that will likely have no effect on mercury in the Bay and its biota.

Furthermore, we suggest that the Water Board staff seriously consider revising the Staff Report and BPA to incorporate a Phased implementation approach, similar to that used in the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (CVRWQCB 2004). This approach can be divided into a two-phase process. Phase I may include conducting studies to better determine sources, controllability, and cost effectiveness. Initiating public outreach activities to inform consumers of the potential risks of consuming unsafe amounts of fish may also be included in Phase I. Once a collaborative stakeholder process has developed adequate information, Phase II would begin. Phase II would include the development of implementation plans to further reduce mercury, based on new information collected during Phase I. Without the

phased approach, early implementation of costly management actions that will likely provide little if any benefits to the Bay and its beneficial uses may be required.

Unresolved technical and policy-related issues are further discussed in the balance of this letter.

### **Technical Issues**

#### **1. Based on available information, the mercury load from Bay bed erosion (as presented in the Staff Report) is substantially underestimated**

Through our review of readily available information, BASMAA agrees with the Staff Report that bed erosion is likely the largest source of total mercury to the Bay, given past resource management history (i.e., mining) and the likelihood of bed sediments continuing to erode. Therefore, we believe providing the best estimate of bed erosion for the entire Bay is of utmost importance when determining sources of mercury. Unfortunately the Staff Report does not attempt to include bed erosion from segments other than San Pablo and Suisun Bays, as requested in BASMAA's comments on the TMDL Project Report. Water Board staff responded to this request (dated August 25, 2003) with the following statement:

*"The desired information is unavailable. We do not intend to speculate in areas where we have no information. This information is being developed, however. Unfortunately, it won't be available in time for the Basin Plan Amendment. Thus we intend to rely on adaptive implementation to incorporate this information when it becomes available".*

Information is available and is contained in a recently published USGS open file report (USGS 2004) to estimate bed erosion from the South Bay. In fact, this information was included in the recently published *2004 Pulse of the Estuary* (SFEI 2004). BASMAA believes that without an assessment and quantitative estimate of bed erosion from all segments of the Bay, the largest source of mercury to the Bay is likely to be substantially underestimated, potentially having great consequence on estimated recovery times and necessary load reductions assigned to other sources.

Including this information into the approach used by Water Board staff to estimate overall sources and losses suggests that substantially more mercury (3x more) is attributable to bed erosion than was originally calculated. Furthermore, including this information indicates that the percentage of mercury coming from urban stormwater runoff pales in comparison to that coming from bed erosion. In fact, including bed erosion estimates from the South Bay into the single-box model used to develop the recovery curves presented in the Staff Report (which we do not agree is necessarily representative and appropriate) indicates that Bay sediment would likely meet the proposed sediment target (0.2 ppm) in a much shorter time-frame, even without load reductions.

***Suggested Change*** - We suggest that the source assessment section of the Staff Report and BPA be revised, prior to consideration by the Water Board to adopt the BPA, to include the new information on bed erosion developed by the USGS. Not doing so will drastically underestimate the contribution of mercury from bed erosion and place undue emphasis on other sources, requiring costly management actions that will not substantially reduce mercury in the Bay or speed up the estimated recovery time.



**2. The load reduction proposed in the Staff Report and BPA for urban stormwater runoff, which was developed to meet the proposed sediment target, is based on inaccurate assumptions and not grounded in sound science**

As raised in comments previously submitted by BASMAA, the methodology used to develop the loading estimate presented in the Staff Report and BPA for urban stormwater runoff is based on inaccurate assumptions and not grounded in sound science. As stated in the Staff Report and BPA, the total mercury load from urban runoff is roughly 160 kg/yr. These estimates were developed on the basis of sediment loads and mercury concentrations in bedded sediment. The estimated total annual sediment loads attributed to urban stormwater runoff is 410 M kg/yr and the estimated average mercury concentration in bedded sediment from urban stormwater runoff is 0.38 mg/kg.

BASMAA believes that the use of bedded sediment data to establish current loading estimates for urban and non-urban storm water runoff introduces very high uncertainty. Furthermore, the San Francisco Estuary Institute (SFEI) has recently stated that it is not possible to determine the bias and error associated with loading estimates based on bedded sediment concentrations (McKee et. al 2003). BASMAA recognizes that there is a lack of sufficient data regarding mercury concentrations in urban stormwater runoff in the Bay Area, which are needed to make loading calculations for the TMDL. Therefore, assuming that uncertainty is formally recognized, it may be possible (on a preliminary basis) to use bedded sediment data to calculate loadings. Notwithstanding any of the previous comments BASMAA or BASMAA member agencies have submitted regarding the use of bedded sediment data to develop loading estimates, we would like to suggest an alternative loading scheme based more on reality. This suggestion is presented in the following paragraphs and supported by the current state-of-science.

***Instream vs. Land-based Sediment Sources***

BASMAA believes that the estimated total sediment load from urban (410 M kg/yr) areas has been substantially overestimated by a factor of four. Sediment transported to the Bay via small tributaries originates from three source categories; 1) urban stormwater runoff, 2) non-urban stormwater runoff, or 3) “instream and hillslope erosional processes”, such as landslides and channel bank/bed erosion<sup>1</sup>. Sediment loading estimates have been developed for urban and non-urban stormwater runoff (Davis et. al 2000; KLI and EOA 2002) using the Simple Method developed by Schueler (1987). Additionally, estimates of sediment production from instream and hillslope processes have been developed for Bay Area creeks (Anderson 1981; Lehre 1981; Leopold 1994; Collins 2001; Stillwater Science 2002). This information is summarized in a recent literature review on urban runoff processes in the San Francisco Bay Area, which states that method used by KLI and EOA (2002) and Davis et. al. (2000) to develop sediment loading estimates from urban and non-urban land use areas is suspected to understate loads by a factor of 2 to 3 (McKee et al. 2003). While we do not disagree with this statement, we would like to clarify our understanding of what the Simple Method is, and is not intended to estimate. The following excerpt is from, *Controlling urban runoff: a practical manual for planning and designing urban BMPs* (Schueler 1987):

*“The Simple Method provides a general planning estimate of likely storm pollutant export from development sites. More sophisticated methods, such as watershed and receiving water simulation modeling, may be needed to analyze larger more complex watersheds.”*

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<sup>1</sup> This differs from the two categories, urban and non-urban runoff, presented in the Staff Report.

Based on Schueler's intended use of the Simple Method, it is not unlikely that sediment loading estimates from Bay Area watersheds underestimated loads to the Bay by a factor of 2 to 3. The estimates made using the Simple Method only estimate the sediment load coming off the surface of the watershed into creeks; not the load being transported to the Bay, which includes sediment from instream and hillslope processes such as bed and bank erosion. This assertion is supported by McKee et. al. (2003) who summarize that sediment is supplied to Bay Area creeks by landslide erosion (38-64%) and bed/bank erosion (8-60%).

BASMAA member agencies have developed new preliminary sediment loading estimates for urban and non-urban stormwater runoff, and instream and hillslope processes. These estimates were developed using the estimated total annual sediment load from small tributaries (810 M kg/yr) that was used in the Staff Report, and loading estimates of total suspended solids (TSS) from urban and non-urban stormwater runoff developed by KLI and EOA (2002)<sup>2</sup>. These revised estimates of sediment loading to the Bay are presented in Table 1.

**Table 1. Revised sediment loading estimates from urban runoff, non-urban runoff and instream and hillslope processes**

Source Category	Estimated Sediment Loads (M kg/yr)	
	<i>Hg TMDL</i>	<i>BASMAA</i>
<b>Urban Runoff</b>	410	91a
<b>Non-Urban Runoff</b>	400	86a
<b>Instream and Hillslope Processes*</b>	-	633b
<b><i>Total</i></b>	<b><i>810</i></b>	<b><i>810</i></b>
<p>* Includes instream sediment storage, bed and bank erosion, gullyng and landslides</p> <p>a - Sediment loads are based on estimates presented in KLI and EOA (2002) <i>Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides</i>.</p> <p>b – Estimated sediment load from this source category = total sediment load (SFRWQCB 2004) - land-based sources (i.e., urban + non-urban)</p>		

#### ***Estimated Mercury Concentrations in Sediment***

The best available data (see Attachment A) suggests that the average concentration of mercury in creek bed sediment (0.21 ppm) roughly equal to the proposed sediment target (0.2 ppm), and therefore, should not require a load reduction via the TMDL. Considering this, BASMAA has

<sup>2</sup>Although it is expected that there will be variations in particle size distribution of sediment from urban runoff, recent studies have shown that sediment from urban stormwater runoff is made up of predominantly (90-100%) fine particles that are included in total suspended solid (TSS) measurements (USEPA 1983; Driscoll 1986; and Ball et al. 1995).

developed an alternative total mercury loading scheme based on the best available data. These loading estimates are presented in Table 2 and are intended to assist the Regional Board staff in assigning load and wasteload allocations to the proper sources.

**Suggested Change** - BASMAA requests that the Staff Report and BPA be revised, prior to consideration by the Regional Board, to exclude mercury and sediment from urban stormwater runoff loading estimates that is attributable to instream and hillslope processes. Mercury and sediment from this source should instead be placed in a separate source category and assigned a separate load allocation (LA). This source category is consistent with USEPA Region 9 *Guidance for Developing TMDLs in California* (2000), which states "...load allocations may be expressed...by pollutant discharge process (e.g., landslides)". Furthermore, due to the average concentration of total mercury in creek bed sediment being equal to the sediment target, the LA for this source should be equal to the current loading estimate. In other words, no load reduction should be required for the channel bed/bank source category.

**Table 2. Revised mercury loading estimates from urban runoff, non-urban runoff and instream and hillslope processes**

	Estimated Sediment Loads (M kg/yr)		Estimated Hg Concentrations (mg/kg)		Estimated Hg Load (kg/yr)	
	<i>Hg TMDL</i>	<i>BASMAA</i>	<i>Hg TMDL</i>	<i>BASMAA</i>	<i>Hg TMDL</i>	<i>BASMAA</i>
Urban Runoff	410	91a	0.38	0.46b	<b>160</b>	<b>42d</b>
Non-Urban Runoff	400	86a	0.06	0.06	<b>25</b>	<b>5d</b>
Instream and Hillslope Processes	-	633	-	0.21c	-	<b>146</b>
<b>Total</b>	<b>810</b>	<b>810</b>	<b>-</b>	<b>-</b>	<b>185</b>	<b>193</b>
<p>* Includes instream sediment storage, bed and bank erosion, gullyng and landslides</p> <p>a - Sediment loads are based on estimates presented in KLI and EOA (2002) <i>Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides</i>.</p> <p>b – Estimated mercury concentrations are derived from sediment collected in Bay Area storm drain facilities (KLI and EOA 2002)</p> <p>c – Estimated mercury concentrations are derived from sediment collected in Bay Area creeks and open channels (KLI and EOA 2002; Gunther et. al 2001)</p> <p>d – These estimates include mercury attributable to indirect air deposition, which should be removed from the urban and non-urban stormwater runoff source categories (see Policy Issue #1).</p>						

**3. The assumption regarding the linkage between mercury in sediment and methylmercury in fish is not supported by science so the implications of the assumption are too significant to justify the proposed allocation scheme and implementation schedule.**

The linkage analysis and technical foundation of the Bay TMDL for mercury is not supported by the current state of science. From BASMAA's review of the scientific literature, there is no technical basis for assuming that if sediment mercury concentrations are reduced by 50%, then fish tissue and bird egg mercury concentrations will be reduced accordingly. Data from San Francisco Bay do not support this assumption.

The Staff Report acknowledges that, "Factors relating to mercury methylation and accumulation within the food web are complex and not fully understood." However, "In the absence of additional information, reductions in mercury loads are assumed, for purposes of this (TMDL) report, to result in proportional reductions in fish tissue residues (pg. 48)." The report specifically assumes that a reduction in median sediment mercury concentrations in the Bay will produce a proportional reduction in fish tissue mercury concentrations. BASMAA believes the implications of this assumption, which is not supported by the current state of scientific knowledge, are too significant to justify establishing the proposed allocation scheme, and that requiring new implementation actions based on such an unsupported assumption could lead to a significant waste of increasingly scarce public resources. Without, at least, a semi-quantitative understanding of what really controls mercury methylation rates in San Francisco Bay, there can be no confidence that the costly and often unreasonably ambitious sediment mercury target reductions and associated control measures implied by the allocations in the proposed TMDL will produce the desired environmental benefits.

**Suggested Change** - We recommend that the Water Board postpone consideration of the BPA at this time and instead direct the staff to work with Bay Area stakeholders to substantially revise the Staff Report and BPA, including the incorporation of a phased implementation approach, similar to that used in the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (CVRWQCB 2004). The approach can be divided into a two-phase process. Phase I may include conducting studies to better determine linkage, sources, controllability, and cost effectiveness. During Phase 1, existing NPDES permit requirements; including the mercury reduction plan requirements in municipal stormwater permits would continue to result in enhanced control measures and reduction of mercury discharges. Once the "working hypothesis" that the reduction of total mercury in sediment will reduce methylmercury in fish tissue is tested and affirmed or rejected through a collaborative stakeholder process, Phase II would begin. Phase II would include the development of additional implementation plans to further reduce mercury based on new information collected during Phase I. Without the phased approach, actions to address scientifically flawed allocations and load reduction targets may provide little if any benefits to the Bay and its beneficial uses at significant (and unjustified) public expense.

## **Policy Issues**

- 1. A significant portion of the estimated current urban stormwater load is likely attributable to an uncontrollable source – indirect air deposition and should be removed from the urban stormwater runoff load estimate and waste-load allocation (WLA) to be consistent with the Water Board’s treatment of direct air deposition**

Indirect air deposition of mercury to the San Francisco Bay Area watershed is not a controllable water quality factor and should be removed from the urban stormwater runoff load estimate. The Staff Report includes estimates of dry and wet deposition of mercury directly deposited onto the Bay. However, estimates of indirect deposition onto the watershed are treated to the contrary, assumed to be 100% controllable, and included in the stormwater load estimates.

The Staff Report recognizes the sources of mercury in atmospheric deposition and their relevant contributions are not well understood, but likely include global background sources (e.g., imports from Asia). In assigning a load reduction of zero for direct atmospheric deposition to the surface of the Bay, the Staff Report notes that “...the potential to reduce deposition by controlling local sources is believed to be limited.” Later in the report, Water Board staff go on to say that “In view of the degree to which global (non-local) sources appear to dominate Bay Area air concentrations and presumably deposition, mandated load reductions do not appear appropriate at this time.” Although Water Board staff uses such logic to justify not proposing a reduction in deposition directly to the Bay surface, they do not use that same logic when constructing the urban runoff load or allocation.

These sources are not “reasonably controlled” or likely to be reduced in the near future, and, therefore, should be considered uncontrollable water quality factors – whether deposited on the Bay surface or on the watershed – that are outside the jurisdiction of state and local agencies, including the urban runoff management programs. This approach is also consistent with the narrative objective for bioaccumulation in the San Francisco Bay Basin Water Quality Control Plan (SFBRWQCB 1995):

*“Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.”*

Furthermore, the Staff Report (p. 21) incorrectly states that indirect atmospheric deposition to the watersheds is estimated to be 55 kg/yr. In our review of the SFEI report that was cited for this estimate (Tsai and Hoenicke 2001), the 55 kg/yr is the estimated mass of mercury from indirect deposition to the watershed that likely runs off into local water bodies. This estimate was derived by using an average runoff coefficient of 0.32 for the San Francisco Bay watershed. Back calculating provides us with more correct estimate of roughly 172 kg/yr of mercury that is indirectly deposited onto the watershed, via air deposition.

***Suggested Change*** - We request that the Staff Report be revised prior to consideration for adoption by the Water Board to state that an estimated 172 kg/yr of mercury is annually deposited onto the watershed via indirect air deposition. Additionally, consistent with the Water Board’s treatment of this source of mercury to the Bay itself, the estimated 55 kg/yr of mercury from this source that annually runs off should be removed from the urban and non-urban stormwater load estimates, due to the fact that the source cannot be reasonably controlled.

**2. The proposed requirements and WLA for urban stormwater runoff are technically infeasible, go beyond the MEP standard, and would place an undue burden on urban runoff management programs**

The BPA proposes requirements and a WLA of 82 kg/yr (48% reduction) from Bay Area urban runoff management programs. The information presented below firmly suggests that these requirements and WLA are technically infeasible, go beyond the maximum extent practicable standard, and would place an undue burden on urban runoff management programs.

*Technical Feasibility and Costs of Meeting the Proposed Wasteload Allocation (WLA)*

With regard to reducing the mass of mercury entering the Bay, theoretically, urban runoff management programs will likely be called on to use one or more control and/or treatment options described below. However, as demonstrated, the implementation and success of many of these options is likely limited, due to technical infeasibility and extremely high capital costs and ongoing implementation costs (see Table 3).

A summary of each possible control option, its technical feasibility, likelihood of success and anticipated costs are briefly described below.

- Recycling Programs – includes developing recycling programs, operating recycling facilities and promoting the recycling mercury containing devices such as fluorescent light bulbs, thermometers and mercury switches.
- Source Controls – includes developing programs that remove mercury latent sediment from municipal storm drain facilities and creek channels.
- Treatment Controls – includes developing and implementing mechanisms that capture and treat stormwater through the removal of fine sediment.

Recycling Programs

Estimates developed by SCVURPPP indicate that currently in the Bay Area, between 11 and 30 kg/yr of mercury in the Bay Area is recycled annually from fluorescent light bulbs<sup>3</sup> (ALMR 2003). However, as shown in previous studies, only a portion of this mercury (1-20% or 0.1 to 6 kg/yr) may actually be released into the environment through volatilization<sup>4</sup> (USEPA 1994; NEMA 2000; Aucott et al. 2003). To determine the extent to which recycling fluorescent light bulbs could aid urban runoff management programs in meeting the proposed load reduction (78 kg/yr), BASMAA has estimated that if every fluorescent light bulb purchased in the Bay Area were recycled, the load of mercury that would be avoided from entering the environment is between 1 and 20 kg/yr<sup>5</sup> (ALMR 2003). In other words, not taking into account technical feasibility or costs, only between 1-26% of the mercury load reduction required from urban stormwater runoff could be accounted for through fluorescent light bulb recycling.

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<sup>3</sup> Estimates are based on the following assumptions: 1) 2,892,000 bulbs recycled annually in the Bay Area by businesses and households combined (ALMR 2003) and, 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000).

<sup>4</sup> Estimated 1 to 20% mercury volatilization rate.

<sup>5</sup> Estimates are based on the following assumptions: 1) 12,000,000 bulbs purchased/disposed of annually in the Bay Area by businesses and households combined (ALMR 2003); 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000); and, 3) 1-20% mercury volatilization rate (USEPA 1994; NEMA 2000; Aucott et al. 2003)

Costs estimates associated with increased recycling of fluorescent light bulbs and other mercury containing devices (e.g., thermostats and switches) have been recently developed by BASMAA member agencies (i.e., Santa Clara County and City of Palo Alto). Infrastructure and operating costs of handling increased quantities of these devices by Santa Clara County's Household Hazardous Waste (HHW) Program could exceed \$10 million per year (D'Arcy 2002). Additionally, the City of Palo Alto (2003) has estimated that the average cost of recycling each fluorescent light bulb is approximately \$0.51. Therefore, based on these cost estimates, the estimated number of fluorescent light bulbs that are purchased/disposed of by households in the Bay Area each year (~1.8 million), and the assumption that each of the seven BASMAA member agencies would accrue similar costs, the total cost for BASMAA member agencies combined would be significant (\$70 million annual capital costs and \$9 million annual maintenance and reporting costs). These costs do not take into account the technical feasibility of collecting, shipping and recycling these wastes and do not include the costs of tracking and reporting recycling activities conducted by businesses (i.e., large waste generators).

#### Source Controls

##### *Mercury Source Control Program*

As you know, BASMAA member agencies have spent a significant amount of resources and staff time in recent years on developing and implementing a Mercury Pollution Prevention Plans (Mercury Plans), per NDPES permit requirements. BASMAA assumes that the "Source Control Program" requirement for urban runoff management programs listed in the BPA will be met through the implementation of previous developed and implemented Mercury Plans. Under this assumption, the BASMAA has estimated costs for developing and implementing Mercury Plans, based on the costs accrued by one member agency (SCVURPPP). These costs include:

- Plan Development and Initial Outreach - Direct costs to the SCVURPPP to set up the mercury pollution prevention program and perform the initial outreach were \$25,000. Indirect costs to the SCVURPPP co-permittees to set up the program were approximately \$120,000.
- Implementation of Plan - This step involves development of policies, guidelines, and model ordinances. The SCVURPPP has allotted \$60,000 as the direct cost for program implementation. Additionally, indirect costs are incurred by co-permittees through the use of their own staff time. The SCVURPPP estimates that the implementation of the pollution prevention program costs SCVURPPP co-permittees \$120,000 initially and will cost an additional \$240,000 annually.

Therefore, the estimated total cost of developing and implementing Mercury Plans for all seven BASMAA member agencies combined is roughly \$1.8 million for development and \$2.1 million annually to implement.

##### *Additional Source Controls*

Given the relatively low mass of mercury that could be removed via recycling programs and the extremely high costs associated with implementing these programs, it is likely that the BASMAA agencies will be required to increase the extent of source control activities to meet the proposed WLA. Additional source controls (with regard to mercury) are those activities that involve the removal of sediment (and therefore mercury) during storm drain facility and creek/channel maintenance, and street sweeping. All BASMAA agencies currently implement source controls as part of their urban runoff management programs. However, as structured, the WLA and implementation plan will provide no credit for these activities even though they reduce mercury from entering the Bay.

In an attempt to further examine the feasibility and costs associated with increasing additional source control activities, we have developed preliminary estimates of the mass of sediment that would have to be removed via source controls to meet the proposed WLA for urban stormwater runoff (Bay-wide). Opportunities for additional source control activities were focused on controls (i.e., storm drain facility and channel/creek maintenance) that have been shown in recent studies to have the greatest potential for removal of an additional mass of mercury (Salop et al. 2004). Based on available information, we estimate that in order to meet the proposed WLA for urban stormwater runoff (82 kg/yr), BASMAA agencies would have to remove an additional 200 million kilograms of sediment per year from storm drain facilities and/or creeks/channels<sup>6</sup>.

The best available data (see Attachment A) suggests that the average concentration of mercury in creek /channel bedded sediments (0.21 ppm) is roughly equal to the proposed sediment target (0.2 ppm), and therefore the removal of these sediments would not substantially aid the recovery of the Bay. Taking this into account, we developed estimates of the mass and volume of material that would have to be removed from municipal storm drain facilities to meet the proposed WLA. Since only a portion (~25%) of the material typically removed from storm drain facilities is actually sediment, it is estimated that BASMAA member agencies would actually have to remove and dispose of an additional 800 million kilograms of material per year from storm drain facilities. This mass of material equates to 1.4 million yd<sup>3</sup> or 47,000 30-yd<sup>3</sup> truck loads of material annually<sup>7</sup>. This is roughly a 500% increase from current storm drain maintenance activities. The technical feasibility of removing this volume of material annually from the municipal storm drain facility is highly questionable, considering that this volume of material probably does not exist<sup>8</sup>.

Regardless of technical feasibility, the costs associated with removing, hauling and disposing of this material is prohibitive. Preliminary estimated costs for BASMAA member agencies to conduct additional source control activities, in response to the mercury TMDL are estimated to be approximately \$50 million in capital costs (annualized to 3.5 million per year for 25 years @ 5% interest) and \$85 million in annual operating costs<sup>9</sup>.

### Treatment Controls

Stormwater treatment controls are methods of treatment to reduce pollutants from stormwater. Treatment methods typically include the infiltration, retention or filtering of stormwater. For the purposes of this discussion, treatment controls fall into one of two categories: 1) Treatment Control Measures, and 2) Diversion of Stormwater Flows to Wastewater Treatment Plants.

It is important to note, the assumption that new and redevelopment requirements (i.e., C.3.) will offset future increases in mercury from the increased population is unrealistic and unsubstantiated. A large majority of Bay Area cities are promoting smart growth, which encourages people to live in metropolitan hubs and urbanized areas where impervious surfaces

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<sup>6</sup> Estimate is based on a 49% decrease in the estimated 410 M kg/yr sediment load that contains an average mercury concentration of 0.38 mg/kg (ppm)

<sup>7</sup> Estimate is based on a sediment mass to volume conversion factor of 570 kg per yd<sup>3</sup>

<sup>8</sup> Preliminary estimates based on 91 kg/yr of annual TSS loading from urban areas (KLI and EOA 2002) and assuming that roughly 25% of the material in storm drain facilities is sediment (Salop et al. 2004) indicate that only an estimated 400 million kilograms of material may be entering the municipal storm drain system annually

<sup>9</sup> These costs are based purchasing, operating and maintaining vector trucks; constructing and operating storage facilities; hauling; staffing; and, waste disposal in a municipal landfill.



are already present. As you know, new and redevelopment requirements appropriately do not apply to such urbanized and highly developed areas, as they would otherwise create incentives for sprawl.

As noted in many previous studies, reports and guidance manuals, most treatment controls are extremely inefficient at removing fine sediment (and therefore mercury) during the treatment process and require ongoing maintenance (Metropolitan Council 2001; VCSQMP 2002; CASQA 2003). Those typical treatment controls that have shown efficiency in removing fine sediment are typically large in size (> 1 acre), due to the relatively long residence time needed to allow fine/suspended sediment to be removed from the water column through settling. Other treatment controls will likely require the construction of additional infrastructure (e.g., stormwater treatment plant). The technical feasibility and estimated costs of constructing, operating and maintaining these treatment controls are described below.

#### *Treatment Control Measures*

Structural treatment control measures treat incoming stormwater by settling and should usually hold water for at least 24-72 hours. These design standards for maximum pollutant removal efficiency indicate that a large area (>1 acre) is needed if effective treatment is to occur. Therefore, the implementation of treatment controls such as wet ponds, and detention and infiltration basins is technically infeasible in most urbanized areas of the Bay, due to the lack of undeveloped land area on which such facilities would need to be constructed.

Costs of constructing and maintaining treatment controls vary. Without considering the costs of purchasing land needed to construct treatment controls, Minton (2003) estimates that the cost of constructing a wet pond can range between \$1,600 and \$9,000 per acre of development. Additionally, it is likely that land costs in the urbanized areas of the Bay Area can exceed \$1 million per acre. Although little information was available to estimate operation and maintenance costs, they are believed to be substantial, ongoing and likely much higher than construction costs.

#### ***Diversion of Stormwater Flows to Wastewater Treatment Plants***

This strategy would divert urban runoff to wastewater treatment plants for removal of mercury (LWA 2002, Abu-Saba 2002). Based on currently available information, it appears highly unlikely that stormwater could feasibly be diverted to existing treatment plants, without substantial retrofits to the treatment plant infrastructure. This is due to the lack of existing plant capacity and the timing of diversion (i.e., early season rains and first flush events)<sup>10</sup>. These retrofits would include, at a minimum, increasing plant capacity and constructing new sanitary sewer lines. Preliminary costs estimates of implementing these retrofits (excluding land, additional piping, pumping costs, flow equalization/detention basins and recognizing the difficulties of urban and non-urban runoff) are between \$261 million per year for primary treatment (i.e., \$146 million /year for O&M and \$115 million per year capital) and \$347 million per year for primary plus filtration (i.e., \$194 million per year for O&M and \$153 million per year for capital)<sup>11</sup>.

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<sup>10</sup> Sanitary sewer collection systems and wastewater treatment plants are often designed with capacity exceeding that needed to accommodate dry weather flows. The extra capacity typically is used to treat increased wet weather flows caused by inflow and infiltration into the collection system and to accommodate population growth in a community.

<sup>11</sup> Preliminary cost estimates are based on treating the flow volume for annual runoff (Davis, J.A. 2000) estimated for watersheds draining to the Bay at approximately 600,000 acre-ft/year and utilizing updated primary and primary+filtration unit costs for wastewater treatment (UC Davis, 1992). Unit costs of

#### *Urban Stormwater Runoff Source Investigations*

Initiating and implementing special studies to determine the spatial extent, magnitude, and locations of potential *de minimus* sources of mercury in urban stormwater runoff can be an expensive, time consuming and unfruitful experience. Furthermore, the number of and extent of studies that will be required is currently unknown, but could include all sites where previous studies have determined that mercury concentrations in storm drains or creeks/channels exceeded the proposed 0.2 mg/kg sediment target (i.e., ~56 sites)<sup>12</sup>. Based on previous experience conducting PCB Case Studies, the estimated cost of each of these studies is between \$10,000 and 100,000 annually, suggesting an annual cost between \$560,000 and \$5.6 million Bay-wide.

#### *Monitoring System*

The proposed BPA includes a requirement for urban runoff management programs to develop and implement a monitoring system to quantify either mercury loads or the loads avoided through treatment, source control, and other management efforts. Although the scope and extent of the monitoring system is not fully understood, we anticipate that this requirement will include both ambient environmental monitoring and monitoring loads avoided/removed from recycling programs, source controls and treatment controls. It is estimated that environmental monitoring conducted solely for mercury will likely cost BASMAA agencies between \$700,000 and \$1.5 million annually, due to the level of precision needed to develop accurate loading estimates from tributaries to the Bay. Additionally, monitoring loads avoided/removed from implemented controls is estimated to cost roughly \$800,000 annually. Therefore, the total estimated cost for BASMAA to meet this requirement is between \$1.5 and \$2.3 million annually.

#### *Fate, Transport, and Biological Uptake Investigations*

BASMAA assumes that this requirement can be satisfied by participating in the Regional Monitoring Program for Trace Substance and/or the Clean Estuary Partnership at our current level of funding. If this assumption is correct, the estimated cost of complying with this requirement would be equal to current annual contribution to the RMP and CEP combined (~\$1.25 million), plus the costs of staff time (~\$250,000) needed to participate in and track these programs (i.e., total costs to BASMAA = ~\$1.5 million annually). These costs do not include contributions to the RMP and CEP from BASMAA agencies that own and operate POTWs. Any additional studies requiring funding or staff time would substantially increase costs.

#### *Caltrans Allocation-sharing Scheme*

Developing WLAs for dischargers covered by NPDES permits is not the responsibility of municipal urban runoff management programs. BASMAA member agencies have no jurisdiction over Caltrans activities.

**Suggested Change** - While we do not disagree that Caltrans should be addressed under this TMDL and the BPA, we request that the approach currently recommended by staff be revised to include a separate WLA specifically for Caltrans.

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\$100,000 per acre-ft./day for primary plus filtration and a unit cost of \$78,000 acre-ft/day for primary treatment were used. The unit treatment costs were escalated to 2004 dollars and annualized over a twenty year period (i.e., includes capital plus O&M). The annual cost for O&M is roughly 56% of the total. The annualized cost for capital is based on a 25 year term at 5% interest.

<sup>12</sup> Identified sites may be only a small portion of the sites that contain mercury above the sediment target. Therefore, costs could be much greater than estimated.

#### *Annual Report Preparation*

If the BPA is approved, then BASMAA agencies will be required to prepare an annual report that measures progress towards achieving the WLA and documents either mercury loads or loads avoided through ongoing pollution prevention and control activities. While the above indicates that there is no reasonable prospect of addressing the BPA's unrealistic load reduction targets for urban runoff even with enormous public investment, we estimate that the development of specialized reporting forms documenting this likely outcome (and concurrently serving as a target for criticism and potential third party legal action) will cost roughly \$175,000 initially, while ongoing staff time needed to prepare annual reports will cost the roughly \$250,000 annually.

#### *Summary of Estimated Costs*

Total estimated costs for BASMAA agencies to meet the proposed WLA and requirements presented in the Staff Report and BPA are between \$107 and \$167 million for capital costs and between \$94 and \$127 million in annual costs. A summary of these costs is presented in the in Table 3.

**Table 3. BASMAA's Estimated Costs of Complying with the Proposed WLA and Requirements for Urban Runoff Management Programs**

<b>Control/Requirement</b>	<b>Annual Capital Costs(*)</b>	<b>Annual Ongoing Maintenance &amp; Reporting Costs</b>
<b>Recycling Programs</b>	\$ 70 million	\$ 11 million
<b>Source Controls</b>	\$ 3.5 million	\$ 85 million
<b>Treatment Controls</b>		
<b><i>Treatment Control Measures</i></b>	Unknown	Unknown
<b><i>Diversion to POTWs</i></b>	\$115 million per year (primary) to \$153 million per year (primary plus filtration)	\$146 million per year (primary) to \$194 million per year (primary plus filtration)
<b>Source Investigations</b>	-	\$560,000 to 5.6 million
<b>Monitoring System</b>	-	\$ 1.5 to 2.3 million
<b>Fate/Trans/Uptake Studies</b>	-	\$ 1.5 million
<b>Allocation Scheme</b>	Unknown	Unknown
<b>Annual Reporting</b>	\$12,000	\$250,000
<b>Total Costs<sup>13</sup></b>	<b>\$188 to 226 Million</b>	<b>\$246 to 300 Million</b>

\* Annual Capital Costs are annualized over a 25 year term at a 5% interest rate. It may be possible to remove some or all of the source control costs for sediment removal and disposal depending on the flow and treatment assumptions utilized for modification and/or building new facilities, however all costs are at this point in the analysis.

<sup>13</sup> Total costs presented in Table 3 and within the text are a summation of the estimated costs for all treatment and source controls presented. It is feasible that all controls will not need to be implemented simultaneously. In this case, estimated total costs may be less than presented.

**Suggested Change** - The Staff Report's economic analysis is insufficient and substantially underestimates the costs of meeting the proposed WLA. We request that a more rigorous review of the true costs and benefits be included in a revised version of the Staff Report and BPA prior to consideration for adoption by the Water Board. This analysis should be conducted as required by section 13242 of the California Water Code.

**3. The WLA for urban runoff does not fully consider projected population growth in the Bay Area, which will most likely increase mercury loads in the future**

The population in the Bay Area is estimated to increase 14% by 2025 (ABAG 2004). Mercury in urban stormwater runoff is believed to partially originate from local air sources (e.g., fluorescent bulb breakage), which will likely increase with the increased population. The proposed wasteload allocation (WLA) for urban stormwater runoff does not factor in projected growth, as often is done in TMDLs. As suggested by Dr. Sedlak's peer review comments on the Staff Report and BPA, we suggest that the Water Board staff address the issue of future increase of mercury concentrations entering the Bay via growth. Additionally, the WLA for urban stormwater runoff should be revised to include these inevitable increases.

**4. The proposed Basin Plan Amendment language regarding achievement of the urban runoff allocation needs substantial revision to be acceptable to urban runoff management agencies**

Based on our recent meeting, we expect there to be considerable further discussion on the proposed Basin Plan amendment language so we will reserve most of our comments until then. However, we feel compelled to make one comment regarding the current proposed language. The proposed language includes a requirement that the urban runoff allocation shall be achieved within 20 years. Based on the best professional judgment of urban runoff management agencies, there is no technical, scientific, or economic basis for assuming or projecting that the proposed allocation for urban runoff will be achieved in 20 years. Such a timeframe is highly speculative and therefore should not be the basis of an absolute requirement. Phrasing the implementation schedule in such a definitive way in such a formal document as a Basin Plan is inappropriate.

**Suggested Change** – We propose phrasing the language in a way that maintains its intent while more accurately recognizing the lack of basis for establishing the actual timeframe for achieving the allocation.

BASMAA Comments – Mercury in San Francisco Bay TMDL Staff Report and Proposed Basin Plan Amendment

We hope you find these comments and suggested improvements to the Mercury TMDL Staff Report and proposed Basin Plan Amendment useful. Due to the significance of our comments and following up on our meeting with you, BASMAA representatives look forward to working together with you and other Water Board staff to address our concerns and incorporate the suggested changes into a revised Staff Report, BPA, and implementation plan.

Please contact me at (925) 313-2373 if you have any questions regarding the comments or suggested changes.

Sincerely,

A handwritten signature in black ink, appearing to read "Donald P. Freitas". The signature is fluid and cursive, with a large, stylized initial 'D' and 'F'.

Donald P. Freitas  
BASMAA Executive Board Chair

cc: Arleen Feng, BASMAA Monitoring Committee  
Jim Scanlin, ACCWP  
Kevin Cullen / Larry Bahr, FSURMP  
Liz Lewis, MCSTOPPP  
Bob Davidson, SMCSTOPPP  
Adam Olivieri, SCVURPPP  
Emily Dean, SCWA  
Jack Betourne, VSFCD  
Chris Sommers, CEP Mercury Work Group  
Geoff Brosseau, BASMAA  
Tom Mumley, SFBRWQCB  
Dyan Whyte, SFBRWQCB  
Richard Looker, SFBRWQCB  
Bill Johnson, SFBRWQCB  
Dale Bowyer, SFBRWQCB  
Andy Gunther, Clean Estuary Partnership

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**Attachment A**

**Total Mercury Concentrations from Bedded Sediments Collected in Open Channel/Creek Substrate (KLI and EOA 2002; Gunther et al. 2001)**

Site	Total Mercury (mg/kg)	Land Use	Site	Total Mercury (mg/kg)	Land Use
CCC001	0.47	Industrial	SMC029	0.63	Res/Com
CCC009	0.07	Industrial	SMC030	0.66	Res/Com
CCC020	0.14	Industrial	SMC031	0.18	Res/Com
CCC026	0.47	Industrial	VFC001	0.18	Res/Com
CCC029	0.07	Industrial	VFC002	0.15	Res/Com
CCC030	0.63	Industrial	VFC010	0.57	Res/Com
FSS001	0.06	Industrial	Arroyo Viejo	0.04	Mixed
FSS006	0.12	Industrial	San Lorenzo		
MCS009	0.22	Industrial	S.B.	0.13	Mixed
MCS012	0.38	Industrial	Castro Valley S-		
SCV044	0.05	Industrial	3	0.08	Mixed
VFC004	0.33	Industrial	Line 6-G,		
CCC016	0.15	Mixed	Chevron	0.14	Mixed
CCC017	0.11	Mixed	San Leandro		
CCC018	0.1	Mixed	Creek	0.26	Mixed
MCS002	0.36	Mixed	Seminary Creek	0.16	Mixed
MCS003	0.05	Mixed	Lion Creek	0.29	Mixed
MCS004	0.09	Mixed	Alameda Creek	0.11	Mixed
MCS006	0.27	Mixed	Laguna Creek	0.11	Mixed
SCV021	0.12	Mixed	Cabot Creek	0.11	Mixed
SCV024	0.05	Mixed	Aqua Caliente	0.17	Mixed
SCV041	0.03	Mixed	Castro Valley	0.06	Mixed
SCV042	0.06	Mixed	Cerrito Creek	0.34	Mixed
SMC010	0.06	Mixed	Glen Echo	0.17	Mixed
SMC012	0.05	Mixed	Sausal Creek	0.31	Mixed
SMC013	0.11	Mixed	Crandall Creek	0.12	Mixed
SMC028	0.05	Mixed	Scott Creek	0.15	Mixed
VFC009	0.42	Mixed	Strawberry		
CCC012	0.03	Res/Com	Creek	0.05	Mixed
CCC019	0.19	Res/Com	Dry Creek	0.04	Mixed
FSS003	0.02	Res/Com	Balentine Drive	0.1	Mixed
MCS013	0.21	Res/Com	Codornices	0.49	Mixed
SMC005	0.2	Res/Com			
SMC024	1.31	Res/Com			

**Average Hg Concentration in Open Channel Sites = 0.21 mg/kg (ppm)**



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June 14, 2004

Mr. Bill Johnson, Environmental Scientist and  
Mr. Richard Looker, Water Resources Control Engineer  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Re: Mercury in San Francisco Bay – TMDL Basin Plan Amendment--Dredged Material

Dear Messrs. Johnson and Looker,

The Bay Planning Coalition (BPC) is pleased to submit comments on the Mercury in San Francisco Bay, TMDL Basin Plan Amendment. The development of a TMDL is a very complex scientific and policymaking process, and BPC congratulates the RWQCB on this accomplishment. Below are some comments on the TMDL approach focused on dredged material which BPC recommends should be incorporated into this Basin Plan amendment and future TMDL reports and amendments.

### General accounting of sources and losses

BPC agrees with your general accounting of sources and losses of mercury in the Bay for dredged material. Specifically we would like to emphasize our agreement that in-bay dredging and disposal has a net zero loading allocation, that out-of-bay disposal of dredged material is considered a net loss, and that the LTMS strategy is part of the solution. We also agree that the natural transport of sediment through the Golden Gate is considered a net loss.

### Sediment Dredging and Disposal Allocations

The TMDL states that the proposed allocation for in-bay disposal of dredged sediment is concentration-based and is not to "...exceed the baywide ambient median suspended sediment mercury concentration from all RMP bay monitoring stations". We are concerned about how the RWQCB defines ambient conditions. The concept of an allocation based on ambient in-Bay concentration is subject to serious statistical problems in implementation. As applied to dredged material disposal decisionmaking, this definition must be (1) scientifically accurate, reflecting the variable and dynamic conditions of the Bay; (2) integrated with and consistent with the philosophy and regulatory decision-making guidance applied by the Dredged Material Management Office (DMMO) – the collection of regulatory agencies that permit dredging activities in the Bay – and their determination of suitability for in-bay disposal; and (3) achievable in terms of analytical methodologies.

We recommend that you return to the LTMS implementation strategy as a basic tool for the purpose of the TMDL as distinguished from relying on a concentration-based limitation. We would like to continue to work with you to reach agreement on a definition of ambient that meets our three objectives above. For your further review, the Port of Oakland has also identified and elaborated on these technical concerns for the purpose of reaching agreement on the definition for "ambient sediment" with which

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*Executive Director*

BPC agrees. We understand that the Port of Oakland has initiated discussion of this topic with RWQCB staff, and we would like to continue to participate in this dialogue.

**TMDL Implementation - Proposed new permit requirements**

The Mercury TMDL implementation plan proposes the imposition of new requirements on dredging permits "...to investigate the potential for dredging to enhance mercury uptake into the food web". These proposed requirements, however, are not defined in the proposed Basin Plan amendment; and so we presume that this proposal is primarily for discussion purposes and is not intended as a new regulation. It appears that the general aim is to bring scientific certainty to unknowns about the propagation and impact of mercury or methylmercury throughout the Bay. We would be opposed to additional permit requirements, as permittees are already contributing to the Bay scientific knowledge base through their mandatory financial contributions to the S. F. Estuary Institute's Regional Monitoring Program (RMP). While we understand the need to determine the impact of mercury on Bay health, we recommend that it may be more appropriate that general studies be conducted and funded by established programs such as the RMP.

Again, we would like to commend the RWQCB on their tremendous efforts and accomplishments in the TMDL process. We look forward to participating in the TMDL program in the future to ensure the integration of sound science and the balancing of economic and environmental policy goals.

Sincerely yours,

Ellen Joslin Johnck  
 Executive Director

Cc: LTC Michael McCormick, S. F. District Engineer, U. S. Army Corps of Engineers  
 Ms. Alexis Strauss, Director, Water Division, U. S. Environmental Protection Agency,  
 Region IX

Mr. William Travis, Executive Director, S. F. Bay Conservation and Development  
 Commission

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June 14, 2004

Mr. BRUCE WOLFE, Executive Officer  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Attention: Mr. Bill Johnson

Dear Mr. Wolfe:

The current draft staff project report for "Mercury in San Francisco Bay, Total Maximum Daily load" and proposed Basin Plan amendment includes provisions pertaining to the Departments' responsibility for reducing mercury loads to San Francisco Bay. We are supportive in efforts to improve water quality in the Bay, but concerned with the proportional allocation, numeric targets and implementation plan that is proposed for the Department.

The Department disagrees with the approach of determining our allocation based on a percentage of each urban stormwater discharger's mercury load. This approach does not recognize current monitoring data for roadway runoff, watershed area contributing to runoff and the minimal significance of roadway runoff as a major source of mercury. Therefore, the Department requests that the determination of the allocation be based on data specifically associated within the Department Right-of-Way and not solely based on an equitable allocation scheme associated with each urban stormwater discharger.

The Basin Plan amendment acknowledges that *"assigning loads by watersheds could be a useful approach to managing pollutant loads....."*. We believe that this concept is directly applicable to the Department. Approximately 27 square miles of Department right-of-way within Region 2 drains to the San Francisco Bay. This area represents only 0.7% of the total watershed (4,000 square miles) that flows to the Bay. Given that less than 1% of the runoff into the Bay within Region 2 is from the Department's watershed, our equitable annual loading and share allocation must be based on tangible data.

It is important that the Board include in this Basin Plan amendment a revision for the Department that is based on new evidence that supports a watershed-based allocation. The Department proposes to implement studies to clarify mercury loading in association with roadway runoff. With these studies in place, the TMDL for mercury assigned to the Department can be modified based on reliable and accepted information. The methodologies and data in the Boards' draft project report related to quantifying mercury loading in various discharges currently lack specific information

Mr. Bruce Wolfe  
June 11, 2004  
Page 2

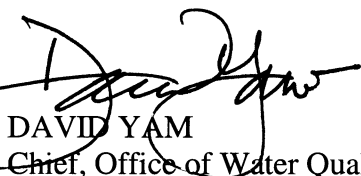
related to quantifying mercury loading in various discharges currently lack specific information related to roadways as a source of mercury loading. Based on these findings, numeric targets and an implementation plan can be developed that recognizes the Boards' objectives of reducing mercury loading. Attached to this letter are additional comments that support our position.

The Basin Plan amendment provides alternatives and flexibility in reaching goals for reduction in Mercury loads. The Department will work in cooperation with other urban dischargers and the Board to find equitable ways to reach our fair reduction goals. However, our responsible load determination and share allocation must not be exclusively tied to percentages associated with other urban discharger's mercury load. Our current efforts in implementing construction and post-construction (Pollution Prevention and Treatment) Best Management Practices (BMPs) indicates our commitment to improving water quality in compliance with our Statewide NPDES permit. We feel that these BMPs are reducing erosion and sediment loading and should be recognized as already contributing to reductions in the mercury loading.

Future monitoring may result in substantial changes to the estimates of the stormwater runoff contribution to San Francisco Bay mercury loading. The TMDL allocated to the Department needs to clearly recognize these changes.

Thank you for the opportunity to comment. If you have any questions, please contact me at (510) 286-5662.

Sincerely,

A handwritten signature in black ink, appearing to read 'David Yam', is written over the printed name and title.

DAVID YAM

Chief, Office of Water Quality and Mitigation

Attachment:      Additional Comments Supporting the Department's Position

## **Attachment**

### ***Department of Transportation Letter to:***

California Regional Water Quality Control Board  
San Francisco Bay Region

*Re:* San Francisco Bay Mercury TMDL - Draft Basin Plan Amendment (April 30, 2004)

June 14, 2004

This attachment provides additional comments on the TMDL documents.

1. **Mercury concentration in roadway runoff** - The available monitoring data appear to indicate that Department facilities are not a major source of the mercury entering the bay. Mercury concentrations measured during the statewide stormwater quality characterization study found that mercury in roadway runoff averaged 37 ng/l (total). The CTR criterion for mercury is 51 ng/l (dissolved) and the Basin Plan's objective is 25 ng/L.
2. **Flexibility for Caltrans** – We are concerned that some jurisdictions may assign Caltrans a sub-allocation based on an arbitrary value such as percentage of flow, which may not represent Caltrans actual contribution. If this occurs, Caltrans would have extreme difficulty demonstrating the required reduction in mercury mass loading because virtually none of the proposed municipal implementation options are available to Caltrans (e.g., fluorescent light bulb diversion, thermometer collection). We propose that the TMDL specifically state that the Caltrans allocation will be based on data representative of Caltrans actual contribution to the mercury loading, preferably on a watershed basis.
3. **Lack of feasible options for achieving allocations given to stormwater sources** – As currently drafted, municipal stormwater sources are expected to reduce their mercury loadings by almost 50%. The TMDL relies on “adaptive implementation” – that is, the dischargers are asked to provide the Board with information on feasibility, effectiveness and costs. The goal is that this cooperative approach will lead to the identification of appropriate controls. Cleanup of watershed “hot spots” has been postulated as one likely control. The other postulated controls include pollution prevention activities such as collection of mercury-containing devices. Unfortunately, there is very little evidence that hot spots exist such that focused soil removal could achieve the desired major reductions in mercury in runoff. Additionally, it seems very unlikely that such hot spots are present on Caltrans property. We are concerned that Caltrans will not be able to demonstrate the required reductions (loads avoided) because there are quite possibly no hotspots in the right-of-way and runoff concentrations appear to already be low.

In the absence of appropriate discharger-specific controls, some permittees such as Caltrans will be faced with two alternatives: (1) provide retrofit treatment controls at runoff locations, or (2) purchase equivalent load reductions elsewhere. We believe

that neither of these likely outcomes have been adequately discussed in the TMDL documents or represented in the cost estimates.

We propose that the TMDL not proceed until realistic reduction alternatives are identified and assessed. These alternatives should include the retrofit construction of treatment facilities and a reduction-credit purchase program, which we see as the likely result of this TMDL.

4. **Background and other unavoidable loading** – The TMDL appears to assume that background soil concentration values are approximately 0.06 ppm based on the Santa Clara sampling of agricultural areas. We believe this value may be low based on the University of Riverside's compilation of trace element concentrations in 50 different soils from around the state (*Background Concentration of Trace and Major Elements in California Soils*, G.R. Bradford, et. al., 1996). This report showed a geometric mean concentration of mercury in uncontaminated soils of 0.2 mg/Kg and a relatively wide range. Several soil mercury concentrations were above 0.4 which is significantly above the goal for the Bay. Thus, in some areas, dust from local soils could cause the roadway sediment to exceed the goals.

An additional factor is aerial fallout which potentially contributes significantly throughout the watershed but is not controllable except by treatment of runoff.

Our concern is that that natural (uncontaminated) background soil concentrations of mercury plus aerial fallout may be the major contributors to roadway mercury. As discussed in the previous comment, the suggested controls of pollution prevention and hot spot removal will not address these sources.

5. **Economic assessment** – We believe the economics in the basin plan amendment may substantially understate the potential costs of the TMDL. This draft estimates \$2 million initially and additional \$3M per year thereafter, for stormwater. These costs do not seem realistic. If achieving adequate loading reductions requires the construction of end-of-pipe treatment facilities or the purchase of offsets, then the costs may be higher than estimated. The Board assumes that non-structural measures will provide substantial benefit, however we do not see how any of these would be applicable to the Department.

We propose that the TMDL specifically identify the costs of reduction alternatives that are realistically available to the Department

6. **Need to assess cumulative costs and engineering compatibility of this and other Bay TMDLs** – We are concerned that the Board has not examined the cumulative cost and technical implications of this TMDL combined with possible future TMDLs in the Region. The problem we see is that while some initial TMDLs may be fundable, the full set of TMDLs may be beyond available public resources. Our related concern is that controls implemented for the initial TMDLs may not be compatible with subsequent TMDLs.

The current 303(d) listing means that stormwater runoff agencies will have substantial burdens in achieving waste load allocations for mercury, as well as PCBs, dioxin, and the legacy pesticides. It is also possible that other constituents may be listed. For example, the Los Angeles Board and other Boards have possibly been more aggressive in their approach to listing and have included "trash" and bacteria, for example, as contributing to impairment

of their waterways. We presume there is a likelihood that these constituents, along with other typically listed constituents, may eventually be listed and require TMDLs in San Francisco Bay.

In addition to cumulative costs, we see an issue of treatment compatibility. If treatment controls are required, the controls build for the initial TMDL constituents may not be compatible with the controls needed to attain reductions for subsequent TMDLs. For example, a retrofit stormwater control facility for mercury reduction will need to be designed differently if it ultimately will need to address trash or bacteria.

We propose that the Board provide an estimate of the costs applicable to stormwater dischargers for achieving the expected allocations for the currently listed constituents. In addition, a supplemental cost estimate should identify a range of costs for achieving compliance with other constituents that the Board believes may potentially be placed on the 303(d) list.

We also proposed that the TMDL provide an assessment of the compatibility of the controls likely to be implemented for the whole suite of TMDLs. The final result of this overall assessment may be a prioritization based on the most cost effective reduction of those constituents presenting the greatest environmental risk.

7. **Need for a broader approach to mercury control including atmospheric deposition** – Recent work in Lake Tahoe has found that sediments in the lake have concentrations of mercury averaging 0.191 ppm. This is a five-fold increase over the mercury present in the local bedrock. This is essentially the same concentration as the sediment goal for San Francisco Bay. The source of the metal is presumed to be direct atmospheric deposition primarily from regional and global sources. Mercury tends to preferentially settle out at high, cold elevations, and so atmospheric deposition in coastal areas will be less. However, this Tahoe data indicates that atmospheric deposition is widespread and potentially significant. (See <http://trg.ucdavis.edu/research/annualreport/contents/lake/article11.html> )

The TMDL discusses atmospheric deposition as it directly affects the Bay and local watershed but does not propose any reductions in this deposition. The TMDL estimates that as much as 30% of the stormwater loading may result from atmospheric deposition. Since the TMDL acknowledges that deposition contributes substantially to mercury concentration in surface soils it should more aggressively consider control opportunities. It may be appropriate for the SWRCB to address some of the regional sources through legislation or coordinated action with the Air Resources Board. (For example, controls on crematoria and car dismantlers could be considered.) As noted in the TMDL, this is a global issue which additionally should be addressed by the U.S. EPA and the federal government. We are concerned that the incremental loading from deposition may make the TMDLs goals unattainable. Stormwater agencies have limited control options if they are expected to reduce their loadings by about 50 % but one third of the loading is from atmospheric deposition and not controllable. In effect they will need to remove about 70% of the “controllable” mercury.

8. **Estimate of Storm Water Loading** – We note that the characterization of the amount of mercury in urban runoff described in the report cited in the Amendment (*Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs and Organochlorine*, April 2002)



is based on runoff analysis that did not include any highway sites. The Board's estimate of the mercury contribution in urban runoff is almost 2/3 higher than the estimate in this report due to differences in assumption in sediment load and whether the median or mean is the better estimate of central tendency of mercury concentrations in runoff. We believe that future monitoring may result in substantial changes in the estimates of the stormwater runoff contribution to Bay mercury loading. The TMDL document needs to clearly address how substantial changes will be addressed in the assigned allocations.



## Delta Diablo Sanitation District

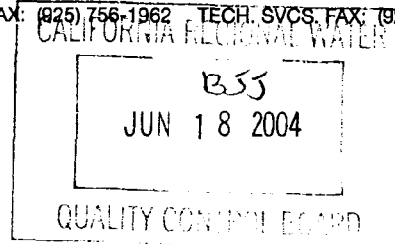
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June 14, 2004

VIA FACSIMILE NO. (510) 622-2460 (hard copy to follow)

Mr. Bruce Wolfe, Executive Officer  
Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612



**SUBJECT: COMMENTS ON MERCURY IN SAN FRANCISCO BAY TMDL,  
PROPOSED BASIN PLAN AMENDMENT AND STAFF REPORT DATED  
APRIL 30, 2004**

Dear Mr. Wolfe:

The Delta Diablo Sanitation District's (District) Board and staff appreciate the efforts by you and your staff to develop a Mercury Total Maximum Daily Load (TMDL) and bring forward a Basin Plan amendment and supporting documentation. The District, serving 185,000 residents in East Contra Costa County, believes that the concept of developing a Mercury TMDL in order to meet water quality standards is consistent with its strategic planning and Mission Statement "to safeguard and enhance the environment..." Over the last year, the District and Regional Water Quality Control Board (RWQCB) staff worked together to renew the District's National Pollutant Discharge Elimination System (NPDES) permit. As stated at the December 3, 2004 public hearing where the District's NPDES permit was adopted by the RWQCB, the District was impressed with the cooperation and professionalism experienced during the negotiation process.

Upon review of the April 30, 2004, Mercury in San Francisco Bay TMDL Proposed Basin Plan Amendment and Staff Report, the District has some very serious concerns, including WLA changes from the June 2003 draft TMDL to the April 2004 TMDL. As an Associate member of the Bay Area Clean Water Agencies (BACWA), we fully support the input that BACWA is providing to the TMDL and Basin Plan Amendment process. In addition to BACWA comments, the District feels compelled to raise a couple concerns:

- 1) The District has consistently invested in ways to decrease contaminant loading on the San Francisco Bay Estuary. It has implemented a strict pretreatment program, commenced operations of the largest industrial recycling project in the State of California in 2001, and opened a \$1M household hazardous waste facility in 2003. Our recent NPDES permit term requires us to implement a MRP costing the District's ratepayers the equivalent of a 0.5% rate increase. All of those public ratepayer investments have resulted in fewer pollutants reaching the District's outfall. The proposed Basin Plan Amendment gives no credit for these investments, and, in fact, penalizes the District for improved performance.
- 2) The District negotiated a Mercury mass limit based on permitted design capacity and current performance that became effective with its new permit in February 2004. The

Mr. Bruce Wolfe, Executive Officer

June 14, 2004

COMMENTS ON MERCURY IN SAN FRANCISCO BAY TMDL, PROPOSED BASIN  
PLAN AMENDMENT AND STAFF REPORT DATED APRIL 30, 2004

Page 2

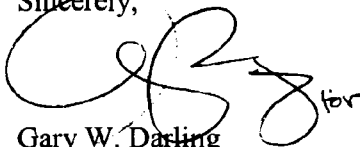
District determined that the adopted permit limit of 0.038 kg/month (0.46 kg/y) could be met without violation during the 5-year permit term.

In addition to explaining how the District's WLA changed from the June 2003 proposed amendment to the April 2004 proposed amendment, the District requests the following changes to the Basin Plan Amendment:

- 1) Establish the POTW WLA that provides recognition for POTWs who have been investing in improvements that are resulting in decreasing Mercury discharges.
  - a. Under the Mercury Sources Control Actions section for Municipal Wastewater in Appendix A (Proposed Basin Plan Amendment), include language similar to the Urban Stormwater Runoff and Guadalupe Watershed sections allowing dischargers to receive credit against their WLA for their efforts to reduce mercury discharges as a result of implementing pollution prevention programs, source control programs, and additional treatment.
  - b. Set the time period for calculating credits so that it is consistent with the time period for collecting data under this TMDL analysis.
  - c. Change the language from the "the Water Board may recognize" to "the Water Board will recognize" efforts taken toward load reduction.
  - d. In cooperation with BACWA, establish a methodology for determining credits. By doing that the RWQCB will provide the certainty the POTWs need in order to justify public dollar investments in Mercury Reduction Programs.
- 2) Consistent with strategies for determining attainment of the load allocation in the Central Valley and Guadalupe Watersheds and the Urban Stormwater Runoff sources, return to the rolling 5-year average for determining POTW attainment to recognize there is seasonal variability in wastewater flows.

Again, as an Associate member of BACWA, we support the comments being offered by BACWA on behalf its members. We thank you for taking our comments into consideration and we look forward to changes that will result in appropriate and beneficial results for the San Francisco Bay Estuary.

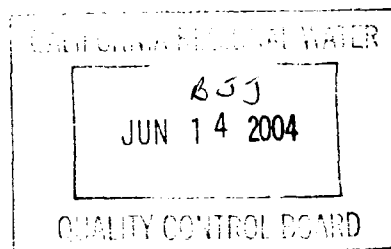
Sincerely,



Gary W. Darling  
General Manager/District Engineer

Cc: Donald P. Freitas, Board Chairman  
Board of Directors  
Jim Kelly, BACWA Chair

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June 8, 2004

Mr. Bill Johnson  
Mr. Richard Looker  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Subject: Comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report*  
Project No. 8602415.001 0201

Dear Gentlemen:

Exponent wishes to submit the attached 2 copies of comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* for consideration by the Regional Water Quality Control Board. We request that these comments be made a part of the record for the Board's consideration during the public hearings scheduled for June 16, 2004 and September 15, 2004.

Sincerely,

Gary N. Bigham  
Principal

Enclosures (1)

**Exponent's Comments on  
Mercury in San Francisco Bay:  
Total Maximum Daily Load (TMDL) Proposed Basin Plan  
Amendment and Staff Report**

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**Introduction and Summary of Conclusions**

The following comments on *Mercury in San Francisco Bay: Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* (Staff Report) (SFBRWQCB 2004) have been prepared by Exponent on behalf of the Santa Clara Valley Water District. The comments are based on our 15 years of experience with investigations of mercury cycling and bioaccumulation at contaminated and uncontaminated freshwater and estuarine sites across the country.

In general, we believe that the San Francisco Regional Water Quality Control Board's (the Board's) sole focus on mercury in sediment overlooks much of the state-of-the-science knowledge regarding the behavior of mercury in the environment, and this oversight renders the conclusions of the analysis invalid. The Staff Report recognizes many of the complications of assessing cycling and bioaccumulation that are unique to mercury, but does not take them into account. As described in detail below, it is well documented that the assumptions that all mercury species are equally available for methylation and that there is a proportional relationship between mercury in sediment and mercury in fish tissue, as the Board has assumed, are incorrect.

The linkage analysis and technical foundation of the Bay TMDL for mercury do not reflect the state of the science. There is no technical basis for assuming that, "If sediment mercury concentrations are reduced by 50%, then fish tissue and bird egg mercury concentrations will be reduced by 50%" (pg. 90, SFBRWQCB 2004). Data from San Francisco Bay do not exhibit a proportional relationship between sediment total mercury and methylmercury. Also, a causative relationship between sediment methylmercury and fish tissue concentrations cannot be argued for food webs where the lower trophic levels are dominated by plankton. In this case, dissolved methylmercury is the more important parameter affecting bioaccumulation. No attempt to reconcile bioaccumulative pathways was made in the TMDL presented in the Staff Report. The Bay TMDL for mercury also incorrectly assumes that, "Mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web" (pg. S-2, SFBRWQCB 2004). This is an overly simplified assumption that neglects that mercuric sulfide (HgS) contributed from abandoned mercury mines has a lower methylation potential than adsorbed inorganic mercury or elemental mercury from other sources.

In addition, the proposed TMDL does not account for the relative bioavailability of mercury from different sources, although it acknowledges, "Mercury newly deposited in the environment is more readily methylated than existing mercury already in the system (Benoit et al. 2003).

[Furthermore,] this suggests that, although most of the mercury in San Francisco Bay results from historical sources (Dorrance 2002; USGS 2000), recent mercury additions may be proportionally more responsible for human and wildlife mercury exposure” (USGS 2003) (pg. 51–52).

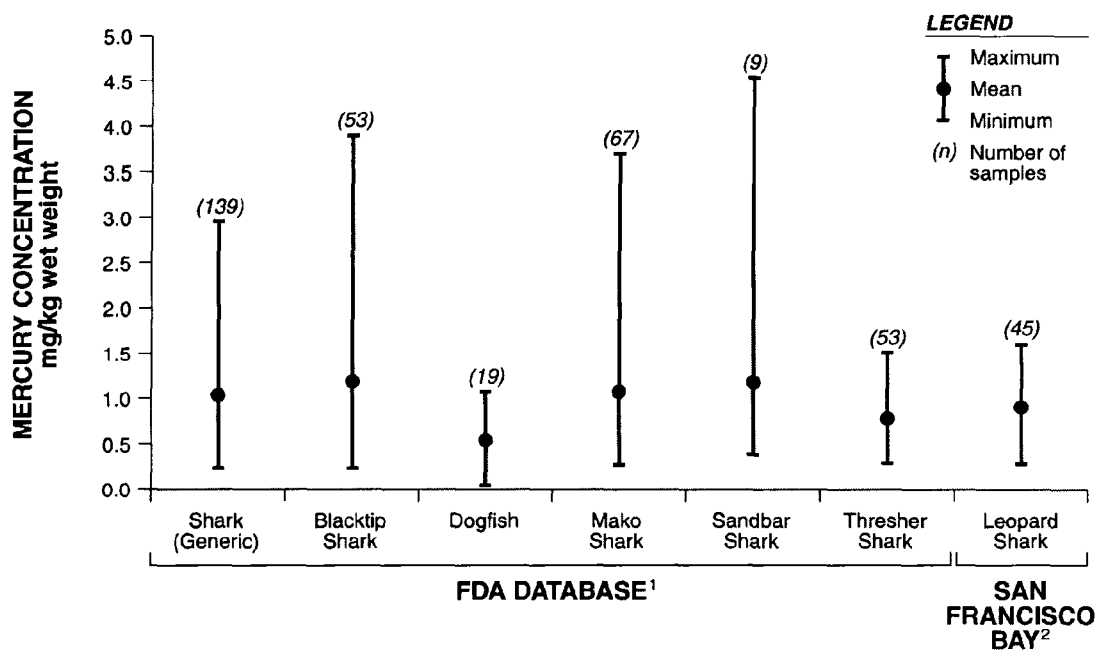
Finally, the proposed San Francisco Bay TMDL for mercury does not distinguish between dissolved and sediment-bound mercury in its load allocations. Instead, “The proposed allocations are based on the assumption that the mercury from all sources is equally available to be converted to methylmercury and incorporated within the food web” (pg. 51). This assumption is inconsistent with the known methylation process, whereby dissolved mercury is first incorporated into the cells of sulfate-reducing bacteria, either through passive (Benoit et al. 1999a,b) or facilitated (Golding et al. 2002) mechanisms.

## **Mercury Concentrations in Leopard Shark are Probably Not Related to Mercury in San Francisco Bay Sediment**

Fish consumption is one of the three lines of evidence of impairment described in the Problem Statement section of the Staff Report. The California Office of Environmental Health Hazard Assessment (COEHHA) has issued an interim advisory to limit consumption of certain fish from San Francisco Bay (COEHHA 2001). The interim advisory applies primarily to sturgeon and striped bass and was imposed “because of elevated levels of mercury, PCBs, and other chemicals.” The average mercury concentration in sturgeon only slightly exceeds the U.S. Environmental Protection Agency (EPA) water quality criterion for methylmercury in water, which is 0.3 mg/kg wet weight in fish tissue, as shown in Figure 2.2 of the Staff Report. The average mercury concentration in striped bass is less than 0.4 mg/kg. The highest tissue mercury concentrations in Figure 2.2 are reported for leopard shark, ranging as high as 1.6 mg/kg and with a mean of 0.9 mg/kg.

It is unclear whether mercury concentrations in any of these species are truly “elevated” because of mercury in sediment. The white sturgeon and leopard shark are relatively long-lived species that naturally exhibit higher levels of mercury bioaccumulation. Similarly, the leopard shark and striped bass are piscivorous predators, near the top of the food web, that naturally exhibit the highest levels of biomagnification.

Data for mercury in shark presented in Figure 1 show that levels in San Francisco Bay leopard shark are not significantly different from concentrations in other shark species measured by the U.S. Food and Drug Administration (FDA). The FDA’s sampling locations are not listed in the database (<http://vm.cfsan.fda.gov/~frf/seamehg2.htm>); however, the locations are believed to be representative of uncontaminated areas where shark are captured commercially. FDA data for mercury in sturgeon and striped bass are not available; however, comparison of data from San Francisco Bay with other uncontaminated locations may show that, like the leopard shark, the concentrations at uncontaminated sites and San Francisco Bay are similar.



<sup>1</sup> Data from FDA March 2004. <http://vm.cfsan.fda.gov/~frf/seamehg2.html>

<sup>2</sup> Data from San Francisco Bay Estuary Institute. <http://www.sfei.org/rmp/data/rmpfishissue.htm>

Figure 1. Comparison of mercury concentrations in San Francisco Bay leopard shark with other sharks tested by FDA

### Relevance to San Francisco Bay

This is a critical issue that should have been evaluated in the Staff Report. Because tissue concentrations similar to uncontaminated sites indicate that there is no unusual pathway for mercury transport from the sediment, and that the tissue concentrations are “naturally occurring.” Under these circumstances, reduction of sediment mercury concentrations will not lower tissue concentrations.

### The Linkage Between Total Mercury in Sediment and Methylmercury in Fish is Inadequate

The Staff Report for mercury bases its load allocations on the inappropriate assumption that total mercury measured in benthic or suspended sediment and methylmercury measured in fish tissue in the Bay are proportional.

## Scientific Background

The concentration of mercury in fish tissue depends on the nature and efficiency of a number of biogeochemical processes that vary among and/or within estuarine ecosystems:

1. The first governing process is the solubilization of sediment-bound mercury into the porewater. As demonstrated by Bloom et al. (2003), the relative degree of mercury solubility is dependent on its chemical form, with sorbed or organo-chelated compounds exhibiting higher solubility than mercuric sulfide. Although solubility is also enhanced by the complexation of mercury with dissolved organic matter (Ravichandran et al. 1998), it is diminished by the sequestration by particulate-bound organic matter (Hammerschmidt and Fitzgerald 2004), re-precipitation as sulfides under fluctuating redox conditions, or adsorption onto iron oxides (Bonnissel-Gissinger et al. 1999; Caille et al. 2003; Gagnon et al., 1996, 1997) or clays (Nguyen et al. 1994).
2. A second governing process is the transformation of dissolved mercury to methylmercury. Net methylmercury production, which generally occurs within the top few centimeters of anaerobic sediment (Compeau and Bartha 1985), is controlled primarily by the activity of sulfate-reducing bacteria. Bacterial activity is dependent on temperature (Matilainen et al. 1991), pH and sulfate/sulfide concentrations in the overlying water (Gilmour et al. 1998), and dissolved oxygen (Gill et al. 1999). Methylmercury production is also dependent on the concentration of certain aqueous species of mercury, although the exact mercury forms are a topic of current scientific research. Benoit et al. (1999a,b) provided evidence that neutral mercury sulfide species are important, presumably due to their ability to passively diffuse into the cell membrane of sulfate-reducing bacteria. Golding et al. (2002), by contrast, observed enhanced bacterial uptake in the presence of weak organic acids, indicating a facilitated transport mechanism.
3. Finally, the degree of mercury bioaccumulation depends on the structure of individual food webs (Morel et al. 1998). Entry into the food web can occur via two pathways: 1) assimilation of dissolved species, or 2) ingestion of sediment-bound forms. An example of the former is the direct uptake of dissolved methylmercury in the water column by phytoplankton (Watras et al. 1998). Examples of the latter include the direct ingestion of sediment-bound methylmercury via detritivores and/or sediment-dwelling organisms (Parkman and Meili 1993; Nuutinen and Kukkonen 1998), or the ingestion of mercury bound to suspended particulate matter by filter-feeding zooplankton or grazing organisms, detritivores, or particle-degrading bacteria (Gilmour and Henry 1991; Plourde et al. 1997; Tremblay et al. 1998). Depending on the nature of the food web, tissue concentrations in a particular fish species may be predominantly a function of the concentrations of either dissolved or particulate-bound methylmercury (Becker and Bigham 1995).



## **Inadequate Linkage Between Total Mercury and Methylmercury in Sediment**

The authors of the Staff Report acknowledge, “Factors relating to mercury methylation and accumulation within the food web are complex and not fully understood.” However, “In the absence of additional information, reductions in mercury loads are assumed, for purposes of this (TMDL) report, to result in proportional reductions in fish tissue residues” (pg. 48, SFBRWQCB 2004). The Staff Report specifically assumes that a 50% reduction in median sediment mercury concentrations will produce a calculated 40% reduction in fish-tissue mercury concentration, which would be required to protect the Bay’s beneficial use of sport fishing. (Note that this reduction is also assumed to be protective of wildlife and rare and endangered species.) The justification for this assertion is the following: “At any particular location, the mercury methylation rate in surface sediment is probably roughly proportional to mercury concentrations in the sediment when sediment concentrations are less than 1 ppm” (pg. 47, SFBRWQCB 2004). Although the report acknowledges, “The structure of the food web (what eats what) determines the efficiency of transfer among organisms” (pg. 48, SFBRWQCB 2004), the proposed TMDL report does not attempt to link impaired fish species to food-web pathways.

Due to the numerous variables that contribute to the transformation of mercury into methylmercury, it is not surprising that the Board’s citation, purported to demonstrate a proportional relationship between total sediment mercury and sediment methylmercury below a sediment mercury concentration of 1 ppm, does not provide the correlation attributed to it. The U.S. Geological Survey (USGS) study of Krabbenhoft et al. (2003) consisted of sampling 106 sites from 21 basins across the United States for total mercury and methylmercury and looking for trends in the data. The apparent relationship between basin-averaged total and methylmercury concentrations is shown on Figure 2a. Although there is a positive correlation indicating that, “At high total mercury levels little additional methylmercury is produced with additional total mercury” (Krabbenhoft et al. 2003), the data below 1 ppm (equivalent to 1 mg/kg) display a weak, negative correlation (Figure 2b).

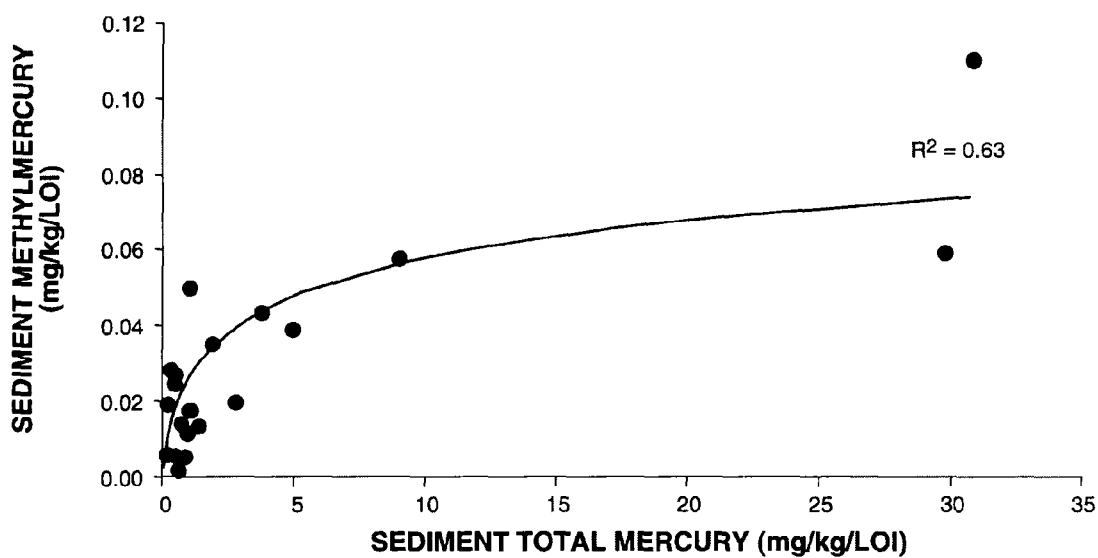


Figure 2a. Average normalized (to loss on ignition [LOI]) sediment methylmercury vs. total mercury for the 21 basins studied by Krabbenhoft et al. (2003)

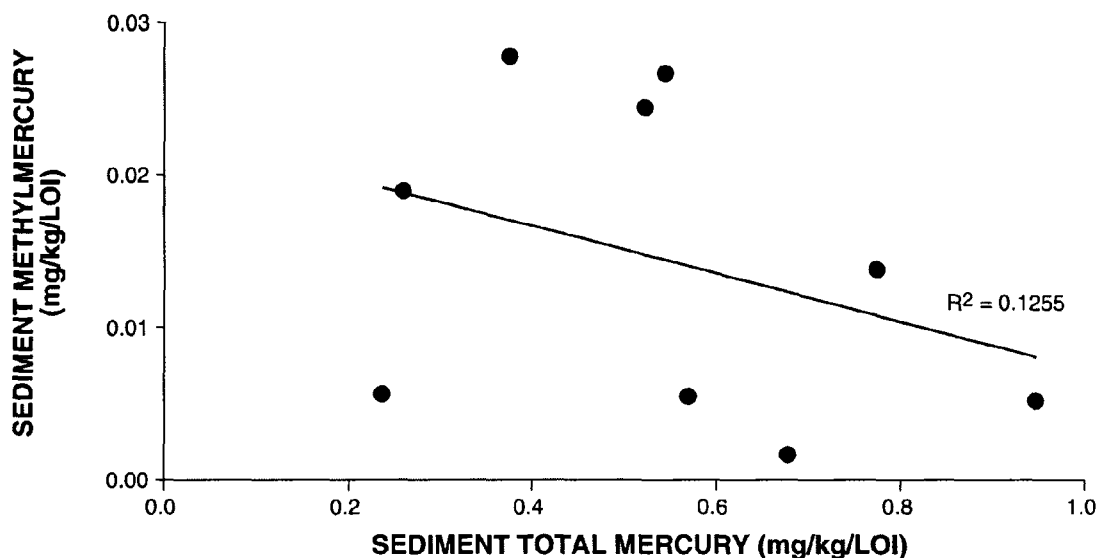


Figure 2b. Average normalized (to LOI) sediment methylmercury vs. total mercury for the 21 basins studied by Krabbenhoft et al. (2003), for total mercury less than 1 mg/kg/LOI

There is also a weak correlation between total sediment mercury and methylmercury concentrations evident in data for the San Francisco Bay estuary (Figure 3). Although there are likely several causes for the scatter in the data, one identified explanation is the difference in chemical environments represented by the many channels and subtidal salt marshes in the Bay. For example, Heim et al. (2002) found an improved correlation ( $R^2 = 0.52$ ) when marsh habitats

were considered independently. Also, Marvin-DiPasquale et al. (2003) found that marsh and open-water sediment samples from San Pablo Bay had similar total mercury concentrations (0.3–0.6 ppm) and isotopic signatures indicative of historical mining activities; however, the marsh sample had an in-situ methylmercury concentration of 5.4 ppb (relative to <0.7 ppb for open-water sites), and had measurable microbial methylmercury production. A link between sediment methylmercury and fringing wetlands is consistent with the conclusion of Krabbenhoft et al. (2003) that wetland density is the most important basin-scale factor controlling methylmercury production.

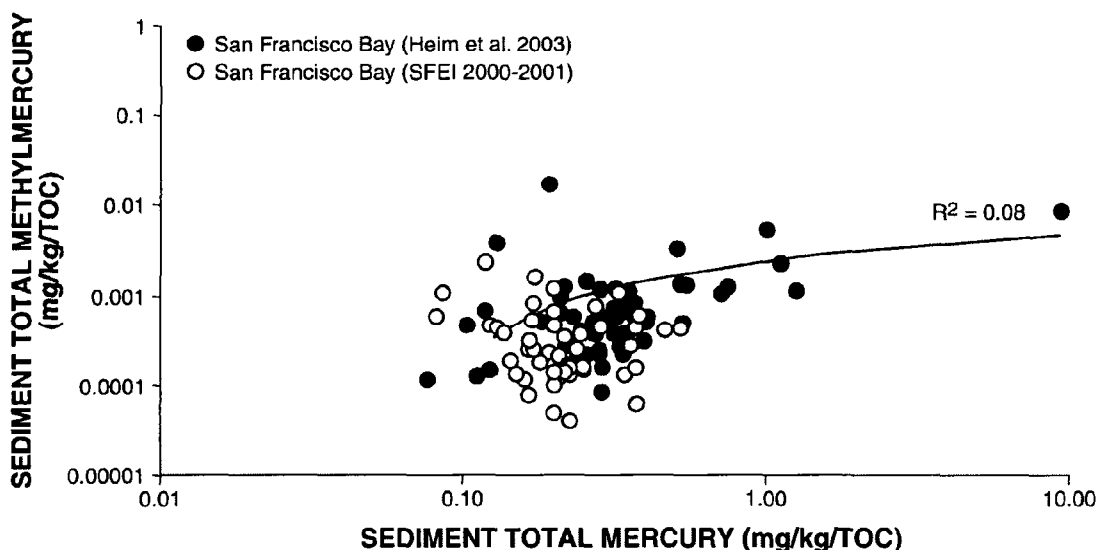


Figure 3. Relationship between methylmercury and total mercury in San Francisco Bay sediment (normalized by total organic carbon [TOC])

### Inadequate Linkage Between Total Mercury in Sediment and Fish Tissue

Given the lack of correlation between total sediment mercury and methylmercury, it is not surprising that the combined USGS data of Krabbenhoft et al. (2003) and Brumbaugh et al. (2001) do not exhibit a correlation between total sediment mercury concentrations and fish tissue (Figure 4). In fact, Brumbaugh et al. (2001) concluded that the best predictor of mercury concentrations in largemouth bass is dissolved methylmercury.

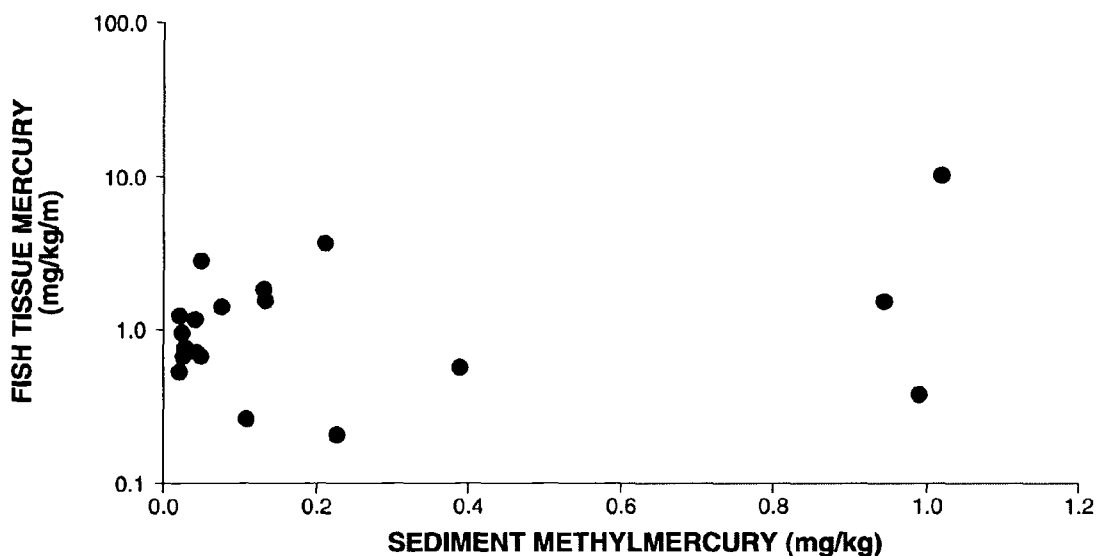


Figure 4. Average normalized (to length) fish-tissue mercury vs. sediment methylmercury for the 21 basin studies by Krabbenhoft et al. (2003)

Evidence for the importance of the dissolved food-web pathway is provided on Figure 5. Mercury concentrations in sunfish from Reality Lake (Oak Ridge, Tennessee), a site highly contaminated by mercury in the sediment, were monitored for the period 1999–2000. Following the elimination of the primary source of dissolved mercury to the lake in 1998, there was a dramatic decrease in fish-tissue mercury concentrations.

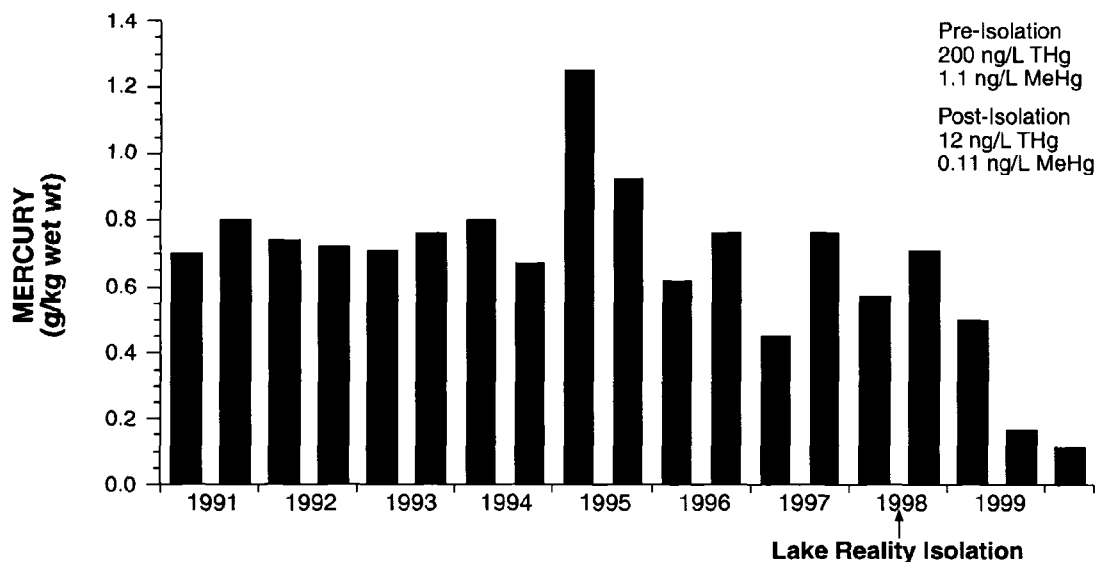


Figure 5. Mercury in Reality Lake sunfish decreased over the first growing season, when a bypass eliminated inputs of dissolved mercury

Direct correlation between dissolved mercury loads and fish tissue is also evident from the data on Figure 6 for Onondaga Lake, New York.

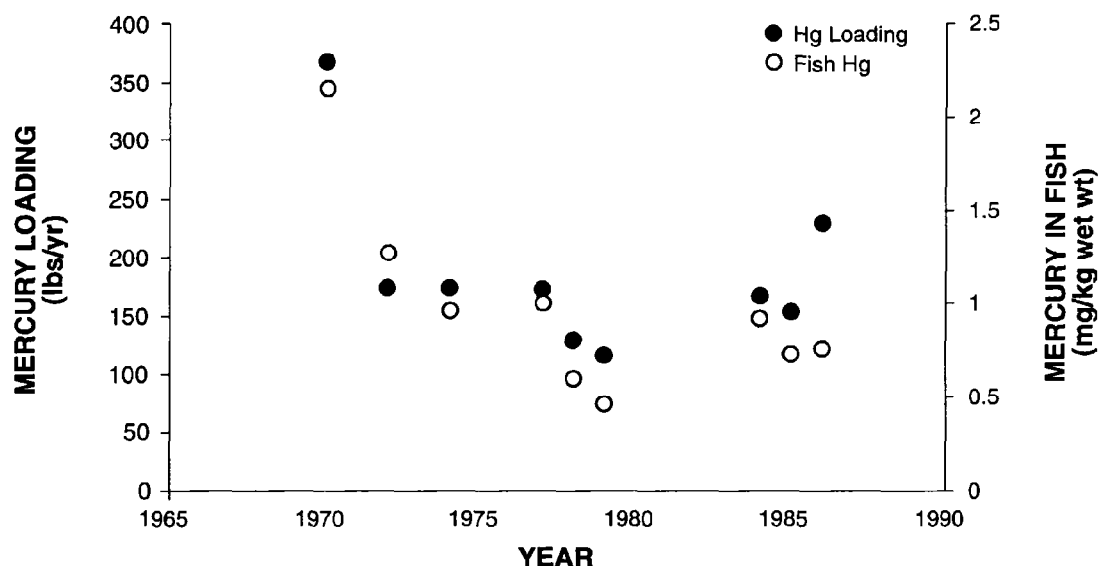


Figure 6. Mercury loading and mercury in fish tissue at Onondaga Lake, New York

Finally, the Central Valley Regional Water Quality Control Board (CVRWQCB 2004) used the following scientific evidence in developing their linkage analysis for the Cache Creek, Bear Creek, and Harley Gulch TMDL for mercury (pg. 73):

“The relationships between aqueous and biotic methylmercury concentrations were investigated in an intensive 20-month study in the Cache Creek watershed (Slotton et al. 2002). Statistically significant positive log/log relationships were observed between waterborne mercury and methylmercury tissue concentrations in bottom dwelling invertebrates when all locations were grouped together. Similar relationships were noted between waterborne mercury and methylmercury in small fish... The conclusion that biotic tissue concentrations correlate best with raw waterborne methylmercury is consistent with the observations of others (Foe et al. 2002; Brumbaugh et al. 2001).”

Accordingly, considering the complexities involved in mercury bioaccumulation, the CVRWQCB has not adopted numeric criteria for sediment: “Concentrations of mercury or methylmercury in sediment are not as closely related to measures of impairment, as are measures of methylmercury in water or fish tissue” (pg. 17, CVRWQCB 2004). Studies cited in their linkage analysis show that the greatest methylmercury production rates occur in seasonally flooded wetlands (Heim et al. 2002), and the greatest linkage to fish-tissue concentrations is dissolved methylmercury concentrations (Slotton et al. 2002). Consequently, the CVRWQCB is proposing numeric targets for dissolved methylmercury and a phased implementation plan that

will attempt to reduce mercury loads to areas of the watershed, such as wetlands, where dissolved methylmercury is generated.

## **Adsorbed Inorganic Mercury is Not the Same as Mercuric Sulfide with Respect to Methylation Potential**

### **Mercury Forms in San Francisco Bay**

The largest external sources of mercury to San Francisco Bay are estimated by the Staff Report to be the Central Valley watershed, urban stormwater runoff, and the Guadalupe River watershed (SFBRWQCB 2004). Mercury from the former two sources is best characterized as inorganic mercury adsorbed to suspended particulate matter in drainage from abandoned mercury mines such as the New Almaden in the Guadalupe River watershed. The reasoning is that cinnabar (HgS) was the predominant form mined in the Coastal Ranges, whereas elemental mercury (Hg<sup>0</sup>) was the chemical form used to extract gold ore along the front range of the Sierra Nevada. Evidence for this difference in chemical form is provided by Bloom (2001), who sampled sediment downstream of three inactive mercury-mining districts in the Cache Creek watershed and a gold mining district in the Consumnes River watershed of the Sierra Nevada. The study found that HgS constituted 98% of the solid-phase fraction of mercury in the former, but organically complexed forms were predominant in the latter.

It is acknowledged that mercuric sulfide (HgS) originating from abandoned mercury mines may be converted to more labile forms over time (Bloom et al. 2003) and distance from the source (Bloom 2001); however, the conversion is likely incomplete. For example, Hines et al. (2001) reported that cinnabar was the predominant form of mercury in the Gulf of Trieste, an aquatic environment that receives drainage from abandoned mercury mines.

### **Methylation Potential of Mercury Mine Drainage**

Figure 7 compares estimated methylation rates and total porewater mercury concentrations from the Gulf of Trieste (Hines et al. 2001) to Long Island Sound (Hammerschmidt and Fitzgerald 2004). Whereas mercury in the Gulf of Trieste is predominantly characterized by cinnabar, mercury in Long Island Sound is organically complexed. As shown on the figure, methylation rates and total dissolved mercury concentrations are lower for the Gulf of Trieste, consistent with the lower methylation rates measured for cinnabar in batch incubation experiments (Bloom et al. 2003). The USGS study of Cache Creek (Domagalski et al. 2004) concluded, "Solid-phase cinnabar-containing minerals do not represent a major methylation source" (pg. 10).

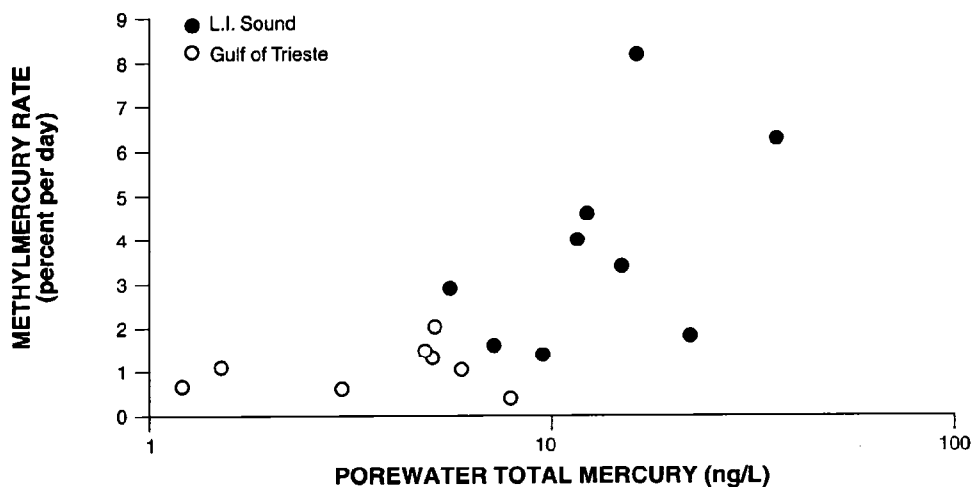


Figure 7. Relationship between mercury methylation rate and porewater mercury concentration

### Implications of SFBRWQCB Approach

The lower methylation potential of cinnabar is consistent with the lower methylation potential measured for Coastal Range relative to Sierran sediment (Heim et al. 2002). This relationship is important because it implies that mercury from all sources (to San Francisco Bay) is not similarly available to be converted to methylmercury. Figure 8 compares dissolved porewater methylmercury from the two sites to the total sediment mercury concentration numeric target of 0.2 mg/kg. Assuming that the concentrations presented on the figure are consistent with the solubility and degree of mercury transformation of organic versus inorganic sulfide forms, a reduction in sediment mercury concentrations from cinnabar-dominated areas is not predicted to achieve a reduction in dissolved methylmercury. This consideration is not included in the load allocation for the Guadalupe River.

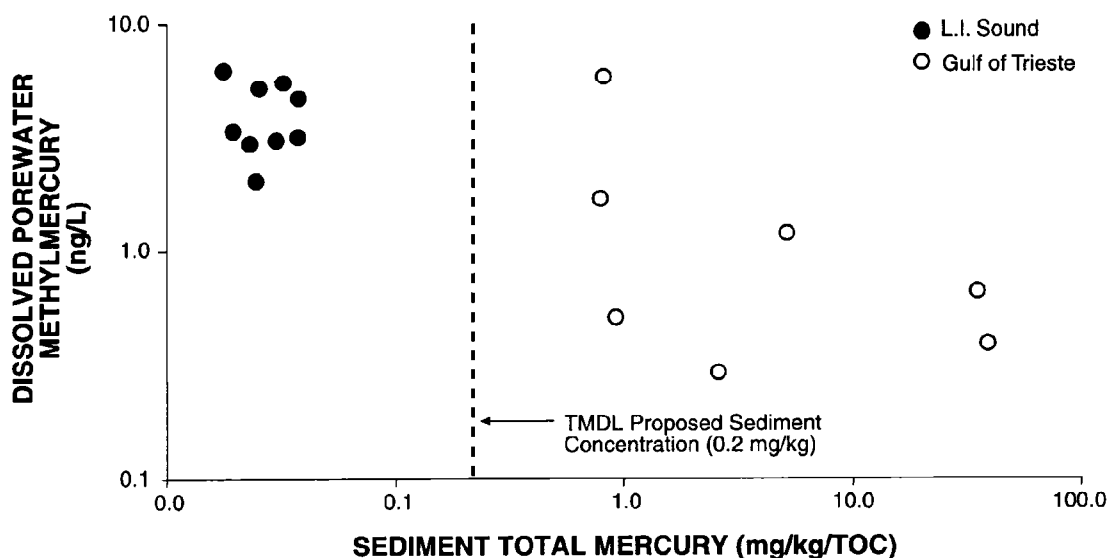


Figure 8. Relationship between total dissolved porewater methylmercury and total mercury in sediment (normalized by TOC)

## **“New” Mercury from Point Sources and Tributaries is a More Significant Source for Methylation than “Old” Mercury**

### **“New” Versus “Old” Mercury**

The relative bioavailability of “new” versus “old” mercury can be deduced by introducing stable isotopes of mercury (e.g.,  $^{202}\text{Hg}$ ) into a water body. The introduced mercury can then be distinguished from ambient mercury using mass spectrometry. This technique was used in four mesocosm experiments in the Florida Everglades (USGS 2003). The result of spiking the enclosures with different doses of mercury revealed the following.

1. There is a positive and linear relation between mercury added and the production of methylmercury.
2. There is an exceptionally close tie between mercury added and bioaccumulation of the added mercury in fish.
3. There is an “aging effect” for new mercury added to the ecosystem, such that more recent doses of mercury isotopes are more likely to be bioaccumulated than older mercury.



## **Relevance to San Francisco Bay**

Mesocosm experimental results are important because they imply that “aged” particle-bound mercury introduced into the San Francisco Bay estuary may be a less important source of methylmercury than dissolved forms. This conclusion is consistent with measured mercury concentrations in sunfish from Reality Lake, a site highly contaminated by mercury in the sediment (Figure 5). Following elimination of the primary source of dissolved mercury to the lake in 1998, there was a dramatic decrease in fish-tissue mercury concentrations.

## **Dissolved Mercury Loads are a More Significant Source for Methylation than Sediment-Bound Mercury Loads**

### **Dissolved Versus Sediment-Bound Mercury**

The methylation potential of various dissolved and sediment-bound mercury loads was investigated by Bloom (2001) using sediment from Cache Creek. First, various dissolved and sediment-bound mercury forms were spiked to methylating sediment. Next, the slurries were incubated for one week, and the total methylmercury concentrations were measured. It was found that the smallest net change in methylation occurred for the mine tailings spike. It was also found that mercury adsorbed to kaolin was half as bioavailable as the dissolved mercury spikes.

## **Relevance to San Francisco Bay**

Some dischargers introduce mercury into San Francisco Bay that is predominantly dissolved (Hsu and Sedlak 2003). By not considering the relatively high methylation potential of dissolved mercury, the assumption that the mercury from all sources is equally available implies that some waste-load allocations will be overestimated. Consequently, if the proposed San Francisco Bay TMDL for mercury is implemented, the most bioavailable forms of mercury may continue to be released into the Bay.

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## Fairfield-Suisun Sewer District

Richard F. Luthy, Jr.  
General Manager/District Engineer

June 14, 2004

RW-100.10.10/04

Mr. Richard Looker  
Mr. Bill Johnson  
San Francisco Bay Regional  
Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Reference: Comments on *Mercury in San Francisco Bay – Total Maximum Daily Load Proposed Basin Plan Amendment and Staff Report*, April 30, 2004

Dear Mr. Looker and Mr. Johnson:

The Fairfield-Suisun Sewer District (District) appreciates the opportunity to comment on the above referenced document and wishes to acknowledge the substantial efforts of both you and other Regional Board staff in drafting this complex and comprehensive document.

The District provides wastewater collection and treatment and stormwater pollution prevention services to approximately 131,000 customers in central Solano County. Our wastewater treatment facility treats wastewater to near drinking water standards and discharges the treated effluent to either the environmentally sensitive Suisun Marsh or for reuse by agriculture, landscape irrigation, and/or industrial cooling. As a Phase I Stormwater Permittee, the District has been responsible for control of stormwater pollution to the maximum extent practicable in our service area for nearly 12 years.

Because of potentially grave impacts to the District's wastewater and stormwater NPDES permits and to projected growth in the District's service area, the District provides the following comments to aid Regional Board staff in development of an environmentally sound TMDL that is equally protective of the economic and social needs of the communities the Regional Board serves:

- 1) The District is strongly supportive of comments submitted by the City of San Jose and the Bay Area Stormwater Management Agencies Association (BASMAA).



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2) Relative to impacts on the District's wastewater NPDES permit, the District provides the following:

- a. The treatment plant's mercury load allocation was reduced by greater than a factor of 3 between the June 6, 2003, draft report and the April 30, 2004, report (from 0.45 kg/yr to 0.14 kg/yr – at current design flow, concentration limits are reduced from 19 ng/l to 6 ng/l). In reviewing the loading allocation tables, it appears that the treatment plants with the best performance have been the most penalized by the revised allocations. This violates the Board staff's stated intent to not penalize the best performers to protect the poorer performers and is counter to common sense (What incentive is there to perform well when excellent performance is penalized by reducing allocations?).

**Action – The best performing Bay area wastewater treatment plants should not be penalized for their excellent performance.**

- b. In the next 5 years, the District will expand its treatment plant's dry weather flow capacity by 35% (from 17.5 mgd to 23.7 mgd). The reduced allocation in the April 2004 report results in a 4 ng/l concentration limit at the revised design flow (23.7 mgd). Current plant performance is over 3 ng/l. In a wet year, such as the 1998 *El Nino* year, the treatment plant will certainly violate this load allocation; therefore, this allocation is a de facto growth cap for the cities of Fairfield and Suisun City and a critical national defense facility, Travis Air Force Base.

**Action – Allocations must be set at levels that do not inhibit planned growth within Bay area communities.**

- c. The June 2003 mercury report proposed a compliance determination averaging period of five years. This longer averaging period would tend to smooth out the inherent annual variability caused by wet and dry years. The April 2004 mercury report revised the compliance determination averaging period to one year. This change will result in greater probability of violating both individual and group allocations in a wet year.

**Action – Regional Board staff should set the compliance determination averaging period as long as legally possible to avoid unintended violations of loading allocations.**

- d. Based on loading values from the April 2004 mercury report, wastewater treatment plants constitute about 1% of the mercury loading to the San Francisco Estuary. In the June 2003 mercury report, the wastewater treatment plant allocation was set at 17 kg/yr. In the April 2004 mercury report, the wastewater treatment plant allocation was set at 14 kg/yr, an unexplained 18% reduction. The change appears intended to hold wastewater treatment plants to current performance and, as a consequence, acts as a growth cap for growing communities in the Bay area, violating specific terms of the Clean Water Act that require allowance for reasonable municipal growth when setting limits.

**Action – The total allocation for all wastewater treatment plants should be set at a minimum of 17 kg/year to insure adequate room for planned municipal growth.**

- 3) The District provides the following comment relative to impacts on our stormwater NPDES permit. The April 2004 mercury report requires a 51% reduction in mercury loads from urban sources. The report states that these reductions can be achieved through implementation of pollution prevention activities, elimination of highly enriched waste streams (i.e., mine drainage and waste), treatment of runoff through vegetated strips, and, potentially, treatment of stormwater through diversion to wastewater treatment plants. While each of these activities may reduce mercury loads to varying degrees, there is no assurance, in fact it is highly unlikely, that these activities will result in the dramatically reduced mercury loads to the San Francisco Estuary contemplated in the report.

**Action – The District requests that Board staff develop and include in the final report an implementation plan that formalizes periodic loading status/attainability reviews coupled with adaptive management to insure the loading reduction estimates included in this document are reasonable and real and that they do not place proactive NPDES permit holders in jeopardy of permit violations.**

District staff looks forward to working with you to implement a successful mercury TMDL that fully supports the needs of our estuary and the citizens who live in the surrounding communities.

Please contact me by e-mail at [lbahr@fssd.com](mailto:lbahr@fssd.com) or by telephone at (707) 429-8930.

Sincerely,



Larry Bahr  
Senior Environmental Scientist

/cb



June 11, 2004

Bill Johnson

San Francisco Bay Regional Water Quality Control Board

1515 Clay Street, Suite 1400

Oakland, CA 94612

by e-mail: [bjj@rb2.swrcb.ca.gov](mailto:bjj@rb2.swrcb.ca.gov)

*Subject:* TMDL for Mercury in San Francisco Bay

Dear Mr. Johnson:

In reviewing the TMDL Project Report it appears that the document does not fully address natural background levels of mercury nor unavoidable mercury inputs such as aerial deposition.

The TMDL is predicated on a number of assumptions concerning sources including 0.26 ppm for sediment from the Central Valley, 0.38 ppm for Hg in sediment carried by urban stormwater, and 0.06 ppm carried by non-urban runoff. The TMDL goal is 0.2 for sediment.

However, a review of typical "natural" (i.e., uncontaminated) soil concentrations for mercury indicates that some soils in the state are significantly above the goals. These include soils around Sacramento which potentially may be developed and contribute sediment which could be substantially above the goals or even above present loading. Thus, the loading in some locations may be more dependent on the particular soils being eroded than on mercury contamination.

In other words, by not considering the "natural" component of the mercury loading which may be dominant in some locations, we could be establishing up goals which cannot be attained. Natural erosion or soil dust on roadways may exceed the goals of 0.2 ppm.

The core taken from San Pablo Bay (Fig 4.2) seems to show a possibly "natural" concentration of Hg ranging from 0.3 to 0.4 ppm located in a depositional stratum below the spike from hydraulic gold mining. Grizzly Bay background is around 0.2 but this may be indicative of different inputs. Also, the Tomales Bay "reference" core showing a 0.0 to 0.2 range is, of course, from a different soil type and may not be an appropriate reference.

A preferential approach may be to somehow extract out the "natural" mercury from the source and control requirements so that LAs and WLAs only address the added (human induced) mercury.

A similar issue concerns mercury which is atmospherically deposited. The TMDL estimates that this could represent 30% of the loading. It seems that these two burdens – natural mercury plus atmospherically deposited mercury - could present a burden that could prevent urban agencies from ever attaining the sediment goals regardless of the pollution prevention-type controls they implemented.

Thank you for considering these comments.

S/

Fred Krieger  
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Berkeley CA 94705

[E:MAIL VERSION]  
LEBOEUF, LAMB, GREENE & MACRAE, LLP  
ONE EMBARCADERO CENTER, FOURTH FLOOR  
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June 11, 2004

BY FACSIMILE, WITH E:MAIL VERSION SENT SEPARATELY

Bill Johnson and Richard Looker  
Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street  
Oakland, CA 94612

Re: Comments of the City of Sunnyvale On the Proposed Basin Plan  
Amendment Implementing the TMDL for Mercury for San  
Francisco Bay and the Accompanying Report Entitled: "Mercury in  
San Francisco Bay; Total Maximum Daily Load (TMDL): Proposed  
Basin Plan Amendment and Staff Report," dated April 30, 2004.

Dear Mr. Johnson and Mr. Looker:

This letter is written on behalf of the City of Sunnyvale, the holder of NPDES  
Permit No. CA 00037621, and supplements comments sent under separate cover by  
Marvin A. Rose, Director of Public Works for the City of Sunnyvale.

Sunnyvale acknowledges the extensive efforts that the Regional Board staff have  
made in attempting to establish a TMDL for mercury for San Francisco Bay. However,  
Sunnyvale believes that there are a number of practical and legal problems to be resolved  
before the TMDL should be established. The following comments indicate our concerns:

**1. The Individual Wasteload Allocations (WLAs) To Sunnyvale And  
Possibly Other Municipal POTWs Leave No Room For Inevitable  
Population Growth.**

As more fully discussed in Mr. Rose's comment letter, the individual WLA for  
Sunnyvale caps its mercury discharge at its current level (.08 kg/yr), with no allocation

for future growth. As also discussed in that letter, Sunnyvale anticipates a population growth rate approaching 14% by the year 2025. This population growth, together with hoped-for improvements in the business climate in Silicon Valley, are expected to result in a proportional increase in its wastewater influent. This increase will be accompanied by a proportional increase in both influent and effluent mass mercury loadings. There is nothing in the record to substantiate the claim by staff that this growth can be accommodated by any practicable means.

**2. The Assumption That Sunnyvale Can Offset Growth Through Additional Source Control, Plant Improvements, Pollution Reduction or Reclamation is Unfounded.**

As Mr. Rose's letter points out, there is no practicable way to improve on Sunnyvale's already stellar performance in pollution prevention and source control for mercury, and the only available opportunity for further water reclamation would accommodate a scant one MGD (eliminating only 5.5 grams/yr of mercury) at a cost of \$20 million. There are no other practicable means of reducing mercury loads to accommodate future growth except a moratorium on development, including new housing. Despite the severe implications of this result, the TMDL Report does not even discuss the problems it would create. Sunnyvale cannot speak for other POTW operators affected by the new wasteload allocations, but it submits that similar factors may be present in their situations, particularly among those POTWs with advanced treatment systems. It would be extremely reckless, arbitrary and capricious for the Regional Board to adopt the proposed Basin Plan Amendment without taking into account the obvious need to accommodate future growth over the life of the projected attainment period.

**3. The Assumption That Municipalities May Obtain Offsets From Other Mercury Sources Is Unfounded.**

The TMDL Report hypothesizes that POTWs that need to grow may obtain offsets from cleaning up other sources of mercury, but this hypothesis is nowhere supported by the record. The TMDL Report admits that "no such [offset] program currently exists."<sup>1</sup> There is no discussion of the enormous problems such a program would face, including: dealing with the CERCLA liability issues arising out of the court's decision in the Penn Mine case; deciding which ratio of offsets to use when allowing growth-induced mercury discharges; persuading the federal EPA to authorize the use of "offsets" when the sources of the "offsets" (i.e. bay margin sites) are not even included in the TMDL; and overcoming the resistance of environmental groups, who traditionally have objected strongly to trading programs on the grounds that they allow pollution to be concentrated into the hands of those who can afford to pay for offsets, with attendant adverse local effects.

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<sup>1</sup> TMDL Report, p. 83.

Likewise, the TMDL Report's suggestion that some mercury-discharging "agencies" might reduce their loads, allowing credits for other sources, is unfounded.<sup>2</sup> There is no discussion in the TMDL Report dealing with the multitude of problems that such a concept would face before it could result in a viable means for POTWs to obtain offsets for growth-induced mercury increases: What are the incentives that would be needed to persuade a POTW to reduce its mercury discharge below its lawful allocation? Assuming any such reduction were to occur, how could one prevent price-gouging by the "owner" of the offsets who would have the growth-starved municipalities at its mercy? Who would administer such a program? How could an "agency" be induced to part with any mercury "credit" it produced, rather than keep it for future use to meet its own anticipated future needs? How can the Regional Board be expected to implement such a program, when the federal EPA has tried repeatedly to do so without success?

It would be unreasonable, arbitrary and capricious for the Regional Board to rely upon a hypothetical future offset trading program to meet the growth needs of the municipalities.

**4. If The Regional Board Establishes Individual Wasteload Allocations For The Municipal POTWs, It Must Consider The Impact Of Federal NPDES Regulations, Which May Require Those Wasteload Allocations To Be Incorporated As Mass Limits, Leading To Semi-Permanent Caps On Mercury Discharges Extending Beyond The Year 2025.**

Although the authors of the TMDL Report seem to be aware that federal law requires that NPDES permits issued subsequent to the establishment of a TMDL must contain water quality based effluent limitations (WQBELs) that are consistent with wasteload allocations in the TMDL,<sup>3</sup> the Proposed Basin Plan Amendment naively states that the "wasteload allocations for individual wastewater dischargers" are only to serve as one of part of a dual "trigger" mechanism, the other part being the concentration "triggers" of 11 nanograms for advanced treatment plants and 21 nanograms for secondary plants, suggesting that they will not be incorporated into NPDES permits as enforceable WQBELs.<sup>4</sup> However, the record shows clearly that the Regional Board is proposing to create both a bay-wide wasteload allocation as well as individual wasteload

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<sup>2</sup> Ibid.

<sup>3</sup> See TMDL Report, p. 76. The authors state that one facet of the implementation plan would be to: "[c]omply with water quality based effluent limitations, to be elaborated through the permit, that are consistent with the assumptions and requirements of the wasteload allocation." (emphasis added)

<sup>4</sup> Proposed Basin Plan Amendment, p. A-11.

allocations for the POTWs, although it is proposing to treat only the bay-wide allocation as having validity under federal law for NPDES purposes.<sup>5</sup>

The TMDL Report contains no analysis of the potential impact of the NPDES permitting regulations (40 C.F.R. 130.2(h) and 40 C.F.R. 122.44(d)), which state that the permit conditions must be consistent with “any” available wasteload allocations.<sup>6</sup> If the Regional Board contends otherwise, it should explain on the record the legal rationale for avoiding the application of these regulations once the individual wasteload allocations are established. Absent a sound legal justification for assuming that language in a Basin Plan amendment stating that the wasteload allocations are to be treated only as “triggers,” we are concerned that the Regional Board will subsequently be compelled to impose the wasteload allocation for Sunnyvale as a mass mercury limit in the Sunnyvale NPDES permit. Failure to resolve this issue before adoption of the proposed Basin Plan Amendment would subject Sunnyvale and other POTWs to unacceptable risks, and would be arbitrary and capricious. Sunnyvale joins with BACWA in urging the Regional Board to eliminate the individual wasteload allocation for municipal POTWs so as to avoid a harsh and unnecessary result.

**5. If the Individual Wasteload Allocations Become NPDES Permit Limits, the Regional Board May Not be Able to Revise Them in the Future Without Serious Problems Under Federal Anti-Backsliding Law, Thereby Making the Proposed Growth Cap Semi-Permanent.**

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<sup>5</sup> The allocations to the municipal POTWs are clearly described and labeled as “wasteload allocations” at various points in the TMDL Report and the proposed Basin Plan Amendment (e.g. Table 4-x on page A-6 of the proposed Basin Plan Amendment).

<sup>6</sup> 40 C.F.R. 130.2(h) states: “(h) Wasteload allocation (WLA). The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.” (emphasis added)

40 C.F.R. 122.44(d)(i)(vii) states: “When developing water quality-based effluent limits under this paragraph the permitting authority shall ensure that:

(A) The level of water quality to be achieved by limits on point sources established under this paragraph is derived from, and complies with all applicable water quality standards; and

(B) Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the State and approved by EPA pursuant to 40 CFR 130.7.” (emphasis added)

Although the proposed Basin Plan Amendment states that the TMDL is to be reviewed every five years, and “[a]ny necessary changes to the targets, allocations or implementation plan will be incorporated into the Basin Plan,”<sup>7</sup> this intention may be completely frustrated by federal anti-backsliding requirements. Under federal anti-backsliding law, a WQBEL that is based on a wasteload allocation contained in a TMDL may be changed only if the resulting revised TMDL “will assure the attainment of such water quality standard.”<sup>8</sup> This could seriously derail the Regional Board staff’s proposed approach to growth management. The Regional Board staff has explained in its response to a peer review comment that there is sufficient room in the proposed 14 kg/yr bay-wide mercury allocation to meet anticipated needs for additional treatment until 2025 (at which point the Regional Board can reassess the wasteload allocations), and it anticipates that POTWs may in the meantime be able to curtail their mercury discharges through “improvements in treatment efficiency and increased water re-use.”<sup>9</sup> As pointed out in Mr. Rose’s letter, these assumptions are unfounded. The assumption that the allocations can be changed if future growth justifies it is unsupported by any anti-backsliding analysis. The failure of the Regional Board to foresee the potential impact of anti-backsliding law casts its assumptions about future relief into serious doubt.

How does the Regional Board propose in the future to “assure” the federal EPA (or a reviewing court) that an amendment granting an additional allocation to municipalities is justified? We submit that the scientifically indefensible methodology being proposed to justify the TMDL at this time would not suffice. The word “assure” implies that there is a heavy burden to carry in showing by hard data and sound scientific

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<sup>7</sup> Proposed Basin Plan Amendment, p. A-16.

<sup>8</sup> 33 U.S.C.A. § 1313(d)(4)(A) states: “(4) Limitations on revision of certain effluent limitations.

(A) Standard not attained. For waters identified under paragraph (1)(A) where the applicable water quality standard has not yet been attained, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section may be revised only if (i) the cumulative effect of all such revised effluent limitations based on such total maximum daily load or waste load allocation will assure the attainment of such water quality standard, or (ii) the designated use which is not being attained is removed in accordance with regulations established under this section.” (emphasis added)

<sup>9</sup> The Staff’s assurance in its response to the peer reviewer, that: “If growth becomes a concern, for example 15 to 20 years from now, we expect to know more about how our mercury control efforts are working and have a more solid basis for determining if modification to the wasteload allocations are appropriate.” Memorandum from Bill Johnson and Richard Looker dated May 18, 2004 entitled: “Responses to Scientific Peer Review Comments, San Francisco Bay Estuary,” response number 26, at p. 7. (emphasis added)

reasoning (as opposed to the numerous scientifically indefensible “assumptions” in the currently-proposed TMDL) that the water quality standard will be attained irrespective of the additional mercury associated with growth. Such a change would undoubtedly be vigorously challenged by the federal EPA and by environmental groups. The final result could well be that the currently-proposed wasteload allocations become semi-permanent caps, thereby seriously affecting the ability of the POTWs to meet normal growth needs. How long “semi-permanent” may be is unknown at this time, but it could extend far beyond the year 2025. The Regional Board’s failure to take into account the potential for having a semi-permanent cap on mercury discharges would be arbitrary and capricious.

**6. The Use Of A Far-Reaching “Interpretation” Of The Narrative Objective For Bioaccumulate Pollutants In The Basin Plan Is Illegal; The “Interpretation” Is Simply The Adoption Of A New Objective.**

The proposed TMDL may not be adopted because it improperly relies on an informal “interpretation” of a policy statement in the Basin Plan, not upon a properly-adopted water quality objective. The federal Clean Water Act states that a TMDL “shall be established at a level necessary to implement the applicable water quality standards.”<sup>10</sup> A “water quality standard” must contain “water quality criteria.”<sup>11</sup> “Applicable standard” is defined in the federal TMDL regulations to be: “a numeric criterion for a priority pollutant promulgated as part of a state water quality standard.”<sup>12</sup> (emphasis added) The applicable water quality standard for mercury in the South Bay is the 0.051 ug/L criterion contained in the California Toxics Rule.<sup>13</sup> Because the South Bay is already in attainment with that objective, the proposed TMDL exceeds the bounds of federal law. The Regional Board is proposing to change the applicable water quality objective without compliance with the Water Code.

Further, the narrative objective for bioaccumulative pollutants may not be “interpreted” by the Regional Board as proposed in the TMDL Report, without the basis for such interpretation having been previously approved by EPA as part of the standard itself.<sup>14</sup>

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<sup>10</sup> 33 U.S.C.S. § 1313(d)(1)(C).

<sup>11</sup> 40 C.F.R. 130.2(d) states: “(d) Water quality standards (WQS). Provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.” (emphasis added)

<sup>12</sup> 40 C.F.R. 130.10(d)(4).

<sup>13</sup> 65 F.R. 31681 (May 18, 2000); 40 C.F.R. 131.38(b).

<sup>14</sup> 40 C.F.R. 131.11(a)(2).



Even assuming that the “narrative objective” were applicable in this case, neither the plain language of the “narrative objective” nor the original meaning intended when it was adopted will support such a far-reaching interpretation as the TMDL Report urges upon the Regional Board. The “narrative objective” refers to “controllable water quality factors” and states that such factors “shall not cause” a “detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.” (emphasis added) It may not be applied to the sources which are described as noncontrollable (e.g. historic mining deposits). Nor can it be applied to sources which, due to their comparatively minute contribution, do not “cause” the observed detrimental increases, such as the municipal POTWs. We note that the so-called “narrative objective” contains only the word “cause” and not the phrase “cause or contribute,” which is used elsewhere in the federal Clean Water Act, to require the imposition of WQBELs. The TMDL Report admits that the municipal POTWS altogether generate less than 1% of the bay’s total mercury load, and thus, as a *de minimus* source, they cannot be said to be the “cause” of the mercury exceedances, within any commonly-understood meaning of the word.<sup>15</sup>

A more logical interpretation of the so-called narrative objective is that it was originally intended (and accepted by EPA) as a policy statement to guide the Regional Board in approaching certain then-unidentified sources which could be shown by evidence to be a cause of a local methylmercury problem. There is no other historic application of the narrative objective that is anywhere comparable to the overly-stretched and unreasonable reading the TMDL Report is making. We ask that the Regional Board place in the administrative record the entire regulatory history of the narrative objective, including any documents relating to the purposes for which it was originally adopted and the various administrative applications and interpretations that have been made of the narrative objective since its original incorporation into the Basin Plan.

We submit that the TMDL Report’s specific numeric “targets” extend far beyond a mere “interpretation” of the so-called “narrative objective,” and are, in fact, a form of “underground” water quality objective which is specifically designed as a subterfuge to evade the statutory protections built into the Water Code.<sup>16</sup>

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<sup>15</sup> Webster’s II New Collegiate Dictionary, for example, defines the word “cause” as follows: “1.a. Something that produces an effect, result or consequence. B. The person, event or state responsible for an action or result.”

<sup>16</sup> The absurdity of the proposed use of the “narrative objective” becomes apparent when one considers whether the general “narrative objective” (i.e. “there shall be no chronic toxicity in ambient waters” (1995 Basin Plan, p. 3-4)) could be similarly “interpreted” to justify numeric “goals” for all other pollutants, without going through the required Water Code processes for the development of water quality objectives. Or consider the mischief which could result if the Regional Board were to similarly “interpret” the Basin Plan “narrative objective” for “Specific Chemical Constituents” which states: “Surface waters

**7. The “Interpretation” Of The “Narrative Objective” Requires Compliance With Sections 13241 And 13242 Of The Water Code.**

The proposed new fish tissue methylmercury “target” of 0.2 ppm,<sup>17</sup> the bird egg mercury concentration “target” of .5 ppm, and the sediment mercury “target” of 0.2 ppm are numeric criteria that are functionally equivalent to numeric water quality objectives. They have regulatory impact which is equivalent to a water quality objective. No “interpretation” of the “narrative objective” may establish new water quality objectives without compliance with Sections 13241 and 13242 of the Water Code, which are intended by the legislature to ensure that the State Board and the Regional Board carefully weigh numerous critical factors when setting water quality objectives.

The application of the reasonableness standard set forth in Section 13241 would not permit the Regional Board to impose a cap on municipal growth. Such a cap is patently not “reasonable” when the beneficial impact on water quality, if any, is infinitesimal. If the Regional Board intends to impose a cap on municipal dischargers, it should openly declare its intention and use the legal tools available to it under the Water Code.<sup>18</sup>

**8. The TMDL Report Does Not Address The CEQA Requirement To Consider The Economic Impacts Of The Proposed Cap On Mercury Discharges.**

Public Resources Code Section 21159 requires the Regional Board to take into account economic factors when establishing the type of requirements contained in the Proposed Basin Plan Amendment. The economic impacts of a cap on municipal growth are not discussed in the Staff Report or in the accompanying CEQA documentation.<sup>19</sup>

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shall not contain concentrations of chemical substances in amounts that adversely affect any designated beneficial use.” 1995 Basin Plan, p. 3-5

<sup>17</sup> The proposed fish flesh “target” of .02 ppm has never been adopted as a water quality objective by the Regional Board. It represents an attempt to “adjust” the current federal recommended water quality criterion for mercury, which is the methylmercury residue in fish flesh (0.3 ppm). 66 F.R. 1344 (January 8, 2001)

<sup>18</sup> See e.g. Water Code § 13301, which authorizes a connection ban on new sources of waste when a POTW is not in compliance with a waste discharge requirement.

<sup>19</sup> Section 21159(c) states: “The environmental analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites.” See a memorandum dated October 27, 1999 from Sheila K. Vassey, Senior Staff Counsel, State Water Resources Control Board, entitled: “Economic Considerations in TMDL Development and Basin Planning.”

**9. The TMDL Report Makes A Scientifically Indefensible Assumption Regarding The Relationship Between Sediment Mercury And Fish Tissue Methylmercury.**

The TMDL Report states: “In the absence of additional information, reductions in mercury loads are assumed, for purposes of this report, to result in proportional reductions in fish tissue residues.”<sup>20</sup> This simplistic approach is contrary to EPA’s guidance for determining the relationship between environmental mercury and fish tissue residual methylmercury.<sup>21</sup> The record for the TMDL indicates no attempt to apply either a bioaccumulation model, site-specific bioaccumulation factors or even the default bioaccumulation factors produced by EPA. We submit that the use of a linear relationship not supported by an appropriate scientific explanation would be arbitrary and capricious.<sup>22</sup> Such an approach would not be approvable by EPA under the regulatory “scientifically defensible” test for the adoption of water quality standards.<sup>23 24</sup>

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<sup>20</sup> TMDL Report, at p. 48.

<sup>21</sup> See 66 F.R. 1344, 1355 (January 8, 2001).

<sup>22</sup> The use of such far-reaching and scientifically indefensible “assumptions” pervades the TMDL Report. Examples of this are: “Reductions in sediment mercury are assumed to result in proportional reductions in fish tissue and bird egg mercury concentrations.” p. S-2. “Assuming the amount of mercury needs to be reduced by about 50% to meet the proposed targets, the assimilative capacity of the Bay is about 32,000 kilograms.” p. S-2. “The allocation scheme is based on the assumption that mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web.” p. S-2. “Because the active layer is assumed to have a fixed depth, its mass cannot change.” p. 15. “The sediment inputs are assumed to equal the sediment outputs.” p. 15. “The sediment steady state assumption is used to fill critical information gaps.” p. 16. “For purposes of this report, mercury loads from bed erosion from bay segments other than San Pablo Bay and Suisun Bay are assumed to be negligible . . .” p. 21. “Using Equation 1, assuming that eroding sediment from the Bay floor contains about .042 ppm mercury, and assuming that the net annual sediment loss is about 1,100 M kg/yr, the mercury load associated with the exposed sediment is roughly 460 kg/yr.” p. 22. “Agricultural land was assumed to be like open space in terms of mercury loads.” p. 23. “This approach assumes that that all sediment discharged from the Guadalupe River would be discharged with or without the mining legacy.” p. 27. “Assuming the sediment load entering the bay equals the sediment load leaving the bay, the Golden Gate load equals the sum of the sediment loads entering the bay minus the other sediment losses.” p. 32. “The mercury load in exported sediment is assumed to come from all over San Francisco Bay.” p. 32. “Most modeling in support of mercury TMDLs has been based on an assumption that reducing mercury loads to the environment will have a proportional effect in reducing fish tissue concentrations (DTMC and SWRP 2002).” p. 48. “In the

### **10. There Is No “Necessity” For The Municipal Growth Cap, Within The Meaning Of The California Administrative Procedures Act.**

The proposed Basin Plan amendment, if adopted, is subject to review by the Office of Administrative Law under Government Code Section 11349. Among the criteria listed for OAL is the “necessity” for the proposed regulation. How “necessary,” indeed, is the proposed municipal growth cap in order to ensure that fish taken from the bay may be safely eaten without observing the quantity restrictions contained in the applicable fish advisory? The TMDL Report itself claims that the bay will attain the proposed “target” through natural processes, “without any specific implementation measures”<sup>25</sup> According to the TMDL Report, the bay cleanses itself of mercury in such a

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absence of additional information, reductions in mercury loads are assumed for the purposes of this report, to result in proportional reductions in fish tissue residues.” p. 48. “In the absence of additional information, however, reductions in bird egg concentrations are assumed for purposes of this report, to be proportional to reductions in fish tissue mercury.” p. 49. “Assuming that the amount of mercury in San Francisco Bay needs to be reduced by about 50% to meet the proposed targets, the assimilative capacity of the bay is about 32,000 kilograms.” p. 50. “The proposed allocations are based on the assumption that mercury from all sources is equally available to be converted to methylmercury and incorporated within the food web.” p. 51. “This report assumes that the same amount of bed erosion will continue indefinitely. It also assumes that the mercury concentrations of eroding sediment will drop to .02 ppm. . . . As a result, the mercury load will eventually drop to about 220 kg.yr without any specific implementation measures.” p. 53. “The model accounts for San Francisco Bay mercury inputs and outputs and relies on assumptions about how sources and losses will change over time.” p. 59. “The proposed plan involves measuring progress towards meeting the proposed targets, and, as necessary, re-evaluating the validity and appropriateness of the assumptions underlying the analysis.” p. 61. “The allocation scheme assumes that all methylmercury reductions in fish and wildlife must come from total sediment reductions in the bay sediment.” p. 62. “The proposed allocation is based on the assumption that mercury from all sources is similarly available to be converted to methylmercury and taken up into the food web.” p. 64. (emphasis supplied)

<sup>23</sup> See 40 C.F.R. 131.11(d).

<sup>24</sup> Although the TMDL Report has undergone a form of scientific peer review, the results of that process do not validate the scientific leaps that the TMDL Report is making. We join with Robert Falk, attorney for SCVURPPP, in the objections to the peer review process which he is making in his letter of comment to the Regional Board. Also, the peer review process does not, of course, justify or excuse any of the regulatory and legal flaws pointed out in this letter.

<sup>25</sup> TMDL Report, p. 53.

manner and at such a rate that, at the end of the 120 to 200 year period, the environmental mercury in the bay will attain a safe level and continue to decline indefinitely.<sup>26</sup> The presence or absence of a cap on municipal growth will not materially affect the outcome of this process. At worst, the final attainment date could be delayed for a very short time in a very long attainment period. We submit that the Regional Board would not prevail with OAL on the “necessity” issue if the regulation is adopted as proposed because the imposition of a drastic bay-wide growth curb is not “necessary.”

Thank you for the opportunity to provide comments on this important rulemaking.

Very sincerely yours,

Robert C. Thompson

Cc: Adam W. Olivieri, EOA, Inc.  
Thomas W. Hall, EOA, Inc.  
Marvin A. Rose, City of Sunnyvale  
Donna A. Scott, City of Sunnyvale  
Lorrie Gervin, City of Sunnyvale

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<sup>26</sup> Ibid.

# CITY OF LIVERMORE



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### Water Resources Division

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June 7, 2004

Bill Johnson, Environmental Scientist and  
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San Francisco Bay Regional Water Quality Control Board  
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Oakland, CA 94612

### **Subject: Comments on the Proposed San Francisco Bay Mercury TMDL Basin Plan Amendment**

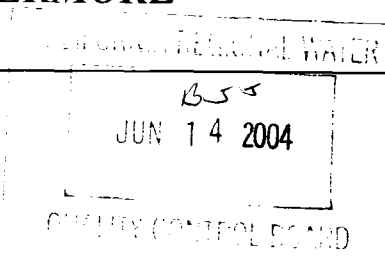
Dear Messrs. Johnson and Looker:

The City of Livermore appreciates the opportunity to comment on the proposed San Francisco Bay Mercury TMDL Basin Plan Amendment. The Livermore Water Reclamation Plant holds an NPDES permit with a permitted average dry weather discharge not to exceed 8.5 million gallons per day. Currently, the plant discharges an average of 6.5 mgd. The City, along with the Dublin San Ramon Services District (DSRSD) and City of Pleasanton, are members of the Livermore Amador Valley Water Management Agency (LAVWMA). Effluent from the Livermore Water Reclamation Plant, and the DSRSD Regional Wastewater Treatment Plant (which also treats wastewater from Pleasanton), is discharged into the LAVWMA export system where it is eventually disposed of in the San Francisco Bay through the East Bay Dischargers Authority outfall.

The City of Livermore strongly opposes the approach that has been taken to allocate the mercury wasteload. The Proposed San Francisco Bay Mercury TMDL Basin Plan Amendment and Staff Report states that "allocations were computed on the basis of each facility's fraction of the entire municipal wastewater category mercury load from 2000 through 2003." No consideration was given to POTWs that have performed well. If the proposed Basin Plan Amendment is adopted, the City of Livermore will be unfairly penalized for having had a history of low mercury levels in its effluent; the Regional Water Quality Control Board will create a mercury problem for the City of Livermore where one did not exist. Also, adoption of the current mercury wasteload allocation will not allow Livermore to implement its recently updated General Plan without exceeding its mercury allocation, since no provisions for growth are included in the allocation.

### Inequity in Proposed Allocations

The inequity in the proposed wasteloads is evident when comparing the allocations proposed for the municipal wastewater dischargers in the Livermore Amador



Valley. According to Table 7.3: Proposed Wasteload Allocations for Individual Municipal Wastewater Dischargers, the City of Livermore would be assigned an allocation of 0.090 kg/yr of mercury, while a neighboring agency, DSRSD, would be allocated a mercury wasteload of 0.52 kg/yr. Livermore's current average discharge flow is about 6.5 mgd. DSRSD's discharge flow currently averages about 11.5 mgd, about 77% greater than Livermore. Yet, DSRSD has been assigned an allocation that is 478% greater than Livermore, despite having a similar service area and treatment process. This situation demonstrates the inequity in the Regional Water Quality Control Board's approach to the mercury wasteload allocations.

In addition, the City of Livermore's allocation is half what was proposed in the June 6, 2003 draft, while DSRSD's allocation has been increased by 79%. The June 6, 2003 allocations were based on the facility's fraction of the entire municipal wastewater category mercury load from 1999 - 2001. The currently proposed wasteload allocations are based on the fractional flows from 2000-2003. The data from 2000-2003 are supposedly more accurate because ultra-clean sampling and analytical methods were required beginning January 1, 2000. The Regional Water Quality Control Board notified POTWs of this requirement in a letter dated August 4, 1999. In a second letter dated October 22, 1999, the initiation date for implementing the ultra-clean sampling and analytical methods was postponed until January 1, 2000; the requirements were clarified, and a waiver until January 1, 2001 was granted to the requirement for using only certified laboratories for compliance analyses using EPA Method 1631 for mercury. The City of Livermore did not delay in its compliance with the new requirements and submitted samples to a certified, experienced analytical laboratory in the state of Washington (Brooks-Rand, Ltd) until the California lab currently being used became certified for EPA Method 1631. The City of Livermore proactively chose to send samples to an out-of-state lab to assure reliable and accurate mercury data.

#### No Relief from Additional Source Control Strategies

If the proposed Basin Plan Amendment is adopted, the Regional Water Quality Control Board would require the development and implementation of mercury source control programs to minimize significant mercury sources. However, BACWA has provided evidence that for well-run treatment plants with comprehensive pretreatment and pollution prevention programs, the effluent mercury concentrations appear to be independent of influent mercury concentrations, and that it is therefore expected that additional pollution prevention programs will not necessarily result in actual reductions of mercury loads.

Livermore has been proactive and conscientious in its approach toward mercury and already has mercury source control programs in place. In July 1999, mercury was chosen as one of the constituents to focus on because of the move toward Total Maximum Daily Load (TMDL) calculations for impaired receiving waters throughout the State. Mercury was chosen out of concern for ultimate discharge capacity, based on the potential impacts of the extremely low concentration limit being proposed for the next NPDES permit, and the prospect of a mass limit being imposed based on the results of the Mercury TMDL. Information and data were gathered on sources and possible control strategies. It was estimated that the majority of the mercury in the influent wastewater, about 62%, is from domestic sources. The City's efforts regarding

domestic mercury sources have been directed towards identifying the residential contribution, supporting efforts to ban mercury-containing products statewide, and implementing outreach strategies such as thermometer exchange programs. The Association of Metropolitan Sewerage Agencies study, Evaluation of Domestic Sources of Mercury (August 2000), indicated that the levels of mercury in domestic wastewater vary with time of year, and may result from differences in the number of amalgam surfaces per individual, fish/shellfish consumption rates, water usage, water source, and rates of mercury settling/re-suspension in sewers. Human wastes (feces and urine) from amalgam-loaded individuals are believed to be the most significant (>80%) source. It noted that controlling human wastes is impractical.

Lawrence Livermore National Laboratory (LLNL) contributes about 14% of the mercury loading. The City of Livermore's source control staff continues to work with LLNL representatives to minimize the mercury discharges from LLNL. However, additional control strategies are likely to yield little improvement since most of the mercury in LLNL's discharge to the Livermore Water Reclamation Plant is from mercury that has historically accumulated in the existing piping system.

The City of Livermore will soon begin implementing a dental mercury program. However, based on the 2003 average influent mercury, even if the remaining 24% of the influent mercury load can be attributed to dental offices, eliminating the dental mercury discharge would not significantly reduce the influent mercury.

#### Allocation Curtails Growth

The proposed wasteload allocation for the City of Livermore could curtail the City's future growth, or at a minimum subject the City to certain violation of the mercury allocation at build out. Professor David Sedlak noted the lack of a term to allow for growth in his Proposed Mercury TMDL 2003 Peer Review Comments. In response, the Regional Water Quality Control Board acknowledged that it chose not to allocate a portion of the TMDL for future growth. It responded, "...the Association of Bay Area Governments' year 2025 growth projections for the Bay Area suggests that there will be modest (~14% region wide) population growth over that period. We believe modest influent flow increases could be offset both by slight improvements in treatment efficiency and increased water re-use; therefore, the mercury allocations will not pose a compliance challenge to wastewater treatment plants or necessitate flow limitations. If growth becomes a concern, for example 15 to 20 years from now, we expect to know more about how our mercury control efforts are working and have a more solid basis for determining if modifications to the wastewater allocations are appropriate."

It is unreasonable to consider the 14% growth rate as applicable to all POTWs. Livermore's flow is projected to increase by 23% above the current design flow, and about 62% above current dry weather flow. As previously noted, the Livermore Water Reclamation Plant is currently permitted for 8.5 mgd. At a flow of 9.0 mgd, and the current daily average 0.009 ug/L mercury concentration, the wasteload would already be at the proposed 0.09 kg/L allocation. At the projected buildout flow of 10.5 mgd and the current daily average mercury concentration of



0.009 ug/L, the mercury wasteload in the effluent would be 0.130 kg/year, exceeding the proposed allocation.

Improvements in treatment efficiency and increased water reuse are cited as offsetting increases resulting from growth. The low levels of mercury in the effluent from the Livermore Water Reclamation Plant demonstrate the already high treatment efficiency of the plant. Increased water reuse may not offset growth and help the City of Livermore meet the proposed allocation. Drinking water is supplied by groundwater from the Livermore Amador Valley Groundwater Basin that underlies the Livermore Amador Valley. Because of concerns with increasing salts in the groundwater basin, salts from irrigation with recycled water must be mitigated. The Livermore Amador Valley wastewater agencies, DSRSD and City of Livermore, together with the manager of the groundwater basin, Zone 7 Water Agency, have developed a Salt Management Program. Groundwater demineralization has been identified as a key method for controlling salt loading from recycled water irrigation, with the demineralization concentrate disposed of in the LAVWMA export pipeline. Preliminary data from Zone 7 indicate that the concentrate may contain 0.004-kg/month of mercury.

In conclusion, the proposed mercury wasteload allocation for the City of Livermore is not an equitable allocation. The City of Livermore is in essence being penalized for having been proactive in its approach to mercury analysis, and for a history of low mercury levels in its effluent. The wasteload allocation will curtail the City of Livermore's ability to build out its General Plan without certain violation of the mercury mass limit. Remedies in the proposed implementation plan are not effective remedies for the City of Livermore to overcome future compliance challenges that would be imposed by the proposed mercury wasteload allocation.

The City of Livermore strongly objects to the adoption of the mercury TMDLs as outlined in the proposed San Francisco Bay Mercury TMDL Basin Plan Amendment dated April 30, 2004. The Regional Water Quality Control Board is urged to adopt a more equitable mercury wasteload allocation for the City of Livermore.

Sincerely,



Darren Greenwood  
Water Resources Manager

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June 14, 2004

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*Via Messenger and Email*

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Oakland, California 94612

**Re: Proposed Basin Plan Amendment – Total Maximum Daily Load for  
Mercury in San Francisco Bay Basin/Implementation Plan**

Dear Mr. Johnson and Mr. Looker:

These comments on legal issues are submitted on behalf of the Santa Clara Valley Urban Runoff Pollution Prevention Program ("SCVURPPP" or "Santa Clara Municipalities")<sup>1</sup> with regard to the above-referenced proposed Total Maximum Daily Load, Implementation Plan, and related Basin Plan Amendment concerning the regulation of mercury in San Francisco Bay dated April 30, 2004 (collectively, "TMDL"). The Santa Clara Municipalities will provide you with separate additional comments on other technical, programmatic, and policy issues of concern. Several of the municipalities have or will also be submitting comments individually.<sup>2</sup>

The Santa Clara Municipalities thank the members of the Regional Board staff who have worked on this TMDL. Each has shown professionalism in this process, and we appreciate the difficult and challenging task assigned to them. The result of their efforts is a document that reflects a large volume of technical information, attempts to cope with numerous uncertainties, and undoubtedly seeks to balance the input and perspectives of many individuals and constituencies holding disparate views.

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<sup>1</sup> The Santa Clara Municipalities are composed of 13 cities and towns in the Santa Clara Valley, the County of Santa Clara, and the Santa Clara Valley Water District; these entities share a common NPDES permit to discharge municipal storm water to South San Francisco Bay.

<sup>2</sup> The comments submitted below, as well as others being submitted by the Santa Clara Municipalities either individually or collectively are not intended to and do not waive any grounds of legal argument not discussed below; they also do not constitute admissions.

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***Unfortunately, while the Santa Clara Municipalities congratulate the Regional Board staff on their efforts, we cannot support adoption of the TMDL or related Basin Plan Amendment in their current form and instead believe substantial revision is required.***

\* \* \* \* \*

## EXECUTIVE SUMMARY

The proposed TMDL, Implementation Plan, and Basin Plan Amendment raise a number of complex legal, technical, and practical issues of concern to the Santa Clara Municipalities. The following are among the key legal issues:

1) The proposed approach reflected in the TMDL is not legally authorized under Federal Clean Water Act ("CWA") and California Porter Cologne Act ("Water Code") requirements. Among other things, adopting a mercury TMDL for the *South San Francisco Bay* is improper because:

- a) the water quality standard/objective for mercury related to the use for which the South Bay was listed under CWA section 303(d) (i.e., 0.51 ug/L as duly promulgated by US EPA in the California Toxics Rule) is *not* being exceeded;
- b) the TMDL allocates loading and associated reductions from air deposition, bedded sediments, Caltrans, and other *uncontrollable* sources to urban runoff; and
- c) the urban runoff provisions in the TMDL (and particularly in the proposed Implementation Plan) have not been properly analyzed within the framework of the CWA's unique maximum extent practicable ("MEP") standard for municipal stormwater dischargers, especially in the South Bay where the Basin Plan already recognizes unique circumstances need to be considered;

2) The scientific peer review questions for the TMDL were not properly formulated, and, hence, render the peer review inadequate;

3) There has been a failure to comply with the California Environmental Quality Act ("CEQA") in terms of sufficiently evaluating the impacts of, alternatives to, and burdens to be imposed by the TMDL; and

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4) Adoption of the TMDL's allocation to urban runoff and Implementation Plan provisions concerning urban runoff would create an unfunded mandate in violation of the California Constitution by imposing significant burdens on local governments without providing resources for funding them.

## LEGAL COMMENTS

### **I. The Proposed Approach taken in Developing this TMDL is Not Authorized under Applicable Clean Water Act and Porter Cologne Act Requirements**

The staff has structured this TMDL by establishing so-called "numeric targets" for wildlife (expressed as a bird egg mercury concentration below 0.5 ppm) and sport fishing and human health (expressed as a fish tissue mercury concentration 0.2 ppm). These initial targets are then related through a "linkage analysis" to a third "numeric target" of 0.2 ppm of mercury in sediment to form the critical parameter by which loading is allocated and implementation of load reduction targets is measured. These "numeric targets" are not legally authorized and, hence, cannot form the basis of this TMDL.

Specifically, the numeric targets do not support the TMDL's proposed application to the South San Francisco Bay because:

1) As part of the California Toxics Rule ("CTR"),<sup>3</sup> US EPA has already officially promulgated the *only* numeric water quality mercury standard/objective that applies in the South San Francisco Bay to the use that is the subject of the CWA section 303(d) listing triggering the TMDL, and the data contained in the Staff Report indicate that it is being met. The Regional Board cannot legally employ its narrative water quality standard/objective (or further translation of it into numeric targets) to supplant the duly adopted CTR standard/objective.

2) TMDL-derived numeric targets may be developed to address only those particular impairments for which the water bodies were previously identified and listed under CWA section 303(d) and/or confirmed by assessment under CWA section 305(b). South San Francisco Bay has been listed as impaired for mercury only on the basis of fish consumption advisories, not harm to bird eggs or protection of wildlife habitat. The numeric targets for wildlife therefore are not authorized.

3) Even if they were appropriate (and they are not for the South Bay), "numeric targets" cannot be calculated on the basis of novel criteria or avoid required procedures

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<sup>3</sup> The CTR was published at 65 Fed. Reg. 31,682 (May 18, 2000).

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for the promulgation of water quality standards/objectives. Before a numeric target can be established as an “interpretation” of existing narrative water quality standards/objectives, US EPA must have already approved the translation procedures as part of the water quality standard/objective, and it has not done so here. In addition, where a TMDL’s translation makes use of novel parameters and is inconsistent with prior practice, as has been the case here,<sup>4</sup> it amounts to *de facto* establishment of a new water quality standard/objective and necessitates analysis pursuant to section 13241 of the Water Code;<sup>5</sup>

4) Insofar as the TMDL sets any of its numeric targets and resulting allocations, load reduction targets, and related implementation plans to address the current Basin Plan’s narrative water quality standard/objective for bioaccumulative substances, it imposes requirements that are not authorized because sources of mercury in the South San Francisco Bay are not “controllable” as defined by the Basin Plan, and the narrative’s bioaccumulation standard/objective applies only to sources that are “controllable”; and

5) The TMDL’s proposed allocation to urban runoff and related load reduction targets, timetable, and Implementation Plan provisions fail to address the Clean Water Act’s unique “maximum extent practicable” (“MEP”) standard for municipal stormwater and are inconsistent with prior State Board precedent decisions regarding the application of numeric regulatory criteria to stormwater.

We explain these issues in more detail immediately below.

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<sup>4</sup> As recently as January 2004, the Regional Board regulated discharges of mercury to the South San Francisco Bay based only on the CTR’s numeric standard/objective and *not* a translation of a narrative standard/objective. See Waste Discharge Requirements issued to the U.S. Fish & Wildlife Service re: South San Francisco Bay Low Salinity Salt Ponds.

<sup>5</sup> The TMDL’s use of a target based on whole mercury concentrations in sediment is also inconsistent with the TMDL approaches being pursued in the Guadalupe River Watershed and in the Central Valley which focus on the more reliably determined level of methylmercury in fish tissue as the key regulatory parameter.

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## **A. The TMDL Cannot Use Numeric Targets Derived from a Translation of a Narrative Standard/Objective When US EPA Has Already Promulgated an Applicable Numeric Mercury Standard/Objective for the South San Francisco Bay**

The Staff Report proposes a numeric target of 0.2 ppm mercury in fish tissue – a number calculated to “translate” the Basin Plan’s narrative water quality objective limiting bioaccumulative substances.<sup>6</sup> While ingestion of mercury from fish consumption is a potential public concern, this in itself does not mean either that the Basin Plan’s narrative bioaccumulative substances standard/objective is applicable in South San Francisco Bay or that a mercury TMDL for this body of water is appropriate. The opposite is the case here because, in the CTR, US EPA promulgated the *exclusive* legally applicable *numeric* water quality standard/objective for protection of human health in South San Francisco Bay and, as a result, the Regional Board is not permitted to substitute its *narrative* water quality standard/objective (or numeric targets purporting to translate this narrative standard/objective) as the appropriate basis for further regulatory action.<sup>7</sup>

For toxic pollutants such as mercury, when a state (or US EPA in the absence of state action) has adopted a numerical water quality standard/objectives to protect a use, it is the *exclusively* applicable basis for a TMDL. The regulations state:

For purposes of listing waters under § 130.10(d)(2), applicable standard means a numeric criterion for a priority pollutant promulgated [by either US EPA or the State] *as part of* a state water quality standard. Where a state numeric criterion for a priority pollutant is *not* promulgated as part of a state water quality standard, for the purposes of listing waters “applicable

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<sup>6</sup> Staff Report at 11, 36. The basis for this and the TMDL’s related mercury-in-sediment numeric target are the staff’s beliefs that: 1) threats to human health from San Francisco Bay fish consumption are demonstrated by California state fish advisories, 2) the Basin Plan’s narrative criterion to limit bioaccumulative substances is a legally applicable water quality objective corresponding to that threat that may not be exceeded, and 3) as a result, the CWA *obligates* the Regional Board to develop this TMDL to address the claimed impairment affecting human health. *Id.* at 13.

<sup>7</sup> Although the TMDL states: “US EPA recommends that states adopt their own water quality criteria using local consumption data (US EPA 2001)” (Staff Report at 35), the Regional Board cannot do so in this TMDL. As discussed in section I.C below, if the Regional Board wishes to pursue such a policy, it may adopt a new numeric water quality standard/objective only through appropriate procedures (including compliance with Water Code Section 13241) and only after appropriate public review and comment.

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standard” means the state narrative water quality criterion to control a priority pollutant (*e.g.*, no toxics in toxic amounts).<sup>8</sup>

The CWA regulations make clear that the exclusive water quality standards/objectives that can be used for a TMDL are the applicable numeric standards/objectives *when they have been published* and that narrative criteria may be used *only in their absence*.<sup>9</sup>

In the CTR, US EPA previously promulgated a numerical water quality standard/objective for mercury applicable to the South San Francisco Bay to protect public health from fish consumption. As the Staff Report acknowledges, the CTR’s standard/objective is .051 µg/L and *is currently being met*.<sup>10</sup> Since no exceedance of the *applicable* numerical water quality standard/objective can be demonstrated as to the South Bay, given the section 303(d) listing, all components of the TMDL must be withdrawn as to this water segment.

In addition, application of the TMDL’s proposed Bay-wide numeric targets to the South San Francisco Bay in lieu of the duly promulgated .051 µg/L numerical water quality standard/objective contradicts longstanding policy concerns reflected in the existing Basin Plan, which states:

The South Bay below the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Regional Board. *Site-specific water quality objectives are absolutely necessary in this area* for two reasons. First, its unique hydrodynamic environment dramatically affects the environmental fate of pollutants. Second, potentially costly nonpoint source pollution control measures must be implemented to attain any objectives for this area. The costs of those measures must be factored into

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<sup>8</sup> 40 C.F.R. § 130.10(d)(4) (emphasis added).

<sup>9</sup> When the CTR was issued, US EPA also explained the reason numeric standards/objectives are to be used for TMDL purposes where they have been promulgated:

Numeric criteria for toxic pollutants allow the State and EPA to evaluate the adequacy of existing and potential control measures to protect . . . human health. Numeric criteria also provide a more precise basis for deriving . . . *wasteload allocations for total maximum daily loads (TMDLs)* to control toxic pollutant discharges. Congress recognized these issues when it enacted section 303(c)(2)(B).

65 Fed. Reg. at 31,684 (emphasis added).

<sup>10</sup> 40 C.F.R. § 131.38 (b)(1); Staff Report at 8.

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economic impact considerations by the Regional Board in adopting any objectives for this area.<sup>11</sup>

The proposed Basin Plan amendment that accompanies the TMDL does not alter the longstanding requirement for site-specific objectives below the Dumbarton Bridge (“SSO-Dumbarton”). Until the requirement for SSO-Dumbarton objectives is met through an appropriate rulemaking and supersedes or complements the .051 µg/L numerical water quality standard/objective set forth by US EPA in the CTR, the application of the TMDL’s numeric targets to South San Francisco Bay is legally impermissible.

**B. TMDL Derived Numeric Targets Must Address the Particular Impairments Previously Identified for a Water Segment Listed under CWA Section 303(d), and the South San Francisco Bay Has Not Been Listed on the Basis of a Harm to Bird Eggs or Protection of Wildlife**

A TMDL is essentially the third and last of three major steps which begins when authorities act under CWA section 303(d) to identify a particular water body segment as impaired and set forth the reasons the segment is officially so listed.<sup>12</sup> A TMDL may address only those impairments for which the water body was identified and listed under section 303(d). 40 C.F.R. § 130.7(c)(1). Here, the State has listed the South

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<sup>11</sup> Basin Plan at pp. 3-5 (emphasis added).

<sup>12</sup> US EPA explains:

“Clean Water Act § 303(d) established the TMDL process to guide application of state standards to individual water bodies/watersheds. The process has three steps:

1. Identify Quality Limited Waters – States must identify and prepare a list [§ 303(d) list] of waters that do not or are not expected to meet water quality standards after applying existing required controls (e.g., minimum sewage treatment technology).
2. Establish Priority Waters/Watersheds – States must prioritize waters/watersheds and target high priority waters/watersheds for TMDL development.
3. Develop TMDLs – *For listed waters*, States must develop TMDLs that will achieve water quality standards, allowing for seasonal variations and an appropriate margin of safety. A TMDL is a quantitative assessment of water quality problems, contributing sources, and load reductions or control actions needed to restore and protect individual water bodies.”

US EPA, Region 9, TMDL Fact Sheet, <http://www.epa.gov/docs/region09/water/tmdl/fact.html> (emphasis added).



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San Francisco Bay for mercury based on concerns with regard to fish and wildlife *consumption* only.<sup>13</sup> The 303(d) listing for this water segment states:

Current data indicate fish *consumption* and wildlife *consumption* impacted uses: health *consumption* advisory in effect for multiple fish species including striped bass and shark.<sup>14</sup>

Consumption of fish and wildlife are the *only* uses that form the basis of the current section 303(d) listing and that this TMDL may legally address. The Staff Report is *incorrect* when it states: "All segments of San Francisco Bay appear on the list because mercury impairs the bay's established beneficial uses, including . . . preservation of rare and endangered species, and wildlife habitat."<sup>15</sup> Biological criteria or standards to address threats to the wildlife itself (*e.g.*, bird egg targets) as opposed to human consumption of fish or wildlife have not previously been made the basis for listing and, hence, are not an appropriate subject in this TMDL.<sup>16</sup>

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<sup>13</sup> In fact, the Regional Board has itself previously acknowledged that "mercury's effects on wildlife were *not* listed in the 303(d) finding of impairment." California Regional Water Quality Control Board, San Francisco Bay Region, Watershed Management of Mercury in the San Francisco Bay Estuary: Total Maximum Daily Load Report to US EPA at 35 (June 30, 2000) <http://www.swrcb.ca.gov/rwqcb2/download/aug00HgTMDL.pdf>.

<sup>14</sup> CWA Section 303(d) List of Water Quality Limited Segment, approved by US EPA July 2003, <http://www.swrcb.ca.gov/tmdl/docs/2002reg2303dlist.pdf> (emphasis added).

<sup>15</sup> Staff Report at 1.

<sup>16</sup> The 2002-2003 303(d) list meaning of the terms "fish consumption" and "wildlife consumption" does not refer to the consumption of fish by endangered or threatened species or wildlife. These terms refer to consumption by humans. See California Office of Environmental Health Hazard Assessment, Chemicals in Fish: Consumption of Fish and Shellfish in California and the United States at 10 (October 2001) <http://www.oehha.ca.gov/fish/pdf/fishconsumptionrpt.pdf>; US EPA, Guidance for Conducting Fish and Wildlife Consumption Surveys (November 1998) <http://www.epa.gov/waterscience/fish/fishguid.pdf>. At the time the 303(d) list was compiled, US EPA had made a finding that no impacts to the eating habits of endangered or threatened species had been documented. When US EPA promulgated the CTR to establish water quality criteria for segments, including South San Francisco Bay, it stated:

As part of the consultation process, EPA submitted to the Services a Biological Evaluation for their review in October of 1997. This evaluation found that the proposed CTR was not likely to jeopardize the continued existence of any federally listed species or result in the destruction or adverse modification of designated critical habitat. In April of 1998, the Services sent EPA a draft Biological Opinion which tentatively found that EPA's proposed rule would jeopardize the continued existence of several Federally listed species and result in the destruction or have adverse effect on designated critical habitat. After lengthy discussions with the Services, EPA agreed to several changes in the final rule and the Services in turn issued a final Biological Opinion finding that EPA's action would not likely jeopardize the continued existence of any Federally listed species or result in the destruction or adverse modification of designated critical habitat.

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While protecting wildlife species and habitat may ultimately be desirable, those are *not* the uses for which CWA technology-based limits have been found unable to achieve water quality standards/objectives. Before a TMDL can address these goals, this alleged additional use impairment must be formally identified and subjected to public comment through the listing process for the South San Francisco Bay. To the extent the TMDL seeks to establish a numeric target to address mercury in bird eggs or rare and endangered species, it is not legally appropriate and must be withdrawn, at least insofar as the South Bay is concerned.<sup>17</sup>

**C. Adoption of the Proposed “Numeric Targets” Would Amount to the Illegal Adoption of a New Water Quality Standard/Objective – Before Translating Narrative Standards into Numeric Targets, the State Must Specify and US EPA Must Approve the Translation Procedures; Hence a Water Code Section 13241 Analysis is Also Required for the Numeric Targets Proposed**

The Staff Report appears to offer the explanation that adoption of its numeric targets will not amount to the setting of numerical water quality standards/objectives but instead only involves the “interpretation” or “translation” of the existing narrative water quality standards/objectives.<sup>18</sup> However, adoption of the proposed numeric targets here will impermissibly go well beyond mere translation or interpretation, does not comply with applicable regulatory requirements, and amounts to the *de facto* setting of new water quality standards or objectives.

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65 Fed. Reg. 31,709 (May 18, 2000).

Newer evaluations of the alleged threat to wildlife are only first proposed now in this TMDL (*see* Staff Report at 37) on the basis of USFWS studies published in 2003. The public has not had an opportunity to comment on such findings as part of the listing of the water body segment under CWA section 303(d). Until that opportunity is available, the basis for listing South San Francisco Bay does not include the wildlife threats for which the numeric target is proposed.

<sup>17</sup> This conclusion is fully consistent with US EPA policy: “If the State determines a TMDL is not necessary after the TMDL development process has begun, the State would normally stop work on the TMDL . . . .” *See* EPA Guidance for Developing TMDLs in California at 3 (January 7, 2000) <http://www.epa.gov/docs/region09/water/tmdl/caguidefinal.pdf>.

<sup>18</sup> “Numeric targets for mercury concentrations in suspended sediment, fish tissue, and bird eggs are needed to translate water quality objectives into monitoring metrics that reflect the beneficial uses to be protected.” Staff Report at 11.

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## **1. The Proposed Numeric Targets are Arbitrary and Capricious; the Translator Mechanism/Method has Not Previously been Promulgated and Approved as is Required**

The numeric targets proposed here are not legally authorized because they are not based on approved and duly promulgated translation mechanisms/methods. US EPA previously defined what it considers appropriate elements of the water quality standard/objective-setting process when using narrative criteria for toxic pollutants such as mercury. The standard/objective itself must include *not only* a narrative statement expressing the appropriate quality of water to support uses, *but also a US EPA-approved procedure to calculate derived numeric criteria* based on the narrative standard when applied to CWA actions such as a TMDL. As far back as 1988, US EPA stated:

Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it *must* formally adopt such a procedure *as a part of* its water quality standards. The procedure must be used by the State to calculate derived numeric criteria that [will] be used as the basis for all standards purposes, including: developing TMDLs ....<sup>19</sup>

To pass legal muster, setting of a numeric target corresponding to a narrative criterion must be preceded by formal adoption and US EPA approval of a “translator mechanism.”

EPA believes that adoption of a narrative standard along with a translator mechanism *as part of* a State’s water quality standard satisfies the substantive requirements of the statute. These criteria are subject to all the State’s legal and administrative requirements for adoption of standards plus review and either approval or disapproval by EPA, and result in the development of derived numeric criteria for specific section 307(a) toxic pollutants.<sup>20</sup>

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<sup>19</sup> US EPA, Guidance for State Implementation of Water Quality Standards for CWA § 303(c)(2)(B), December, 1988, p. 14. (“1988 Guide”) (emphasis added). This guidance was later adopted more formally again in 1994. See footnote 22 below, Handbook, p. 3-20. Earlier in 1983, US EPA stated: “Where narrative criteria are adopted, the State should indicate *as a part of* its water quality standards submission how it intends to regulate the discharge of the toxic pollutants.” 48 Fed. Reg. 51,402 (Nov. 8, 1983) (emphasis added).

<sup>20</sup> 1988 Guide at 10 (emphasis added).

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This same US EPA Guidance goes on specify: “States must adopt a specific *procedure* to be applied to a narrative water quality criterion. To satisfy section 303(c)(2)(8), this procedure shall be used by the State in calculating derived numeric criteria, which criteria *shall be used* for all purposes under section 303(c) of the CWA.”<sup>21</sup>

These US EPA directions have been codified in CWA implementing regulations and instructions for water quality standards development. For example, US EPA’s water quality standards regulations for toxic pollutants state:

Where a State adopts narrative criteria for toxic pollutants to protect designated uses, the State must provide information *identifying the method* by which the State intends to regulate point source discharges of toxic pollutants on water quality limited segments based on such narrative criteria.<sup>22</sup>

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<sup>21</sup> 1988 Guide at 11 (emphasis added).

<sup>22</sup> 40 C.F.R. § 131.11(a)(2) (emphasis added). US EPA’s directions to implement the regulation confirm the need to include translation procedures as part of approved standards: “Section 131.11(a)(2) requires States to develop implementation procedures which explain how the State will ensure that narrative toxics criteria are met.” Water Quality Standards Handbook: Second Edition (1994) <http://www.epa.gov/waterscience/library/wqstandards/handbook.pdf> (“Handbook”).

Lest the above leave room for doubt, US EPA expressly clarified in its interpretation of the CWA’s regulations that implementing procedures for narrative criteria must accompany the plain narrative statements and must be formally adopted and approved:

## **The Procedure Must Be Formally Adopted and Mandatory**

Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it must formally adopt such a procedure *as a part of its water quality standards*. The procedure must be used by the State to calculate derived numeric criteria that will be used as the basis for all standards’ purposes, including the following: developing TMDLs, WLAs . . . .

## **The Procedure Must Be Approved by EPA as Part of the State’s Water Quality Standards Regulation**

To be consistent with the requirements of the Act, the State’s procedure to be applied to the narrative criterion must be submitted to EPA for review and approval, and *will become a part of the State’s water quality standards*. (See 40 C.F.R. 131.21 for further discussion.)

Handbook, p. 3-22 (emphasis added).

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With regard to wildlife protection considerations, the CWA also specifies that in the absence of numeric criteria/objectives, biological monitoring or assessment *methods* – such as those necessary to document or support the Staff Report’s conclusions or proposals – must be adopted first and are clearly *part and parcel of* the water quality standard/objective establishment process:

[Water quality] criteria shall be specific numerical criteria for such toxic pollutants. Where such numerical criteria are not available, whenever a State reviews water quality standards pursuant to paragraph (1), or revises or adopts new standards pursuant to this paragraph, such State *shall adopt* criteria based on biological monitoring or assessment *methods* consistent with information published pursuant to section 304(a)(8).<sup>23</sup>

US EPA has provided substantial guidance to states defining the ways in which wildlife numeric targets – “biological criteria” – should be developed in order meet the CWA goal for the protection and propagation of wildlife by means of a TMDL.<sup>24</sup> Briefly, US EPA’s guidance sets out a stepwise procedure to: 1) establish clear statements of biological criteria, 2) evaluate local conditions with careful study of reference conditions appropriate to the area, 3) perform quantifiable biological surveys, 4) employ “hypothesis testing” to ensure that the true causes of any biological impairment are properly documented, and 5) develop the implementation measures that properly respond to measures of impairment.<sup>25</sup>

As the technical comments being submitted on behalf of Santa Clara County demonstrate, the proposed TMDL does not meet US EPA’s standard for such studies because, among other things: a) its measurement of mercury in bird eggs is inaccurate, b) there is no reference site analysis concerning its evaluation of bird egg/survival issues, c) causation of “wildlife harm” has not adequately been linked to mercury

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<sup>23</sup> CWA § 303(c)(2)(B).

<sup>24</sup> CWA § 101(a)(2); US EPA, Biological Criteria: National Program Guidance for Surface Waters (April 1990) <http://www.epa.gov/waterscience/library/wqstandards/handbookappx.pdf> (Handbook, Appendix C); US EPA, Procedures for Initiation of Narrative Biological Criteria (October 1992) <http://www.epa.gov/ost/biocriteria/technical/brochure.pdf>. US EPA explains that use of the Appendix C procedure helps States to meet CWA § 303(d) TMDL obligations. Handbook, Appendix C, p. 10.

<sup>25</sup> Although the State and US EPA may have developed a translator mechanism as part of the CTR for metals, it does not apply to procedures for wildlife protection criteria involving mercury. See 40 C.F.R. § 131.38; 62 Fed. Reg. 42,160 (Aug. 5, 1997). US EPA has acknowledged the current difficulties, lack of data, or useable models necessary to develop a procedure that could lead to a numeric target for ecological effects or wildlife receptors. California Toxics Rule Response to Comments Report (December 1999) <http://www.epa.gov/waterscience/standards/ctr/responses.pdf>.

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concentrations in bird egg shells, and d) there has been a failure to perform testing of null hypotheses.

## **2. Because the TMDL's Numeric Targets Represent More than Authorized "Translation" and instead are *De Facto* Water Quality Standards/Objectives, Compliance with Water Code Section 13241 is Required**

Although the Staff Report purports merely to "interpret" an existing water quality standard/objective, use of these numeric targets would take place without the required approval process governed by other formal statutory and Administrative Procedure Act ("APA") requirements.<sup>26</sup> Specifically, in California, before novel translation methods create *de facto* water quality standards/objectives, they must first be subject to analyses under section 13241 of the Water Code.<sup>27</sup> Water Code section 13241 requires that, at a very minimum, the following factors be analyzed in advance of Regional Board action:

(a) Past, present, and probable future beneficial uses of water.

(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

(d) Economic considerations.

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<sup>26</sup> See for example *Simpson Tacoma Kraft Co. v. Department of Ecology*, 119 Wash.2d 640, 835 P.2d 1030 (1992) (affirming a superior court's ruling that Washington State could not develop a numeric standard for dioxin based on narrative standards without going through rulemaking procedures).

<sup>27</sup> While the staff can be expected to claim that the Chief Counsel's Office of the State Water Resources Control Board has authorized the type of translation activities undertaken here, it is important to recognize that the Chief Counsel also recognizes that there must be limits to this process and that some portions of a TMDL can amount to the adoption of formal water quality standards/objectives and not mere translation:

Although entire TMDLs, their primary elements, and their implementation plans are not water quality standards, *in some instances other parts of a California TMDL may be standards* subject to section 303(c)(3), and thus the Alaska Rule.

Memo from Michael Levy, SWRCB Office of Chief Counsel, to Paul Lillebo at 5 (January 28, 2002) (emphasis added).

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(e) The need for developing housing within the region.

(f) The need to develop and use recycled water.

Under the California APA, this section 13241 analysis must be made available to the public and subjected to comment in advance of the Regional Board's contemplated action.

Here, even if it were not legally required (and it is), the Regional Board should direct that the staff prepare a full and adequate section 13241 analysis and circulate it for public comment. It makes practical and policy sense for the Regional Board to know, at the time it considers the TMDL for adoption, what, for example, the likely economic and housing burden of this proposed twenty plus year regulatory plan entails.<sup>28</sup> As the existing Basin Plan SSO-Dumbarton objective requires with respect to the South San Francisco Bay, the Regional Board also needs to consider the water quality conditions that could *reasonably* be achieved through the coordinated control of all factors which uniquely affect water quality *in the area*.

Indeed, at least one California court has found that a regional board is in violation of 40 C.F.R. § 131.11(a)(2) when it fails to identify the method in its Basin Plan of how it intends to translate a narrative objective into useable numeric equivalents for CWA purposes.<sup>29</sup> Such translation methods can only be adopted pursuant to Water Code section 13241.<sup>30</sup>

In sum, until the Regional Board staff completes a Water Code section 13241 analysis and publishes and receives approval for its translator mechanism or procedures, the numeric targets in the TMDL cannot be utilized.

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<sup>28</sup> As discussed below and in comments submitted directly by the Santa Clara Municipalities, the Staff Report's discussion of impacts and costs is incomplete, seriously flawed, and inadequate to meet the requirements of either the California Environmental Quality Act ("CEQA") or Water Code section 13241.

<sup>29</sup> *City of Los Angeles Bureau of Sanitation v. State Water Resources Control Board*, Los Angeles Superior Court, Case BS 060 957, Statement of Decision April 4, 2001, p. 10. The case has been appealed by the State on other grounds, but this ruling of the court has not been appealed and remains the law of the case.

<sup>30</sup> See *Ibid.* p. 9.

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## **D. The Narrative Criterion for Bioaccumulative Substances on Which the TMDL is Based Applies Only to “Controllable” Water Quality Factors; Sources of Mercury Subject to this TMDL are Not “Controllable” as Defined By the Basin Plan**

Even if it were appropriate to “translate” numeric targets for mercury (and, it is not, particularly with regard to the lower South Bay), any such “translation” is authorized only to the extent the current Basin Plan defines the term “controllable” as used in its narrative bioaccumulative standard/objective:

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. *Controllable* water quality factors shall not cause a *detrimental increase* in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.<sup>31</sup>

In adopting its narrative standards/objectives and utilizing the term “controllable,” the Basin Plan further explains:

The Board recognizes that limited information exists in some cases [and] makes it difficult to establish definitive numerical objectives, but the Board believes its conservative approach to setting [narrative] objectives has been proper. In addition to technical review, *the overall feasibility of reaching objectives in terms of technological, institutional, economic, and administrative factors is [to be] considered at many different stages of objective derivation and implementation . . . .*

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as [narrative] water quality objectives, the Board *will conduct a case-by-case analysis of the benefits and costs* of preventing further degradation . . . . Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State and that may be *reasonably* controlled.

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<sup>31</sup> Staff Report at 9 (emphasis added).



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Compliance with [narrative] water quality objectives *may be prohibitively expensive or technically impossible* in some cases . . . . [T]he Board will conservatively *compare benefits and costs* in these cases because of the difficulty in quantifying beneficial uses.<sup>32</sup>

The Regional Board must perform a feasibility and cost/benefit analysis before making decisions or prescribing implementation measures based on a Basin Plan objective that is limited to actions that are “controllable.” The sources of mercury the TMDL identifies and proposes to regulate by means of the Basin Plan amendment may be controlled to some degree generally but not to the degree the Staff Report would require.

Among other things, the TMDL appears to assume, without analysis, that a mercury discharge is “controllable” simply because it happens to land on or pass through the geographical boundaries of a municipality subject to regulation by the Regional Board. For example, mercury from air deposition is assumed to be completely uncontrollable when it lands directly on San Francisco Bay, but completely controllable through urban runoff permits when it happens to land within an NPDES-permitted municipality. Nowhere is feasibility of the municipality’s ability to control the source of the pollutant or cost/burden of treating this aspect of an urban runoff allocation even discussed. The TMDL fails to consider that *both* may be equally uncontrollable, particularly when, as here, the origin of the mercury (power plants in China) is geographically so distant.<sup>33</sup>

Therefore, if it is to remain consistent with the existing Basin Plan, a much more rigorous analysis to tell the difference between what is truly controllable and what is not is necessary before the TMDL can legally be adopted.<sup>34</sup>

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<sup>32</sup> Water Quality Control Plan for the San Francisco Bay Basin (1995), p. 3-1-2 (emphasis added).

<sup>33</sup> As discussed in the Santa Clara Municipalities’ comments being submitted by the SCVURPPP, mercury already present in bank and bed sediments of tributaries to the South Bay is not a point source discharge properly subject to a waste load allocation to or control by urban runoff programs and, hence, should also be deducted from the urban runoff allocation currently set forth in the proposed Basin Plan Amendment.

<sup>34</sup> The Basin Plan’s bioaccumulation substances criterion is also forward-looking or prospective in character. It refers only to “detrimental *increases*” of toxic substances in sediments and not to effects from concentrations already present as a result of historical activity. Prospective controls such as the numeric targets and related load reductions described in the Staff Report that do not separate out the effects of existing sediment levels would *unreasonably* regulate conditions that are not “increases.” Hence, it appears that historical conditions, such as the legacies of mining present in the South Bay,

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**E. The Clean Water Act's Unique Standard for Municipal Stormwater Discharges has Not Been Accounted For in Constructing the Allocation to Urban Runoff; the Implementation Plan is Inconsistent with Prior State Decisions Regarding the Application of Numeric Regulatory Standards to Stormwater – The Urban Runoff Allocation and Related Implementation Plan Parameters Must be “Practicable”**

In addition to addressing Water Code section 13241 and the SSO-Dumbarton provisions of the Basin Plan (and CEQA's requirements), the Regional Board must take into account feasibility and potential costs in establishing the TMDL's allocation to urban runoff and in crafting numeric reduction targets, timetables, and other provisions of the proposed implementation plan because the feasibility and cost of achieving an allocation is a critical element in determining whether it meets the CWA's practicability standard for municipal stormwater discharges.

The Clean Water Act draws a distinction between NPDES permits for industrial stormwater discharges and NPDES permits for discharges from MS4s. The NPDES permitting requirements for stormwater discharges are found at Section 402(p) of the CWA. Subsection 402(p)(3)(A) provides that permits for industrial stormwater discharges “shall meet all applicable provisions of this section and [CWA section 301.]” Section 301 of the CWA is entitled “effluent limitations” and 40 C.F.R. section 122.44(d)(5) requires that permits incorporate limitations (such as WQBELs) “established under Federal or State law or regulations in accordance with section 301(b)(1)(C) of CWA.”

In contrast, CWA section 402(p)(3)(B), which governs permits for discharges from MS4s, does not require that such permits meet the requirements of CWA section 301. Rather, permits for MS4 discharges must “require controls to reduce the discharge of pollutants to the maximum extent practicable” (“MEP”). Thus, while the CWA may require that NPDES permits for industrial stormwater dischargers contain WQBELs, Congress did not contemplate requiring WQBELs (or any other traditional form of effluent limitations) in NPDES permits for MS4s; instead, they are subject to “controls” under the different MEP standard.

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should not be subject to the Basin Plan's bioaccumulation standard/objective or a TMDL (including any numeric target, or load reduction derived therefrom).

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This interpretation of the CWA was confirmed in *Defenders of Wildlife v. Browner*, 191 F.3d 1159 (9<sup>th</sup> Cir. 1999). There, the Ninth Circuit concluded that

Congress' choice to require industrial storm-water discharges to comply with [CWA section 301], but not to include the same requirement for municipal discharges, *must be given effect*. When we read the two related sections together, we conclude that [CWA section 402(p)(3)(B)(iii)] does not require municipal storm-sewer discharges to comply strictly with [CWA section 301(b)(1)(C).]

191 F.3d at 1165 (emphasis supplied).<sup>35</sup>

While the Regional Board may have certain discretionary authority under section 402(p)(B)(iii) to impose certain additional "controls" on MS4s in certain circumstances, even this discretion is *limited*. Specifically, the additional controls must not demand more than the maximum extent practicable.

The allocation to urban runoff and Implementation Plan and timetable proposed here *has not even been analyzed for practicability*. Since controls extending beyond the limit of practicability are not authorized for MS4s under the CWA and *Browner*, and this fundamental principle remains true even in circumstances where TMDLs need to be implemented, adoption of the TMDL and Implementation Plan should not proceed at this time.

Indeed, under the CWA, it is not even necessary for the Regional Board to adopt an implementation plan at the same time it adopts a TMDL and submits the TMDL to the State Board and US EPA for approval. The Santa Clara Municipalities and the Bay Area Stormwater Management Agencies Association ("BASMAA") have repeatedly advocated separating the "technical" portion of the TMDL from the more policy sensitive related Implementation Plan aspect of its Basin Plan Amendment as such is permissible under US EPA regulations and would maximize State control and autonomy over the process.

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<sup>35</sup> Because the Ninth Circuit has determined that the CWA does not require MS4s to strictly comply with section 301(b)(1)(C), the regulations promulgated pursuant to section 301(b)(1)(C), including those set forth in 40 C.F.R. section 122.44(d), are equally inapplicable to MS4s. See *Komarenko v. Immigration & Naturalization Service*, 35 F.3d 432, 436 (9<sup>th</sup> Cir. 1994) ("In order to be valid, a regulation must be consistent with its enabling statute."); see also *Aerolineas Argentinas v. United States* 77 F.3d 1564, 1575 (Fed. Cir. 1996) ("When a statute has been repealed, the regulations based on that statute automatically lose their vitality. Regulation do no maintain an independent life, defeating the statutory claim.").

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Moreover, many aspects of the TMDL and Implementation Plan are highly impracticable and, hence, cannot be legally imposed with respect to urban runoff, particularly with regard to the Santa Clara Valley Municipalities. For example:

- The necessary allocation to urban runoff has been grossly overestimated. As the Santa Clara Municipalities' comments graphically illustrate, if improved estimates of bed erosion from the Bay based on updated data from the U.S. Geological Survey and more accurate estimates of loadings contained in urban and non-urban stormwater runoff exclusive of bedded sediments would be employed in the TMDL's calculations, *dramatically lower* loading and much more practicable load reduction targets could be assigned to urban runoff sources; projected recovery time for the Bay would also be halved from the TMDL's current projection, even without any additional control efforts and their associated fiscal and planning burden on local governments;
- The percentage mercury load reductions proposed in conjunction with the TMDL's allocations to the Guadalupe Mining Legacy (98%) and Urban Runoff (approximately 50%) are not only unnecessary, they are *grossly disproportionate* to the reductions being imposed on other sources, including those not even subject to the MEP constraint imposed under the CWA;
- Even though they hold NPDES permits and are subject to WQBELs, wasteload allocations and reduction targets for Caltrans and stormwater discharges associated with industrial and construction activities *have not even been estimated or directly assigned to them*; MS4s are instead being asked to address and be given responsibility for waste loads from sources within their geographic boundaries, including Caltrans and Air Quality Management District-regulated air emitters (among others), over which they *lack* any control or jurisdiction;
- Contrary to the Basin Plan, no analysis has been conducted to even suggest that load reductions of the magnitude specified (90 kg/year for the Guadalupe and 78 kg/yr for Urban Runoff of which 21.38 kg/year is to come from the Santa Clara Municipalities) are *even within the control* of those MS4s being asked to address them; for example, by the Staff Report's own admission, almost one-third (55 kg/year of the 160 kg/yr load estimated for urban runoff) comes from atmospheric deposition;
- The timetables and milestones specified under the Implementation Plan have *not* been derived or informed by any analysis of what is practicable in terms of

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MS4 programs;<sup>36</sup> twenty year time horizons are not practicable for achieving the magnitude of load reductions specified (and ten year time horizons for achieving half of these reductions are even more far-fetched);

- MS4s, like the Santa Clara Municipalities, which have already undertaken mercury elimination and sediment removal/control programs are receiving *no credit* for these efforts under the TMDL even though they have contributed and will contribute to load reductions;
- The overall Urban Runoff allocation has been assigned among Bay Area MS4 programs on the basis of *current* population rather than land mass, anticipated new development, or other factors more likely to be tied to mercury;
- Total estimated costs for the Santa Clara Municipalities to address the proposed WLA and load reduction targets presented in the TMDL and Implementation Plan are *\$40 million to \$50 million per year for capital costs and \$63 million to \$78 million per year for ongoing costs (e.g., operation and maintenance, reporting); and*
- Perhaps most importantly, rather than set forth the allocations and associated load reduction targets as goals to be “addressed” by MS4s, the proposed Implementation Plan goes well *beyond* the CWA’s TMDL “consistency” requirement and violates the MEP standard, the Ninth Circuit’s decision in *Browner*, and prior State Board precedent decisions<sup>37</sup> by stating that MS4s will be assigned responsibility for “demonstrating compliance with” or “achieving” the numeric load reduction targets.

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<sup>36</sup> According to Mr. Looker’s comments at the May 25, 2004 Bar Association of San Francisco seminar on this TMDL, the timetables in the Implementation Plan were informed by the State Implementation Plan (“SIP”) concerning the CTR. However, because of the MEP standard, the SIP on its face, *does not apply* to municipal stormwater discharges. (It is also seemingly inconsistent that the State Board prescribed a 20 year timetable for implementation of the CTR’s standards/objectives (*i.e.*, .051 µg/L for mercury in the South Bay) in the SIP where the TMDL’s Implementation Plan only proposes to provide that amount of time to achieve more ambitious and burdensome results.)

<sup>37</sup> SWRCB Order Nos. 91-03, 91-04, 96-13, 98-01; *see also* Order Granting Petition for Writ of Mandate and Statement of Decision in *S.F. BayKeeper v. RWQCB, SF Region* (SF Superior Court Case No. 500527), Nov. 14, 2003 at 1-2.

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## **II. The Questions Regional Board Staff Presented to Peer Reviewers for the TMDL Were Not Properly Formulated**

The Regional Board was required to solicit peer review of the scientific conclusions supporting its TMDL pursuant to Health and Safety Code section 57004.<sup>38</sup> Peer reviews from three University of California experts were solicited under this "Problem Statement" defining the issues posed by the TMDL:

### **The Problem Statement**

This section of the report describes the basis for concluding that mercury impairs San Francisco Bay, including the water quality standards not being met. High levels of mercury have been found in fish, including the fish humans eat, and birds, including the endangered California clapper rail and least tern. Mercury levels in San Francisco Bay exceed the Basin Plan objective for bioaccumulation and threaten beneficial uses, such as sport fishing, wildlife habitat, and preservation of rare and endangered species.<sup>39</sup>

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<sup>38</sup> Health and Safety Code § 57004(d) states:

(d) No board, department, or office within the agency shall take any action to adopt the final version of a rule unless all of the following conditions are met:

(1) The board, department, or office submits the scientific portions of the proposed rule, along with a statement of the scientific findings, conclusions, and assumptions on which the scientific portions of the proposed rule are based and the supporting scientific data, studies, and other appropriate materials, to the external scientific peer review entity for its evaluation.

(2) The external scientific peer review entity, within the timeframe agreed upon by the board, department, or office and the external scientific peer review entity, prepares a written report that contains an evaluation of the scientific basis of the proposed rule. If the external scientific peer review entity finds that the board, department, or office has failed to demonstrate that the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices, the report shall state that finding, and the reasons explaining the finding, within the agreed-upon timeframe. The board, department, or office may accept the finding of the external scientific peer review entity, in whole, or in part, and may revise the scientific portions of the proposed rule accordingly. If the board, department, or office disagrees with any aspect of the finding of the external scientific peer review entity, it shall explain, and include as part of the rulemaking record, its basis for arriving at such a determination in the adoption of the final rule, including the reasons why it has determined that the scientific portions of the proposed rule are based on sound scientific knowledge, methods, and practices.

<sup>39</sup> Peer Review of Technical Basis of Proposed Basin Plan Amendment for Mercury TMDL for San Francisco Bay, October 24, 2003.

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As a statement of the problem and charge to the peer reviewers, we object to the formulation that the staff provided of relevant questions. It is an assumption to say – and in our view incorrect – that mercury levels exceed all objectives in South San Francisco Bay or that the beneficial uses are threatened, two assertions that are themselves the kind of conclusion for which a peer review is necessary.

Because the peer reviewers were told to accept these and other premises as given “facts,” they were not in a position to exercise scientific judgment on the underlying bases or data to controvert those issues in their peer review product. Had the inquiry been pursued appropriately, the peer reviewers could very well have indicated that the assumptions underlying this TMDL – that all mercury is the same and that sediment mercury concentrations relate proportionately to fish tissue levels (among others) – do not reflect the current state of the science on these issues. See, for example, the comments being submitted on this TMDL by Exponent Corporation on behalf of the Santa Clara Valley Water District.

As a result we request that the Regional Board direct the staff to retract its posted peer review of the TMDL and restate the problem for further peer review analysis pursuant to the Health and Safety Code’s requirements.

### **III. There has been a Substantial Failure to Comply with CEQA in terms of Evaluating the Impacts of, Alternatives to, and Burdens to be Imposed by the TMDL and its Implementation Plan**

#### **A. Environmental Impacts**

Before the Regional Board may approve the Basin Plan amendment, it must prepare an environmental impact report (“EIR”) or a functionally equivalent document (“FED”). Pub. Res. Code § 21080.5(a). When preparing the FED, the Regional Board must comply with CEQA. Pub. Res. Code § 21080.5(c). The Regional Board must also comply with the State Board’s regulations for the preparation of FEDs. 23 C.C.R. §§ 3775-3781.

The FED must describe the Basin Plan amendment, identify and consider reasonable alternatives to the Basin Plan amendment, identify any significant adverse environmental impacts of the Basin Plan amendment, and propose mitigation measures to minimize the significant adverse environmental impacts of the proposed TMDL and

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[http://www.swrcb.ca.gov/rwqcb2/TMDL/SFBayMercury/instructions\\_to\\_reviewers.pdf](http://www.swrcb.ca.gov/rwqcb2/TMDL/SFBayMercury/instructions_to_reviewers.pdf). See responses at <http://www.swrcb.ca.gov/rwqcb2/sfbaymercurytmdl.htm>.

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Basin Plan amendment. Pub. Res. Code § 21080.5(d)(3); 14 C.C.R. § 15252; 23 C.C.R. § 3777.

CEQA requires the Regional Board to analyze both the direct and the indirect impacts of the Basin Plan amendment. 14 C.C.R. § 15358. The Regional Board may not approve the Basin Plan amendment if the Basin Plan amendment would have a significant environmental impact and there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant impacts of the project. Pub. Res. Code § 21081.

Accordingly, the Regional Board must consider the impacts of the TMDL and proposed Basin Plan amendment (especially its Implementation Plan) in light of the criteria for significance established pursuant to section 21083(b) of CEQA. In particular, the Regional Board must find that the TMDL and proposed Basin Plan amendment would have a significant effect on the environment if they have the potential to degrade the quality of the environment or to achieve short-term environmental goals to the disadvantage of long-term environmental goals. Pub. Res. Code § 21083(b).

Such findings must be made here. The Staff Report has incorrectly concluded that the Basin Plan amendment would not have a significant effect on the environment. (Staff Report at 106.) Significant impacts are likely to result from this TMDL and its allocations and load reduction targets for the Guadalupe Mining Legacy and Urban Runoff. The Staff Report even identifies several categories of "Direct and Indirect Physical Changes," including: (1) minor construction; (2) earthmoving operations; and (3) waste handling and disposal likely to result from the TMDL and admits that these activities are reasonably foreseeable. (Staff Report at B-12, B-14.)<sup>40</sup>

The Staff Report also mentions that mercury reduction activities could include sediment removal and disposal using dump trucks. As the Santa Clara Municipalities' comments explain, approximately 47,000 truck loads of material would need to be removed from storm drain facilities each year to meet the proposed WLA for urban runoff. This represents a five-fold increase from current storm drain maintenance activities, which is clearly significant.

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<sup>40</sup> The Staff Report acknowledges that the Basin Plan amendment would have impacts on the environment, but impermissibly dismisses the significance of these impacts and avoids any meaningful analysis thereof because the "exact nature of these changes is often speculative pending specific project proposals." (Staff Report at B-14.). The Staff Report does not provide any legitimate basis for this speculation; nor, as discussed below, does it contain substantial evidence that the impacts in question would be less than significant.



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The types of stormwater detention/retention practices that the Staff Report indicates would be required to avoid the need for extensive sediment removal, transportation, and waste disposal activities could substantially increase the risk of vector-borne disease. (See Declaration of Tim Mulligan, Santa Clara County Vector Control District Manager, attached as *Attachment A*.)<sup>41</sup> Standing water is a prime breeding habitat for disease-carrying insects, such as mosquitoes. Mosquitoes can carry various diseases, such as encephalitis and malaria, which pose a serious threat to public health. (*Id.*)

As Santa Clara Valley Water District explained to the Regional Board staff in comments on a prior version of the San Francisco Bay Mercury Total Maximum Daily Load Project Report, the removal of significant amounts of riparian soil for purposes of removing mercury would have significant impacts on vegetation since the mercury was deposited. The impact on vegetation and fisheries habitat therefore must be carefully analyzed pursuant to CEQA before the TMDL can legally be adopted. Those negative impacts may be more severe than the alleged harms to wildlife staff claims are attributable to the mercury itself – a “cure worse than the disease.”

The TMDL and proposed Basin Plan amendment would also have an indirect but reasonably foreseeable significant impact on land use, air quality, and traffic because they would increase the cost of residential development in the Santa Clara Valley and displace some of that development to rural areas to the south and the east. Activities undertaken by the Santa Clara Municipalities as conditions of approval of specific projects in order to address the Santa Clara Municipalities’ Urban Runoff allocation are likely to drive up the cost of residential, commercial, and industrial development in Santa Clara County. The increase in the cost would displace development to rural areas outside of the San Francisco Bay Region, such as in Santa Cruz County, Stanislaus County, Merced County, San Benito County, and Monterey County.

Therefore, in addition to its impacts on waste hauling and disposal, vector issues and riparian habitat, the proposed Basin Plan amendment, among other things, would have a significant impact on the following aspects of land use, traffic, and air quality:

- Displaced residential development would result in urban sprawl, which would be inconsistent with local plans;
- Residents of the displaced residential development would suffer longer commute, but would likely continue to commute by car. Public

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<sup>41</sup> We specifically request that this and all other prior submissions on Project Reports related to this TMDL be made part of the record.

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transportation is generally limited between areas south and east of Santa Clara County the San Francisco Bay Region and the commercial and industrial areas in Santa Clara County. Consequently, longer commutes would result in increased vehicle-miles, which would result in increased traffic, particularly along major highways such as U.S. Highway 101; and

- Longer commutes and increased vehicle-miles would also result in increased vehicle emissions, which would degrade air quality.

As the City of San Jose previously explained in response to the Regional Board's proposed NPDES permit requirements for new development and redevelopment ("C.3 requirements"), the required sediment controls would impose substantial costs on the City and would have adverse impacts on the production of housing, the revitalization of downtown San Jose, and the local economy. (*See Comments of the City of San Jose on the Regional Board's Tentative Order dated May 18, 2001, attached as Attachment B.*) The City's prior comments remain highly relevant to the TMDL and proposed Basin Plan amendment, because the Staff Report indicates that implementation of the C.3 requirements is a primary part of the TMDL's Implementation Plan.

As the result of these and other measures that will be necessary to address the TMDL's mercury sediment targets and associated load allocations and reductions (possibly including the construction of *massive* storm water detention and treatment facilities), the Basin Plan amendment would likely result in significant impacts, drive up both municipal and development costs, and create dislocations and associate secondary impacts.<sup>42</sup> A more rigorous CEQA environmental impact analysis is therefore required.

### **B. Mitigation Measures**

The Staff Report does not comply with CEQA because it defers mitigation analysis until an undetermined later date without establishing any standard or guidance or requirement for the deferred mitigation. (Staff Report at B-14.) The Staff Report shifts also impermissibly the mitigation obligation to subsequent lead agencies, stating: "As specific implementation proposals are developed and proposed, lead agencies

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<sup>42</sup> In particular, the City's comments note that detention/retention basins, which could also be necessary to achieve the allocation under the Basin Plan Amendment, substantially reduce the amount of developable land, particularly where on-site detention/retention is required. (San Jose Comments at 7-10.) These types of control measures would also significantly increase the cost of development and render certain projects infeasible, shifting development to outlying areas. (San Jose Comments at 11.) The displaced development would be farther from transit opportunities and would conflict with the City's plans to curtail urban sprawl. (San Jose Comments at 11-12.)

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would undertake environmental review and identify specific environmental impacts and appropriate mitigation measures.” (Staff Report at B-14.)

Deferred mitigation is generally *unacceptable*, especially where, as with the proposed Basin Plan amendment, there can be little doubt that significant environmental impacts will be created. *See Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296. In certain cases, the Regional Board may defer the formulation of mitigation measures where further study is necessary to determine the nature of the significant impacts or the appropriate design for the mitigation measures. *Sacramento Old City Association v. City Council of Sacramento* (1991) 229 Cal.App.3d 1011, 1028. However, in such cases, the Regional Board must establish *a standard* for determining what sort of mitigation measure is appropriate and must commit *itself* to adopting the mitigation measure when it is formulated. *Id.*<sup>43</sup>

The Regional Board should instead analyze and consider adoption of feasible measures to mitigate the significant impacts of the proposed Basin Plan amendment *now*, in conjunction with this process. At a minimum, the Regional Board should direct its staff to prepare an environmental review document that more fully satisfies the requirements of, and extent of analysis associated with, an environmental impact report (“EIR”) prior to adopting any Basin Plan amendment containing an implementation plan for the TMDL.

## C. Alternatives Analysis

To comply with CEQA, the Regional Board must also consider reasonable alternatives to the proposed Basin Plan amendment. 23 C.C.R. § 3777. The Staff Report briefly considers eight alternatives to the proposed Basin Plan amendment, but this is inadequate because none of the alternatives would address any of the significant environmental impacts of the proposed Basin Plan amendment.

Significantly, the Staff Report only considers one alternative that varies the implementation schedule – a “Faster Implementation” alternative, under which the Implementation Plan would be accelerated into full effect in just ten years. The Staff Report should also consider other alternatives, particularly alternatives under which the

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<sup>43</sup> The Regional Board staff’s attempt to shift the mitigation obligation to subsequent lead agencies is particularly egregious in light of the fact that, as the Regional Board is well aware, the Regional Board is exempt from the mitigation requirements of CEQA when adopting or amending NPDES permits. In addition, the NPDES permit, once adopted, is likely to constrain the authority of municipalities and other public agencies to develop effective measures to mitigate the indirect environmental impacts that would result from the increased costs of development.

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Implementation Plan would be phased in over twenty-five, thirty, or forty years.<sup>44</sup> These alternatives could give the Santa Clara Municipalities members and other public agencies *greater flexibility* in allocating resources to and managing mercury reduction activities, thereby lessening some of the economic and environmental impacts of and dislocations and secondary impacts associated with the proposed Basin Plan amendment. These alternatives could also give the Santa Clara Municipalities and other public agencies the opportunity to take advantage of additional advances in remediation, treatment, and monitoring technology. Moreover, based on Figure 7.2 of the Staff Report, it appears that these alternatives might not materially change the point at which mercury-related water quality standards/objectives throughout the Bay will ultimately be achieved.<sup>45</sup>

### **D. Economic Burdens to be Imposed**

The Regional Board must prepare an economic analysis for the Basin Plan amendment which identifies reasonably foreseeable methods of achieving the load allocations and considers the economic impact of those methods. In developing the TMDL and the allocations, the Regional Board must give the same consideration and weight to economic factors as is required under section 13241 in order to comply with CEQA. The Regional Board may not dismiss the methods of compliance with the load allocations as “speculative,” nor may the Regional Board shift the burden of conducting an economic analysis to the public.

As the State Board Chief Counsel’s office has explained:

[T]he Regional Water Board must identify the reasonably foreseeable methods of compliance with the wasteload and load allocations and consider economic factors for those methods.

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<sup>44</sup> In addition, as suggested in the Santa Clara Municipalities’ comments submitted by the SCVURPPP, alternatives based on the use of different assumptions concerning bed erosion from the Bay and a separate non-point source load allocation to stream/creek bank and beds (as distinguished from urban runoff) should be assessed. Alternatives based on treating the South Bay as a separate “box,” assigning portions of the urban runoff allocation based on factors other than current population, and for understanding how a regulatory approach might work if based on methylmercury should also be evaluated.

<sup>45</sup> According to Mr. Richard Looker of the Regional Board, the Regional Board has a simple Excel spreadsheet model available which allows the Regional Board to estimate the amount of time necessary for the sediment mercury concentrations to reach the sediment target, depending on the schedule for implementing the allocations. This spreadsheet model would appear to allow the Regional Board to estimate the amount of time necessary for the sediment mercury concentrations to reach the sediment target if the Implementation Plan were phased in over twenty-five, thirty, or forty years rather than twenty years.

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This economic analysis is similar to the analysis for water quality objectives [as required by section 13241 of the Water Code and guidance from the Chief Counsel of the State Board to the Regional Boards]. *That is, the Regional Water Board should determine: (1) whether the allocations are being attained; (2) if not, what methods of compliance are reasonably foreseeable to attain the allocations; and (3) what are the costs of these methods.*

(Memorandum from Sheila K. Vassey, Senior Staff Counsel for the State Board, to Stefan Lorenzato, TMDL Coordinator for the Division of Water Quality of the State Board at 5 (Oct. 27, 1999) (emphasis added).)

The Staff Report's purported economic analysis is insufficient to meet these applicable legal requirements. It grossly underestimates some of the costs of implementing the urban runoff provisions of the Basin Plan amendment and completely ignores most of the other costs that will be borne by the Santa Clara Municipalities.

### **a) Cost of Sediment Removal, Erosion Control, Treatment, Waste Disposal, Source Reduction**

The Staff Report relies on information provided by EOA Inc. for its analysis of the cost of mercury reduction activities by the Santa Clara Municipalities to achieve the allocation for urban runoff. However, the Staff Report mischaracterizes the estimates EOA provided. (See Staff Report at 103.)

EOA provided a "very preliminary rough" estimate of the cost to the Santa Clara Municipalities of implementing the provisions regarding urban runoff as proposed by BASMAA on September 17, 2003. Contrary to the suggestion in the Staff Report, EOA did not estimate the cost of the mercury TMDL-related activities listed in the proposed Basin Plan amendment for urban runoff.

Indeed, the Basin Plan amendment proposes significantly different and additional requirements, the cost of which will likely be *much greater* than the estimate asserted in the Staff Report. In particular, the sediment removal and disposal costs, the capital costs of constructing treatment controls, and the costs of operation and maintenance for treatment controls would likely be *orders of magnitude* higher than the estimate presented in the Staff Report. As explained in the Santa Clara Municipalities' comments, the Santa Clara Municipalities have prepared an updated and more thorough estimate of the total costs for the Santa Clara Municipalities to address the proposed WLA and load reduction targets presented in the TMDL and Implementation Plan.

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According to the Santa Clara Municipalities estimate, the total costs would be *\$40 million to \$50 million per year for capital costs and \$63 million to \$78 million per year for ongoing costs.*

US EPA recently confirmed the *critical importance* of the cost of implementation when determining best management procedures for urban runoff and stormwater controls. US EPA withdrew a proposed new source performance standard (“NSPS”) for construction and development, because US EPA found that the proposed NSPS would be too expensive to implement. 69 Fed. Reg. 22,472, 22,480-81 (Apr. 26, 2004). According to the Federal Government, the cost of the proposed NSPS would have been in excess of \$3.3 billion per year. 69 Fed. Reg. at 22,480. Even though US EPA withdrew the proposed NSPS, the Santa Clara Municipalities likely will need to require similar management procedures for specific projects. Even then, this alone is unlikely to address most of the load reduction target associated with their proposed allocation.

In sharp contrast to the approach taken in the Staff Report, the Central Valley Regional Water Quality Control Board (“Central Valley Regional Board”) has pursued a more credible economic analysis in its development of a mercury TMDL for the Sacramento-San Joaquin Delta Estuary. In order to analyze the economic impacts of the TMDL, as required under the California Environmental Quality Act (“CEQA”) and guidance from the State Board counsel, the Central Valley Regional Board asked the U.S. Geological Survey (“USGS”) to prepare a written report regarding the cost of mercury reduction activities in the Delta watershed (“Delta TMDL Cost Data”). The Delta TMDL Cost Data describes per unit costs of mercury reduction activities in the Delta watershed. The high end and low end per unit costs are summarized in table 9.2 of the Staff Report. (Staff Report at 103.) The per unit costs identified in the Delta TMDL Cost Data for mercury reduction activities indicate that the cost of achieving the allocations in the proposed Basin Plan amendment could impose a *massive burden on public agencies* and development projects.<sup>46</sup>

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<sup>46</sup> According to Dave Drury, an engineer at the Santa Clara Valley Water District (“District”) who is familiar with mercury reduction activities undertaken by the District, the per unit cost of mercury reduction activities to achieve the Santa Clara Municipalities allocation would be similar to the high-end per unit cost estimates identified in the Delta TMDL Cost Data.

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To assure compliance with CEQA, the Regional Board should, at the very minimum, prepare a written report of cost data for the Basin Plan amendment similar to the Delta TMDL Cost Data prepared by the Central Valley Regional Board.<sup>47</sup>

## **IV. Adoption of the TMDL's Allocation to Urban Runoff and Related Provisions of the Implementation Plan would Create an Unfunded Mandate by Imposing Significant Burdens on Local Governments Without Providing Resources for Funding them**

The TMDL's allocation to urban runoff and related provisions of its Implementation Plan concerning urban runoff create an unfunded mandate on the Santa Clara Valley Municipalities in violation of the California Constitution. *See* Cal. Const. Art. 13B § 6. Under the California Constitution, the State is required to reimburse local governments for State mandated programs. *See* Cal. Const. Art. 13B § 6. While the CWA is a federally mandated program, case law makes clear that the prohibition on unfunded mandates applies, unless the State has "no true choice" in the manner of implementing the federal program. *See Hayes v. Commission on State Mandates*, 11 Cal.App.4th 1564, 1593 (1992) (emphasis added).

Here, the State, through the Regional Board, has a very real choice about whether to impose these requirements on Santa Clara Valley Municipalities. US EPA's water quality standard/objective for mercury in *South San Francisco Bay* is *not* being exceeded; as a result, no TMDL for mercury *in the South Bay* is required, and both US EPA and the Federal Courts (*see Browner*) have issued no mandate to impose WQBELs or similar requirements on municipal stormwater dischargers either in excess of the MEP standard or based on the particular numeric targets the Regional Board staff has proposed to rely on here.

Hence, the costs associated with the TMDL's urban runoff allocation and the related Implementation Plan requirements are not "costs mandated by the federal government" and may not be imposed in the absence of a concurrent provision of funding to the local government entities involved. Cal. Gov't Code § 17513. Accordingly, because no funding is provided and there are real and significant costs that would be associated with the implementation of the requirements contained in the TMDL (*see supra*, Section III.C), it constitutes an illegal unfunded mandate under State law.

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<sup>47</sup> According to Alexander Wood, the USGS staff person who prepared the Delta TMDL Cost Data, a similar written report likely could be prepared for the proposed Basin Plan amendment.

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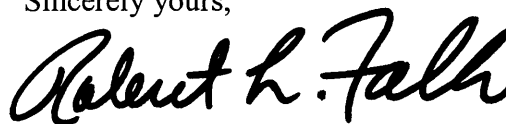
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## CONCLUSION

The Regional Board staff should be commended for its effort and the work it had accomplished to date in developing a mercury TMDL for the San Francisco Bay. However, because it is technically flawed and fails to comply with applicable statutory and regulatory requirements; has not undergone adequate scientific peer review; has not adequately addressed the requirements of CEQA; and constitutes an unfunded mandate in violation of State law, the Santa Clara Municipalities cannot support adoption of the TMDL in its current form at this time.

Instead, the Santa Clara Valley Municipalities respectfully request that the Regional Board direct its staff to significantly and fundamentally revise the TMDL, its implementation plan, and the associated proposed Basin Plan amendment to address the concerns delineated above and in the various comments the Santa Clara Municipalities have submitted under separate cover.

Sincerely yours,



Robert L. Falk  
Legal Counsel to  
Santa Clara Valley Urban Runoff  
Pollution Prevention Program

## Attachments

cc: Bruce Wolfe  
Tom Mumley  
Dorothy Dickie  
SCVURPPP Management Committee  
SCVURPPP Legal Steering Group  
A. Olivieri



**Attachment A**

Declaration of Tim Mulligan,  
Santa Clara County Vector Control District Manager

DECLARATION OF TIM MULLIGAN

I, Tim Mulligan, declare as follows:

1. I am currently the Santa Clara County Vector Control District Manager. I have acted in this capacity since 1995. I have over 27 years of experience working on suppression of vector borne diseases (diseases transferred from one animal or insect to humans) and issues involving public health risks from insect and animal infestations. I have a Bachelor of Science degree in Microbiology from San Jose State.

2. In my capacity as the Vector Control District Manager, I am charged with protecting the public from real and potential health risks posed by insects and animals that can transmit diseases and also work to ensure that district services resolve problems arising from insect or animal infestations, which also may pose public health risks. On account of my current and past professional experiences, I am very familiar with the potential vector production associated with stormwater detention and treatment devices.

3. I have reviewed and am familiar with Provision C.3, providing new development and redevelopment requirements, proposed by the Regional Water Quality Control Board, San Francisco Bay Region ("Regional Board") set forth in the May 18, 2001 Tentative Order amending the Santa Clara Valley Urban Runoff Pollution Prevention Program NPDES municipal storm water permit ("Tentative Order"). The Tentative Order would require municipalities to require or undertake the creation of certain types of stormwater detention and treatment devices in connection with the approval and construction of new and redevelopment projects.

4. The Tentative Order encourages and would result in the construction of detention/retention basins throughout Santa Clara County and in decreased peak flows in the county's various creeks and streams. Both results will increase the amount of standing water in Santa Clara County.

5. Standing water is prime breeding habitat for disease carrying insects, such as mosquitoes. Mosquitoes can carry various diseases, such as encephalitis and malaria, which pose a serious threat to public health. An increase in disease carrying insects increases health risks to all residents from vector-borne diseases.

6. Based on my knowledge and experience, it is my professional opinion that the Tentative Order's stormwater treatment devices present an increased risk of vector-borne disease by encouraging treatment measures that create more standing water while discouraging alternative treatment measures that do not increase standing water and thereby result in fewer vector-related problems.

I declare under penalty of perjury of the laws of the State of California that the foregoing is true and correct.

Executed this 14 day of June, 2001, at SAN JOSE, California.

  
TIM MULLIGAN

**Attachment B**

Comments of the City of San Jose on the  
Regional Board's Tentative Order dated May 18, 2001

### ATTACHMENT 3

**Proposed Comments to the San Francisco Bay Regional Water Quality Control Board on Tentative Order dated May 18, 2001, revising provisions C.3 of Order NO. 01-024 for the Santa Clara NPDES Municipal Separate Storm Sewer System Discharge Permit (NPDES Permit No. CAS029718).**

The City of San Jose objects to adoption of the Tentative Order which would impose new requirements on the City's land use and development approval process on the grounds stated in this letter and in the comments submitted under separate cover by counsel for the Santa Clara Valley Urban Runoff Pollution Prevention Program. We incorporate by reference the comments that we and Program legal counsel submitted in November 2000 concerning Board's October 13, 2000 Tentative Order, which also contained land use and development approval requirements.

Briefly, the requirements contained in the New Development provision, C.3, are not supported by the evidence in the record and exceed the Board's legal authority. Further implementation of the requirements would impose substantial costs on the City and would have adverse impacts on the production of housing, the revitalization of downtown San Jose and the local economy. In addition to these substantive objections to the proposed new requirements, we object to the proposed implementation schedule as it completely fails to recognize the often lengthy internal review, public participation, CEQA and other statutory processes that are required to make the extensive changes to City programs that are contemplated by these new performance standards. Finally, the City urges the Regional Board to work with local stakeholders in its own Watershed Management Initiative (WMI) process to set clear, objective water quality goals and allow the stakeholders to develop the appropriate technical, and locality specific approaches for adoption in a time frame consistent with the municipal administrative processes.

1. **The Regional Board rationale for imposing SUSMP type requirements is not supported by data regarding local water quality conditions.**

The City is concerned that provision sections (C.3. b-g) require the City to specify structural storm water controls on development projects to alleviate vague or otherwise undetermined impacts on local hydrologic conditions. The City does not believe that the need for these new and redevelopment site design requirements have been adequately linked to water quality impacts in the Santa Clara Basin watershed. Unlike southern California, where there is a well-documented linkage between storm water flows and negative impacts to local beaches, impacts to waterbodies due to changes in the runoff volumes, flows or peak flows have not been adequately demonstrated or documented in the Santa Clara County permit.

The Regional Board findings [Findings 5, 6 and 7] that form the basis for several key elements of the order, declare possible impacts without adequate documentation, and prescribe control measures that have no apparent link to the impacts described. For example, Finding 5 discusses pollutants associated with vehicles and transportation, and even natural-occurring minerals from local geology and acknowledges that these "*may be derived from extraneous sources that Dischargers (municipalities) have limited or no direct jurisdiction over.*" On that basis the finding declares that "*Dischargers can implement control measures, or require developers to implement control measures, to reduce entry of these pollutants into storm water.*" It is unclear what relationship new development control measures have on these types of pollutants.

Finding 6 notes that "*these pollutants*" [the ones that the City has little control over] *can have damaging effects on both human health and aquatic ecosystems.*" The City does not dispute the potential harmful effects of pollutants such as atmospheric mercury, however, the causal relationship of these pollutants to the reported impacts is not established by the next statement, i.e.:

*"In addition, the increased flows and volumes of stormwater discharged from new impervious surfaces resulting from new and redevelopment can significantly impact beneficial uses of aquatic ecosystems due to physical modifications of watercourses, such as bank erosion and widening of channels."*

The basis for the Regional Board's findings in either item 6 or 7 does not rely on local studies or on an understanding of historic development patterns of Santa Clara County. The findings ignore the degree to which the watershed and flow regime has been altered by flood and water supply management considerations over the last fifty years. Recent evaluations of the indicators cited in Finding 7, undertaken by the Urban Runoff Program and supported by the Water Environment Research Federation (WERF), found that it was not possible to directly link urban factors such as imperviousness and storm sewer operations to influences in stream hydrology without conducting additional studies. The study concluded that other factors including dams, diversions, channel modifications, sedimentation and the episodic nature of local precipitation patterns play an important role in local stream function.

*"Interpreting imperviousness as the cause of ecosystem degradation is not defensible based on the type of analysis conducted here [calculations of percent impervious correlated to aquatic habitat metrics]; rather imperviousness may be interpreted as an indicator of areas with potential problems. Identifying the cause of such potential problems requires a much more in-depth analysis of the location and frequency with which additional factors disturb aquatic ecosystem function."*<sup>1</sup>

The concept that higher stream flows create more scouring and erosion is not necessarily true in the Santa Clara Basin watershed with its many small creeks, many of which are concrete-lined channels and others which are protected from erosion by significant riparian banks. The City's commitment to protect these riparian corridors has, in fact, been the reason why higher flows do not cause erosion in the watershed. Finally, "accelerated erosion of downstream natural channels" is not a problem common to the lower Santa Clara Basin watershed. Here, channel aggradation is a major problem brought about by subsidence of the valley floor as a result of over-pumping of the groundwater aquifers in the 1920-30's – long before urbanization was prevalent.

For Santa Clara County, the relationship between pollutants and hydrologic effects of local storm water discharges to that of new development controls is fragile and not supported by recent studies or historical comparison of hydrologic effects. The concept that structural control measures for volume and flow placed on the relatively small portion of the urbanized area represented by new and redevelopment projects would have demonstrable effect on channel morphology, or flow regime of local streams, is not supported by the record. As constructed, Section f. could result in costly control measures that fail to address the water quality issues in

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<sup>1</sup> See Stormwater Environmental Indicators Pilot Demonstration Project – Technical Memoranda #7 and #14 (Santa Clara Valley Urban Runoff Pollution Prevention Program, January 2001).

Santa Clara County watersheds. The prescriptive aspect of these control requirements is not technically justified by the findings. Nor can the substantial increases in public investment for public works projects and for the operation of the storm sewer system, and in private costs in the form of higher housing costs be warranted by these findings.

Where water quality problems have been clearly identified, San Jose has demonstrated a strong commitment to improving the water quality conditions and to formulating sound and feasible solutions. The City funded the development of a Total Maximum Daily Load process that characterized the copper and nickel problem in South San Francisco Bay and resulted in action plans aimed at reducing these pollutants in the storm sewer system to reduce the impacts to both streams and the Bay. Currently, the City, together with the Santa Clara Valley Water District, is supporting a similar TMDL process to address Mercury levels in the Guadalupe River and in monitoring for PCB hot spots throughout the region.

The City urges the Regional Board to work with local stakeholders using its own WMI process to complete the watershed assessments, currently underway. The assessments will enable the Board and the public to develop a common understanding of water quality conditions in local streams based on actual monitoring data. This would enable the Board to carefully craft regulatory goals and requirements that will serve to protect and maintain the unique aquatic environment of Santa Clara County streams and waterbodies.

**2. The requirements imposed on Santa Clara County, including the City of San Jose, exceed the requirements previously approved by the State Board**

Program legal counsel will address our legal objections to using the State Water Resources Control Board "SUSMP" Order<sup>2</sup> as a basis for adopting the Santa Clara Basin Tentative order. Here, we want to express our concern that, despite a lack of data regarding local climate, soil, groundwater and land use conditions in Santa Clara County, the Regional Board has broadened the scope of SUSMP requirements while, at the same time, imposing narrower prescriptions for compliance. Our analysis of SUSMP provisions imposed on Los Angeles and San Diego reveals that the language of this Tentative Order is far more prescriptive and contains additional provisions not contemplated by the State Water Resources Control Board order.

For example, the Los Angeles SUSMP provisions focus on large commercial projects (greater than 100,000 sq. ft.), and land use types with greater potential to generate or transport pollutants such as automotive repair shops, parking lots, gasoline stations and residential hillside developments. In the proposed provision C.3.c, the Regional Board has significantly broadened the scope of development projects subject to the requirements by reducing the size of the projects to one-acre (43,580 square feet) of combined impervious surface area, and by expanding the types of projects covered to include residential subdivisions, redevelopment projects and public streets (the "Group 1" projects). In addition, the language calls for a phasing in of "Group 2" projects, those as small as 5,000 square feet, regardless of land use type unless the City proposes a different size range that treats 80% of the new impervious surface area annually. This inclusion of a wider range of developments is not contained in the SUSMP provisions.

The Tentative Order offers no rationale for broadening the sweep of its 'SUSMP-like' provisions, for either the Group 1 or Group 2 projects. It would be more appropriate for the

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<sup>2</sup> SB Order WQ 2000-11: SUSMP Issued October 5, 2000.

language to set a reasonable treatment goal and allow the municipalities to develop categories that can achieve that goal. To do otherwise squanders public and private resources and ignores existing development policies. For instance, unlike Los Angeles, San Jose Municipal Code does not allow construction of homes outside the Urban Service Area (USA) which largely deters development of homes on steep, erodable hillside sites. The City also has policies in place to control development above the 15% slope line (the SUSMP provisions are not triggered for residential development except single family hillside development on slopes greater than 15%.) The City currently requires gas stations, parking lots, wrecking yards, recyclers, and other land uses with high pollutant generating potential to treat their runoff to prevent pollutants from entering the City's storm system.

At the same time that the provision broadens its reach to include more development projects, it prescribes specific numeric hydraulic sizing criteria for storm water volume- and flow-based structural treatment measures similar to those established in the Los Angeles permit. These criteria are not based on San Jose or Santa Clara Basin climate or soil conditions, nor does the language allow localities to propose alternative criteria based on actual conditions in the basin, in a specific locality or sub-basin. It is puzzling that the Regional Board Fact sheet for the permit cites "other methods of establishing storm water treatment measures" and provides numerous examples of municipalities and states where various alternative methods have been applied as well as describing methods acceptable to USEPA. Neither the findings nor the Fact Sheet provide a rationale for the particular design criteria imposed by the permit language. In fact, the discussion supports the concept of setting clear regulatory goals and allowing localities to establish both hydraulic sizing criteria and treatment methods suitable for application to local conditions, rather than imposing specific criteria in an arbitrary manner without the obtaining appropriate local information.

In a similar fashion, the requirement set forth in Section C.3.f., *Limitations on Increase of Peak Stormwater Runoff Discharge Rates* extends beyond the SUSMP precedent. This section mandates that post-development peak stormwater discharges rates and durations not exceed pre-development levels for new and redevelopment projects. It requires that the City develop and implement a 'Hydrologic Modification Plan' complete with evaluation protocols, and management measures. These specific requirements represent new standards imposed solely on Santa Clara County permittees, for which there is no guidance or precedent.

It should be pointed out that several other elements of the recently issued 'precedent setting' permits in Los Angeles and San Diego Counties have been required of the Santa Clara County permittees since 1995 and have been implemented by the City and its co-permittees since 1996. These requirements include minimizing pollutants of concern, stenciling storm drain inlets, incorporating source control in designs for material and trash storage areas, vehicle and equipment wash areas, fueling areas at gas stations and automotive repair shops. San Jose has actively implemented Post-Construction Treatment measures for structural storm water control since its adoption of its policy in 1997. The policy targets land uses that have potential to generate pollutants including wrecking yards, automotive servicing shops, parking lots and a broad range of commercial uses. Some 60 major new developments have been required to install such control measures on their sites since that time.

In addition, the City has contributed substantial time and resources to the Regional Board-sponsored Watershed Management Initiative and over the last five years has been instrumental in supporting this approach for identifying and solving water quality and watershed management



issues using local stakeholders. The City asks the Regional Board to respect the stakeholder process it has created and allow local stakeholders to determine the manner in which it can comply with the goals set out by the provision rather than impose rigid command and control requirements that do not reflect the communities' solution to the problems identified.

The use of State Board precedent to justify the imposition of permit requirements may be a standard regulatory practice, however, the proposed provision extends beyond existing precedent in crucial areas. The Regional Board has also chosen to ignore previous direction regarding the use of the WMI stakeholder process to discuss controversial issues as part of the public participation process. This language imposes an additional burden on the City of San Jose and other co-permittees that is not warranted by its history of compliance, or by its willingness to respond to previous Regional Board initiatives. In fact, San Jose and the other municipalities in Santa Clara County have a clear record of developing innovative solutions to the regulatory goals of the stormwater permit program. On that basis, the City requests that the Regional Board consider these efforts in determining the methods of compliance for new and redevelopment projects.

***3. The implementation schedule for the Enhanced New and Redevelopment Performance Standards is not achievable.***

The City of San Jose is extremely concerned that compliance with elements contained in Provision C.3. New and Redevelopment Performance Standard Enhancements is not achievable. The implementation schedule requires the City to modify its development review procedures and implement new design standards, and operation and maintenance requirements in eleven months (C.3.b and e. by July 15, 2002). It further contemplates that the City repeats this process every year of the permit period to fulfill other provisions (section f. July 2003, sections k. & m. March 2003, section j. September 2004, section l. July 2005). This schedule wastes resources by forcing the City to go through a series of procedural changes that, with more time and proper scheduling, could be done all as one process as discussed below. The proposed schedule requires the City to impose little-understood engineering requirements on the community first and determine the efficacy and implications of these requirements later. This is not only unworkable, it would lead to confusion on the part of the public and City because, as result of the timing, the approval process procedures would be in a constant state of flux for the next four years. The compliance schedule shows little understanding of municipal administrative processes and negatively impacts local decision-making processes.

Effective modification of the development project approval process procedures to incorporate all of the changes contemplated by this provision requires additional time to develop the necessary technical support information, guidance, policies and, where needed, ordinances. In a municipality the size of San Jose, development of even routine, well defined and technically acceptable changes to ordinances, policies and procedures requires eighteen months to ensure adequate internal and public review prior to adoption. In this instance, the required standards are fraught with technical and procedural barriers. For this reason, it would require a minimum of thirty-six months to effectively develop the necessary ordinances, policies, procedures and stakeholder input required to incorporate the requirements set forth in sections C.3. b., d., e., g. i. and the pesticide element of n. into the City's existing new development approval process. The Table below outlines the steps and schedule needed to establish and apply the elements of hydraulic based designs and Operation and Treatment measures.

<b>Schedule for Implementation of Procedural Changes In Development Approval Process</b>	
<b>Tasks/Actions</b>	<b>Completion Date</b>
<b>Adoption of Permit Requirement</b>	<b>8/01</b>
• Informational staff report to Council, Departments <b>Inventory existing design standards, criteria</b>	<b>11/01</b>
• Review existing ordinances, policies and guidelines • Identify barriers to design standards • Identify elements of design standards already being implemented <b>Develop multiple alternatives for new standards</b>	<b>3/02</b>
• Compare current requirements to LA and other standards utilized elsewhere • Prepare multiple rainfall design criteria • Analyze costs and effectiveness of alternatives <b>Develop analysis of alternatives</b>	<b>8/02</b>
• Focus meeting with developers, etc. • Planning commission information report <b>Revise alternatives based on impact</b>	<b>10/02</b>
• Choose recommended alternative • Prepare documentation plus staff report • Prepare budget estimates – resources needed <b>Finalize recommendations at staff level</b>	<b>12/02</b>
• Interdepartmental review • Prepare budget documentation <b>Forward ordinance and budget recommendation for action</b>	<b>2/03</b>
• Ordinance language changes prepared by attorneys <b>Ordinance staff report prepared</b>	<b>5/03</b>
• Compare to other geographic areas • Regional board review • Developers review • All staff review <b>Ordinance public review process</b>	<b>08/03</b>
• Address public concerns • Revise as needed <b>Ordinance to Planning Commission</b>	<b>10/03</b>
• Address Planning Commission concerns • Revise as needed <b>Ordinance to City Council</b>	<b>1/04</b>
• Develop detailed implementation procedures • Train staff • Notify affected parties with outreach information <b>Effective date of new requirements</b>	<b>7/04</b>

This schedule assumes that the technical considerations can be addressed using existing hydraulic and climate information and that the treatment methods have standard specifications suitable for inclusion in plans. Inherent technical issues (discussed below) and lack of necessary data to establish hydrologic modification criteria could defer implementation of Section C.3.f. (Limitations on Peak Runoff Discharges). That provision can only be undertaken once studies are conducted and appropriate data is acquired. These studies and data should be the primary driver for the implementation schedule for the development of Hydro-modification Management Plans.

This provision also contemplates substantial changes in the City's development plan approval process, capital improvement program and operations and maintenance without regard to its management, planning, budgeting and staffing processes. For instance, next year's budget and revenue requirements will have been set by the time these requirements are being adopted. The compliance schedule does not allow the City adequate time to identify or garner the resources needed to meet these requirements. San Jose has instituted a stormwater utility to fund the current program. However, the additional workload and public project costs that are generated by these new requirements will require rate increases. Implementation of rate increases necessitate several months of advance preparation before increased fees can be considered, much less imposed on the rate-paying public. The compliance timetable ignores the realities of public program revenue generation under Proposition 218, which mandates that rates be collected in proportion to the benefit received by the ratepayer.

4. *If the proposed provision is adopted, there are extensive adverse economic impacts on housing, infill development policies, redevelopment projects, municipal budgets and the local economy that have not been considered by the Regional Board.*

The tentative order does not provide an evaluation of the economic impacts of the requirements on the municipalities. There has been insufficient time for the City to evaluate the cost of these requirements. However, preliminary estimates of the costs of compliance are considerable and have the potential to negatively impact housing, infill development policies, redevelopment projects, municipal budgets and the local economy.

#### **Housing and Infill Development**

Under the proposed provisions, the City would essentially need to require that every development project detain/retain storm runoff on site. This approach would decrease the amount of developable land area for each project, ultimately reducing the total number of housing units or square footage of job-generating uses. The reductions in housing and jobs are direct trade-offs for a presumed water quality benefit. In other words, the City will not be able to achieve its jobs and housing goals.

For infill locations, it is just not practical to set aside land for detention/retention basins on a project-by-project basis. If approved, these Provisions would affect the design and physical layout of projects. The costs associated with these stormwater controls would inhibit infill development, reduce the production of affordable housing, and add significant costs to the construction of important City facilities (i.e., new City Hall, branch libraries, fire stations, etc.).

Since the mid-1970s, the City of San Jose has been encouraging and fostering infill development to accommodate growth while not sprawling southward or into the hillsides. For much of that time, infill development has occurred on vacant parcels that had been previously overlooked for development. Since the late 1980's, the City has been aggressively planning for the reuse of underutilized parcels, resulting in the recycling and redevelopment of land for more intensive residential, commercial, and industrial development. In addition, this approach has led to the revitalization of Downtown as well as transit-oriented development along existing and planned rail lines, contributing to a "smarter" growth pattern.

San Jose is expected to continue to grow in infill locations and to intensify land use patterns as called for in the *San Jose 2020 General Plan*, many specific plans, *Downtown Strategic Plan*,

and other planning documents. The proposed stormwater controls for detention/retention under the draft Provisions would result either in land being set aside for detention basins or in detention basins built underground. These requirements would affect the physical design and site layout of all development, resulting in unattractive detention basins all over the City. The requirements would also add tremendous costs to private infill development and to other projects of great interest to the City, such as the construction of new affordable housing and City facilities (i.e., new City Hall, branch library expansions, new fire stations, etc.).

The draft Provisions do identify a waiver process from treatment controls if they are determined to be impracticable due to limitations of space, high water table, unstable soils, or other below surface conditions. If a waiver is granted, then the developer would be required to pay a fee equivalent to the cost of the stormwater control into a fund which could then be used to address stormwater pollution in the watershed of the development. Program legal counsel's comments will address the legal deficiencies with the proposed fee for waiver provision.

In any event, the cost to development (private or public) would be significant, either effectively reducing the project's size or rendering it financially infeasible. These requirements may hinder the private sector from building in areas long planned for infill development. More importantly, the City's limited dollars for affordable housing and capital improvements would be further constrained, resulting in fewer affordable housing units or smaller City facilities. Therefore, the City would not be able to achieve its economic development, housing, or service level goals.

The Regional Board has presented no evidence that the water quality and watershed benefits of the proposed Provisions outweigh the negative effects and total costs associated with constructing the stormwater controls. Nor has the Regional Board considered the opportunity costs associated with the loss of smart, infill development, Downtown revitalization, affordable housing, and expansion of needed City facilities. The proposed Provisions unfairly penalize infill development, particularly on already developed sites, and would result in inefficient, unsightly, detention basins throughout San Jose, contrary to City policies.

#### **Public Works Department**

The proposed changes to the permit would result in more labor intensive and costly reviews in the planning stages of a project, in the grading plan review, and in construction inspection. In the planning stage, it will be necessary to review the numerical sizing calculations to certify the control measures as BMPs. In the grading plan review, drainage details and calculations would have to be reviewed. The inspection of the grading of the detention/retention facilities is more labor intensive than are the current reviews necessary for piping systems. Cost recovery fees for planning review and grading permits would need to be increased to account for the additional plan review and inspection staff that would be needed for the implementation of these new requirements. These costs will be passed on the developers, and ultimately the public increasing of costs of housing and commercial space in an already highly priced market.

All staff would have to be trained in the subject of detention and retention basin design. Although the nineteen civil engineers in the division are trained and capable of reviewing hydraulic and drainage designs, detention and retention design is a specialized subject that would require continuous specialized training.

Implementation of traffic flow improvements (street-widening projects) would be severely impacted by the application of these requirements to new streets. The average public residential street covers 4.36 acres per mile, therefore even minimal widening and expansion projects encompassing one quarter mile could be subject the provision. The costs to install control measures to mitigate street runoff volume would be substantial even where there is sufficient vacant land area to do so. In most cases where traffic flow improvements are needed there is little right-of-way available for such structures and in those areas the cost to incorporate volume and/or flow controls would render the project infeasible.

Construction of the required structural control measures on new public facility sites will have a significant impact on the City's Capital Improvement Program and would have the effect of reducing the availability of funds for other projects including critical storm sewer collection system rehabilitation.

### **Department of Transportation**

DOT would have the primary responsibility for Operations and Maintenance on public and, possibly, some privately constructed facilities. This could have significant resource implications which might require resolution of the Special Assessment District funding as these costs would have to be incorporated in the Storm Sewer Charge Fee.

DOT currently reviews all public storm facility construction plans. The new provision would increase the review period because additional time would be needed to ensure that structural controls are designed to optimize Operations and Maintenance efficiency as well as report on the outcomes. This new level of effort is currently not funded and would require at least one full time engineering staff at a cost of approximately \$80,000/year to conduct plan reviews and fulfill the reporting requirements.

DOT currently maintains five regional debris/detention basins. Maintenance of these facilities consists of removal of sediment once to twice per year at a cost of approximately \$39,000 per location per year. Structural control facilities designed to treat volume would presumably require more specific types of maintenance particularly if landscaping were a key element of the treatment. The estimated cost to maintain the facilities mandated by this provision is estimated at up to \$50,000 per location per year.

## **Planning, Building and Code Enforcement**

Compliance with the proposed Provisions would add to the workload of the Plan Implementation Division Staff. The proposed Provisions have the greatest impact on the Plan Implementation Division in terms modifying the development review process (described above) and implementing the Provisions. In particular, the implementation of the Provisions would involve working closely with applicants to resolve project design issues associated with the Provisions and assuring compliance with the Provisions. Due to these provisions, extended processing times are expected for all applications and would necessitate the addition of one Planner II position (\$80,000 per year) to keep processing times within reason.

Compliance with the proposed Provisions will add to the workload of Building Division staff. Plan Checkers, would need to verify that the Public Works approved civil engineering and grading plans are included in the building plan set. The civil engineering and grading plans would document the stormwater controls.

For certain stormwater controls, such as inlet filters or Jensen interceptors, the Building Division may need to review hydraulic calculations at the time of plumbing permit issuance.

Compliance with the proposed Provisions will affect the workload of Code Enforcement staff and may require additional staff resources to complete proactive, random inspections of stormwater controls. Code Enforcement's role would consist primarily of enforcing development permit conditions, which would include the operation and maintenance of stormwater controls. While the enforcement of permit conditions is one of several existing responsibilities for Code Enforcement Inspectors, it is currently performed only on a complaint basis. The proposed Provisions would require a more proactive approach to randomly inspect a sample of projects every year to determine compliance with the permit conditions associated with the operation and maintenance of the stormwater controls. Code Inspector(s) would need to be trained to understand various stormwater controls and be able to evaluate their performance. The information collected by the Inspector(s) would need to be documented and provided to the Urban Runoff Planner in the Planning Services Division for inclusion in the Annual Report to the Regional Board. It is estimated that compliance with this Provision would require 0.5 FTE of a Code Enforcement Inspector II (\$38,000 per year).

### ***5. Additional evaluation is required to ensure that the enhanced Control Measures are economically and technically feasible.***

As there was not enough information to establish a sound technical link between water quality conditions and the need for these particular control measures, there is a need for additional evaluation of whether technically appropriate measures are "practicable" (technically feasible, cost-effective and consistent with other City policies and mandates) for the City to implement. This information is absolutely critical to the process of developing effective standards, policies, and procedures for incorporating control measure requirements into the project approval process.

A majority of the control measures to be considered by developers involve setting aside portions of a site for detention basins, vegetated swales, or infiltration devices. However, the high clay content of local soils and low percolation capacity could make infiltration infeasible for many areas in the Santa Clara Basin. Local conditions could necessitate larger retention basins on sites to allow for evaporation of runoff. This means a larger portion of the site would have to be

dedicated to treatment and less area would be available for development. This creates a twofold economic impact in that there is the loss of the value of the land dedicated to treatment and an opportunity cost associated with the loss of development potential. Preliminary estimates from Public Works indicate that the likely impact of these measures on a project may be around 10 % of the project cost.

These cost considerations strike heavier on infill and other non-suburban projects and the economics of constructing these structures may result in unintended consequences to the environment. For example, the requirements appear to conflict with current City policies to promote infill and affordable housing projects, and increase densities along transit corridors. These requirements may be difficult to incorporate into these types of sites and could result in pushing development onto lands that have no previous development.

For example, the City's Redevelopment Agency (RDA) estimates that construction on both large office and other infill projects could be halted by these requirements, as there is not sufficient land to accommodate the buildings and retention systems. These projects include:

- Boston Properties, Almaden Boulevard - 800,000 sq. ft.
- Adobe Phase II - 200,000 sq. ft.
- Riverpark Tower II - 300,000 sq. ft.
- Block 2 Tower - 300,000, sq. ft.
- Legacy on Julian Street - 1,000,000 sq. ft.
- Palladium Mixed Use - 3,000,000 sq. ft. (of which a significant portion will be housing mixed with retail; or hotel)
- Convention Center expansion - 500,000 sq. ft. (or more or less)

Where redevelopment replaces surface parking lots water quality is actually improved without the additional burden of detention/retention/infiltration. By eliminating a direct source of automobile pollution into the storm drain (asphalt oils, motor oil, brake fluid, radiator fluid, brake dust, and other toxics mobilized from the paved surface by stormwater), and replacing it with a structure that has controlled drainage, covered vehicles, and the ability to control automobile waste by containing it within the building as well as by being required to connect the interior drains to the sanitary system, the pollutant loads will be reduced and runoff volume will be decreased. The connection of washdown and other interior garage drains to the sanitary system in essence creates a combined sewer system for these projects, which is hugely beneficial to the goals of the Board.

The Redevelopment Agency and the Housing Department are under Council (and public) directive to create in excess of 1,000 housing units in and around the downtown each year for the next five years. These are all infill projects, many in existing residential neighborhoods that would consolidate small parcels into development size sites.

The addition of an exaction or mitigation fee to pay for the hypothetical cost of a retention system would make these difficult projects even more economically infeasible than they already are in a marginal and struggling environment. The redevelopment of economically underutilized and under valued properties into economically productive land would be severely hindered by the implementation of these rules.

Housing, especially affordable housing, is difficult to construct in the downtown. To add costs to these projects could render them infeasible, shifting development to the outlying areas, i.e., the

undeveloped areas of the city and county, away from transit opportunities and continuing the pattern of sprawl.

In the absence of local stakeholder involvement in developing these provisions, the Regional Board has neglected to evaluate the impacts of these requirements on local housing supplies. The City suggests that these impacts are vast and require additional evaluation prior to imposition of these requirements on the municipalities in this County where the shortage of housing is indisputably one of the most severe in the region, if not the state.

*6. Additional study and time is needed to establish the technical bases for the structural controls.*

These requirements and timeframe essentially mandate a 'piecemeal' project by project approach to managing storm water flow. The haste to impose these requirements essentially drives the construction of hundreds of detention/retention facilities scattered within a watershed. This is contrary to accepted engineering practices that recommend regional facilities as more efficient and cost effective from a maintenance and operations perspective. Many widely scattered detention basins are more costly and inefficient and will increase the resources needed to respond to emergency maintenance on both public and private facilities during storm events.

Staff has found that more "regional" solutions achieve stronger water quality and hydrologic benefits than individual project-by-project solutions. Regional solutions have been incorporated into the planning and zoning of several large development areas. For example, a retention basin could serve all 50,000 jobs in North Coyote Valley, basin(s) on Communications Hill could support the development of the planned 4,000 units, and basins in Edenvale would facilitate significant job generating uses.

Finally, there are significant vector control consequences, particularly mosquitoes, associated with detention basins and other treatment devices. The water quality benefit of these treatments needs to be evaluated against the potential to impact public health.

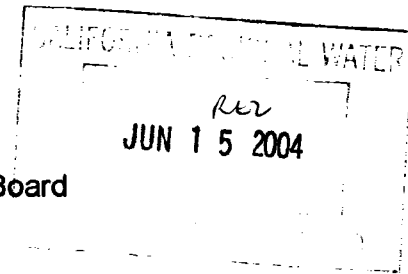
It would be nearly impossible for the City to gather the information necessary to fully consider the implications of these requirements and to determine whether there are additional practicable control measures by the proposed compliance dates for these provisions. The compliance dates do not allow adequate time to evaluate the optimum approaches to these programs, to involve the affected publics, or to conduct administrative processes associated with crafting feasible policies and ordinances.





June 14, 2004

Mr. Richard Looker  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street 1400  
Oakland, CA 94612



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Subject: Mercury in San Francisco Bay: Total Maximum Daily Load  
(TMDL) Proposed Basin Plan Amendment and Staff Report,  
April 30, 2004

Dear Mr. Wolfe:

We have reviewed subject report and wish to offer our comments as follows:

1. The proposed Mercury waste load allocation for municipal dischargers as a group is reduced to 14 kg/yr in the April 2004 Report from 17 kg/yr in the June 2003 Report, representing a 17% reduction. Similarly, the allocation for Mt. View Sanitary District is reduced to 0.024 kg/yr in the 2004 Report from 0.060 kg/yr in the 2003 Report representing a 60% reduction. This reduction will cause a serious compliance problem for our district, especially in the wet years, because of increased waste water flows. Because municipal wastewater dischargers, as a group, currently contribute only 1.3% of total mercury loading to the Bay, further reduction for municipal dischargers' waste load allocation from what was proposed in 2003 will contribute little to the overall load reduction needed to meet the proposed waste load reduction targets. We suggest that you consider restoring the proposed allocation for municipal dischargers to 17 kg/yr and Mt. View Sanitary District's allocation to 0.06 kg/yr as was proposed in the 2003 Report.

2. The 2004 Report proposes to evaluate waste load compliance for municipal dischargers as a group annually. We recommend the compliance be evaluated every five years using five-year averages. This will address our concern of higher waste loading from our and other municipal wastewater treatment plants due to higher loading caused by high flows during wet years.

3. We would like to have an opportunity to work with your staff either through Bay Area Clean Water Agencies or individually to resolve our concern.

Thank you very much for the opportunity to comment on the proposed Mercury TMDL and Waste Load Allocations.

MT. VIEW SANITARY DISTRICT  
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P. O. BOX 2757  
MARTINEZ, CA 94553  
925-228-5635  
FAX: 925-228-7585



Sincerely,

*David R. Contreras*

David Contreras  
District Manager  
MT. View Sanitary District

cc: Bill Johnson - RWQCB  
Richard Looker - RWQCB  
Robert Schlipf - RWQCB



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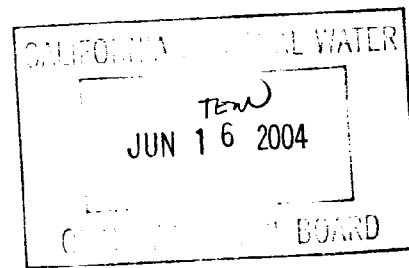
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Association

Western States Petroleum  
Association

Craig S.J. Johns  
Executive Director

June 14, 2004



Dr. Thomas Mumley  
Planning and TMDLs Division Chief  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, California 94612

**Re: Comments on the "Mercury in San Francisco Bay Total  
Maximum Daily Load (TMDL) Proposed Basin Plan  
Amendment and Staff Report" dated April 30, 2004**

Dear Dr. Mumley:

The Partnership for Sound Science in Environmental Policy (PSSEP) appreciates the opportunity to comment on the San Francisco Bay Regional Water Quality Control Board's (Regional Board) April 30, 2004 *Mercury in the San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* (Mercury TMDL) (hereafter, "April 2004 Draft"). PSSEP is an association of San Francisco area and statewide public and private entities – businesses, municipal wastewater treatment agencies, trade agencies and community organizations. PSSEP was founded on the overriding principle that federal, state and local environmental policy decisions should be predicated on sound, objective science.

PSSEP commends your staff for their efforts in dealing with mercury and its methylation in a complex ecosystem. The Mercury TMDL clearly articulates the science used to develop the TMDL and its limitations. We support the adaptive process to refine the TMDL as additional information becomes available.

However, we were extremely surprised and disappointed to see the significant changes in the implementation plan for point sources contained the April 2004 draft Mercury TMDL as compared with the June 6, 2003 draft ("June 2003 Draft"). Frankly, we question the derivation of these changes, as well as the purpose behind making them at this stage, particularly given their stark contrast to prior drafts, as well as the impending date to adopt the Mercury TMDL. None of the members of PSSEP, including those that participate in the Clean Estuary Partnership, were aware that any of these changes were being considered. PSSEP is very disheartened at the Board's lack of communication and cooperation with the regulated community.

Dr. Thomas Mumley

June 14, 2004

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We believe the changes contained in the April 2004 Draft can and will have significant negative impacts on point sources without any noticeable improvements to the Bay. The April 2004 Draft recognizes that wastewater treatment plants, as groups, "perform well and load reductions would incur substantial costs and contribute little to the overall load reductions needed to meet the proposed targets." (p. 53). In fact, the Mercury TMDL states that reducing wastewater discharges could cost from between \$87 million and nearly \$1 billion, yet fails to detectably accelerate target attainment. (p. 110). PSSEP concurs with these findings that clearly show wastewater discharges from POTWs and industrial sources, which make up approximately one percent of the current total load to the Bay, are well controlled and are *de minimus* sources in the overall mercury picture. PSSEP is concerned that, with some of the changes that occurred in the April 2004 Draft as outlined below, these dischargers will not be able to comply with the TMDL - - nor future permits - - and will be forced to make large expenditures that the TMDL is currently trying to avoid, without any significant improvements to the Bay.

#### **Waste Load Allocations (WLA)**

The April 2004 Draft Mercury TMDL contains lower waste load allocation (WLA) for publicly owned treatment works (POTWs) and significant changes in the balance of loads for the industrial wastewater dischargers. The proposed allocations in the April 2004 Draft could have significant, unintended impacts on wastewater dischargers by creating compliance problems not contemplated in the Mercury TMDL and its alternatives and economic analysis. PSSEP believes that the changes made in this last draft will have very little impacts in attaining the mercury sediment targets, but could have significant impacts from the standpoint of NPDES permit compliance. Therefore, the magnitude of the POTW allocation and the pooling of the industrial groups allocation is vitally important.

POTWs: The POTW group WLA has decreased from an allocation of 17 kilograms per year (kg/yr) in the June 2003 Draft to 14 kg/yr in the April 2004 Draft. PSSEP understands that the changes are due to not only to a reevaluation of newer data (2000 to 2003) but also by using a modified statistical approach. This reduction puts the POTW community very close to being out of compliance with the proposed WLA, and could likely be out of compliance due to growth, economic changes, mathematical errors or weather patterns. Indeed, many of the POTWs that already employ advanced treatment of their effluent - - at great historical cost - - will likely be affected most negatively.

PSSEP believes it is imperative that the TMDL explicitly acknowledge the need for future growth and development, and contain a WLA that can accommodate this. This recommendation is consistent with the comment received by peer reviewer, Mr. David Sedlak of UC Berkeley. Although the April 2003 draft hints that future growth may be accommodated through offsets, we point out that offset feasibility has yet to be established.

Dr. Thomas Mumley

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In addition, in the response to peer review comments, Regional Board Staff identifies water recycling and plant optimization as the types of improvements that will be required to accommodate growth. These are the same types of improvements that were identified in the Mercury TMDL alternatives analysis for lower WLA or a more expedited attainment and were not chosen because, “[t]o the extent that lower allocations are actually feasible, this alternative could be unreasonably costly for limited environmental benefit. For example, reducing wastewater discharges could cost from \$87 million to almost \$1 billion (LWA 2002) and fail to detectably accelerate target attainment.” (p. 100.) In addition, most wastewater facilities are already implementing mercury pollution prevention programs that have reduced mercury discharges and availability. It is unknown – if not unlikely – that further source control efforts can create additional room to accommodate growth under the proposed allocation.

***PSSEP Recommendation: PSSEP supports a long-term average WLA of 16 kg/yr to the POTW community to allow for an approximate growth increment of 20-25 years.***

*Industrial Wastewater Dischargers:* The April 2004 Draft has made significant changes in the way the WLAs are handled for industrial wastewater discharges. In the June 2003 Draft, industrial wastewater dischargers were given a WLA of 2 kg/yr as a group. In the April 2004 Draft, refineries are allocated 1 kg/yr as a group and the individual sum of the non-refinery industrial WLA adds up to 1 kg/yr. Another significant change in the industrial wastewater WLA is that the individual WLA have significantly changed. The April 2004 Draft states that the individual allocations were selected after considering each facility’s fractional mercury load and effluent volume for the period 2000 through 2003.

PSSEP is concerned that measuring individual allocations in this sector could stifle economic growth, limiting the opportunities for businesses to change and grow. In addition, many of the allocations in this sector are based on very limited data. Because these WLA will be contained in both the individual NPDES permits and the Basin Plan, it will be harder to respond to market forces than if compliance was measured as a group. As a group, this sector could adjust individual loading without the additional regulatory constraints of antibacksliding concerns and basin plan amendments. Low production years due to the recent economic conditions and plant down times used to determine the individual WLA could cause future compliance problems when the economy rebounds and the plants are operating at full capacity. Measuring the compliance of the industrial wastewater community as a group, rather than individuals or a class of dischargers, will provide some additional flexibility to respond to economic conditions, without requiring Basin Planning or NPDES permitting changes.

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***PSSEP Recommendation: Compliance with the WLA for all industrial wastewater dischargers should be measured as a group with a group allocation of 2 kg/yr.***

**Annual v. Five-Year Average Compliance Determination**

The April 2004 Draft TMDL proposes measuring compliance with the WLAs for point source discharges on an annual compared to the a five-year average basis that was contained in the June 2003 Draft. PSSEP supports a five-year averaging period for a number of reasons.

First and foremost, a five-year averaging period for point source discharges allows for flow variations due to weather and the economic driven fluctuations in plant flows. The April 2004 Draft recognizes that rainfall causes substantial inter-annual variability and recognizes that multi-year evaluation is needed to smooth out the high and low rainfall years and that this inter-annual variability effects wastewater discharges. (p. 63). Yet, for some reason, the April Draft ignores this reality and removes the five year averaging period for wastewater dischargers, without adequate explanation. An annual averaging period will likely cause wastewater dischargers to be out of compliance portions of the time, especially during wetter seasons, because the basis for the WLA was a long-term average.

Second, long-term averages are consistent with the major premise of the Mercury TMDL, in that it will take time to meet the mercury targets in the Bay. The Mercury TMDL states that the overall time frame for recovery is 120 years, with the initial load reduction goals occurring within 20 years. (p. 60). The Mercury TMDL provides a five-year averaging period for other sources such as Central Valley Watershed, the Guadalupe River and Stormwater. PSSEP believes these long-term averaging periods are not only appropriate but essential for a fair and equitable TMDL implementation plan. They are also appropriate for the *de minimus* source of wastewater discharges and will have very little, if any impact on the Bay. For example, if one year due to wet weather conditions, the mercury discharge by both wastewater discharger groups is 20% above the WLAs, the overall change to the Bay will only equate to a 0.3% increase based on current loads and a 0.5% increase if all allocations were met.

Finally, the April Draft contains appropriate protections for short-term exceedances. Wastewater dischargers have agreed to study the short-term local effects of their discharges through local bioavailability studies. Concentration triggers will also be implemented in the NPDES permits and Basin Plan. Both these actions both serve to protect the Bay and better understand the fate of mercury near and from wastewater discharges.

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***PSSEP Recommendation: Compliance with the WLA for all wastewater dischargers should be on a five-year average basis.***

**Watershed Permits, Individual WLAs, and Concentration Triggers:**

POTWs: The Regional Board proposes to issue a watershed NPDES permit for all municipal wastewater dischargers. If the group exceeds an annual allocation, the Regional Board will consider enforcement against those who exceed their individual WLA. The approach to individual WLA for POTWs has changed significantly between the June 2003 Draft and the April 2004 Draft. The April 2004 Draft calculates individual allocations based on the fraction of the mercury that plant dischargers compared with other POTWs. The June 2003 Draft calculated the individual WLA based on percentage of flow. Both of these methods do not result in fair individual allocations, and must be revised.

In the April 2004 Draft, POTWs with advanced treatment and aggressive source control programs are penalized due to their low effluent concentrations of mercury. In the June 2003 Draft, treatment plants with only secondary treatment capability would have a hard time meeting the individual allocation, forcing expensive improvements to meet the individual WLA if the group WLA was exceeded.

Determining a fair, equitable, and rational approach for individual WLA is extremely difficult since many factors, such as unused permitted capacity, future growth projections, wet weather or economy-based impacts on flows, recycled water use and potential for recycled water use all differ from POTW to POTW.

PSSEP is also concerned that individual mass allocations will be implemented directly into NPDES permits at some time in the future, especially given that instruction not to include the individual WLAs in individual NPDES permits is never clearly stated in the proposed Basin Plan Amendment. The proposed Basin Plan language on page A-11 (second bullet) requires the permit contain water quality based effluent limits (WQBEL) consistent with the assumptions and requirements of the WLA. This language may be interpreted that individual mass limits and concentration limits, rather than triggers, should be included in NPDES permit as WQBELs. PSSEP recommends that this language be changed to clearly state that the WQBEL is the group WLA. Individual WQBELs for dischargers would be the concentration calculated for the different types of treatment.

PSSEP believes that the individual WLA are unnecessary and should be removed from the TMDL and the proposed Basin Plan Amendment. Unless removed, POTW dischargers will be subject to a watershed permit with a group WLA and concentration trigger appropriate for the level of treatment available. PSSEP does not believe that individual WLA add a necessary level of protection. We support additional evaluation

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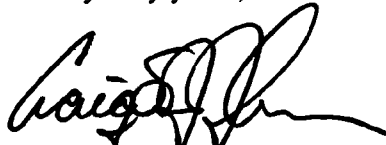
requirements for individual POTWs if the group WLA is exceeded and the individual's concentration limit is exceeded. The process is not enhanced by individual WLA that were determined by a random approach that does not consider the individual POTW. Concentration triggers serve to protect against local adverse effects in the vicinity of the discharge.

**Industrial Dischargers:** The April 2004 Draft proposes to include a group WLA into the permits of refinery dischargers and individual WLA in the permits of other industrial dischargers. As mentioned in our comments on WLAs, PPSEP believes that compliance for industrial dischargers should be measured as a collective group. We believe this could also be achieved through a watershed permit. For similar reasons as just outlined for POTWs, and due to the limited data from some dischargers, PSSEP also advocates that individual WLA for industrial wastewater dischargers be deleted and concentration triggers be used to determine further action when the group mass load is exceeded.

***PSSEP Recommendation: (1) the tables depicting individual WLA should be deleted from both the Mercury TMDL and the proposed Basin Plan amendment. (2) Concentration triggers should be the controlling factor to require additional evaluation and possible pollution prevention or other activities when the group WLA is exceeded. (3) Bullet 2 on pages A-11 and A-12 should be replaced with a statement that permit should contain the group WLA mass limit.***

Thank you for the opportunity to provide these comments on the April 2004 Draft Mercury TMDL. We look forward to working with you and your staff in resolving these issues before final consideration by the Regional Board.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Craig S.J. Johns', with a stylized, flowing script.

Craig S.J. Johns  
Executive Director





June 14, 2004  
Bruce Wolfe, Executive Officer  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, 14<sup>th</sup> Floor  
Oakland, CA 94612

Subject: Comments on the "Mercury in Bay", Total Maximum Daily Load Proposed Basin Plan Amendment and Staff Report, April 30, 2004.

Dear Dr. Wolfe:

This letter constitutes the Port of Oakland's comments on the proposed TMDL program. While we will provide a number of detailed comments on aspects of the program, I would like to start by praising the efforts of your staff. Overall, the proposed Basin Plan Amendment and staff analysis is rigorous and balanced. The staff work exhibits, in most parts, a good understanding of the statistical limitations of the available data, and proposes continuing monitoring and/or research to narrow the bounds of uncertainty. To improve the rigor of the effort, the staff has used the university community to provide for peer review of the proposal. Given the magnitude of the problems posed by the legacy of mercury and gold mining in the tributary watersheds of San Francisco Bay, and the substantial data gaps in information about mercury loads, your staff has come up with a credible and responsible program. We will urge in these comments that you provide in the program incentives for creative actions that might better sequester legacy mercury contaminants, and that you integrate this effort with regulatory policies in your implementation of the California Toxics Rule, and in the Long Term Management Strategy to achieve the purpose of this TMDL program.

#### WASTELOAD ALLOCATION TO DREDGERS

The staff report accurately portrays the role of dredging as moving contaminants that are already in the Bay to another location, where they **might** be more available. It also identifies the likely scenario that the LTMS policies will result in material being removed from the Bay and thus that dredging will represent a net loss. Two aspects of the general proposal concern us. First, the concept of an allocation based on the ambient in-Bay concentration, while appearing reasonable, may be fraught with serious statistical problems in implementation. The statistical limitations of existing data, and possible approaches to implementing this concept, might result in material that is well within the scatter of data about ambient sediment quality being rejected for in-Bay disposal. We have begun a dialogue with your staff, and will continue our efforts to try to see this term defined efficiently and accurately.

The second concern we have about the concepts in the report involving regulation of dredging comes from the language at the bottom of page 78 and continuing on to page 79 that provides:

...we propose requirements in the dredging permits to investigate the potential for dredging to enhance mercury uptake. The requirement can be satisfied by supporting or conducting investigations that result in this information being made available to the Water Board beginning with the first adaptive implementation review.

While we recognize the authority of the Regional Board to mandate monitoring, that authority is qualified by the “reasonableness” test. Since dredgers do not create the in-Bay contaminants that they must dredge to maintain navigable channels, it is only reasonable to ask that the dredgers investigate whether or not dredging and subsequent disposal could increase the potential for uptake of mercury from dredging and in-Bay disposal. The Port of Oakland’s recent dredging record involves disposal of the vast majority of dredged material from deepening and maintaining the Federal Navigational channel outside of the Bay, where it removes mercury from the system. We also participate financially in the Regional Monitoring Program at a rate far above any estimates of our relative contribution as a discharger, thus, we think that we have already satisfied the proposals of the TMDL program.

#### ASSUMPTIONS AND ADAPTIVE IMPLEMENTATION

We are particularly impressed with the Board staff’s approach to data limitations in developing this TMDL. The approach that begins on page 86 under “Management Questions” is clear, well organized, and identifies the key assumptions that the staff has made to develop the TMDL and the necessary steps to refine those assumptions. In particular, we endorse your approach to investigation of the uptake of mercury, and your clear intent to try to ascertain whether there are differences in the potential for biological uptake in the various forms that mercury may take. The report identifies (page 59) the assumption that mercury, whether “inorganic, elemental, chemically bound, or not bound” is equally likely to be converted to methylmercury and thus likely to enter the food chain. To these distinctions, we would urge you also consider grain size and mineral province, which might provide physical as well as chemical barriers to uptake. With these additions, we endorse the further investigation of this uptake pathway proposed.

We urge you to establish a greater specificity in your work program for adaptive implementation, particularly with respect to the assumptions made about the active sediment layer, and the potential for erosion and subsequent uptake of mercury enriched sediments. The uniform assumption about the active sediment layer that is made in the TMDL effort derives from assumptions made by SFEI in developing the box model for sediment, that is, that the active sediment layer in the Bay is 15 centimeters. As we have commented on multiple occasions, this assumption, while a reasonable starting point, does not reflect the physics of the Bay. We would like to see the plan of investigation of

the active layer made more specific, since the erosion and re-suspension of sediments is one of the assumptions most critical to loading estimates. We think that investigations in adaptive implementation should, as a high priority work item, identify the areas of highest shear stress in the Bay. We believe that there are two candidates, and a better understanding of the physics of sediment erosion and re-suspension in these areas is critical to adaptive implementation. The highest priority area should be the deposits in Suisun Bay because they contain a mass of bedded mercury with the highest concentration in benthic sediments. Erosion of those sediments from their location upstream of habitat in San Pablo Bay could lead to subsequent deposition in mudflats or wetlands where those sediments could increase methylation rates. The critical shear stress that will affect erosion in that area of Suisun Bay is associated with flood velocity. There should be information available from flood modeling of the river, the ongoing USGS stations, and the recent work by Lester McKee of SFEI that would allow reasonable estimates of velocity profiles during erosive events. That information can and should be used to refine estimates of inputs. The second highest priority area should be San Pablo Bay because the bedded sediments there are also substantially enriched, and because the wave fetch for seasonal wind waves is sufficient to generate substantial waves and associated bottom shear stress. That shear stress can be readily measured, or hind cast from wind data. Information about shear stress rather than assumptions about the active layer should be used to refine our understanding both of the active sediment layer in this region of the Bay, and of erosion potential.

A review of the morphological changes in San Pablo Bay since initiation of gold mining will illustrate this issue. By 1902, a navigational channel had been dredged across Pinole Shoal, but had disappeared in response to currents and the outflow from the Delta. By 1919, a new navigational channel had been dredged and a sheet pile breakwater had been partially constructed. The breakwater can now be seen as a massive structure that prevents shoaling of sediments eroded by wind waves into the Carquinez Strait. That breakwater has trapped nearly 100 million cubic yards of sediment in a broad expanse of tidal marshes and mudflats. That marsh system was not present when hydraulic mining began, and is clearly the product of material reworked from the shoals in San Pablo Bay and brought to the shoreline, where it is anchored by the breakwater.

Examination of the accreted marshes and mudflats along the perimeter of San Pablo Bay, and of recent wetland restoration efforts near the mouth of Petaluma Creek can provide valuable clues to the morphological forces that have shaped the system, and the fate of the mercury present in the system. Core samples can reveal both the types of sediment that have been moved and deposited, and the sequestering of mercury within the accreted areas. Methylation rates at the historically created marsh, and the recently restored marshes, can be compared for valuable clues in the stages of mercury cycling over the maturation of a restored marsh. Mercury levels can be measured from egg shell studies to determine the pattern of uptake in the Clapper Rail. In effect, we have the pilot projects in place to examine and determine what lessons we need to draw upon as we approach wetland restoration planning for both the North and South Bays.

We recommend that you use this testing of the existing marshes in the North Bay to develop the aspects of the adaptive implementation program referred to on pages 85 and 90 (the relationship between mercury concentrations in sediment and in the food web), and before defining further the regulatory measures alluded in the bullet at the bottom of page 62.

#### AREAL VARIATION OF MERCURY ENRICHMENT AND LOADING FROM EROSION

We have been involved in discussions with staff about their estimates of the loading from erosion, and the current version of the TMDL report provides a clear analytical framework for the estimates of loads associated with erosion. Again, this represents a reasonable starting point. However, it is impossible to account for all of the mass of mercury that might have been discharged into the Bay as a result of mining and rendering gold ore. One estimate of the mass of mercury associated with mining; Davis (citing R. K. Churchill in a 1999 talk (2003)) was that 2.4 to 4.8 million kg of mercury were released with the hydraulic mining debris. Better estimates about total sediment loads are available through Bruce Jaffe's work on bathymetric changes in San Pablo and Suisun Bays. That mapping effort shows that roughly half of the estimated sediment load of mining can be accounted for in deposits in San Pablo and Suisun Bays. Yet the volume of mercury subject to continued erosion in the staff report, 50,000 kg, differs substantially from any estimates that might be derived from Churchill's work. While we are not recommending any change in the staff report, we are urging that specific work be targeted to provide a better estimate of the mass of mercury that might be subject to erosion.

#### CREATE FLEXIBILITY IN IMPLEMENTATION

At present, the staff report calls for a reduction in loads from urban water runoff of 78 kg/year, nearly a 50% reduction. It is not clear whether this would be accomplished by physical measures, best management practices, or by waiting until the watershed supplies of enriched mercury are washed through the system. While it is not our intent to comment on the regulation of urban runoff, we would urge that the Board consider a flexible policy framework that would allow load reductions through innovative measures. For example, it might be substantially cheaper for urban runoff dischargers to sequester mercury sediments that are already in the system—perhaps by removing near shore deposits in some area, or capping sediments in another area, or removing sediments from an eroding stream.

To suggest one hypothetical example of such a concept, consider sediments located in Suisun Bay that might be subject to erosion. If such sediments were equivalent to a load reduction of 78 kg/yr, and could be sequestered in a site like the Montezuma wetlands site for lower costs than removing sediments from storm drains, both the Bay and the dischargers would benefit. Removing sediments before they enter San Pablo Bay would provide superior benefits to wetlands fringing the margin of the Bay. This option should also reduce the residence time of mercury in the system as compared to mercury in the

Central Bay since mercury at the northern end of the Bay is much further from the exit path through the Golden Gate.

## INTEGRATE THE TMDL EFFORT WITH OTHER WATER QUALITY PROGRAMS

In order to implement the TMDL, it may be necessary to recognize that program in some of your other efforts, and modify some of the policy framework. We will provide several examples of how this might be done.


- a. Integrate with restoration goals of the LTMS. Currently, the LTMS calls for reuse of 40% of the sediment generated through dredging by reuse in wetlands. Management of mercury methylation in wetlands might dictate certain approaches in wetland design or in the timing of wetland restoration that might require adjustment of this goal, at least during the initial stages of adaptive implementation. Certainly, as a dredger, we would be unwilling to absorb the entire responsibility for analyzing and managing mercury uptake in a multi-user dredged material reuse site. Further thinking is needed to make sure that the LTMS policies are not rendered moot by the mercury TMDL, and that we continue to pursue wetland reuse of dredged material in an environmentally responsible manner.
- b. Consider using wetland restoration sites to sequester mercury sediments and reduce risk. As mentioned above, the Montezuma wetlands restoration site could be used to remove sediments from areas of Suisun Bay where they would be expected to erode in a major flood. This option might be a way to reduce the cost of restoring those wetlands, as well as a way to reduce the environmental risk of the sediments as they are currently present in the environment. Making that option environmentally and economically feasible might require amendments to the Wolfenden Carlin criteria, and possibly to the implementation tools for the California Toxics Rule. These will be discussed in sequence.
- c. Consider modifying the wetland non-cover criteria for mercury and PCB's. When the Wolfenden-Carlin guidelines were prepared, they were intended to represent a conservative approach to ensuring that wetlands could be restored using dredged material with minimal risk. The criteria did not consider either the nature of wetlands that were formed through reworking of fluvial sediments, or the risk that fluvial sediments posed to re-contaminate restored wetlands. We can see the results in the regulatory standards for the Montezuma project—the wetland non-cover limits for that project are substantially lower than the background mercury levels in Suisun Marsh. The elevated mercury levels within the Suisun Marsh are strong evidence that this system was affected by transport of sediments from the gold mining era. Given the very high cost that we are paying to use the site, and the lack of other dredgers who are committed to use the site, the regulatory effort seems to be overzealous. It seems to us counterproductive to set criteria for restoration at this site as low as they have been set—these criteria may prevent completion of restoration of the site economically, and may also

prevent utilization of the site for reducing mercury risk. It seems more appropriate to us to integrate wetland and chemical restoration in a manner that reduces ecological risk.

d. Consider modifying the CTR provisions to allow higher concentrations as part of either sediment clean-up or habitat restoration. The Port of Oakland has had experience with taking "chemically challenged" material to an upland site at Galbraith Golf Course in order to cap a landfill. That effort removed well over 99.99% of the sediments of concern from the Bay. Testing of the material after placement showed that it was nearly the same chemically as that material placed at Sonoma Baylands, suggesting that either the testing protocol was extremely conservative and average levels were below those in the test samples, or that organics were broken down somewhat in the upland placement. While we generally met discharge requirements under the previous Basin Plan, it is unlikely that we could have met the requirements of the CTR. We would suggest that the CTR be implemented in a manner that allows the Board to consider clean-up of sediment hot spots at the Bay margins, or habitat restoration, without meeting those requirements or using an outfall to dilute the discharge. In those cases, the loss of a tiny fraction of the material would not diminish the project accomplishments. On the other hand, controlling the rate of runoff from sediment placed in either a wetland restoration project or a sediment clean-up project, could seriously undermine the feasibility of the project, or increase the cost of sediment remediation without commensurate benefit.

e. Consider the habitat value of contaminated sites at the Bay Margin. While the report mentions the possibility of remediating sediment in sites with elevated mercury levels at the margins of the Bay, the analytical framework for this concept is quite complicated because some of those sites have substantial habitat value despite elevated levels of contamination. I have already mentioned Suisun Marsh, but central Bay sites like Castro Cove and San Leandro Bay are similar in supporting substantial habitat values even though contaminated. It may well be that the levels of contamination in these systems are high enough to represent a substantial ecological risk; perhaps from elevated mercury levels in the endangered Clapper Rail. In that case, the loss of habitat during remediation may well be warranted. However, each of these cases deserves careful scrutiny.

Very truly yours,



Jim McGrath  
Environmental Manager



## WaterKeepers

June 14, 2004

Via Electronic Mail

Bill Johnson, Environmental Scientist  
Richard Looker, Environmental Scientist  
San Francisco Regional Water Quality Control Board  
1515 Clay St., Suite 1400  
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**Re: April 30, 2004 Proposed Basin Plan Amendment on Mercury TMDL for San Francisco Bay**

Dear Mr. Johnson and Mr. Looker:

I am writing today on behalf of San Francisco Baykeeper, a project of Waterkeepers Northern California, and its members ("Baykeeper"), to offer the following comments on the proposed Basin Plan amendment for the Mercury TMDL in San Francisco Bay ("Basin Plan Amendment"). Baykeeper appreciates the time and energy that the San Francisco Bay Regional Water Board ("Board") has spent developing a TMDL for the serious mercury problem in San Francisco Bay. The TMDL process offers the Board a unique opportunity to meaningfully reduce mercury loads into the Bay and to make lasting improvements to the health of the region.

Unfortunately, the Basin Plan Amendment, as currently proposed, squanders this unique opportunity through an implementation plan that aims to attain water quality standards after 120 years. Through a number of other flaws, the Basin Plan Amendment also violates the Clean Water Act ("CWA"), California's Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California ("SIP"), and the California Environmental Quality Act ("CEQA"). Baykeeper strongly urges the Board to address the failures underlying the Basin Plan Amendment identified herein and to take significant steps to immediately reduce mercury levels in the Bay.

### **I. GENERAL COMMENTS**

#### **A. Mercury Is Impairing The Bay And The Board Should Use This Opportunity To Protect At-Risk Communities and Beneficial Uses**

It is widely documented that the Bay is impaired by mercury, and in fact, has no assimilative capacity for additional mercury discharges. The whole purpose of the

TMDL process is thus to limit discharges of mercury into the Bay in order to move towards meeting water quality standards. The one-box model used to present mercury loads and waste load allocations under this TMDL seems to credit natural attenuation due to export of historically enriched sediment as a reduced load allocation for “bed erosion.” This model on which the Basin Plan Amendment is based seems insufficient and is confusing. While it is true that we can expect a decrease in the total mass of mercury in the Bay due to natural outflow of enriched sediment, the rate of future attenuation is more uncertain than the presentation suggests. Additionally, the model assumes that the enriched sediment will be gradually replaced by “cleaner” sediment, but given the Basin Plan Amendment’s failure to meaningfully decrease mercury loadings into the Bay from, for example, air sources, and wastewater dischargers, the real-world situation is unlikely to be as clean as the model implies.

Furthermore, even if sediment concentrations of mercury are reduced through natural attenuation as suggested by the model, it has been widely documented that total mercury in sediment correlates poorly with mercury in fish tissue. Thus Board Staff’s attempt to impose a linear relationship between mercury in sediment and mercury in fish may not be supported by the evidence.<sup>1</sup> In general, Board Staff understates the uncertainties regarding whether reductions in mass mercury in the Bay – even if achieved – will actually reduce fish tissue concentration of mercury.

This uncertainty is unnerving and seems irresponsible on the part of Board Staff because exposure to mercury has been frequently linked to adverse reproductive and developmental health effects in fish, bird and other wildlife species.<sup>2</sup> When humans consume enough mercury-contaminated fish, they may suffer from severe health effects including headaches, impaired fine motor skills, a weakened immune system, kidney failure, deafness, blindness, mental retardation and death. Fetuses are highly at risk when their mothers consume mercury-tainted fish; they may suffer from various health problems including delayed onset of walking and talking, altered muscle tone, mental retardation, cerebral palsy, deafness and blindness. Some of these health effects have already been documented in wealthy Marin County residents.<sup>3</sup> To date no studies have been done on subsistence fishing communities that actually eat fish out of San Francisco Bay. Studies of these populations are imperative and should be undertaken or assigned by a TMDL process that must assess the environmental impacts of Bay mercury on human health.

According to studies by the Environmental Working Group and Natural Resources Defense Council, impacted community members who fish from piers in San Francisco Bay regularly catch halibut, white croaker, walleye, certain sharks and

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<sup>1</sup> See e.g., USGS 2003 “A National Pilot Study of Mercury Contamination of Aquatic Ecosystems along Multiple Gradients” at 14. [www.cerc.cr.usgs.gov/pub/center/pdfDocs/BSR2001-0009.pdf](http://www.cerc.cr.usgs.gov/pub/center/pdfDocs/BSR2001-0009.pdf).

<sup>2</sup> Barnhart et al., Mercury: Global Problems, Local Solutions, Columbia University, April 2004.

<sup>3</sup> Hightower JM, Moore D., Mercury levels in high-end consumers of fish. *Environ Health Perspect.* 111(4):604-8, 2003.



rockfish<sup>4</sup> all of which are known to have levels of mercury dangerous for pregnant women, breast-fed infants, and young children.<sup>5</sup> Studies have found that the majority of Bay anglers, up to 70%, are people of color including Asians and Latinos.<sup>6</sup> A significant portion of these anglers, up to 42%, had not heard of government health warnings about eating Bay fish.<sup>7</sup>

The Basin Plan Amendment should take immediate actions to warn these consumers, especially the non-English speakers, of the threat to their health and their children's health that these mercury-laden fish pose. Not only does the Board have a responsibility to notify these communities of the threats related to subsistence fishing, but Board Staff should also come up with alternate solutions for those who cannot afford to obtain their protein in other ways, at least until mercury levels in Bay fish diminish. Additionally, it is necessary for the Board to educate these communities about the signs of mercury poisoning and to make sure everyone, including the physicians generally responsible for treating subsistence fishing communities, know the symptoms of mercury poisoning.

Mercury pollution in the Bay is adversely impacting not only human health and wildlife habitat, but also the San Francisco commercial and sportfishing industries, which results in direct impacts to the local economy. Ten million pounds of fish worth \$8.2 million were landed at the San Francisco port in 2003; and although striped bass, halibut and other fish are found in San Francisco Bay, no fish from the Bay can be sold at retail markets today.<sup>8</sup> Additionally, recreational fishing is the second most popular activity in the United States and provides nine times the economic benefits of commercial fishing. California is ranked second in the nation in overall economic output from the sportfishing industry, with estimates of total economic output for 2001 between \$2-5 billion.<sup>9</sup> (The U.S. Fish & Wildlife Service reports that anglers in California spent over \$2 billion in 2001; the American Sportfishing Association reports the 2001 total economic output in California from sportfishing as \$5 billion.) However, in recent years, sport fishermen are no longer able to consume their catch due to mercury and PCB contamination and thus they have significantly reduced the number of days they fish, to the detriment of the state economy.<sup>10</sup>

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<sup>4</sup> See [www.nrdc.org](http://www.nrdc.org)

<sup>5</sup> See [www.ewg.org/reports/BrainFood/sidebar.html](http://www.ewg.org/reports/BrainFood/sidebar.html)

<sup>6</sup> See [www.nrdc.org/greengate/health/fishv.asp](http://www.nrdc.org/greengate/health/fishv.asp)

<sup>7</sup> See *id.*

<sup>8</sup> <http://www.nrdc.org/greengate/health/fishv.asp>

<sup>9</sup> <http://www.census.gov/prod/2002pubs/fhw01-ca.pdf>;

[http://www.asafishing.org/asa/images/statistics/economic\\_impact/fish\\_eco\\_impact.pdf](http://www.asafishing.org/asa/images/statistics/economic_impact/fish_eco_impact.pdf)

<sup>10</sup> Clear The Air, [cta.policy.net](http://cta.policy.net)

**B. This TMDL Should Explore Possibilities To Reduce Mercury And To Achieve Water Quality Standards In A More Timely Manner**

While the Basin Plan Amendment correctly states that the “mercury problem in San Francisco Bay may take decades to solve” and that “there are activities that should be taken immediately to help manage the risk to consumers of mercury-contaminated fish,”<sup>11</sup> Baykeeper does not believe that this Basin Plan Amendment represents a good-faith effort to solve the mercury problem or to manage the risk to consumers. Given that the TMDL predicts that Bay fish will continue to have unacceptable levels of mercury for at least 120 years, and that the feasibility of control measures is highly uncertain, risk management should be a major focus of the Basin Plan Amendment and the Board’s future actions with regard to mercury. The Basin Plan Amendment, however, only devotes one paragraph and three bullet points to risk management, all of which refer to activities that are already being implemented.

There are a number of actions that the Board can take right now to reduce mercury contamination in the Bay.

First, Board Staff should include in the Basin Plan Amendment immediate plans to clean up the great number of leaching mine sites that drain into the Bay watershed. In fact, US EPA recommends many techniques to remediate these types of sites. Two of the largest mercury mine sites in the Bay Area watershed are the New Almaden mining district in Santa Clara County and New Idria mine in San Benito County.<sup>12</sup> These mines drain into the San Francisco Bay watershed and are rated by the Office of Mine Reclamation as having the highest potential environmental. Other mines draining into the Bay watershed with potentially significant environmental hazard ratings are in nearby Napa and Marin counties. These sites should be remediated and restored so that these historic mercury sources are no longer contributing to the mercury problem in the Bay.

Other states have successfully adopted strategies to remediate contaminated mine sites. As in the October 15, 1999 TMDL and Implementation Plan for Mercury, Pena Blanca Lake, Arizona, the mercury TMDL for San Francisco Bay should include a plan for aggressive remediation of contaminated mine waste and tailings at the numerous mine sites polluting the watershed.<sup>13</sup> The TMDL should also provide for ongoing monitoring of the mine sites and responses within the Bay, including after the remediation activities are complete. US EPA also describes in detail various conventional and innovative technologies to remediate leaching mine sites. The conventional technologies have a successful track record in mine site cleanup, and include technologies such as chemical treatment, stabilization, solidification, extraction techniques, soil washing or flushing, cutoff walls, capping, detention and sedimentation, erosion controls and diversions.<sup>14</sup>

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<sup>11</sup> Proposed Basin Plan Amendment at A-15.

<sup>12</sup> [www.consrv.ca.gov/OMR/abandoned\\_mine\\_lands/california\\_abandoned\\_mines/volume1.pdf](http://www.consrv.ca.gov/OMR/abandoned_mine_lands/california_abandoned_mines/volume1.pdf)

<sup>13</sup> [www.epa.gov/waters/tmdl/docs/919.pdf](http://www.epa.gov/waters/tmdl/docs/919.pdf)

<sup>14</sup> [www.ott.wrcc.osmre.gov/library/hbmanual/epa530c/chapter10.pdf](http://www.ott.wrcc.osmre.gov/library/hbmanual/epa530c/chapter10.pdf)

Several university studies also suggest innovative techniques to lessen the toxic effects of mercury-laden mine waste, such as treating mine tailings with a carbon source such as whey, or mixing organic matter such as biosolids with inorganic mine waste to make soil that can support vegetation to stabilize the mine tailings and reduced wind erosion.<sup>15</sup>

Second, the alternative management strategy of increasing the loading capacity for mercury in the Bay should also be considered. The Basin Plan Amendment should address innovative new techniques to clean up existing mercury in sediment, or at least slow down the mercury methylation process. This strategy has been adopted successfully by other states with aquatic mercury pollution.<sup>16</sup> Various management intervention methods may decrease rates of bacterial methylmercury production or increase rates of burial and sequestration of mercury in sediment. The applicability of such methods to the San Francisco Bay should be studied. Strategies include aeration and mixing, sulfur chemistry modification, alum treatment, and sediment dredging. Board Staff should not only review these strategies adopted by other states, but should also look at US EPA recommendations for innovative and emerging technologies for remediation of existing sediment contamination, including bioremediation, phytoremediation and vitrification.<sup>17</sup>

Third, Board Staff should use the Basin Plan Amendment process to include specific proposals to be included in adaptive implementation. These must include measures to mitigate and compensate for damage to human health, including means to assist the most affected communities with dietary change and health monitoring. Board Staff should also be using this process to identify measures that might compensate for ecological risk to wildlife, including habitat restoration or other means that can help compensate for the impacts of mercury on reproductive success. In this regard, actions related to “Bay margin contaminated sites” or mercury hot spots, should receive higher priority and more emphasis than is given in the proposed amendment.

While Board Staff proposes to require additional monitoring, reporting, and quantification at some unidentified point in the future, the Basin Plan Amendment contains not one strategy that would actually speed up the pace of investigation and remediation of these sites or create assimilative capacity in the watershed.

### **C. The Proposed Basin Plan Amendment Sends The Wrong Message**

Baykeeper appreciates that the existing mining legacy in California continues to contribute to mercury loadings in the Bay. We also appreciate that under the Basin Plan Amendment some sources of mercury loadings will be somewhat reduced within twenty

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<sup>15</sup> [www.montana.edu/commserv/csnews/nwview.php?article=1617](http://www.montana.edu/commserv/csnews/nwview.php?article=1617);  
<http://cals.arizona.edu/media/archives/6.2.html>

<sup>16</sup> See e.g., TMDL and Implementation Plan for Mercury, Arivaca Lake, AZ, October 15, 1999.  
[www.epa.gov/waters/tmdl/docs/17.pdf](http://www.epa.gov/waters/tmdl/docs/17.pdf)

<sup>17</sup> [www.ott.wrcc.osmre.gov/library/hbmanual/epa530c/chapter10.pdf](http://www.ott.wrcc.osmre.gov/library/hbmanual/epa530c/chapter10.pdf)

years and that attempts are being made under the TMDL to issue individual allocations for wastewater dischargers. But the Basin Plan Amendment remains seriously flawed.

There are many problems with the plan as proposed. First, the Bay has no assimilative capacity for mercury, and until this capacity is available, there cannot be any net loading into waterways that lead to the Bay. Any mercury loading without assimilative capacity violates the CWA and the TMDL program. Second, under the plan, municipal wastewater and industrial waste water dischargers are not required to do anything to reduce their loadings from current levels. And they are still essentially dealt with in the aggregate. The Board's most controllable sources of mercury, therefore, have no reason to reduce a single gram of mercury discharged into the Bay. And third, not only do the dischargers have three different options for "calculating" or manipulating their numbers to show compliance, but exceedences of allocations will trigger only the writing of a report and not monetary fines as required under the Clean Water Act. Requiring dischargers to simply summarize their violations of the limits in different ways with a cover page on top does not create any incentives to reduce inputs into the Bay.

The fatal flaws contained in the Basin Plan Amendment send one clear message to the dischargers: the Board is going to go out of its way to allow business as usual. These same flaws send another message to the public: the Board cares more about keeping dischargers happy than about public health or the health of our aquatic ecosystems. We urge the Board to send a different message; a message with vision, which encourages producers and dischargers of mercury to figure out innovative ways to stop mercury loadings into the Bay, or which creates an incentive for dischargers to clean up the mercury in Bay sediment in order to increase assimilative capacity. Given the serious threat that mercury poses on the environment and public health, Baykeeper believes that this different message is the Board's only true option as the responsible agency for protecting the Bay's waters and communities.

#### **D. TMDLs Are The Clean Water Act's Safety Net**

There is no doubt that Section 303(d) represents the Clean Water Act's "safety net."<sup>18</sup> It is the bedrock component of the CWA by requiring that all waters be restored to levels safe for fishing and swimming, as well as achieving levels to meet all other water quality standards.<sup>19</sup> As a U.S. EPA Assistant Administrator for Water noted:

Almost twenty-five years after the passage of the [Clean Water Act], the national water program is at a defining moment . . . . The [TMDL]

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<sup>18</sup> Houck, Oliver A., *The Clean Water Act TMDL Program* 49 (Envtl. Law Inst. 1999).

<sup>19</sup> See 33 U.S.C. § 1313(d).

program is crucial to success because it brings rigor, accountability, and statutory authority to the process.<sup>20</sup>

TMDLs are “the maximum amount of pollutants a water body can receive daily without violating the state’s water quality standard.”<sup>21</sup> Specifically, Section 303(d) requires the states to identify, and U.S. EPA independently to review and assess, those waters within their boundaries for which existing technology-based pollution controls are not stringent enough to ensure that the water quality standards applicable to such waters are achieved and maintained.<sup>22</sup> For each water body and pollutant listed on a 303(d) list, the state must calculate the Total Maximum Daily Load necessary to implement the applicable water quality standards.<sup>23</sup> In simple terms, then, each TMDL defines the maximum amount of a pollutant (*e.g.*, oil, pesticide, metal) that an individual water body can assimilate in a day without violating its water quality standards (*i.e.*, without becoming “dirty”). Once a TMDL is calculated for a water body and pollutant, any allowable pollution is allocated among the various dischargers of that pollutant to the water body for which the TMDL has been established.<sup>24</sup>

## **II. SPECIFIC CONCERNS REGARDING THE BASIN PLAN AMENDMENT**

### **A. The Implementation Timeframe Is Too Long Because Meaningful Action Can Be Taken Now**

Baykeeper strongly opposes the 120-year implementation schedule that underlies this Basin Plan Amendment. The Clean Water Act does not contemplate such incredibly long implementation schedules, and in fact, unfalteringly requires that effluent limitations and water quality standards be met within three years after adoption.<sup>25</sup> The CWA also articulates a goal of achieving fishable, swimmable, and navigable waters by 1983.<sup>26</sup> Board Staff’s 120-year timeline, therefore, makes a mockery of the spirit and letter of our nation’s Clean Water Act.

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<sup>20</sup> New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs), Memorandum from Robert Perciasepe, Assistant Administrator for Water, U.S. EPA, to Regional Administrators and Regional Water Division Administrators, U.S. EPA (August 8, 1997).

<sup>21</sup> Alaska Center for Environment v. Browner, 20 F.3d 981, 983 (9th Cir. 1994).

<sup>22</sup> 33 U.S.C. § 1313(d)(1) and (2); *see also* 40 C.F.R. § 130.7(b)(1).

<sup>23</sup> 33 U.S.C. § 1313(d)(1)(C).

<sup>24</sup> 40 C.F.R. §§ 130.2(g)-(i). The TMDLs must be set “at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.” 33 U.S.C.A. § 1313(d)(1)(c).

<sup>25</sup> *See* 33 U.S.C. § 1311(b).

<sup>26</sup> *See* 33 U.S.C. § 1251(a).

Similarly, the improperly long timeframe also violates California's water quality regulations. While the SIP does allow for longer implementation schedules for waters regulated by TMDLs, it in no way permits 120 years for compliance. In fact, the SIP states "the schedule of compliance must be as short as practicable" and must "demonstrate progress towards attainment" of water quality standards.<sup>27</sup> There can be no disagreement that the implementation plan proposed through the Basin Plan Amendment is neither short nor able to demonstrate eventual attainment.

This 120-year timeframe for the Bay's recovery from past and ongoing mercury degradation is completely unacceptable because, as seen by the possible solutions above, we are not convinced that the Board Staff and dischargers are doing everything that they can do now to alleviate the mercury problem. While there arguably may not be any fast solution to eliminating the existing mercury in sediment, there certainly are actions that current dischargers of mercury can take to significantly reduce their loads within the short timeframes envisioned by the CWA and the SIP.

Specifically, a twenty-year compliance timeframe for urban stormwater runoff and the Guadalupe River and Central Valley watersheds to simply reduce their loads by half is unjustified. The SIP states that "in no case" shall the schedule of compliance for point source dischargers exceed "up to five years" for compliance with TMDL-derived effluent limitations.<sup>28</sup> If dischargers cannot immediately comply, they must justify any extension of "up to five years"<sup>29</sup> by submitting "documentation of source control and/or pollution minimization efforts currently underway and a proposed schedule for additional source control measures and pollutant minimization actions."<sup>30</sup> It is not apparent that the mercury dischargers here have provided a level of justification enough to warrant even a 5-year schedule, and they have certainly not justified a schedule that only attempts to achieve partial compliance with water quality standards. Furthermore, there is absolutely no justification for allowing municipal and industrial wastewater dischargers off the hook entirely.

Under this schedule, no one alive today will live to experience this theoretical recovery. More importantly, perhaps, the Basin Plan Amendment's attempt to go more than a century without assimilative capacity in the Bay Area watershed but continue mercury input into the Bay exacerbates the mercury pollution problem. This ill-fated attempt also underscores the TMDL's other flaws and renders the whole process unacceptable. It is all too probable, in fact, that the plan proposed through this TMDL process could fail to lead to recovery even after 120 years. Therefore, Baykeeper urges the Board to implement more creative solutions to try to reduce new mercury inputs into the Bay.

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<sup>27</sup> SIP (2000) at 4.

<sup>28</sup> *Id.* at 19-20.

<sup>29</sup> *Id.*

<sup>30</sup> *Id.* at 4.

## **B. Allocations Should Be Zero Until There Is Assimilative Capacity**

A TMDL must be set at a level that will achieve attainment of water quality standards immediately. Certain sources, such as bed erosion, may be difficult to control and may absorb most or all of the waterway's assimilative capacity. In this situation, the logic of TMDLs requires that the other sources share the remainder of the assimilative capacity. If, as is the case here, the sources that are difficult to control take up all of the assimilative capacity, then all of the controllable sources should receive loads of zero until the assimilative capacity becomes available. According to the TMDL's projections, this should be sometime after 120 years.

Section 303(d) of the CWA takes neither economic feasibility nor consequence into account. It requires that states establish a TMDL for those waters that are not meeting water quality standards. "Such load shall be established at a level necessary to implement the applicable water quality standards."<sup>31</sup> No mention is made, however, of considering the economic feasibility of implementing TMDLs. This "whatever it takes" principle may seem unfair to some dischargers, but it is the law. The law simply insists that sufficiently low loads be set to achieve the relevant standard.

Instead of giving allocations of zero or calling for real reductions in loadings, we are concerned that the TMDL's five-year averagings provides an out to dischargers and can be used to rationalize increased mercury loadings. No legally acceptable rationale for allowing such increases exists given the total absence of assimilative capacity in the Bay. Baykeeper will strenuously oppose any increases in permits and requests that the Basin Plan Amendment eliminate the option to use five-year averages in order to make clear that reductions are necessary.

The TMDL's rationale for failing to reduce the loads allocated to wastewater sources seems to be that the contribution from these sources are small relative to bed erosion. The Basin Plan Amendment, however, does not present a single concrete implementation step to deal with bed erosion. Indeed, the implementation plan does not even include a section on bed erosion. Board Staff at the mercury watershed council meeting acknowledged that they do not expect to see reductions in this source for at least 20-30 years. The report makes clear that without reductions in the contribution of bed erosion, assimilative capacity will not be available until well into the next century. Until that time, then, controllable sources such as wastewater and stormwater should be allocated zero loads and in no event should such sources be permitted to increase their individual contributions.

In particular, the Basin Plan Amendment should make clear that effluent limits based on the TMDL cannot replace more stringent water quality-based effluent limits

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<sup>31</sup> 33 U.S.C. § 1313(d)(1)(C).

(“WQBELs”) or performance based limits (“PBELs”) currently in permits. A waste load allocation may replace a WQBEL or PBEL only when it is more stringent. The CWA’s requirements regarding WQBELs and PBELs are separate and distinct from the TMDL requirements.<sup>32</sup> A WQBEL is required where technology-based limits do not succeed in securing attainment of water quality standards.<sup>33</sup>

Since the Bay will not attain water quality standards for mercury until sometime around 2120, NPDES permits allowing mercury discharge must contain WQBELs until then. In theory, the TMDL’s waste load allocations should be more stringent than WQBELs and PBELs since there is no assimilative capacity. If the Basin Plan Amendment is adopted as framed, however, dischargers may seek to evade the effect of low WQBELs and PBELs that have been calculated for NPDES permits by arguing that these limits have been displaced by the TMDL’s categorical loads. At a minimum, then, permits should contain the most stringent of an individual waste load allocation, an existing water-quality based effluent limit, or an existing performance based limit. The waste load allocation process should never result in permit rollbacks, especially while assimilative capacity remains nonexistent.

### **C. Allocations Must Be Made To Individual Sources, Aggregate Allocations Have No Legal Significance**

The Basin Plan Amendment continues the TMDL’s illegal categorical allocations with respect to Central Valley and Guadalupe River dischargers, to municipal and industrial stormwater dischargers, and to urban stormwater runoff. While the Amendment does assign individual allocations to certain dischargers (e.g., urban stormwater), these individual allocations are superficial because only group allocations are required to be achieved within 20 years.<sup>34</sup> Additionally, as in the case of municipal and industrial wastewater dischargers, an exceedence of the individual’s allocation only results in the writing of a report.<sup>35</sup> In reality, this has the same effect as an individual exemption and provides no accountability for individual dischargers or enforceability against particular sources.

The load must instead be “established at a level necessary to implement the applicable water quality standards....”<sup>36</sup> EPA’s implementing regulations require a TMDL to allocate specific loads to individual sources. Specifically, a waste load allocation is “the portion of a receiving water’s loading capacity that is allocated to one of its existing or future point sources of pollution.”<sup>37</sup> Similarly, a load allocation is “the portion of a receiving water’s loading capacity that is attributed...to one of its existing or

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<sup>32</sup> 33 U.S.C. § 1312(a).

<sup>33</sup> 33 U.S.C. § 1311(b)(1)(c), 2(a).

<sup>34</sup> Proposed Basin Plan Amendment at A-8.

<sup>35</sup> *Id.* at A-11.

<sup>36</sup> 33 U.S.C. § 1313(d)(1)(C).

<sup>37</sup> 40 C.F.R. § 130.2(h). (Emphasis added).



future non-point sources.”<sup>38</sup> Therefore, by essentially allocating loads to categories of sources rather than individual sources, the mercury TMDL violates the CWA.

Additionally, categorical waste load allocations cause unnecessary confusion in the derivation of effluent limitations. The CWA requires that effluent limits developed for permits be equal to or less than the waste load allocations developed in the TMDL.<sup>39</sup> The implementing regulations state that “[w]hen developing water quality based effluent limits, the permitting authority shall ensure that...[e]ffluent limits developed to protect a narrative water quality criterion...are consistent with the assumptions and requirements of any available waste load allocations for the discharge prepared by the State and approved by EPA pursuant to 40 C.F.R. § 130.7.”<sup>40</sup> To have any meaning at all, “consistent with” must mean equal to or less than the waste load allocation. The categorical allocations introduce an obscuring element to these consistency determinations, which we hope is unintentional. Baykeeper urges Board Staff to eliminate this unnecessary and confusing component of the TMDL, if only to make the Board’s monitoring and enforcement jobs easier.

Moreover, the categorical approach slows down implementation by removing all incentives for improving individual performance. The Basin Plan Amendment interposes a complicated group compliance mechanism in place of individual accountability. In an individual allocation scheme, reductions of any single discharger’s mercury loadings below their allocation would benefit the Bay. An exceedence of the allocation would subject the discharger to CWA penalties, thereby creating a strong incentive for more creative solutions to achieve future compliance. In a group allocation scenario the benefits of good performers could and likely would be overshadowed by other dischargers who have not changed their loads. The net result would be to prolong ultimate achievement of water quality standards – in violation of the CWA’s direct mandate. Individual accountability is the tried and true mechanism for achieving pollutant reductions. Baykeeper requests that each mercury source be made accountable for its own output as is required by the CWA and by common sense. Clear individual accountability is the only way to ensure rapid recovery for the Bay.

Lack of information cannot and does not justify the categorical approach. In the case of wastewater dischargers, sufficient information clearly exists to carefully divvy up the categorical allocation and issue real load reductions. But for some inexplicable reason, Board Staff has refused to do so. In the other cases, such as municipal stormwater, Central Valley dischargers, and air sources, where existing loads may not be sufficiently understood, the implementation plan should explicitly set forth how this information will be acquired, a deadline for when it will be acquired, the basis for allocating the individual loads once the information is acquired, and a deadline for

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<sup>38</sup> 40 C.F.R. § 130.2(g). (Emphasis added).

<sup>39</sup> 40 C.F.R. § 122.44(d)(4)(vii)(B).

<sup>40</sup> *Id.* and *EPA NPDES Writers’ Manual*, 1996, at 111.

making the allocations.<sup>41</sup> In the meantime these other sources “should be defined as narrowly as available information allows.”<sup>42</sup>

Finally, the Basin Plan Amendment envisions the writing of a report as a penalty for exceedences. This penalty would be laughable if mercury was not such a serious problem in our watershed. The Board must take its own responsibility to implement the CWA seriously and be crystal clear that the penalty for a violation of waste load allocations and permit effluent limits is always a penalty as defined under the CWA.<sup>43</sup>

#### **D. The Board Has An Obligation To Assign Allocations To ALL Sources**

Even though the Basin Plan Amendment acknowledges that “mercury newly deposited from the atmosphere may be more available for biological uptake” than the mercury already present in the ecosystem, Board Staff continues to fail to take meaningful action with regard to air sources.<sup>44</sup> Board Staff claims that this is because “the extent to which these sources can be controlled is unknown and the Board’s authority to control such sources is limited.”<sup>45</sup> Baykeeper strenuously objects to the Basin Plan Amendment’s failure to allocate loads to local air sources and believes the TMDL is incomplete without this inclusion.

The law is clear that the Board must allocate loads to all sources. If it fails to do so, it is in violation of Section 303(d) of the CWA and also in violation of 40 C.F.R. § 130.2(h). Although some air deposition does come from unknown and uncontrollable sources abroad, a substantial portion of aerially deposited mercury comes from local sources, including power plants, oil refineries, chlorine manufacturers, municipal waste incinerators, and concrete, cement and fabricated metal production facilities, which have, or should have, NPDES permits in addition to Clean Air Act discharge permits. The TMDL indicates that between 10% to 59% of the atmospheric mercury in the Bay Area comes from local sources. This statistic suggests a solid opportunity for reducing the air deposition sources. Given the dire state of affairs described in the accompanying TMDL report, Board Staff cannot afford to pass up any chance to reduce mercury from these known sources. The passing off of this responsibility to US EPA and the Bay Area Air Quality Management District for “investigation” without any real directive is meaningless.<sup>46</sup>

At the July 2, 2003 Watershed Council meeting, Baykeeper raised concerns over the lack of regulations of any atmospheric sources, and the alarming fact that no

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<sup>41</sup> See EPA Memorandum Re: Establishing Total Maximum Daily Load Wasteload Allocations for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs, November 22, 2003, at 4.

<sup>42</sup> *Id.*

<sup>43</sup> See 33 U.S.C. § 1319.

<sup>44</sup> Proposed Basin Plan Amendment at A-13.

<sup>45</sup> *Id.*

<sup>46</sup> See *Id.*

reductions were given to these sources. Staff responded that, at this time and in their opinion, insufficient information exists to allocate loads to air sources. This proposition is clearly false. Many of the local sources of atmospheric mercury are known and understood, are regulated by a sister agency under California EPA, and are regularly monitored. For example, Board Staff's April 1, 2003 memo regarding air sources of mercury deposition makes clear that staff has calculated the mass of mercury in crude oil processed by Bay Area refineries to be 382 kg of mercury per year. The only area of uncertainty seems to involve translating a particular air contribution into a mass load for the Bay. This uncertainty does not excuse Board Staff from establishing an allocation that can be adjusted after more information is obtained. To the contrary, in fact, the lack of information suggests that very stringent loads should be allocated to these sources in order to provide the legally required margin of safety until more is known.<sup>47</sup>

In circumstances such as this where assimilative capacity is zero, there is no justification for delay to further "evaluate the significance of atmospheric depositions"<sup>48</sup> because all sources are contributing to the Bay's nonexistent capacity. As such, each and every local, controllable source must be regulated. "Controllable" simply means the source can be controlled through some entity or means, as opposed to an uncontrollable source, such as bed erosion. The TMDL incorrectly uses the word controllable to mean sources that Board Staff does not currently know how to control or that are not known to be cost-effective to control. Baykeeper objects to this use of the term for air sources. All the available evidence suggests that local air sources are a significant contributor of mercury to the Bay. All the evidence also suggests that reductions in local air sources would benefit the Bay and increase the speed of recovery. The TMDL report even contains some discussion of the cement industry but dismisses loads by suggesting that some technologies may not be "cost effective" for the industry. The CWA, however, does not permit Board Staff to delay achievement of water quality standards under a TMDL on the grounds of costs or other economic factors.<sup>49</sup> Consequently, loads should be allocated to sources such as cement manufacturers despite the costs that will be imposed. Baykeeper is certain that once a meaningful load is allocated to these sources with costly consequences for failing to meet this load, they will use the new market niche to quickly and creatively find cost-effective technologies to meet the allocation.

The Basin Plan Amendment also suggests that local air sources are not meaningfully included as part of the TMDL because the Board's "authority to control such sources is limited."<sup>50</sup> Baykeeper is unaware of any legal basis for this limitation on the Board's authority. To the contrary, the Board's position as the entity delegated authority to issue CWA permits suggests otherwise. The CWA and its implementing regulation impose a clear and unambiguous obligation on California to allocate loads to

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<sup>47</sup> 33 U.S.C. § 1313(d)(1)(C).

<sup>48</sup> Proposed Basin Plan Amendment at A-13.

<sup>49</sup> 33 U.S.C. § 1313(d)(1)(C).

<sup>50</sup> Proposed Basin Plan Amendment at A-13.

all sources.<sup>51</sup> As the state agency responsible for implementing California's mercury TMDL in the Bay, the Board derives its authority directly from Section 303(d) of the CWA. Any state law to the contrary is preempted by the federal statute. If the Board believes it lacks the authority to carry out a legally sufficient TMDL, it should relinquish the TMDL to another state agency that has the power and will to fulfill the CWA's mandates.

If Board Staff continues to insist that knowledge of air mercury sources is still inadequate at this time or that it does not have authority to regulate air sources, it would then be appropriate, and in line with the law, for the Board to include an unallocated reserve and allocate only a portion of the estimated TMDL to known sources. This strategy has been successfully adopted in other states. The 1999 TMDL and Implementation Plan for Mercury, Pena Blanca Lake, Arizona, for example provides for a 45% unallocated reserve to account for aerial deposition.<sup>52</sup> Baykeeper would support this reserve allocation as a temporary solution until more information is gained regarding air sources.

#### **E. The Basin Plan Amendment Must Make Enforceable Allocations To Other Watersheds**

The Basin Plan Amendment continues to inadequately address Central Valley sources. The production and use of fertilizers and biosolids, among other Central Valley sources such as stormwater, wastewater, and air sources, are known to contribute to the large amounts of mercury and methyl mercury in the Bay-Delta watershed. Until allocations to these individual sources in the Central Valley are complete, the Mercury TMDL for the Bay remains incomplete as both a legal and practical matter. The real possibility remains that the future regulatory process in the Central Valley will come to a different total load than 330 kg per year provided for under this process. If this happens, the TMDL equation and allocations for mercury in the Bay will be ruined. If the Central Valley Water Board Staff establishes a dramatically higher TMDL for the Delta then all other loads in the Bay will require adjustment. Consequently, Baykeeper does not support amendments to the Bay's Basin Plan until this critical question is settled. The Central Valley Basin Plan must be amended at the same time as the Bay's plan to assure a consistent and complete TMDL for the Bay.

As an alternative, Baykeeper would support this Board's allocation of loads outside this region. Board Staff believes that the Board does not have jurisdiction to regulate or assign individual loads in this manner. Baykeeper believes the usual jurisdictional limitations on the Board are trumped for TMDL processes, where all sources must receive allocations, by federal preemption under the CWA. Moreover, even if Board Staff continues to insist that its jurisdiction is limited, it can do more to advance

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<sup>51</sup> 33 U.S.C. § 1313(d)(1)(C), 40 C.F.R. §130.2(g) and (h).

<sup>52</sup> [www.epa.gov/waters/tmdl/docs/919.pdf](http://www.epa.gov/waters/tmdl/docs/919.pdf)

the solutions to the problem. The Board can petition the State Board to accelerate development of the Central Valley component of the mercury TMDL, and begin the analyses necessary to complete that portion of the TMDL in order to give the Central Valley an incentive to begin the long process.

With regard to the Guadalupe River TMDL, there is no dispute that this Board has full jurisdiction over that process. Although the Board has established a separate administrative process to deal with the Guadalupe River mercury problems, the Guadalupe River is part of the Bay's watershed and load allocations in the whole watershed are a legally required part of this Basin Plan Amendment. Therefore, without allocations to all those sources, the Bay TMDL is legally incomplete. Baykeeper cannot support Basin Plan amendments that are incomplete and illegal. This amendment must be done contemporaneously and consistently with the amendments implementing the portion of the mercury TMDL in the Guadalupe River.

**F. The Methods For Demonstrating Compliance With Allocations Are Illegal, Especially Since TMDLs Require "Daily" Loads**

The Basin Plan Amendment proposes to allow the entire Central Valley watershed, all urban stormwater dischargers, and all Guadalupe River dischargers to determine compliance with their allocations and/or aggregate loads once every five years by comparing the average load over five years to the allocation.<sup>53</sup> This approach is illegal. Section 303(d)(1)(C) requires calculation and allocation of "daily" loads. The Basin Plan Amendment's use of five-year averages to determine compliance reads the word "daily" right out of Section 303(d). There is no justification for this approach and, in fact, there is no analysis of whether the five-year average is even statistically sufficient to identify mercury discharge trends given interannual variations in rainfall, sediment loading, and pollutant loading.

The use of five-year averaging combined with unlawful categorical allocations means that individual wastewater dischargers could substantially increase their loadings over several years and still not be held liable under the Basin Plan Amendment. Such increases are completely illegal. Moreover, they cannot be permitted until assimilative capacity is available. By further decoupling individual performance from accountability, the five-year averaging mechanism will further delay achievement of water quality standards. In light of the already vast timeframe for recovery under this TMDL, this type of delay is wholly unjustified.

The CWA requires waste load allocations to be expressed as daily mass limitations, especially when incorporated into NPDES permits. If Board Staff cannot comply with the letter of the law, we urge them to at least express the waste load allocations with as much resolution as the effluent limitations in current permits. In the

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<sup>53</sup> Proposed Basin Plan Amendment at A-8 through A-10.

case of wastewater permits, this means monthly and daily concentration limits and/or monthly mass limits. Monitoring should occur at least monthly to determine compliance with the waste load allocations. The Basin Plan Amendments contains no defensible rationale for the five-year compliance review option except the apparent desire to go easy on certain dischargers. In fact, it is likely that this five-year averaging strategy may potentially render enforcement of this amendment impossible depending on when the statute of limitations will begin to run on violations. These are the only dischargers that Board Staff has expressed a willingness to regulate, but unfortunately, this scheme will allow even these dischargers off the hook for real reductions in mercury loadings.

The other two methods for dischargers to demonstrate compliance, as provided in the Basin Plan Amendment, are also improper and will allow “fuzzy math” to prevent meaningful load reductions. For instance, selected dischargers are allowed to “quantify the annual average mercury load avoided by implementing pollution prevention, source control, and treatment efforts.”<sup>54</sup> This type of quantification, if possible, is of course permissible, but it is not acceptable for Board Staff to recognize “loads avoided resulting from activities implemented after 2001 as counting toward the load reductions.”<sup>55</sup> The SIP clearly states that “limitations for the pollutant must be based on current treatment facility performance or on existing permit limitations, whichever is more stringent.”<sup>56</sup> Nowhere in the SIP does it state that dischargers can count source control measures implemented two years earlier in order to assess compliance with new limitations. Any such allowance essentially permits backsliding and is a violation of the SIP.

Furthermore, the final method for calculating compliance with allocations is to allow sediment discharges in the Bay that are below “suspended sediment target.”<sup>57</sup> This method of calculating compliance is problematic, however, because as is the case with all of the discharges permitted by this Basin Plan Amendment, these discharges of sediment will purportedly still allow discharge of mercury-laden sediment into a Bay without assimilative capacity. Any permissible discharge must take into account the cumulative impacts of mercury, especially since we are dealing with a bio-accumulative toxin. These three faulty methods are not protective enough to accurately reflect and encourage reductions in loadings, especially since the amendment is asking dischargers to calculate compliance with already weak allocations.

#### **G. The Basin Plan Amendment Fails To Implement An Adequate Margin Of Safety**

Pursuant to Section 303(d) of the CWA, TMDLs must be established at “levels necessary to meet applicable water quality standards, accounting for seasonal variations

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<sup>54</sup> See e.g., *id.* at A-10.

<sup>55</sup> *Id.*

<sup>56</sup> SIP at 20.

<sup>57</sup> See e.g., Proposed Basin Plan Amendment at A-10.

and with a margin of safety to reflect lack of certainty about discharges and water quality.”<sup>58</sup> A margin of safety is supposed to ensure that the TMDL is protective of water quality in the face of uncertainties in the available data.<sup>59</sup> This Basin Plan Amendment, therefore, should be set at a level that will achieve attainment of water quality standards and should include an adequate margin of safety. While the Basin Plan Amendment and associated TMDL documents claim to include a margin of safety, Baykeeper does not believe that the true function of this requirement has been met here.

For instance, it is unclear why the Basin Plan Amendment only applies a 50% reduction to loads for urban stormwater runoff when greater reductions are entirely possible. It is also unclear why no load reductions are allocated for municipal wastewater and industrial wastewater dischargers when these sources are clearly controllable and no uncertainty exists regarding their discharges. Board Staff’s reasoning that these sources are de minimus does not hold water because the Bay currently has no assimilative capacity for these loadings. Thus each additional loading of mercury should ideally be treated as the equivalent of a violation of water quality standards. At the least, Baykeeper is asking that there should be a significant reduction in these discharges.

These numbers do not express an adequate margin of safety given the lengthy recovery timeframe set forth in the Basin Plan Amendment. Baykeeper therefore urges Board Staff to adjust the load reductions to result in the lowest amount of mercury discharge possible in accordance with law.<sup>60</sup>

#### **H. Target Mercury Level For Bird Eggs Is Not Protective Enough**

The proposed numeric target for bird eggs of 0.5 ppm represents the lowest observable adverse effect of mercury concentration. As Daniel Russell from USFWS pointed out, however, this target will not adequately protect the reproductive capacity of some bird species, including the endangered California Clapper rail.

This target observable effect is also unacceptable because the Basin Plan amendment aims to achieve this target goal within the timeframe of the TMDL’s implementation plan. This means that the target levels will be reached sometime in the next century. Since current rates of mercury already threaten the survival of many of these species, Baykeeper cannot believe Board Staff intends for an additional hundred years of assault to further the level of irreversible damage already experienced by these endangered populations.

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<sup>58</sup> 33 U.S.C. § 1313(d). (Emphasis added.)

<sup>59</sup> 40 C.F.R. 130.7(c)(1).

<sup>60</sup> *Alaska Center for the Environment v. Reilly*, 762 F. Supp. 1422, 1429 n.8 (W.D. Wash. 1991); *aff’d Alaska Center for the Environment v. Browner*, 20 F.3d 981 (9<sup>th</sup> Cir. 1994) (recognizing timely promulgation of TMDLs as imperative, even in the face of inadequate data).

The bird egg target, therefore, should be changed from lowest observable adverse effects to no observable adverse effects to ensure that vulnerable species such as the Clapper rail are not harmed. And more protective measures must be taken in the overall implementation timeframe for mercury reductions to make it more likely that this target goal will be achieved far sooner than the current timeline.

**I. “Watershed Allocation Programs” And Credits Are Not Viable Options At This Time And Such References Must Be Removed**

The reference to pollution trading programs on page A-16 of the Basin Plan Amendment is premature and should be removed. Dischargers are not even being properly regulated under this TMDL and already Board Staff is proposing a way out. It is a violation of federal and state standards to allow increases in loadings in the absence of assimilative capacity. While Baykeeper is not entirely opposed to the possibility in the future of a well-orchestrated mercury credit policy, this Basin Plan Amendment in no way merits such a program. Before a program like this can even be considered, the TMDL will have to contain enforceable limits that represent a significant reduction in loading with meaningful penalties. There would also have to be an all inclusive inventory and implementation of key projects to target mercury hot spots and mine waste sources in order to create some possibility of assimilative capacity in the waterbody. The stakeholder process is discussing the possibility and logistics of a meaningful trading program, but unless that process is successfully completed, the mention of a trading program in the Basin Plan Amendment only confuses stakeholders and makes future dialogue about this type of program impossible. The paragraph discussing this idea in the Basin Plan Amendment is inadequate and should be removed so that no stakeholder will unwisely plan their future based on the thought that trading may be possible when a real program it is not even on the horizon.

**III. CONCLUSION**

**A. Adoption Of The Basin Plan Amendment Would Not Only Violate The CWA And SIP As Described In The Various Sections Above, But It Would Also Violate CEQA**

Under CEQA, a state or local agency must initiate environmental review prior to carrying out or approving any discretionary action that may have a significant impact on the environment.<sup>61</sup> If the agency finds that a project may have a significant effect on the environment, the agency must prepare an environmental impact report (“EIR”).<sup>62</sup> This

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<sup>61</sup> See *Friends of Westwood, Inc. v. City of Los Angeles*, 191 Cal. App.3d at 267, 269-270.

<sup>62</sup> Pub. Res. Code § 21100(a); *Bozung v. Local Agency Formation Com.* (1975) 13 Cal. 3d 263, 277-279. CEQA defines a “significant effect” as a “substantial, or potentially substantial, adverse change.” Pub. Res. Code, § 21068. This means that an activity has a significant effect if it “has the potential to degrade the quality of the environment.” See also 14 Cal. Code Reg. § 15382; *Santa Monica Chamber of Commerce v.*



includes CEQA directives that an agency consider the cumulative impacts of its project approvals,<sup>63</sup> provide timely and adequate responses to comments made by the public,<sup>64</sup> and consider feasible alternatives to the proposed action.<sup>65</sup>

The guiding principle in the review of projects under CEQA is that CEQA must be interpreted so as to afford the fullest possible protection to the environment.<sup>66</sup> EIRs and their functional equivalents under certified programs demonstrate to an apprehensive citizenry that the agency has analyzed and considered the ecological implications of its actions.<sup>67</sup> These CEQA policies are also included in the State Board's regulations.<sup>68</sup>

CEQA requires that EIRs and functionally equivalent documents identify and analyze all significant and potentially significant adverse environmental effects of the project. CEQA defines "significant effects" as any "substantial, or potentially substantial, adverse change."<sup>69</sup> This means that an activity has a significant effect if it "has the potential to degrade the quality of the environment."<sup>70</sup> The CEQA Guidelines require a mandatory finding of significance for projects that will cause "substantial adverse effects on human beings, either directly or indirectly," as well as projects with "potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish and wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare or threatened species."<sup>71</sup>

The TMDL program, as described in section I(D) above, serves as the final protection for the many beneficial uses of San Francisco Bay, including water contact recreation, sport and commercial fishing, fish consumption, habitat for fish and wildlife, and preservation of rare and endangered species. Consequently, the Basin Plan Amendment determines how much protection these beneficial uses will ultimately enjoy from additional mercury loadings into an already impaired waterbody. The project here is

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*City of Santa Monica* (2002) 101 Cal. App. 4th 786, 795; *Azusa Land Reclamation Co. v. Main San Gabriel Basin Watermaster*, 52 Cal. App.4th at 1192. (Citing Pub. Res. Code § 21083.) (Emphasis added.)

<sup>63</sup> *EPIC v. Johnson* 170 Cal.App.3d at 625.

<sup>64</sup> *Id.* at 622; *Dunn-Edwards Corp. v. Southcoast Air Quality Management District* (1993) 19 Cal. App. 4th 519, 534; Pub. Res. Code § 21080.5(d)(2)(D).

<sup>65</sup> *Friends of Old Trees v. Dept. of Forestry and Fire Protection*, *supra*, 52 Cal. App. 4th at 1404-1405. *See also* Pub. Res. Code §§ 21080.5(d)(3), 21080.5(d)(2)(A)

<sup>66</sup> *Laurel Heights* 47 Cal.3d at 390; *Friends of Mammoth v. Board of Supervisors* (1972) 8 Cal.3d 247, 259.

<sup>67</sup> *Sierra Club*, 7 Cal. 4th at 1229; *EPIC v. Johnson*, 170 Cal.App.3d at 609-11. *See also* Pub. Res. Code § 21080.5(d)(3)(i)-(ii) (written documentation for a certified regulatory program shall include a description of activity, alternatives, and mitigation measures to minimize significant environmental impacts, and shall be available for a reasonable time for review and comment by the general public.)

<sup>68</sup> *See* 23 Cal. Code Reg. 3775 *et seq.*

<sup>69</sup> Pub. Res. Code, § 21068. (emphasis added.) *See also* Pub. Res. Code § 21083(a); *Santa Monica Chamber of Commerce v. City of Santa Monica* (2002) 101 Cal. App. 4th 786, 795.

<sup>70</sup> *See also* 14 Cal. Code Reg. § 15382; *Azusa Land Reclamation Co.*, *supra*, 52 Cal. App.4th at 1192.

<sup>71</sup> 14 Cal. Code Reg. § 15065. *See also* CEQA guidelines, Appendix G, § XVII ("Mandatory Findings of Significance").

to assess mercury capacity in the Bay and then allocate loads accordingly to the various sources of mercury discharges in order to meet water quality standards to protect beneficial uses of the Bay. The degree to which the Basin Plan Amendment is or is not precautionary and conservative regarding the allocation of loads will directly increase or decrease the number of beneficial uses that are protected and attained.

The Basin Plan Amendment specifically proposes to undertake this project in a manner that decreases the number of beneficial uses that are protected and attained. It does so by: 1) not implementing a reasonable timeframe for meeting water quality standards, 2) failing to require major dischargers including municipal and industrial wastewater dischargers to reduce loads to zero until assimilative capacity is made available, 3) proposing aggregate rather than individual allocations, and proposing allocations which only require a partial reduction of loads even though assimilative capacity in the Bay is zero, 4) essentially ignoring the largest sources of mercury, including air sources, the Central Valley Watershed, and Guadalupe River discharges, by not allocating meaningful loads to reduce their discharges, 5) allowing improper methods for demonstrating compliance with allocations and not imposing real consequences for exceeding allocations, 6) failing to consider meaningful actions that can be taken now to clean up existing mercury in the Bay, 7) providing for an inadequate margin of safety contrary to law, and 8) implementing target levels of mercury that are not protective of wildlife or human beneficial uses of the waterbody. These actions are not supported by the findings or by the substantial evidence in the report.

The Basin Plan Amendment fails to identify, analyze and mitigate numerous significant and potentially significant adverse environmental effects of the project. In fact, the Environmental Checklist attached at the end of the TMDL report uniformly claims that there will be “no impact” or a “less than significant impact” to numerous biological resources from allowing mercury discharges into the Bay to continue. The substantial evidence in the record and the findings do not support these claims.

The Basin Plan Amendment also fails to fully identify, analyze and mitigate significant adverse impacts to human health and ecological resources. Nor does the Basin Plan Amendment make any attempt to describe the beneficial uses that have been harmed by these impairments. For example, the Environmental Checklist does not describe the human communities who eat fish contaminated with bio-accumulative toxins, the swimmers who are put at risk by mercury loadings, or the threatened and endangered species whose success is compromised, populations diminished and habitat degraded by mercury. Further, the documents fail to include information about rising cancer rates, immuno-deficiencies and other human health problems that have been or may in the future be linked to mercury contamination.<sup>72</sup> This information must not only be

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<sup>72</sup> See, e.g., “Biomarkers of Environmentally Associated Disease, Technologies, Concepts, and Perspectives,” Lewis Publishers, CRC Press LLC, 2002; Ted Schettler, M.D., Gina Solomon, M.D., Maria Valenti, and Annette Huddle; *Generations at Risk, Reproductive Health and the Environment*, MIT Press, 1999; Michael C., Newman and Michael A. Unger; *Fundamentals of Ecotoxicology*, Lewis Publishers,

identified in the Environmental Checklist or accompanying documents, but since there is substantial evidence demonstrating that these are potentially significant impacts that can occur from continued mercury loadings, these impacts must also be mitigated. The documents fail to implement any mitigation measures, especially with regard to impacted communities and wildlife.

Additionally, the Basin Plan Amendment fails to adequately describe the environmental setting of the project. The setting as described in the Environmental Checklist and TMDL report falls far short of CEQA's requirements. CEQA requires a full description of the environmental setting in which a project occurs. These documents fail to describe California's widespread pollution problems and degraded beneficial uses and the cumulative impact that additional mercury loadings may have on an already stressed environment. As such it is inadequate under the law. The Court found that in the absence of such a description, it is "impossible for the [EIR] to accurately assess the impacts the project will have on wildlife and wildlife habitat or to determine appropriate mitigation measures for those impacts."<sup>73</sup>

The Basin Plan Amendment makes no effort to describe or to mitigate the widespread violations of standards and mercury impairments in the watershed. Instead, the documents compound the problem by further allowing violations of standards for at least another 120 years. Board Staff does this through a failure to allocate load reductions to wastewater dischargers, by only requiring partial load reductions for stormwater discharges, and by failing to adequately manage loadings from known sources such as air sources, Central Valley dischargers, and Guadalupe River dischargers.

The Basin Plan Amendment fails to include a statement of overriding considerations. As described above, adoption of the Amendment as written will result in numerous significant and unmitigated adverse environmental impacts. In this circumstance, Board Staff must balance the economic benefits of the project against its environmental harm to determine if the project should proceed.<sup>74</sup> This "statement of overriding considerations," as the last step in the analysis, provides critical information to the public to fulfill the law's public disclosure requirement - that the [functionally equivalent document] function as "a document of accountability" and "informed self government."<sup>75</sup> However, CEQA requires that the agency first identify the adverse effects of the proposed project before it exercises that power.<sup>76</sup> No statement of

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CRC Press, 2003; Jones-Lee & Lee; "Methylmercury: Epidemiology Update," USEPA, Presentation to Fish Forum in San Diego (2004); USFDA, "Draft Advice For Women Who Are Pregnant, Or Who Might Become Pregnant, and Nursing Mothers, About Avoiding Harm To Your Baby Or Young Child From Mercury in Fish and Shellfish" (Dec. 10, 2003).

<sup>73</sup> *San Joaquin Raptor v. County of Stanislaus* 27 Cal. App. 4th at 722-723.

<sup>74</sup> Pub. Res. Code § 21081(d); 14 Cal. Code Reg. § 15903.

<sup>75</sup> *Sierra Club, supra*, 7 Cal.4th at 1229 (...the board retains the power to approve a plan that has significant adverse effects upon the environment, so long as it justifies its action in light of "specific economic, social, or other conditions;" Pub. Res. Code § 21002.)

<sup>76</sup> *Id.* at 1233.

overriding considerations is presented in the Basin Plan Amendment. Moreover, the Basin Plan Amendment repeatedly rejects mitigation measures fails to consider alternatives while selecting options, which favor economic and cost factors and increase the risk of adverse environmental impacts. These choices are not permissible, and are certainly unjustified in the absence of a statement of overriding considerations.

### **B. Adaptive Management Sounds Like A Good Idea, But It Does Not Seem To Be Used To Its Full Potential**

While Baykeeper supports the concept of adaptive management as set forth by Mr. Thomas E. Mumley and Mr. Richard Looker in the 2004 Pulse of the Estuary RMP Report, we do not believe this Basin Plan Amendment actually applies the idea adequately. At this time, adaptive management is poorly understood by the public and dischargers because it has no institutional basis. The proposed Basin Plan Amendment refers to the idea in terms of “collaboration with stakeholders” but only in the context of “opportunities for participation” and to develop “focusing questions.”<sup>77</sup> Unfortunately, this description suggests that Board Staff will approach adaptive management of this TMDL in a way that is too similar to its existing problematic practices. As is evidence in various comments from stakeholder groups, this business as usual approach may not reflect the different expectations or desires of the many stakeholders.

The success of adaptive management depends on a high level of active participation and mutual trust among stakeholders, a strong commitment (including funding) to an appropriate institution that can guide the process, and organizational change within the agency to support the stakeholder process. Baykeeper does not see any of these characteristics in the Basin Plan Amendment.

Scientific uncertainty has been used by polluters and regulators as a rationale for inaction for decades. These polluters and regulators take advantage of scientific uncertainty by interpreting a scientific “we don’t know” as “the science says it’s OK.” By permitting dischargers to proceed unrestrained until all data is available, this approach creates disincentives for them to undertake such investigations.<sup>78</sup> These precise disincentives are evident in the Basin Plan Amendment’s proposals. By allowing mercury loads to continue – despite known harm to human and environmental health and despite a lack of assimilative capacity – until more information is available, the Basin Plan Amendment creates disincentive for dischargers to conduct much-needed research and development of new technologies.

At their very core, adaptive management and a precautionary approach are all about dealing with uncertainty. Uncertainty in science is pervasive; the elimination of

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<sup>77</sup> Proposed Basin Plan Amendment at A-16.

<sup>78</sup> *Id.*

scientific uncertainty is impossible.<sup>79</sup> However, the Basin Plan amendment is replete with provisions that favor tolerance of environmental risk in the name of “adaptive management.” If adaptive management is manipulated to mean business as usual, then Board Staff should just avoid any attempt to sugar coat the truth: in the face of uncertainty, the Board is failing to take meaningful action to protect humans and wildlife from known harm. The Basin Plan Amendment in essence, is using the lack of scientific certainty related to impairment as an excuse for inaction: exactly the opposite of what adaptive management and a precautionary approach stand for.

An approach with more foresight would establish that “[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”<sup>80</sup> There are few policy decisions where it is more critical to employ the precautionary principal than those embodied in this Basin Plan Amendment: the reduction of mercury pollution to healthy levels in the Bay. TMDLs are our last line of defense in the protection of our waterways and are applied only after other Clean Water Act provisions have failed.<sup>81</sup> As such, it is all the more important that this Basin Plan Amendment ensure that all potential mercury discharges to waterways are identified; the consequences of ignoring them include threats to human health and aquatic life, and if these discharges are ignored by the 303(d) program, they are ignored altogether.

An important first step toward adequate implementation of foresight and adaptive management, as we understand it, is full disclosure: decision-making processes need to clearly identify and evaluate areas of uncertainty, and all unknown but potential risks should be clearly articulated. An unknown cost should not automatically be assigned a value of zero merely because its extent or causalities are not yet completely understood. Policies should encourage an open and public debate about the various interests that could be impacted by the uncertainty and the tradeoffs between them. In the absence of this disclosure, the public is ill-equipped to evaluate its tolerance for the uncertainties inherent in this environmental policy.

### **C. Key Points**

Baykeeper does not believe this Basin Plan Amendment lives up to the Board’s responsibility to implement the CWA and to protect human health and aquatic ecosystems. It is known that mercury is causing harm, yet this Basin Plan Amendment allows all major dischargers to continue to discharge mercury in the absence of assimilative capacity, and not one dollar is being spent to clean up the existing contamination or to solve the major sources. Additionally, it will be impossible, if not meaningless, for the Board to enforce this amendment as proposed. This flaw means less

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<sup>79</sup> NRC Report at 4.

<sup>80</sup> Principle 15 as adopted by the United Nations Conference on the Environment and Development in Rio de Janeiro, 1992.

<sup>81</sup> See 33 U.S.C. § 1313(d)(1)(A).

accountability for the known and controllable sources of mercury and thus less likelihood of success to achieve mercury reduction. For these and the forgoing reasons, the Baykeeper urges the Board to:

- 1) Assign individual, daily waste load allocations of zero to all dischargers until assimilative capacity is available (or at least promulgate individual daily limits that will eventually lead to zero loadings or to the creation of assimilative capacity in the Bay);
- 2) Proactively manage aerial sources of mercury pollution and Central Valley discharges as well as set the direction and pace of the Guadalupe River TMDL;
- 3) Assign real penalties for failures to comply with allocations (in line with the CWA) and allocate this money for the clean up of leaching mining sites and/or existing hot spots of sediment contamination;
- 4) Implement creative strategies towards dealing with bed erosion and cleaning up some of the mercury problem now;
- 5) Meaningfully manage the threats to the at-risk human populations and wildlife most impacted by mercury pollution, and
- 6) Delete all references to an unlikely pollutant trading program.

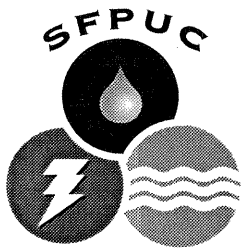
The Basin Plan amendment, as proposed, is legally inadequate and its adoption, as an incomplete entity, will not fulfill the Board's obligation to implement a TMDL for mercury in the Bay. These actions are the least the Board can do in order to ensure that it has done all it currently can to protect our watershed and communities from additional mercury exposure. Baykeeper does not believe it is too much to ask that this Basin Plan Amendment be a good-faith attempt to reduce existing mercury problems within our lifetime.

Thank you for your time and consideration. If you have any questions, please call.

Sincerely,

/SC/

Sejal Choksi  
San Francisco Baykeeper



**WATER**  
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**WATER & POWER**  
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June 14, 2004

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**Subject:** Mercury in San Francisco Bay - TMDL and Proposed Basin Plan Amendment (April 30, 2004)

Dear Messrs. Johnson and Looker:

The San Francisco Public Utilities Commission (SFPUC) appreciates the opportunity to comment on the TMDL Project Report and Basin Plan Amendment for mercury in San Francisco Bay. The strong commitment and the quality of work by you and other Board staff is evident in these documents. We additionally appreciate the public outreach program and the sincere effort to involve all interested parties in this TMDL.

We have several comments on the TMDL and Basin Plan Amendment:

*1. Credit for treatment of stormwater by San Francisco's wastewater control facilities*

On July 14, 2003, we submitted comments on the June 2003 draft of the TMDL. We requested that the TMDL incorporate a credit for San Francisco's removal of mercury from stormwater. This credit would recognize that San Francisco's treatment facilities remove a substantial portion of the mercury carried in runoff from San Francisco's streets and other impervious surfaces. This draft of the TMDL does reference a credit for San Francisco's stormwater treatment and we appreciate this addition.

San Francisco's combined sewer system and associated treatment facilities capture and provide treatment for nearly all of the stormwater runoff in the City. (Untreated runoff does occur from several small separately sewered areas.) As a result, approximately two thirds of the wet weather flows are treated to secondary treatment standards. The remaining wet weather flows receive either primary treatment or the equivalent to primary treatment within the wastewater system storage/transport. The result of San Francisco's treatment of stormwater is that an estimated 60% of the solids in the stormwater are removed from the waste stream (measured as total suspended solids). Mercury in wastewater has a strong affinity for particulates which can then be removed by standard treatment. If we assume that most of the mercury in the stormwater runoff is associated with particulates, then stormwater treatment should provide major benefits.

This revised draft TMDL maintains approximately the same allocation (8.8 kg/yr) and load reduction (8.4 kg/yr) for San Francisco as the earlier July 2003 draft. However, this most recent draft has added a footnote in Table 7.2 (page 55) which acknowledges the treatment provided:

*<sup>e</sup> The urban stormwater runoff load estimate does not account for treatment provided by San Francisco's combined sewer system. This treatment will be credited toward meeting the allocation and load reduction. This allocation includes Bayside CSO (CA0038610) and Northpoint CSO (CA0037672)*

Some editing is necessary for this footnote since the Bayside permits were combined in 2002 into a single permit: Order No. R2-2002-0073; NPDES No. CA0037664. The last sentence in the footnote could be replaced by:

*This credit is based on the treatment (mercury removal) provided to stormwater runoff by the Bayside facilities regulated by NPDES permit CA0037664.*

This new wording addresses the fact that stormwater receives treatment at the Southeast treatment plant as well as at the North Point wet weather facility and within the storage/transport.

We appreciate the addition of the footnote to the table. It is appropriate to incorporate and identify the fact that San Francisco provides treatment to stormwater and thereby reduces the loading of mercury to the Bay.

## *2. Municipal wastewater allocation for San Francisco*

San Francisco's NPDES wastewater permit issued in 2002 (CA0037664) includes an interim water quality-based effluent limitation as well as a mass limitation. The mass limitation is 0.3 kg/month and is enforced as a 12-month moving average. This mass limitation is the equivalent of 3.6 kg/year. However, the allocation assigned to San Francisco in Table 7.3 (page 57) is 2.27 kg/year. This represents a 37% reduction in the allowable discharge.

The TMDL notes that POTW allocations were computed on the basis of each facility's fraction of the entire municipal wastewater category mercury load. Both the permit mass limit and TMDL mass limit are intended to be performance-based limitations and we are not sure why the permit value should differ from the limitation based on apportionment of the bay-wide POTW loadings. Regardless, the limitation derived by the permit is directly based on historical plant performance and would appear more appropriate.

In addition, San Francisco's Southeast treatment facility has an additional and unique treatment burden. After wet weather, the stormwater solids are trapped in the storage/transport. Over time these are drained along with the day-to-day wastewater flow to the treatment plant. This flow, including the wet weather solids, is treated to secondary treatment standards and approximately 90% of the solids are removed. Nevertheless, this additional loading means that San Francisco has to manage and control a proportionally larger mercury loading than other Bay area POTWs which do not treat the flows in their storm drains. This additional loading was taken into account during the process of calculating the permit's performance-based mass



limitation. However, a more restrictive limitation, as proposed in the draft TMDL, becomes a regulatory disincentive to the City's effort to direct more captured run-off to the Southeast plant. Storing the runoff and directing it through the plants treatment facilities is environmental beneficial but could be constrained by a more restrictive mass limitation.

From discussions with Board staff we understand that there will be an opportunity to review these POTW mass limitations prior to final board adoption in September. We look forward to these discussions.

### *3. Compliance with water quality-based effluent limits (for POTW effluent)*

An additional comment concerns the potential that San Francisco, as well as the other POTWs, may not be able to comply with mandatory water quality-based effluent limits (WQBEL) when the TMDL is adopted.

As you may know, our Bayside NPDES permit includes an interim limit for mercury (0.087 ug/L). The interim limit was necessary because the Board concurred that it is infeasible for the discharge to immediately comply with the calculated final effluent limitations for mercury (0.02 ug/l – AMEL). This adopted interim limit of 87 ng/L was exceeded 4 times during 136 sampling events in the period preceding permit adoption. It was the Board staff's best professional judgment that the interim limit of 87 ng/L is attainable.

Because of the inability to meet the calculated final limit the permit included the interim limit and also established a compliance schedule for meeting the mercury limitation. Because the calculated final mercury limitation is derived from a Basin Plan numeric objective (0.025 ug/l) the compliance schedule extends to March 31, 2010. (The CTR value is 0.051 ug/l.) The permit noted that the actual final limitation would likely be based on the TMDL/WLA established for mercury rather than the calculated value.

We are concerned that the TMDL allocations will not be allowed to be substituted for the site-specific WQBELs. In other words, the TMDL allocations, with which most POTWs can comply, may not be able to be used in permits in lieu of calculated final limits based on Bay water quality objectives. The Clean Water Act and EPA regulations indicate that a WQBEL can only be adjusted or replaced if the TMDL provides for attainment with water quality standards. This TMDL projects a compliance date 120 years in the future and obviously many NPDES permits cycles will occur before compliance with standards is attained.

U.S. EPA expressed a similar concern in their letter of September 8, 2003. They state that the TMDL must specify that numeric WQBELs will be used to ensure that localized exceedances do not occur. In other words, they do not appear to agree with the approach of using the waste load allocations to replace WQBELs derived from the water quality objectives. The Board's response (February 13, 2004) disagreed with EPA assertions, however, we note that EPA must approve the TMDL and may be able to enforce its interpretation.

If the TMDL is approved and does not provide relief from WQBELs then the San Francisco Bay POTWs will be required to comply with the final mercury concentration limitations identified in their permits by the end of the permit compliance schedules. San Francisco would have six years to come into compliance. The operators of many POTWs believe these final limits are not

attainable using the existing treatment facilities. New treatment facilities would likely be required. Tertiary treatment is expensive to build and operate. Since POTWs currently contribute 1% or less of the mercury loading, this additional treatment would provide marginal reductions in total loading and negligible benefits to the Bay.

Given the problematic likelihood of the TMDL in its current form resolving this issue, we propose that it be held in abeyance until an approach is developed, with agreement from EPA, to address this issue.

#### *4. Credit for mercury reductions by jurisdictions which have aggressively addressed mercury in the past*

It is not clear from the TMDL if communities will get credit for mercury diversion efforts they have already put into place. Proactive mercury control programs should not have the effect of "moving the goal posts." Otherwise the proactive communities will have much more difficulty meeting their assigned load reduction requirements because they have already implemented the controls suggested in the TMDL. Unless credit is given for these earlier efforts, communities that have lagged behind in addressing mercury will be in a much better position because they will have more opportunities implementing mercury controls and documenting their reductions.

San Francisco has a very pro-active mercury reduction program and was the first in the Bay area to initiate an effort to remove mercury thermometers as well as to control mercury in other products including paint. San Francisco is also one of the first to address dental mercury. San Francisco will continue with these pollution prevention efforts but should receive credit for these control efforts implemented prior to completion of the TMDL.

#### *5. Need to address atmospherically deposited mercury*

The TMDL estimates that approximately 30% of the mercury carried in stormwater results from atmospheric deposition. The San Francisco Estuary Institute report - *San Francisco Bay Atmospheric Deposition Pilot Study* – concluded: "Comparing to other sources and pathways, loading of mercury from atmospheric deposition (combined direct and indirect routes) contributes almost seven (7) times as much as the loading from wastewater discharges." (July 2001). The TMDL suggests that stormwater agencies direct their efforts toward "hot spot" identification and cleanup as well as pollution prevention. The 30% atmospherically deposited mercury is essentially outside the capability of stormwater agencies to address by these suggested controls. The TMDL does not assign any reduction to mercury from atmospheric deposition. Given the importance of this source, we suggest that the TMDL specify measures by other state agencies (e.g., ARB) and the U.S. EPA to address this source.

#### *6. Apportionment based on population*

The stormwater allocations are based on population. However, the sources of mercury in stormwater runoff are not strongly correlated with population. As discussed above, 30% of the stormwater runoff comes from atmospherically deposited mercury which suggests an apportionment based on area. In addition, the TMDL proposes that land-based hot spots are sources which also suggests an apportionment based on area. We suggest that it may be appropriate to base the apportionment partly on land area and partly on population.

Bill Johnson, Environmental Scientist  
Richard Looker, Water Resources Control Engineer  
June 14, 2004  
Page 5

We appreciate your attention to these comments. If you have any questions please do not hesitate to contact me at (415) 934-5787.

Very truly yours,

A handwritten signature in black ink, appearing to read "Michael P. Carlin", with a long horizontal flourish extending to the right.

Michael P. Carlin  
Planning Bureau Manager

cc: Cheryl K. Davis, Acting General Manager, SFPUC  
Bruce Wolfe, Executive Officer, SFBRWQCB  
Thomas Mumley, SWRCB



**Testimony for June 16, 2004 Mercury Basin Plan Amendment Workshop**  
**Carl Mosher, Director, City of San Jose - Environmental Services Department**

My name is Carl Mosher, Director of San Jose's Environmental Services Department. I will be speaking on behalf of the San Jose/Santa Clara Water Pollution Control Plant and San Jose's Urban Runoff program. The City of San Jose acknowledges that mercury is an important priority in the watershed and supports a reasonable approach to protecting beneficial uses.

**POTW Concerns:**

I'll begin with treatment plant issues. I stood here about a year ago to request that Water Board staff revisit the way mercury was being regulated in our draft NPDES permit. At that time, the Regional Board stated that they did not want to penalize good performers or cause compliance issues for our treatment plants, because the Plants contribute minimal amounts of mercury to the Bay. The mercury issue was then addressed in our permits using an interim mass and concentration limits that were not punitive and were acceptable while waiting for the TMDL to be completed.

The Plant has been successful in reducing mercury and volunteered to conduct a special study that would support this Bay-wide Mercury TMDL effort as part of the South Bay stakeholder process. The City has actively participated and supported the CEP financially and through in-kind services. However, we were all completely surprised by the direction taken in this final staff report.

Dramatic changes to our Plant's allocation from 3.23 kg/yr. down to 0.49 kg/yr. (85% reduction) are now being proposed with little opportunity for review or discussion. Not only were we not told of these changes before the report was published, the total proposed allocation for all Bay Area treatment plants has been reduced without technical analysis or input from any of the municipal dischargers. The City of San Jose is extremely concerned about the POTW wasteload allocations and the lack of reasonable implementation mechanisms contained in this staff report.

As you can see in this slide (**Slide 1**), our Plant's contribution to mercury in the Bay is minimal, less than 0.02 percent of the total loading to the entire San Francisco Bay. The final allocation scheme used by Water Board staff is based on recent past performance, and therefore penalizes treatment plants that have implemented advanced treatment, water recycling and water conservation programs for many years. Such allocation schemes provide a disincentive for any other plants to be proactive and implement such programs because their future wasteload allocations would be affected.

In addition, the allocation scheme limits economic recovery, as it represents only the most recent data during a time of recession. As this slide shows (**Slide 2**), our Plant would not have been able to meet its allocation during better economic times. Future economic recovery must be addressed not only for this TMDL but also for future TMDLs, particularly when considering that the treatment plant does not significantly contribute to the mercury problem in the watershed. Otherwise, economic recovery efforts in our community will be crippled and we may be forced to implement mercury reduction efforts that are not only extraordinarily costly, but would provide no real water quality benefit.



To address these concerns, San Jose requests that Water Board staff be directed to re-examine the total POTW allocation and to develop alternative POTW allocations with BACWA and any interested POTW stakeholder to achieve an allocation scheme that is acceptable and equitable to all POTW stakeholders. We believe a solution can be reached on this issue.

### **Urban Runoff Concerns**

With respect to Urban Runoff, the City, as a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program), generally supports the comments that are being submitted on behalf of the Program and those being made by the Bay Area Stormwater Management Agencies Association (BASMAA). San Jose believes there are many remaining scientific questions and large technical uncertainties that affect the loading and proposed reduction estimates in this TMDL and I'm just going to touch on a few here today since others will be covering Urban Runoff concerns in more detail.

First, the basic assumption that there is a linear relationship between a reduction in total mercury in sediment and methylmercury in fish tissue is speculative and will likely lead to efforts that are inefficient and most importantly, ineffective.

Second, the load allocations and proposed reductions from Urban Runoff are based on sediment loads and mercury concentrations in bedded sediment that overestimate the urban runoff contribution. The loading estimates also include uncontrollable sources like air deposition, which are outside of control of local government. Urban Runoff loads should be recalculated removing air deposition and instream and hillslope erosion; instead, these sources should be in separate categories.

Finally, San Jose has significant concerns regarding the feasibility, costs, and environmental benefits of the current allocation scheme and implementation timeline for Urban Runoff. San Jose believes the required reductions allocated to urban stormwater are technically infeasible, costly and may not result in an appreciable improvement to the Bay.

It is imperative that we establish a course of action to reach agreement on this and upcoming TMDLs and allocations for legacy pollutants, many of which will require decades before any improvements may be seen. Therefore, I request that the Water Board allow more time to finalize the Mercury TMDL and Basin Plan amendment using a collaborative approach. San Jose has already voluntarily funded the successful stakeholder approach used to resolve copper and nickel issues in the South Bay. This level of funding is no longer possible, but we are willing to contribute an equitable share towards regional solutions for Bay-wide contaminant issues. San Jose advocates the formation of a Legacy Pollutant Collaborative, a stakeholder supported partnership to reduce technical uncertainties and develop the implementation strategies needed to move forward with TMDLs like the San Francisco Bay Mercury TMDL.

San Jose champions a TMDL that protects the environment, our citizens, and our economy. We look forward to continued collaboration with your staff to complete the Bay-wide Mercury TMDL, one that is adaptive, effective and reasonable. Thank you.

## County of Santa Clara

Environmental Resources Agency  
Office of Development Services

County Government Center, East Wing  
70 West Hedding Street, 7th Floor  
San Jose, California 95110

Bldg. Inspection (408) 299-5700 Land Development 299-5730 FAX 279-8537



June 14, 2004

Mr. Bill Johnson and Mr. Richard Looker  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400 (Via Facsimile: 510-622-2460)  
Oakland, CA 94612

**Re: Mercury in San Francisco Bay Total Maximum Daily Load  
(TMDL) Proposed Basin Plan Amendment and Staff Report**

Dear Mr. Looker and Mr. Johnson:

I am submitting this letter as the Coordinator of the Santa Clara County Nonpoint Source Pollution Control Program (NPS Program), regarding the "Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment" (BPA) and the associated Staff Report, dated April 30, 2004. Thank you for this opportunity to comment.

The County NPS Program concurs with the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) technical and legal comments regarding the proposal. It is respectfully requested that the Regional Board direct its staff to significantly and fundamentally revise the TMDL, its implementation plan, and the associated proposed Basin Plan amendment to address the concerns delineated in the SCVURPPP comments.

Very truly,

A handwritten signature in cursive script, appearing to read "Steve Homan".

Steve Homan  
NPS Program Coordinator

CC: SCVURPPP Management Committee

# County of Santa Clara

Environmental Resources Agency  
Parks and Recreation Department

298 Garden Hill Drive  
Los Gatos, California 95032-7669  
(408) 355-2200 FAX (408) 355-2290  
Reservations (408) 355-2201  
[www.parks.clr.org](http://www.parks.clr.org)



June 14, 2004

**BY FACSIMILE AND FIRST CLASS MAIL**

Mr. Bill Johnson  
Mr. Richard Looker  
California Regional Water Quality Control Board, San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Dear Messrs. Johnson and Looker:

The County of Santa Clara ("County") presents these comments on policy and technical considerations regarding the above-referenced TMDL and related implementation plan, dated April 30, 2004. The Santa Clara Valley Urban Runoff Pollution Prevention Program ("SCVURPPP"), of which the County is a member, has also submitted comments on both technical and legal issues with respect to the TMDL and proposed Basin Plan Amendment. The County supports and adopts those comments, both legal and technical. The County's comments here reiterate the general concerns expressed about the fairness and adequacy of the proposed TMDL and its implementation plan, and provide additional technical comments supporting the legitimacy of those concerns.

Briefly, the County's review of the TMDL report and supporting materials indicates that the TMDL is based on assumptions with no or questionable support in current science, leading to a flawed implementation plan. The County recognizes that the development of a defensible TMDL for mercury in the San Francisco Bay in a relatively short time period is a difficult, if not impossible, task, given the state of knowledge regarding mercury in the environment, and the resource limitations of the agencies. To address the substantial gaps in data and understanding of both the Bay system and the mercury in the system, staff of the Regional Board have incorporated a patchwork of information and data from disparate sources and varying time periods, and rest their central conclusions on the validity of several critical assumptions, chiefly that addressing total mercury loading to the Bay will produce similar reductions methylmercury loading, and likewise reduce mercury impacts on fish and wildlife (birds).

The impact of those assumptions extends to the nature of the implementation plan. The report does not identify or examine alternative approaches to addressing the mercury concerns in the Bay, in terms of cost, effectiveness or -- critical for CEQA purposes -- potential for collateral environmental impact. Indeed, the TMDL report neither addresses alternative approaches, nor adequately addresses whether the allocations assigned are attainable at any cost, let alone at a reasonable cost, and ignores



the potential that incorrect assumptions will lead to heavy expenditures on activities that have little or no impact on the identified problems.

These are not trivial issues. The County removed a substantial volume of calcine materials from the former mining areas in 1997-1999. The Santa Clara Valley Water District has also conducted substantial activities within the past five years that removed significant amounts of mercury. Accordingly, with remaining mercury material within the Guadalupe River Watershed dispersed widely along the waterways and at low concentrations, it is not at all clear that it would be practically feasible to control any significant percent, let alone 98%, of future releases to water from remaining mercury material.

The SCVURPPP comments and related submissions address most of the County's legal and factual concerns and will not be repeated in detail here. The County's concerns can be quickly summarized in a series of questions.

### **Are we addressing the right objective?**

- The TMDL is addressing a problem that arises from methylmercury, through implementation aimed at total mercury.<sup>1</sup> There is no direct correlation between the two forms of mercury, as discussed in the attached technical comments of Dr. Terry Cooke, Senior Project Chemist at URS, a well-respected national environmental consulting firm. Absent an understanding of the relationship of the two forms in the context of the Bay environment, agencies cannot make a reasoned choice among alternative actions aimed at reducing the impact of methylmercury. Thus the TMDL may require expensive implementation directed to total mercury, and have no effect on resource exposure to methylmercury, or on attainment of the TMDL's goals for fish and birds. The implementation of such efforts, however, would squander limited resources and divert efforts to fully understand the methylation process, and may have significant adverse collateral impact on the environment, such as may result from extensive dredging.

The proposal is also inconsistent with the approaches taken in other mercury TMDLs under the Central Valley Regional Board, which is responsible for addressing the inputs identified as the major mercury sources to the Bay. However, the TMDL report also does not address how that difference in approach -- one aimed at total mercury, one at methylmercury -- may affect achievement of the targets adopted for the Bay. In fact, the TMDL is devoid of any alternatives discussion consistent with the spirit and intent of CEQA, despite the fact that the document purports to be the "functional equivalent of a CEQA analysis.

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<sup>1</sup> "The organic form of mercury (methylmercury) is toxic and bioavailable, but information on ways of controlling methylmercury production is limited." Proposed Basin Plan Amendment, p. A-1.



Particularly in a time of stringent fiscal restraint, it would seem that better understanding upfront of the mercury and the methylation process would better serve the public interest.

### **Are we looking at the right target endpoints?**

- The TMDL addresses two endpoints: concentrations in fish tissue and concentrations in bird eggs, calling for reduction of mercury levels in both to specific numeric levels. However, for birds, the technical studies relied upon in the TMDL are not in fact adequate to support a claim that mercury in the Bay is the source of any impact on that resource, because, e.g., of their failure to take into account differences in species and foraging patterns. Nor are those studies adequate to establish that attaining the proposed target for mercury would provide any benefit to bird species or other wildlife. This is addressed more fully in the attached comments provided by Dr. Adrian del Nevo, a highly-regarded expert on avian issues, with direct and continuing experience with the species discussed in the TMDL report, including experience with those species in the Bay Area, both as a consultant on those issues for the County and as an active participant in Bay Area conservation organizations.

### **Are we looking at the right water body?**

- For ease of analysis and implementation, the TMDL uses a “whole bay” approach, which ignores a variety of very substantial differences between the South Bay and the remainder of the Bay. Averaging out data or making the assumption that significant processes affect all parts of the Bay in the same fashion affects the entire analysis by which the plan has been developed. Those differences may also mean that a similar “one size fits all” approach to manner of implementation will be both wasteful and in many instances ineffective.

### **Are we looking at the right data?**

- The allocations for the Bay segments, including the Guadalupe Watershed, are based on mercury and sediment data sets that are not consistent, and that do not incorporate either changes over time in the Bay, or the impact of more recent events, including the County’s removal of over 100,000 cu. yds. of calcine (mercury mining waste) material from the Guadalupe River watershed. The TMDL process is a “forward looking” effort. The baseline for that effort should incorporate a reasonably current understanding of watershed conditions.

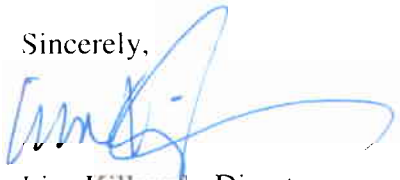
## Are the assigned allocations attainable, and fair?

- The allocations for the Guadalupe River Watershed, which are based on mercury targets and loading estimates, do not include any analysis of whether those levels could be achieved at any cost, let alone at a cost bearing a reasonable relationship to the expected benefit. Because we do not know what effect removal of total mercury will have on the real concern – methylmercury – all we know is that, attainable or not, effective or not, these efforts at removal will be expensive. The County spent over \$6 million in remediating mercury contamination at Almaden Quicksilver Park, removing over 100,000 cu. yds of calcines from along creeks in the watershed.<sup>2</sup> That remediation, moreover, represents the great bulk in terms of removal of significant calcine deposits.

The County does not believe that it is reasonable or appropriate for the Board to adopt the proposed TMDL and Basin Plan Amendment, given the high degree of uncertainty regarding the nature of the problem being addressed, the fairness of allocations, and the effectiveness of proposed implementation activities. These are not matters which can simply be handled through an “adaptive management” approach five or ten years into this process. If the matter moves forward as proposed, substantial amounts of funding may well be expended on efforts that will produce no benefit in terms of the mercury, and would also inevitably entail – as a result of dredging or other removal actions --substantial environmental impacts on other resources. Again, the TMDL does not even purport to address the likelihood of such collateral impacts.

There is an alternative, proposed by in the SCVURPPP comments, but not discussed in the TMDL report. This TMDL should move forward in stages, as our understanding of the Bay processes and the chemistry increases, and we attain the ability to evaluate both the benefits and costs of implementation activities. At a minimum, a phased approach will facilitate the efficient and effective use of limited public resources, and informed efforts at addressing the problems of mercury may in fact speed the ultimate restoration of the affected beneficial uses.

Sincerely,



Lisa Killough, Director  
Santa Clara County Department of Parks and Recreation

cc: Kathryn Berry, Gerald F. George, Terry Cooke, Adrian del Nevo

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<sup>2</sup> While the practical import of “recognition” as used in the TMDL is unclear, the County will have spent over \$6 million to clean up the areas containing the largest volumes of calcines in the Guadalupe River Watershed, but will receive no “recognition” for that activity, because the remediation concluded in 1999, before the 2001 date in the proposed Basin Plan Amendment.



**Santa Clara Valley  
Urban Runoff  
Pollution Prevention Program**

Campbell · Cupertino · Los Altos · Los Altos Hills · Los Gatos · Milpitas · Monte Sereno · Mountain View · Palo Alto  
San Jose · Santa Clara · Saratoga · Sunnyvale · Santa Clara County · Santa Clara Valley Water District

June 14, 2004

Mr. Bill Johnson and Mr. Richard Looker  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed  
Basin Plan Amendment and Staff Report**

Dear Mr. Looker and Mr. Johnson:

This letter is submitted on behalf of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) regarding the *Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment (BPA) and Staff Report (Staff Report)*, dated April 30, 2004. The SCVURPPP would like to thank you for this opportunity to comment on the Report and commend each of you for your hard work.

Impairments to beneficial uses of water bodies in the San Francisco Bay Area are of utmost importance to the SCVURPPP. Furthermore, we agree that the reasonable protection of beneficial uses from controllable mercury sources in and to the Bay should be a high priority for all Bay Area public agencies and citizens. For the SCVURPPP, concern for elevated mercury concentrations in the San Francisco Bay biota have already caused us to refocus a portion of our public resources over the past few years towards reductions of mercury levels in urban runoff. We, as public agencies, take this task very seriously. Therefore, we believe a fair, objective and transparent TMDL and related BPA based on the best available information and sound science is important to its legitimacy, legality, and public confidence.

Over the past five years, the SCVURPPP and the Bay Area Stormwater Management Agencies Association (BASMAA) have attempted to collaborate with Regional Board staff on developing the mercury TMDL<sup>1</sup>. This collaborative approach is evident in SCVURPPP/BASMAA's active participation in the Mercury Watershed Council and more recently in the Clean Estuary Partnership (CEP).

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<sup>1</sup> During this process we have stressed the very important need to utilize a science-based TMDL addressing federal Clean Water Act requirements to inform development of a separate State implementation plan. This 2-step approach would maximize the Regional Board's ability itself to properly develop a risk management based implementation plan consistent with existing Basin Plan and State law requirements.

Unfortunately, the collaborative approach we have attempted to pursue does not yet appear to have been seriously embraced. For example, staff members representing SCVURPPP and BASMAA have attended numerous meetings (e.g., Mercury Watershed Council and CEP Technical Committee) with Regional Board staff and raised numerous issues and suggestions related to the TMDL. These issues, accompanied by constructive suggestions have also been raised to the Regional Board staff in comments concerning each of the following documents related to the Mercury TMDL (see Appendix A).

- Mercury TMDL Workplan-Workload (dated February 5, 1999);
- Watershed Management of Mercury in the San Francisco Bay Estuary: A TMDL Report to USEPA (dated June 30, 2000);
- Presentation of the Draft Mercury TMDL Project Report at the Mercury Watershed Council (October 31, 2002);
- Mercury in the San Francisco Bay Total Maximum Daily Load (TMDL) Project Report (dated June 6, 2003); and,
- Draft Mercury Basin Plan Amendment Language for Urban Runoff (dated September 2, 2003).

On the vast majority of the issues raised by SCVURPPP and BASMAA, a clear and meaningful response has not been given to date, either directly or by means of revisions to the Staff Report or BPA. We are cognizant of the fact that State resources are limited at this time; however responding to comments and concerns of stakeholders that will be directly affected by the proposed TMDL is an important task and there is little incentive or point to us engaging in stakeholder processes if our input is not going to be addressed.

Because the Regional Board staff has not addressed issues presented in comments previously submitted by the SCVURPPP and BASMAA, they remain largely unresolved. These include, but are not limited to:

- **The Linkage Between Mercury in Sediment and Methylmercury in Fish is Not Supported by Science** - The Staff Report focuses on reduction of mercury bound to sediment particles and makes the scientifically unsupportable assumption that this mercury is quantitatively linked to the amount of methylmercury that enters the aquatic food web. Unless the TMDL is substantially revised to focus (i.e., work on understanding how we could regulate based on methylmercury) on methylmercury, pursuing the current course will likely result in inefficient (and perhaps ineffective) control efforts and a related misallocations of resources.
- **Loads from Bed Erosion are Underestimated** – Recently available scientific information (USGS 2004) suggests that the loading estimate from the largest source of mercury to the Bay (i.e., bed erosion) is grossly underestimated (by 3x). Revising this loading estimate will paint a drastically different picture of the Bay's recovery, shortening it from roughly 120 years to 60 years. Not including this information in the TMDL will misinform the public and require larger than necessary, load reductions to be assigned to other source categories (i.e., urban stormwater runoff) which will consume scarce local government resources and not likely reduce mercury in the Bay.

- **Load Reductions from Urban Stormwater Runoff are Overestimated** - The load reduction proposed in the Staff Report and BPA for urban stormwater runoff is grossly overestimated and not grounded in sound science. A significantly large portion (> 75%) of the estimated total sediment load (410 M kg/yr) from urban stormwater runoff is actually attributable to sediment that has already been discharged to Bay Area surface waters. Recently collected data indicates that the mercury in this sediment is equal to the proposed sediment target (0.2 ppm) and, therefore, should require no or minimal load reduction. Not recalculating the urban stormwater runoff loading estimate will place an undue burden on municipal stormwater management programs and local government resources, and it will also misguide public perception as to the relative significance of this source.
- **A Significant Portion of Mercury in Urban Stormwater Runoff is Uncontrollable** - A significant portion of the estimated mercury load from urban stormwater runoff (i.e., in excess of 33%) is attributable to uncontrollable sources and should, therefore, be removed from this source category. As with nearly all mercury-related TMDLs that have been approved throughout the US, air deposition is a significant source and controlling it is beyond the jurisdiction and resource abilities of municipal stormwater management programs. The same is true of mercury loads emanating from Caltrans, which should be the subject of an independent allocation.
- **Technical Feasibility, Practicability and Costs** - The proposed requirements and Waste Load Allocation (WLA) for urban stormwater runoff are technically infeasible, go beyond the maximum extent practicable (MEP) standard and would place an undue burden on urban runoff management programs. It is questioned whether recycling programs, source controls and/or treatment controls designed to meet the proposed WLA are technically feasible to implement or are capable of meeting the load reduction targets even if feasible. Additionally, the estimated costs to the SCVURPPP (capital costs \$41 to \$50 million per year and reporting and maintenance costs of \$63 to \$78 million per year) greatly outweighs the benefit of reducing an estimated 7% (revised for bed erosion) of the source.

These unresolved issues are further discussed in Attachment "A". As you know, the proposed BPA has many new proposed requirements that the SCVURPPP may be required to address. From our estimates, we can foresee that many of these requirements will be technically infeasible, extremely costly, and will divert resources and priorities from other important stormwater management efforts. Considering this, suggested improvements contained within this comment letter need to be seriously considered and, we hope, incorporated into a revised BPA and Staff Report. (We believe that not doing so will most definitely place an undue burden on public agencies in the Bay Area by requiring burdensome implementation actions that will likely have no effect on mercury in the Bay and its biota.)

The Regional Board must also consider the economic impacts of any Mercury TMDL-related amendments to the Basin Plan, as well as the impacts that any amendment would have on the development of housing in the region. (See Water Code § 13241.) Unfortunately, the SCVURPPP member agencies will be required to implement requirements under severe budget restrictions, which have in many cases caused these agencies to cut back on important municipal services. In addition, Proposition 218 has added further restrictions on the ability of local government to generate additional revenues for urban stormwater programs. Thus, as required by the Water Code and the Basin Plan, it is particularly important for the Regional Board to recognize financial constraints on local agencies and to provide flexibility to ensure that


water quality objectives and implementation measures are economically attainable and technically feasible. (This is particularly true given long standing Regional Board policies concerning the South Bay.)

We recommend that the Regional Board postpone consideration of the BPA at this time and instead direct the staff to work with Bay Area stakeholders to substantially revise the Staff Report and BPA, including incorporating a phased implementation approach, similar to that used in the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (CVRWQCB 2004). The approach can be divided into a two-phase process. Phase I may include conducting studies to better determine sources, controllability, and cost effectiveness. During Phase 1, existing NPDES permit requirements, including the mercury reduction plan requirements in municipal stormwater permits would continue to result in enhanced control measures and reduction of mercury discharges. Once adequate information has been developed by a collaborative stakeholder process, Phase II would include the development of additional implementation plans to further reduce mercury based on new information collected during Phase I. Without the phased approach, actions to address scientifically flawed allocations and load reduction targets will likely provide little if any benefits to the Bay and its beneficial uses at significant (and unjustified) public expense.

Additionally, the SCVURPPP is in support and incorporates by reference the comments submitted by its legal counsel, BASMAA, the Santa Clara Valley Water District (SCVWD), the City of San Jose, the City of Sunnyvale, the County of Santa Clara, and its other members.

Please contact Mr. Chris Sommers or me at (510) 832-2852 if you have any questions regarding the comments or suggested changes.

Sincerely,



Adam W. Olivieri, Dr.PH, P.E.  
SCVURPPP Program Manager

CC: Bruce Wolfe  
Tom Mumley  
Dorothy Dickie  
SCVURPPP Management Committee  
SCVURPPP Legal Steering Group  
Donald P. Freitas, BASMAA Executive Board Chair

**“Attachment A”**  
**Unresolved Technical Issues with the Mercury TMDL**  
**June 14, 2004**

**Issue #1: The Linkage Between Mercury in Sediment and Methylmercury in Fish is Not Supported by Science**

The Staff Report bases its wasteload allocations on the inappropriate assumption that the relationship between total mercury measured in bedded or suspended sediments and methylmercury measured in fish tissue in the Bay is linear<sup>1</sup>. As described in comments submitted by Exponent Corporation on behalf of the Santa Clara Valley Water District, science does not support this assumption<sup>2</sup>. Unless the TMDL is substantially revised to focus (i.e., work on understanding how we could regulate based on methylmercury) on methylmercury, continuing to pursue the current course will likely result in inefficient (and perhaps ineffective) control efforts and a related misallocation of scarce public resources. (In other words, we will spend a lot of time and resources trying to remove and control a lot of dirt instead of targeting the actual pollutant of concern.)

The concentration of mercury in fish tissue depends on the nature and efficiency of a number of biogeochemical processes that vary between and/or within estuarine ecosystems. These processes include: 1) the solubilization of sediment-bound mercury into porewater; 2) the transformation of dissolved mercury to methylmercury; and, 3) the structure of the food web. The authors of the report state, “Factors relating to mercury methylation and accumulation within the food web are complex and not fully understood”. However, “In the absence of additional information, reductions in mercury loads are assumed, for the purposes of this report, to result in proportional reductions in fish tissue residues (pg. 48).”

While undoubtedly complex, enough is understood about mercury methylation to support further investigation to understand how we could regulate based on methylmercury (as the Central Valley Regional Board, the Santa Clara Valley Water District and USEPA are doing). The complexity of methylmercury formation is certainly not an excuse sufficient to justify a TMDL based on what science has clearly established is an unsupportable assumption between sediment-bound mercury and fish tissue.

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<sup>1</sup> To the extent that the proposed numeric targets and WLA are based on these assumptions they need to address the numeric standard /objective for mercury in South San Francisco Bay contained in US EPA's California Toxic Rule (CTR). The US EPA numeric standard/objective for mercury contained in the CTR incorporates a fish bioconcentration factor, and thus, was specifically developed by EPA to protect human health associated with the consumption of water and organisms.

<sup>2</sup> The discussion in the comments from Exponent regarding "new" and "old" mercury requires some clarification here. In the context of their comments, Exponent's referral to "old" mercury is applied to mercury in sediment, whereas "new" mercury is dissolved or methylated mercury in the water column, or mercury from atmospheric deposition.

## Issue #2      **The Mercury Load from Bay Bed Erosion (as presented in the Staff Report) is Substantially Underestimated**

The SCVURPPP agrees with the Staff Report that bed erosion is likely the largest source of total mercury to the Bay, given past resource management history (i.e., mining) and the likelihood of bed sediments continuing to erode. Therefore, we believe providing the best estimate of bed erosion for the entire Bay is of utmost importance when determining sources of mercury. Unfortunately the Staff Report does not attempt to include bed erosion from segments other than San Pablo and Suisun Bays, as requested in BASMAA's prior comments on the TMDL Project Report (see Appendix A). Regional Board staff responded to this request (dated August 25, 2003) with the following statement:

*"The desired information is unavailable. We do not intend to speculate in areas where we have no information. This information is being developed, however. Unfortunately, it won't be available in time for the Basin Plan Amendment. Thus we intend to rely on adaptive implementation to incorporate this information when it becomes available".*

But such information is available and must be considered before adoption of the BPA. The information is contained in a recently published USGS open file report (USGS 2004) (see Appendix B). In fact, this information was included in the recently published *2004 Pulse of the Estuary* (SFEI 2004). This new information indicates that the largest source of mercury to the Bay has likely been grossly underestimated in the Staff Report, having great consequence on estimated recovery times and necessary load reductions assigned to other sources. In light of the new available information, the SCVURPPP has developed and provided revised estimates of mercury loads attributable to bed erosion in the Bay. These estimates are summarized in Table 1.

**Table 1. Revised Estimates of Mercury Loads Attributable to Bed Erosion**

Bed Erosion Estimates	Mercury Load (kg/yr)	Sediment Load (M kg/yr)	Mercury Concentration (mg/kg)
<i>Suisun and San Pablo Bay Bed Erosion (TMDL Estimate)</i>	460	1,100	0.42
<i>South Bay Bed Erosion (USGS Estimate)</i>	920	2,200	0.42
<b>Total Bed Erosion (Suisun, San Pablo and South Bay Estimates)</b>	<b>1,380</b>	<b>3,300</b>	-
<i>Percent Increase from TMDL Estimate</i>	300%	300%	-

Including this information into the approach used by Regional Board staff to estimate overall sources and losses suggests that substantially more mercury is attributable to bed erosion than originally calculated. The revised source and loss numbers that include estimates of mercury from bed erosion in the South Bay are presented in Table 2.



As illustrated, the percentage of mercury coming from urban stormwater runoff pales in comparison to that coming from bed erosion. In fact, including bed erosion estimates from the South Bay into the single-box model used to develop the recovery curves presented in the Staff Report (which we do not agree is necessarily a representative and appropriate model) indicates that Bay sediment would likely meet the proposed sediment target (0.2 ppm) in a much shorter time-frame (~57 vs. 120 years), even without load reductions.

Furthermore, if bed erosion is properly accounted for including revised load reductions for urban runoff (see Issue #3) would only speed up recovery by a mere two years. This would suggest that costly management actions from urban stormwater runoff would not be justifiable as they likely have little effect on the recovery of the Bay, when compared to bed erosion.

**Table 2. Revised Estimates of Mercury Loads from Bed Erosion, Urban Runoff and Other Sources.**

	<b>TMDL Mercury Load (kg/yr)</b>	<b>% of Total Load</b>	<b>Revised Mercury Load (kg/yr)<sup>3</sup></b>	<b>% of Total Load</b>
<b><u>Sources</u></b>				
<i>Bed Erosion</i>	460	38%	1,380	64%
<i>Urban Stormwater Runoff</i>	160	13%	42	2%
<i>Other Sources<sup>4</sup></i>	600	49%	726	34%
<b><i>Total</i></b>	<b>1,220</b>	<b>100%</b>	<b>2,148</b>	<b>100%</b>

Therefore, the source assessment section of the Staff Report and BPA should be revised, prior to adoption by the Regional Board to include the new information on bed erosion developed by the USGS.

### **Issue #3: The Load Reduction proposed for Urban runoff is Grossly Overestimated and Not Grounded in Science**

As raised in previously submitted comments (see Appendix A), the loading estimate presented in the Staff Report and BPA attributed to urban stormwater runoff is highly uncertain and the methodology used to derive the estimate is seriously flawed. As stated in the Staff Report and BPA, the total mercury load from urban runoff is erroneously calculated at roughly 160 kg/yr (and non-urban runoff is 25 kg/yr). However, these estimates were developed on the basis of sediment loads and mercury concentrations in bedded sediment and the San Francisco Estuary Institute (SFEI) has recently commented that it is not possible to determine the bias and error

<sup>3</sup> Revised loading estimates include South Bay bed erosion and revised urban and non-urban stormwater runoff loading estimates (further described in Issue #3).

<sup>4</sup> Other sources include Central Valley Watershed; Guadalupe River Watershed; Direct Atmospheric Deposition; Non-Urban Stormwater Runoff; channel bed and bank erosion; and, Wastewater.

associated with loading estimates based on bedded sediment concentrations (McKee et. al 2003).

### ***Instream vs. Land-based Sources***

The estimated total sediment load from urban (410 M kg/yr) and non-urban (400 M kg/yr) areas has been incorrectly assigned in the Staff Report to urban and non-urban source categories. The scientific literature instead suggests that a large majority (>50%) of the estimated sediment load from Bay Area tributaries is attributable to “instream and hillslope erosional processes”, such as landslides and channel bank/bed erosion (Anderson 1981; Lehre 1981; Leopold 1994; Collins 2001; Stillwater Science 2002). This information is summarized in a recent literature review on urban runoff processes in the San Francisco Bay Area (McKee et al. 2003). Furthermore, the average concentration of total mercury in these “instream and hillslope” sediments is roughly equal to the proposed sediment target (0.2 mg/kg), and therefore, they should not require a load reduction via the TMDL. Empirical sediment data collected from bedded sediments in Bay Area urban creeks supports this assertion (see Appendix B).

To assist the Regional Board staff in properly assigning mercury wasteload and load allocations to relevant source categories, new preliminary loading estimates were developed for urban and non-urban stormwater runoff (using the same methodology used in the Staff Report and BPA) and channel bed/bank erosion (i.e., instream and hillslope sources). Using the estimated total annual sediment load from small tributaries (810 M kg/yr); loading estimates of total suspended solid (TSS) from urban and non-urban stormwater runoff<sup>5</sup>; and average total mercury concentrations from urban stormwater runoff (0.46 mg/kg), non-urban stormwater runoff (0.06 mg/kg) and channel bank/bed erosion (0.21 mg/kg) developed during the *Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides* (KLI and EOA 2002), and the *Initial Characterization of PCB, Mercury and PAH Contamination in Drainages of Western Alameda County* (Gunther et. al 2001) new preliminary loading estimates were developed (Table 3).

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<sup>5</sup>Although it is expected that there will be variations in particle size distribution of sediment from urban runoff, recent studies have shown that sediment from urban stormwater runoff is made up of predominantly (90-100%) fine particles that are included in total suspended solid (TSS) measurements (USEPA 1983; Driscoll 1986; Ball et al. 1995; and Wisconsin DNR 1997).

**Table 3. Revised mercury loading estimates from urban runoff, non-urban runoff and channel bank/bed erosion**

	Estimated Sediment Loads (M kg/yr)		Estimated Hg Concentrations (mg/kg)		Estimated Hg Load (kg/yr)	
	<i>Hg TMDL</i>	<i>Revised</i>	<i>Hg TMDL</i>	<i>Revised</i>	<i>Hg TMDL</i>	<i>Revised</i>
Urban Runoff	410	91a	0.38	0.46b	160	42d
Non-Urban Runoff	400	86a	0.06	0.06	25	5d
Channel Bed and Bank Erosion*	-	633	-	0.21c	-	146
<b>Total</b>	<b>810</b>	<b>810</b>	<b>-</b>	<b>-</b>	<b>185</b>	<b>193</b>
<p>* Includes instream sediment storage, bed and bank erosion, gullying and landslides</p> <p>a - Sediment loads are based on estimates presented in KLI and EOA (2002) <i>Joint Stormwater Agency Project to Study Urban Sources of PCBs, Mercury and Organochlorine Pesticides</i>.</p> <p>b – Estimated mercury concentrations are derived from sediment collected in Bay Area storm drain facilities (KLI and EOA 2002)</p> <p>c – Estimated mercury concentrations are derived from sediment collected in Bay Area creeks and open channels (KLI and EOA 2002; Gunther et. al 2001)</p> <p>d – These estimates include mercury attributable to indirect air deposition, which should be removed from the urban and non-urban stormwater runoff source categories (see Issue #3).</p>						

The SCVURPPP requests that the Staff Report and BPA be revised to reflect the above analysis and results shown in Table 3. We also request that mercury and sediment from channel bed and bank erosion instead be assigned a separate load allocation (LA) attributed to non-point sources. This is consistent with USEPA Region 9 *Guidance for Developing TMDLs in California* (2000), which states "...load allocations may be expressed...by pollutant discharge process (e.g., landslides)". (Due to the average concentration of total mercury in creek bed sediment being equal to the sediment target, the LA for this source should be equal to the current loading estimate. In other words, significant public resources should not be required to address the channel bed/bank source category under this approach.)

**Issue #4: A Significant Portion of the Estimated Urban Stormwater Load is Attributable to Uncontrollable Sources and Should be Removed from the Urban Runoff Load Estimate and Waste-Load Allocation (WLA)**

Indirect air deposition of mercury to San Francisco Bay Area watershed is not a controllable water quality factor and should be removed from the urban stormwater runoff load estimate. The Staff Report includes estimates of dry and wet deposition of mercury directly deposited onto the Bay but recognizes that these cannot be controlled or the associated loading reduced. However, estimates of the same indirect deposition onto the watershed adjacent to the Bay are treated exactly to the contrary, assumed to be 100% controllable, and included in the stormwater load estimates.

The sources of mercury in atmospheric deposition and their relevant contributions are not well understood, but likely include global background sources (e.g., imports from Asia). These sources are not “reasonably controlled” or likely to be reduced in the near future, and, therefore, should be considered uncontrollable water quality factors that lie outside of the Basin Plan’s narrative water quality objective for bio-accumulative substances. Further, these sources are outside the jurisdiction of the municipal urban runoff management programs. (Alternatively, if the staff believes that this source is controllable, they should explain why, the extent to which controllability applies, and estimate the likely costs and impacts of the control mechanism they identify.)

**Issue #5      The Proposed Implementation Plan for Urban Stormwater Runoff is Technically Infeasible, goes Beyond the Maximum Extent Practicable (MEP) standard, and would place an Undue Burden on Local Governments**

The Staff Report and BPA propose a 50% (78 kg/yr) reduction in mercury from Bay Area urban stormwater runoff, 21 kg/yr of which will be allocated to the SCVURPPP. (This allocation is exclusive of its members contributions to a 98% (90 kg/yr) reduction targeted for the Guadalupe River Watershed.)

***Technical Feasibility and Costs of Meeting the Proposed Wasteload Allocation (WLA)***

With regard to reducing the mass of mercury entering the Bay, as long as sediment continues to be the focus of this TMDL, urban runoff management programs will likely be called on to use one or more control and/or treatment options described below. However, as demonstrated, the focus on trying to control dirt is a recipe for failure as the implementation and success of many of these options is likely limited due to technical infeasibility and extremely high capital costs and ongoing implementation costs (see Table 4).

A summary of each possible control option, its technical feasibility, likelihood of success, and anticipated costs are briefly described below.

- Recycling Programs – includes developing recycling programs, operating recycling facilities and promoting the recycling mercury containing devices such as fluorescent light bulbs, thermometers and mercury switches.
- Source Controls – includes developing programs that remove sediment (and thus mercury) from municipal storm drain facilities and creek channels.
- Treatment Controls – includes developing and implementing mechanisms that capture and treat stormwater through the removal of fine sediment.

**Recycling Programs**

Estimates developed by SCVURPPP indicate that currently in the Bay Area, between 11 and 30 kg/yr of mercury in the Bay Area is recycled annually from fluorescent light bulbs<sup>6</sup> (ALMR 2003). However, as shown in previous studies, only a portion of this mercury (1-20% or 0.1 to 6 kg/yr)

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<sup>6</sup> Estimates are based on the following assumptions: 1) 2,892,000 bulbs recycled annually in the Bay Area by businesses and households combined (ALMR 2003) and, 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000).

may actually be released into the environment (but not necessarily reaching a water body) through volatilization<sup>7</sup> (USEPA 1994; NEMA 2000; Aucott et al. 2003). To determine the extent to which recycling fluorescent light bulbs could aid urban runoff management programs in meeting the proposed load reduction (78 kg/yr), the SCVURPPP has estimated that if every fluorescent light bulb purchased in the Bay Area were recycled, the load of mercury that would be avoided from entering the environment is between 0.5 and 24 kg/yr<sup>8</sup> (ALMR 2003). In other words, not taking into account technical feasibility or costs, only between 1-26% of the mercury load reduction required from urban stormwater runoff could be accounted for through fluorescent light bulb recycling.

Costs estimates associated with increased recycling of fluorescent light bulbs and other mercury containing devices (e.g., thermostats and switches) have been recently developed by SCVURPPP Co-permittees (i.e., Santa Clara County and City of Palo Alto). Infrastructure and operating costs of handling increased quantities of these devices by Santa Clara County's Household Hazardous Waste (HHW) Program could exceed \$10 million per year (D'Arcy 2002). Additionally, the City of Palo Alto (2003) has estimated that the average cost of recycling each fluorescent light bulb is approximately \$0.51. Therefore, based on these cost estimates and the estimated number of fluorescent light bulbs that are purchased/disposed of by households in Santa Clara County each year (~495,000), the total cost for the SCVURPPP would be significant (>\$10 million annually). These costs do not take into account the technical feasibility of collecting, shipping and recycling these wastes, do not include the costs of tracking and reporting recycling activities conducted by businesses (i.e., large waste generators), and do not take into account the costs associated with marketing and/or enforcement of a 100% recycling effort..

#### Source Control Program.

The SCVURPPP has spent a significant amount of resources and staff time in recent years on developing and implementing a Mercury Pollution Prevention Plan (Mercury Plan). However, it is not clear under the implementation plan whether (or how much) credit will be received for these activities. The Mercury Plan addresses five general goals:

- Elimination of all unnecessary municipal use of mercury-containing products and establishing proper disposal methods for products that cannot be eliminated.
- Providing mercury-containing product disposal services through household hazardous waste (HHW) collection programs for residents and small businesses, and encouraging the use of these programs.
- Participation in coordinated monitoring efforts to support mercury TMDL development and implementation, including assessment of air pollution sources of mercury and concentrations of mercury in sediment.
- Actively participating in regional, state and federal coordination efforts to achieve a reduction in the amount of mercury in urban runoff and air emissions.

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<sup>7</sup> Estimated 1 to 20% mercury volatilization rate.

<sup>8</sup> Estimates are based on the following assumptions: 1) 12,000,000 bulbs purchased/disposed of annually in the Bay Area by businesses and households combined (ALMR 2003); 2) 4 to 10 mg of mercury per light bulb (ALMR 2003; NEMA 2000); and, 3) 1-20% mercury volatilization rate (USEPA 1994; NEMA 2000; Aucott et al. 2003)

- Increasing awareness of proper disposal of mercury-containing products and available non-mercury containing alternatives (SCVURPPP 2003).

The Program has estimated costs for refining and implementing the Mercury Plan. These costs include:

- Further Plan Development and Outreach - Direct costs to the SCVURPPP to set up the mercury pollution prevention program and perform the initial outreach was \$25,000. Indirect costs to the SCVURPPP co-permittees to set up the program was approximately \$120,000.
- Implementation of Plan - This step involves development of policies, guidelines, and model ordinances. The SCVURPPP has allotted \$60,000 as the direct cost for program implementation. Additionally, indirect costs are incurred by co-permittees through the use of their own staff time. The SCVURPPP estimates that the implementation of the pollution prevention program costs SCVURPPP co-permittees \$120,000 initially and will cost an additional \$240,000 annually.

Therefore, the estimated total costs of developing and implementing SCVURPPP's Mercury Plan is roughly \$265,000 for development (i.e., annualized to \$19,000 per year) and \$300,000 annually to implement. (These estimates include costs for both the area-wide program and each of the co-permittee's individual programs.)

#### *Additional Source Controls*

Given the relatively low mass of mercury that can be removed via recycling programs and the extremely high costs associated with implementing these programs, it is likely that the SCVURPPP will be required to increase the extent of source control activities to meet the proposed WLA. Additional source controls (with regard to mercury) are those activities that involve the removal of sediment (and therefore mercury) during storm drain facility and creek/channel maintenance, and street sweeping. (All SCVURPPP co-permittees currently implement source controls as part of their urban runoff management programs. However, as currently structured, the WLA and implementation plan will provide no credit for these activities even though they reduce mercury. Increasing the magnitude of these activities is not feasible given the state of local government budgets; nor, would it be likely to meet the WLA.

In an attempt to further examine the feasibility and costs associated with additional source control, we have developed preliminary estimates of the mass of sediment that would have to be removed via source controls to meet the proposed WLA for urban stormwater runoff (Bay-wide). Opportunities for additional source control were focused on controls (i.e., storm drain facility and channel/creek maintenance) that have been shown in recent studies to have the greatest potential for removal of an additional mass of mercury (Salop et al. 2004). Based on available information, we estimate that in order to meet the proposed WLA for urban stormwater runoff (82 kg/yr), BASMAA member agencies would have to remove an additional 200 million kilograms of sediment per year from storm drain facilities and/or creeks/channels<sup>9</sup>.

However, as noted in Issue #3 of this comment letter, as the estimated average concentration of mercury in creek/channel bedded sediments is equal to the proposed sediment target (0.2ppm),

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<sup>9</sup> Estimate is based on a 49% decrease in the estimated 410 M kg/yr sediment load that contains an average mercury concentration of 0.38 mg/kg (ppm)

removal of these sediments will not substantially aid the recovery of the Bay. Taking this into account, we developed estimates of the mass and volume of material that would theoretically have to be removed from municipal storm drain facilities to meet the proposed WLA. Since only a portion (~25%) of the material typically removed from storm drain facilities is actually sediment, it is estimated that BASMAA member agencies would actually have to remove and dispose of an additional 800 million kilograms of material<sup>10</sup> annually from storm drain facilities. This mass of material equates to 1.4 million yd<sup>3</sup> or 47,000 30-yd<sup>3</sup> truck loads of material annually<sup>11</sup>. This is roughly a 500% increase from current storm drain maintenance activities. The technical feasibility of removing this volume of material annually from the municipal storm drain facility is highly questionable considering that this volume of material probably does not exist. (Preliminary estimates indicate that only an estimated 400 million kilograms of material may be entering the municipal storm drain system annually<sup>12</sup>.)

The costs associated with removing, hauling and disposing of this material is also prohibitive. Preliminary estimated costs for the SCVURPPP to conduct additional source control activities in response to the mercury TMDL are estimated to be approximately \$15 million in capital costs (i.e., annualized to \$1.1 million per year) and \$25 million in annual operating costs<sup>13</sup>. Removal, hauling and disposal of this volume of material would also likely entail several adverse environmental impacts.

### Treatment Controls

Stormwater treatment controls are methods of treatment to reduce pollutants from stormwater. Treatment methods typically include the infiltration, retention or filtering of stormwater. The assumption that new and redevelopment requirements (i.e., C.3.) will offset future increases in mercury from the increased population is unrealistic and unsubstantiated. A large majority of Bay Area cities are promoting smart growth, which encourages people to live in metropolitan hubs and urbanized areas where impervious surfaces are already present. As the Regional Board itself has previously recognized, C.3 requirements appropriately should not apply to such urbanized and high developed areas as they would otherwise create incentives for sprawl.

As noted in many previous studies, reports and guidance manuals, most treatment controls are extremely inefficient at removing fine sediment (and therefore mercury) and require ongoing maintenance (Metropolitan Council 2001; VCSQMP 2002 ; CASQA 2003). Those treatment controls that have shown efficiency in removing fine sediment are typically large in size (> 1 acre), due to the relatively long residence time needed to allow fine/suspended sediment to be removed from the water column through settling. Other treatment controls will likely require the construction of additional infrastructure (e.g., a capital intensive stormwater treatment plant). The technical feasibility and estimated costs of constructing, operating and maintaining these treatment controls are described below.

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<sup>10</sup> The estimate is based the assumption that the 400 million kilograms is split between organic material (300 million kilograms) representing 75% of the total and sediment (100 million kilograms) representing 25% of the total. The revised total mass of material of 800 million kilograms of material is based on the updated mass of sediment to be removed of 200 million kilograms and the proportional increase in the total mass of material based on the 75% to 25% split between organic and sediment material.

<sup>11</sup> Estimate is based on a sediment mass to volume conversion factor of 570 kg per yd<sup>3</sup>

<sup>12</sup> Estimate is based on 91 kg/yr of annual TSS loading from urban areas (KLI and EOA 2002) and assuming that roughly 25% of the material in storm drain facilities is sediment (Salop et al. 2004).

<sup>13</sup> These costs are based on purchasing, operating and maintaining vector trucks; constructing and operating storage facilities; hauling; staffing; and, waste disposal in a municipal landfill.

### *Treatment Control Measures*

Structural treatment control measures treat incoming stormwater by settling and usually hold water for at least 24-72 hours. These design standards for maximum pollutant removal efficiency indicate that a large area (>1 acre) is needed if construction is to occur. Therefore, the implementation of treatment controls such as wet ponds, and detention and infiltration basins is technically *infeasible* in most urbanized areas of the Bay, due to the lack of undeveloped land area on which such facilities would need to be constructed.

Costs of constructing and maintaining treatment controls vary. Without considering the costs of purchasing land needed to construct treatment controls, Minton (2003) estimates that the cost of constructing a wet pond can range between \$1,600 and \$9,000 per acre of development. Additionally, it is likely that land costs in the urbanized areas in Santa Clara County will exceed \$1 million per acre. Although little information was available to estimate operation and maintenance costs, they are believed to be substantial, ongoing, and likely much higher than construction costs.

### *Stormwater Treatment Plant*

The technical feasibility and costs associated with the construction of new stormwater treatment facilities, or the retrofitting of existing wastewater treatment facility infrastructure can vary greatly, and are highly dependent on site specific characteristics (e.g., proximity of storm drain lines to sanitary sewer lines and the capacity of the existing sanitary sewer lines), the availability of land to construct new facilities, existing plant capacity, and the volume and flow of stormwater that is intended for treatment. This analysis is further complicated since mercury in urban runoff is primarily associated with suspended sediments and the suspended sediments concentrations are typically elevated during early season rains and first flush events. In addition, the connection of urban runoff flows to wastewater treatment plants is unconventional since most plants have been designed to exclude runoff and any excess capacity is earmarked for future growth.

Therefore, based on currently available information, it appears highly unlikely that stormwater could feasibly be diverted to existing treatment plants in the South Bay, without substantial retrofits to the treatment plant infrastructure. These retrofits would include, at a minimum, increasing plant capacity and constructing new sanitary sewer lines. Preliminary costs estimates of implementing these retrofits for urban runoff flows in the South Bay (excluding land, additional piping, pumping costs, flow equalization/detention basins and recognizing the difficulties noted above including the assumption that urban runoff

can be separated from non urban runoff) are between \$67 million per year for primary treatment (i.e., \$37 million /year for O&M and \$30 million per year capital) and \$88 million per year (i.e., \$50 million per year for O&M and \$39 million per year for capital) for primary plus filtration<sup>14</sup>.

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<sup>14</sup> Preliminary cost estimates are based on treating the flow volume for urban runoff (Davis, J.A. 2000) estimated for Santa Clara at approximately 153,000 acre-ft/year and utilizing updated primary and primary+filtration unit costs for wastewater treatment (UC Davis, 1992). Flow estimates increase by approximately 30% per year if treatment of all runoff (i.e., urban and non urban) is necessary. Unit costs of \$100,000 per acre-ft./day for primary plus filtration and a unit cost of \$78,000 acre-ft/day for primary treatment were used. The unit treatment costs were escalated to 2004 dollars and annualized over a twenty year period (i.e., includes capital plus O&M). The annual cost for O&M is roughly 56% of the total. The annualized cost for capital is based on a 25 year term at 5% interest.



### Urban Stormwater Runoff Source Investigations

Initiating and implementing special studies to determine the spatial extent, magnitude, and locations of potential small sources of mercury in urban stormwater runoff can be an expensive, time consuming and unfruitful experience. Furthermore, the number of and extent of studies that will be required is currently unknown, but could include all sites where previous studies have determined that mercury concentrations in storm drains or creeks/channels exceeded the proposed 0.2 mg/kg sediment target (i.e., ~56 sites). Based on previous experience conducting PCB Case Studies, the estimated cost of each of these studies is between \$10,000 and \$100,000 annually, suggesting an annual cost between \$560,000 and \$5.6 million Bay-wide.

### Monitoring System

The proposed BPA includes a requirement for urban runoff management programs to develop and implement a monitoring system to quantify either mercury loads or the loads avoided through treatment, source control, and other management efforts. Although the scope and extent of the monitoring system is not fully understood, we anticipate that this requirement will include both ambient environmental monitoring and monitoring loads avoided/removed from recycling programs, source controls and treatment controls. It is estimated that environmental monitoring conducted solely for mercury will likely cost the SCVURPPP between \$100,000 and \$250,000 annually. Additionally, monitoring loads avoided/removed from implemented controls is estimated to cost roughly \$125,000 annually. Therefore, the total estimated cost for just the SCVURPPP to meet this requirement is between \$225,000 and \$375,000 annually.

### Fate, Transport, and Biological Uptake Investigations

The SCVURPPP assumes that this requirement can be satisfied by participating in the Regional Monitoring Program for Trace Substance (RMP) and/or the Clean Estuary Partnership at our current level of funding. If this assumption is correct, the estimated cost of complying with this requirement would be equal to current annual contribution to the RMP and CEP combined (~\$250,000), plus the costs of staff time (~\$50,000) needed to participate in and track these programs (i.e., total costs to SCVURPPP = ~\$300,000 annually). These costs do not include contributions to the RMP and CEP from Co-permittee owned and operated POTWs. Any additional studies requiring funding or staff time would substantially increase costs.

### Caltrans Allocation-Sharing Scheme

The implementation plan envisions urban runoff programs developing agreements with Caltrans to address a portion of the current urban runoff WLA/load reduction targets. However, developing WLAs for dischargers covered by other NPDES permits (which any agreement would effectively necessitate) is not the responsibility of municipal urban runoff management programs. BASMAA member agencies (including SCVURPPP) have no jurisdiction over and cannot control Caltrans activities. While we do not disagree that Caltrans should be addressed under this TMDL and BPA, we request that approach currently recommended by Staff be removed in favor of them identifying a separate WLA and load reduction target specifically for Caltrans.

### Annual Report Preparation

If the BPA is approved, then the Program will be required to prepare an annual report to measure progress towards achieving the WLA and documents either mercury loads or loads avoided through ongoing pollution prevention and control activities. While the above indicates that there is no reasonable prospect of addressing the BPA's unrealistic load reduction targets for urban runoff even with enormous public investment, we estimate that the development of specialized reporting forms documenting this likely outcome (and concurrently serving as a target for criticism and potential third party legal action) will cost roughly \$50,000 initially, while ongoing staff time needed to prepare annual reports will cost the SCVURPPP roughly \$100,000 annually. These estimates include costs for both the area-wide program and each of the co-permittee's individual programs.

### **Summary of Estimated Costs**

***Total estimated costs for SCVURPPP to address the proposed WLA and load reduction targets presented in the Staff Report and BPA are between \$41 to \$50 million per year for capital costs and between \$63 and \$ 78 million per year for ongoing costs (i.e., operation and maintenance, reporting, etc) for reducing an estimated 7% (revised for bed erosion) of the source (see Table 2). A summary of these costs is presented in the in Table 4.***

**Table 4. SCVURPPP's Estimated Costs of Complying with the Proposed WLA and Requirement for Urban Runoff Management Programs (b)**

<b>Control/Requirement</b>	<b>Annual Capital Costs(a)</b>	<b>Annual Ongoing Maintenance &amp; Reporting Costs</b>
Recycling Programs	\$ 10 Million	\$250,000
Source Controls	\$ 1.1 Million	\$ 25 Million
Treatment Controls		
<i>Treatment Control Measures</i>	Unknown	Unknown
<i>Treatment of South Bay Urban Runoff</i>	\$30 million per year (primary) to \$39 million per year (primary plus Filtration).	\$37 million per year (primary) to \$50 million per year (primary plus Filtration).
Source Investigations	-	\$150,000 to \$ 1.5 Million
Source Control Program	\$19,000	\$300,000
Monitoring System	-	\$225,000 to \$375,000
Fate/Trans/Uptake Studies	-	\$300,000
Allocation Scheme	Unknown	Unknown
Annual Reporting	\$4,000	\$100,000
<b>Total Costs (b)</b>	<b>\$41 million to \$50 million per year</b>	<b>\$63 million to \$78 million per year</b>

a. **Annual Capital** costs are annualized over a 25 year term at a 5% interest rate.

b. It may be possible to remove some or all of the Source Control costs for sediment removal and disposal depending on the flow and treatment assumptions utilized for modification and or building new facilities, however all costs are at this point in the analysis.

#### **Issue #5      The WLA for urban runoff does not factor in projected population growth in the Bay Area, which will most likely increase mercury loads in the future**

The population in the Bay Area is estimated to increase 14% by 2025 (ABAG 2004). Some mercury in urban stormwater runoff is believed to partially originate from local air sources (e.g., fluorescent bulb breakage<sup>15</sup>), which will likely increase with the increased population. The proposed wasteload allocation (WLA) for urban stormwater runoff does not factor in projected

<sup>15</sup> Note that uncertainty surrounding this assumption is large.

growth, as often is done in TMDLs. As suggested by Dr. Sedlak's peer review comments on the Staff Report and BPA, we suggest that the Regional Board staff address the issue of future increase of mercury concentrations entering the Bay via growth. Additionally, the WLA for urban stormwater runoff should be revised to include these inevitable increases.

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## **Appendix A**

Comments Previously Submitted by SCVURPPP and BASMAA  
on Mercury TMDL-related Documents



**Santa Clara  
Valley Urban  
Runoff Pollution  
Prevention Program**

November 15, 1999

Mr. Khalil Abu-Suba  
San Francisco Bay Region  
Regional Water Quality Control Board  
2101 Webster Street, Suite 500  
Oakland, CA 94612

Dear Mr. Abu-Suba,

On behalf of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) I would like to submit comments on the draft Mercury TMDL Workplan-Workload (February 5, 1999). These comments were also discussed at the May 19, 1999 Mercury Watershed Council TMDL Work Group Meeting.

The Mercury TMDL Workplan needs to clearly state the need for and define as tasks the following:

1. Develop a **TMDL schematic** (draft attached) that lays out TMDL steps and the relationship between steps as centerpiece for the Work plan.
2. Develop a bay-wide Mercury **Conceptual Model**. The conceptual model should build on the work already conducted by the RWQCB staff. The conceptual model needs to summarize the current understanding of mercury cycling for the entire bay; contain an estimate source loadings, provide an estimated mass balance; describe processes, importance and uncertainty; describe uptake and toxicity from both an ecological perspective and from a human perspective. The work on developing this conceptual model could be done in two phases: initial qualitative model and then a quantitative overlay (the quantitative model would be used to begin evaluating the impact from implementation of alternative potential source control efforts).
3. Develop a **mathematical model** based on very clear and specific research needs tied to addressing questions identified in the conceptual model (the purpose of this model would be to more accurately evaluate the relative effectiveness of alternative source control strategies).
4. Develop a clear plan to link **Sacramento and CalFED** work and resources with the needs for San Francisco Bay.

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5. Develop a clear plan to link the **Regional Monitoring Program (RMP)** effort with the needs of the TMDL Workplan.
6. Develop a **detailed plan that identifies resource needs** required to address a specific scientific question (e.g., methylation) along with the real/potential source(s) of resources.

The SCVURPPP looks forward to continuing to participate in the Mercury Council and TMDL process. Please address any questions or comments to me.

Very truly yours,

*Originally signed by*

Adam W. Olivieri, Dr. P.H., P.E.  
Program Manager

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**Santa Clara Basin Watershed Management Initiative  
Bay Monitoring and Modeling Subgroup  
Technical Review of:**

**Watershed Management of Mercury**

**In the**

**San Francisco Estuary:**

**Draft Total Maximum Daily Load**

**Report to the U. S. EPA**

California Regional Water Quality Control Board

San Francisco Bay Region

May 9, 2000

**Prepared by Tetra Tech, Inc.  
June 19, 2000**

The *Watershed Management of Mercury Report* (Mercury Report) does a good job of summarizing existing information on measured mercury concentrations in fish and wildlife, sediment, and the water column. However, the existing information does not make a sufficiently strong case for the impairment of beneficial uses. Additional information is needed both to address the impairment issue and to develop more appropriate target concentrations in fish, sediment and the water column. This review focuses on the impairment issue and the adequacy of the suggested targets to regulate mercury sources given the existing understanding of background conditions.

**Mercury Concentrations in Fish and Beneficial Use Impairment**

The measurement of total mercury concentrations in fish muscle tissue is a good indicator of the occurrence of bioavailable mercury in a watershed. These measurements are relatively straightforward to make, and the results are therefore dependable. But most

importantly, mercury accumulates in fish tissue, and the mercury levels in the tissue provide a record of mercury exposure.

However, the fish data presented in Figure 5 of the report do not support the conclusion that the Bay is impaired by mercury. With the exception of one species (Leopard shark), fish mercury concentrations are below the FDA standard (1 mg/kg or  $\mu\text{g/g}$ ). The report also states that "half of the fish from San Francisco Bay that were analyzed for mercury showed concentration above the screening value of 0.23  $\mu\text{g/g}$ ". However, the 0.23  $\mu\text{g/g}$  value has no regulatory basis for determining impairment. The interpretation of these data should include a comparison of mercury concentrations found in other water bodies throughout the world. For example, the Agency for Toxic Substances and Disease Registry's Toxicological Profile (ATSDR, 2000) for mercury states:

"typical mercury concentrations in large carnivorous freshwater fish (e.g., pike) and large marine fish (e.g., swordfish, shark, and tuna) have been found to exceed 1  $\mu\text{g/g}$  ..... Methylmercury concentration in muscle tissue of 9 species of sharks were analyzed from 4 locations of Florida.... Muscle tissue methylmercury concentration averaged 0.88  $\mu\text{g/g}$  and ranged from 0.06 to 2.87  $\mu\text{g/g}$ , with 33.1 % of the samples exceeding the FDA action level (1 ppm)."

Sharks throughout the world have elevated concentrations of mercury, and they are not a good sentinel species to gauge the human health risks associated with fish ingestion in the San Francisco Bay watershed.

The mercury concentrations that were presented in the Mercury Report for the other species are not indicative of impaired conditions. The U.S. Environmental Protection Agency in their characterization of human health risks from mercury emission reported that average total mercury concentration in bass, crappie, halibut, mackerel, pike, snapper, and tuna range from 0.2 to 0.3  $\mu\text{g/g}$  (U.S. EPA, 1996). The mean total mercury concentration in muscle tissues of fish studied in the Azores, where there is no major industry and no significant discharge of mercury, was reported to be "generally low, ranging between 0.04 and 0.37 mg/kg" (Anderson and Depledge, 1997). In southern California, the mercury concentrations in Barred sand bass from the nearshore environment ranged from 0.10 to 0.27  $\mu\text{g/g}$  (Phillips et al, 1997). On the other hand, measurements made at a known contaminated site in Princess Royal Harbor, Australia provide a basis of comparison. The mean concentration of mercury was less than 0.5  $\mu\text{g/g}$  in only two of 18 fish species sampled (Francesconi and Lenanton, 1992).

The data presented in Figure 5 of the report provide valuable information on the levels of mercury in fish from San Francisco Bay. This information points to the need to better characterize fish mercury levels, but these data are not sufficient to support the conclusion that San Francisco Bay is an impaired water body.

## Background Conditions

It is necessary to develop a better understanding of background concentrations prior to promulgating new mercury criteria.

The data presented in Figure 18 do not support the conclusion that mercury concentrations of 0.05 to 0.1  $\mu\text{g/g}$  define the range for pre-anthropogenic mercury in sediments. The background concentration in San Pablo Bay is close to the proposed standard of 0.4  $\mu\text{g/g}$  even at a depth of 2.5 m. However, the analysis of the ability and likelihood to obtain a mercury concentration in the water column of 0.025  $\mu\text{g/l}$  (Table 8) is based on the assumption that the pre-anthropogenic mercury concentrations in the sediments were 0.05 to 0.1  $\mu\text{g/g}$ .

Most locations in the Bay have sediment concentrations below the 0.4  $\mu\text{g/g}$  target. The regions that have higher concentrations may have had naturally high concentrations given the widespread presence of mercury deposits. Both the north and south portions of the Bay receive runoff from areas with high mercury-content minerals. Background sediment concentrations in these segments of the Bay are likely higher. Additional data on sediment concentrations from dated, deep cores are necessary to better estimate background mercury levels. These background data are required to determine both the applicability and feasibility of any proposed water quality or sediment objectives.

## Proposed Target Mercury Concentrations

**Total Recoverable Mercury.** The description of the water quality standard (0.025  $\mu\text{g/l}$ ) as total recoverable mercury is misleading. Because the acid-digested ( $\text{HCl}$ ,  $\text{HNO}_3$ , and  $\text{HF}$ ), unfiltered mercury concentration is being measured, this measurement should be referred to as total mercury. Regardless, "recoverable" mercury does not equal "bioavailable" mercury. At a minimum, the RWQCB should consider treating dissolved and particulate-associated mercury separately. Most of the mercury entering natural waters is sequestered in unavailable forms and is buried in the sediments. Very little of it ever becomes bioavailable.

**Methylmercury Target.** As described in the Mercury Report, the methylmercury target in water (0.05  $\text{ng/l}$ ) is conservative and based on wildlife protection concerns. However, regarding the impairment issue, it is important to note that methyl mercury concentrations everywhere in the Bay are below the target 0.05  $\text{ng/l}$  (Table 30). As a point of reference,

it is interesting to note that the methylmercury target is less than methylmercury concentrations measured in rain at remote locations (0.16 ng/L).

**Sediment Mercury Target.** The target value for sediment mercury concentration is based on the relationship presented in Equation 2 (p. 67). However, the proposed target value does not vary as a function of the percent of fine materials. Rather, it is a fixed value that is calculated based on ten samples collected from the mouth of the Sacramento River. Given the importance of this number (0.4  $\mu\text{g/g}$ ) in deriving loads, it is appropriate to show the data used in the calculation and to discuss both the consequence of using different data to derive the target concentration and the relevance of using data from the mouth of the Sacramento River to represent Bay-wide conditions.

Additional analysis before setting a sediment target concentration is also important because of the large range in toxicity and bioavailability of the different forms of mercury. Treating all mercury as equivalent is not justified.

The importance of giving more careful consideration to the setting of a target sediment concentration is demonstrated using the example from the executive summary of the Mercury Report. In that example, it is pointed out, assuming mercury concentrations in the sediments of 1  $\mu\text{g/g}$ , that the load allocation of the Guadalupe River watershed could be met by the removal of 45 million kilograms of sediment or enough sediment to fill 45 large trucks. However, the maximum payload limit of a 5-axle tractor-semitrailer on California highways (USDOT, 1997) is approximately 60,000 lbs (27,000 kg). Therefore, a better estimate of the number of truck loads required is 1,700 at a sediment concentration of 1  $\mu\text{g/g}$  and 170 truck loads at 10  $\mu\text{g/g}$ .

Although the original example in the Mercury Report is not a serious proposal and was obviously intended to provide some perspective to the scope of the load reduction requirements, it is indeed illuminating. It points to the fact that sediment removal on this scale to meet specified load reductions is impractical. Further, this example is instructive because it points out the benefit of considering the form of mercury when setting load allocations. The same benefit in terms of human health and ecological risk reduction could be achieved by the removal of just 1 kg of methylmercury versus the removal of tons of the mineral form of mercury (HgS, cinnabar).

## Summary

Table 1 summarizes the major concerns identified in this review. The principal concern is that the fish data presented in the Mercury Report are not sufficient to support the impairment conclusion. There is a need to develop information on mercury contamination in more species. Any additional data collection efforts also need to focus on a few indicator species and the collection of fish samples within comparable size

ranges. Finally, the screening value of 0.23 µg/g is near the expected background concentration of mercury in fish worldwide and is not a good measure of impairment.

Although the Basin Plan numeric objective for mercury in water (0.025 µg/l) is exceeded, this standard treats all forms of mercury the same regardless of toxicity or bioavailability. The use of this value as a primary indicator of impairment is inadequate.

Finally, the use of a value of 0.4 µg/g as a numeric target does not take into consideration either site-specific background conditions or the toxicity and bioavailability of the different forms of mercury.

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**TABLE 1. SUMMARY OF COMMENTS ON RWQCB PROPOSED MERCURY STANDARDS FOR SAN FRANCISCO BAY**

<b>Environmental Medium</b>	<b>RWQCB Suggested Objective</b>	<b>Basis</b>	<b>Concern</b>	<b>Suggestions</b>
<b>Water - Recoverable Mercury</b>	0.025 µg/l	U.S. EPA	Treats all forms of mercury the same regardless of toxicity or bioavailability.	Some forms of mercury are millions of times more toxic than others. "Recoverable" mercury does not equal "Bioavailable" mercury. As a minimum consider treating dissolved and particulate associated mercury separately. By far, most of the mercury entering natural waters is sequestered in unavailable forms and is buried in the sediments. Very little of, it ever, becomes bioavailable. If all of the mercury entering the SF Bay was converted to methylmercury, mercury concentrations in the fish would certainly not be just fractions of a part per million, as in fact they are.
<b>Fish</b>	0.23 mg/kg	SFEI	A part from sharks, fish in SF Bay have mercury concentrations less than both the U.S. FDA and United Nations limit. Impairment is thus questionable as is the need for such a low standard.	U.S. FDA standard is 1.0 mg/kg, UN World Health Organization standard is 0.5 mg/kg. Several states are now using the 0.5 standard, e.g. Colorado, Wisconsin, Arizona. Given the current minimal impairment, suggest 0.5 to 1.0 mg/kg as standard.
<b>Sediment</b>	0.4 mg/kg	Median Value for Sacramento River Sediment	South & North Bay receive runoff from areas with high mercury content minerals. Background concentrations in these segments of Bay are likely higher. Sacramento River receives runoff from most of N. California with some Hg hot spots, but with much dilution.	Use sediment concentrations from dated, deep cores to better estimate local background mercury levels.

**Load Allocations:** Given the large range in toxicity and bioavailability of the different forms of mercury, it is inappropriate to treat all mercury as equivalent. (The toxicity of methylmercury for example, is many fold more than that of mercury in mineral form). Also the proposed standards do not consider where mercury is discharged into the Bay. With these problems, and with the minimal endangerment, allocating mercury inputs to the hundredths of a kilogram is premature.



**Santa Clara Basin Watershed Management Initiative  
Bay Monitoring and Modeling and Regulatory Subgroup  
Meeting Notes  
June 26, 2000, 10 to 3 PM**

Attending: Dan Bruinsma (Co-chair City of San Jose), Tom Mumley (Co-chair RWQCB), Dave Tucker (San Jose), Trish Mulvey (CLEAN South Bay), Adam Olivieri (EOA), Kirk Willard (Lockheed), Phil Bobel (Palo Alto), Wil Bruhns (Chair RS, RWQCB), Tom Grieb (Tetrattech), Dave Drury (SCVWD), Kristy McCumby (City of Sunnyvale), Deborah Johnston (DFG), Michael Stanley-Jones (SVTC), Libby Lucas (LWV), Richard McMurtry (SVTC), Monica Oakley (LWA), Lorrie Gervin (City of Sunnyvale).

**Summary of June BMM/RS Meeting Notes:**

1. Review and Accept Minutes: The previous minutes were accepted (the minutes were distributed to Core Group at April meeting).
2. Review Action Items: A summary table of actions was distributed. All keys action items have been addressed and/or will be discussed as part of June meeting. It was agreed that updating the BMM Workplan would occur in the fall of 2000. Copies of the April and May BMM reports to the Core Group were distributed.
3. Continue Discussion on Draft POTW Permit Amendments: Discussion continued on the draft language developed by Wil Bruhns. Wil handed out an updated draft. He noted that the revised language: starts delisting process to remove copper and nickel from the 303d list, locks in future CAP/NAP actions, and adds SIP language. He noted that comments were received from Phil regarding Pollution Prevention language, and comments from the City of San Jose and Sunnyvale. The City of San Jose and Sunnyvale (CSJ/CS) handed out comments on the draft amendments which were discussed. The CSJ/Cs comments include request that separate amendments be issued (not a joint amendment), that finding 5 be explicit about which reports have been completed relative to compliance with the existing permit requirements, that finding 10 be edited to conclude no impairment and that delete the default, SIP language be added to finding 11, that the permit include language to recognize factors beyond the dischargers control may impact water quality and that these need to be taken into account relative to initiating CAP and NAP actions, and that the mass limits for copper and nickel be deleted.

Discussion on the above comments continued. Michael and Trish understand POTW request for controllable factors language, expressed concern about generic language and need for step in between trigger and action. Adam suggested using and/or referencing Basin Plan language contained in Chapter III regarding controllable factors issue. Trish asked about Table 4-2 language regarding addition of a finding to address "convening the powers to be."

Trish asked noted that it would be good if both sets (POTW and Stormwater) of permits were available for review together. Adam noted that we could add this to the August 9 Stormwater meeting, if time allows, to look over joint finding language.

**ACTION:** Wil will look at possible re-opener/step language regarding step between trigger being hit and action being taken. Adam will send out City of San Jose and Sunnyvale edits (e-mail) with a request that comments be sent to Wil by July 14. Revised language will be distributed at the end of July for discussion at the next meeting. Also noted that an additional meeting in August may be needed.

Phil raised some questions regarding who was conducting the CAP monitoring and where were the data going to be presented.

**ACTION: The City of San Jose will prepare an approach for how and when reporting of the monitoring data will be conducted.**

4. Discussed Technical Comments on RWQCB Bay-Wide Hg TMDL: Tom Grieb handed out draft technical comments prepared on behalf of the BMM for submission. He also handed out a summary table of the key comments (copies attached). Tom noted that Figure 5 in the RWQCB report does not support conclusion that Bay is impaired and that additional characterization to support this conclusion is required. Tom also noted that the data in Figure 18 do not support the proposed pre-anthropogenic concentration in sediments, that "recoverable" mercury does not equal "bioavailable" mercury, that the methyl-mercury target is conservative and less than what is being measured in rain at remote locations, that the largest single source of mercury (globally) are coal-fired power plants, and the sediment target is based on very limited data and additional data and analysis are required prior to selecting such a number. The BMM/RS discussed the comments and decided to transmit the comments to the RWQCB for consideration as part of developing the Mercury TMDL.

**ACTION: BMM/RS received technical comments and approved forwarding them to the RWQCB without endorsing the comments. Adam will transmit the comments to the RWQCB and include note in monthly status report. Adam will transmit comments to Guadalupe Mercury Work Group and WAS as information.**

5. Information on North Bay Impairment Assessment Work Effort: Tom Mumley briefed group on efforts underway in North Bay. Tom handed out North Bay draft summary of Work plan dated June 21, 2000 and RWQCB's June 21, 2000 letter supporting effort and workplan. Tom noted that South Bay efforts, especially relative to addressing uncertainty for copper should be coordinated with those in the North Bay. Michael asked to be put on North Bay mailing list. Deborah J. also wanted to be added to list. Tom noted that environmental groups would/should probably start getting involved sometime during late summer and that the RWQCB may act as host for the stakeholder group.
6. Status of CAP:
  - a) Phytoplankton Toxicity – J. Lacey noted that work group is developing list of questions. Once questions are identified then the question of the feasibility of addressing and the cost vs. benefit needs to be addressed. The BMM/RSS felt that once the questions were identified, a issue paper should be drafted that looks at the feasibility questions, the cost-benefit issue, and possible options including resources for addressing those questions that are feasible and make sense to from a costs-benefit standpoint. Partnering with the North Bay should also be looked at as one of the options. **ACTION: Tom M., as a first step, will look into the possibility of the RWQCB staff developing the issue paper. Tom will also look into the level of effort and resources to establish and maintain the work group. Tom will report back to BMM, as needed. J. Lacy will circulate questions to interested members.**
  - b) Update on CSJ Bioassessment – Dave Tucker reported that CSJ is working with S.F. State, currently waiting for proposal, expect to take back to EO for approval, start sometime in Dec./Jan., 4-year, 500K program. Deborah J. noted that the proposal should be reviewed openly and requested a copy as soon as it is available. Trish wanted to know about expanding to cover zooplankton and could North Bay participate. Trish noted that SFEI might be able to put in some limited resources. **ACTION: Wil will send proposal out as soon as it is submitted to RWQCB for review.**
  - c) Update Table 4-1 CAP (Urban Runoff Baseline) – Adam reported on work efforts of Storm Water permit Work Group. Adam distributes a June 22, 2000 version of Table 4-1. The BMM reviewed Table and made a number of edits. **ACTION: Adam will**

**incorporate edits into final draft of Table 4-1 and will distribute ASAP. Comments are due from BMM/RS by July 24, 2000.**

- d) Update on Track and Encourage Activities (B-17 & 18) – Trish briefed group on these activities. Trish handed out her May 7 e-mail that includes information on who is doing what relative to B-17, 18 and 20. Trish also handed out Rainer's Jan 20 e-mail re. Work that RMPTS is doing that may be helpful to CAP. Trish noted that South Bay representatives need to participate in TC at a higher level and push uncertainty agenda. **ACTION: Local agencies will look into greater participation. ACTION: BMM will look at Rainer's memo relative to B -1 and 18 at August meeting.**
  - e) Discussion on POTW CAP Activities (B-19 & 20) – The City of Sunnyvale handed out proposed text for B 19. B -20 was edited by BMM/RS as part of review of Table 4-1. **ACTION: Incorporate changes into Table 4-1 and distribute ASAP for comment by July 24.**
- Issue Bin:
    - Consider discussing newspaper article on PG&E PCB dumping at future meeting.
    - Need to define BMM subgroup connection to RMP to track RMP efforts. Tom M. will begin looking into defining issue and possible solutions.

#### **Wrap Up**

- BMM members felt that desired meeting outcome was achieved.
- Did not have time to review issue bin items.
- BMM/RS Meeting Schedule:
  - July 27, 1-3:30 at San Jose (ESB): review POTW language, finalize CAP Table 4-1, and status of NAP
  - August 9, 10-12 at San Jose: review findings in both POTW and Storm water permits for consistency.
  - August 23, 10-3 at San Jose: final review of POTW permit prior to release for public review.

**Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)  
Response to the October 31 2002 Mercury TMDL Implementation Plan Presentation  
Mercury Council Meeting**

**I. General Comments**

Thanks for all your hard work on the October 31 Mercury Council presentation. The SCVURPPP has a few preliminary comments and questions regarding the mercury source assessment and associated implementation plan. A more comprehensive review of the draft reports developed through the Clean Estuary Partnership will be provided in the near future.

The presentation suggested that reducing the “controllable” sources of total mercury to the proposed levels would reduce fish tissue concentrations to acceptable levels. In other words, if dischargers reduce Hg loads to the levels in the presentation, wildlife, fish, and humans will no longer have to worry about mercury toxicity and bioaccumulation over some time frame. However, the data to support this assumption are not apparent. There are major data gaps, assumptions, uncertainties, and rationales that were not adequately discussed in the presentation. For example, slide 9 illustrates that there is currently a 21% exceedance of Hg water quality criteria. It is suggested that control measures (via load reductions) will reduce Hg exceedances of water quality criteria to 10%. Why not 15% or 5%? What is the rationale for picking 10%? There are many of these type of examples throughout the presentation that seem arbitrary, or at best have high uncertainty that is not well defined. (i.e., linkage analysis = 1:1 relationship and the rationale for determining % reductions for each source).

The central problem is the lack of an adequate bay-wide Hg conceptual model, as mentioned in a letter to the San Francisco Bay RWQCB from the SCVURPPP dated November 15, 1999. The model should, at a minimum, summarize the current understanding of mercury cycling and fate in the bay; estimate source loadings; estimate mass balance; describe uptake and toxicity from both an ecological and human health perspective; and attempt to quantify the uncertainties associated with all of these factors. The development of this type of model was also recommended in a letter from the U.S. EPA, Region IX, dated December 18, 2000, discussing the review of the mercury TMDL Report. Without the foundation of an adequate conceptual model, we may foster public misconceptions and false expectations regarding the attainability of the suggested goals.

Below we have provided a few general comments/questions pertaining to the presentation, followed by more specific comments on source assessment, load allocations, and the implementation plan.

**General Questions**

1. Has an assimilative capacity analysis been completed for the entire bay? If not, what are the plans and schedule for completing the analysis?
2. Why is a simple steady-state model used, in light of North Bay sediment core profiles that appear to show mercury declining sharply after about 1980?
3. The mercury TMDL report, included the remobilization of historic sediments as a component of the source assessment. The estimate was between 100 and 400 kg/yT in the report. In the presentation, sediment remobilization was included in “other sources”, which was allocated a load of 28 kg/yr. Why such a drastic change?

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4. Slide 9 of Bill's portion indicates 21% of grab samples exceeded the 0.025 ug/L Hg objective. Were all these samples from north of the dumbarton bridge where this objective is in place?
5. Why make the assumption that there is a 1:1 relationship between changes in total mercury inputs and concentrations in fish and wildlife in the linkage analysis? What is the rationale and scientific evidence to support this assumption?
6. Richard mentions all the uncertainties in slide 25, which leads us to believe that we know very little about the extent of the problem, risk to humans and aquatic biota, and how to solve the problem. So how can we say we know enough to move on? We have no idea of the extent and location of methylation and how beneficial uses will respond if proposed reductions are put into place. It makes me question why we are moving forward into load allocations/reductions, which may have major cost implications to storm water programs, when we do not have reasonable assurance these reductions will change mercury concentrations in fish/bird tissue or bird eggs.
7. In slide 58, Richard discusses "Adaptive Management". This concept is not well defined. What is the process and timeline of including new data that suggests changes (increases or decreases) in load allocations, methylation potential, sediment loads, linkage analysis, and other key concepts in determining the sources of the problem? How does this translate into initial Basin Plan Amendment language and subsequent revisions?
8. Will a source control/load reduction cost-benefit analysis be conducted? If so, when? What are the legal requirements for conducting a cost benefit analysis? How does BAT and MEP fit into the cost benefit analysis?
9. What is the regulatory/legal meaning of "target"?
10. How does the RWQCB plan to incorporate and utilize the significant body of scientific research being conducted by CALFED?
11. What specifically are the RWQCB's plans to have all their work products technically peer reviewed by an independent outside third party?
12. The specific process for receipt, review and comment on RWQCB products is unclear. The current release of numerous documents and essentially no time to provide even a cursory review has caused significant confusion and anxiety regarding the RWQCB process to provide a meaningful public review and comment process. What specifically are the RWQCB's plans to ensure that a meaningful public review process is conducted?
13. Our initial review of the RWQCB staff slides (specifically slide 46) indicates that a significant resource burden could be placed on municipal stormwater programs regarding addressing areas of uncertainty. For example, How (both from a qualitative and quantitative standpoint) will addressing this uncertainty improve the analysis and estimates made by the RWQCB staff? Has the CEP and/or any other expert group reviewed the need for this additional information?

## **II. Hg Source Assessment for Urban and Non-urban Runoff**

**Background:** It is our understanding that the total Hg load allocation for urban and non-urban storm water was estimated through the following steps:

- A. Calculate total sediment load to the Bay from Bay Area watersheds (i.e., excluding the Central Valley) (Krone, 1979 & Davis et al., 2000) = **707 M kg/yr**
- B. Calculate % of urban and non-urban area of Bay Area watersheds:

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Non-urban = 73%

Urban = 27%

- C. Calculate sediment load from non-urban and urban areas discharging to the bay by multiplying % of urban/non-urban areas by total sediment load

**Non-Urban sediment load:**  $707 \text{ M kg/yr} \times 0.73 = 516 \text{ M kg/yr}$

**Urban sediment load:**  $707 \text{ M kg/yr} \times 0.27 = 191 \text{ M kg/yr}$

- D. Calculate average concentrations of Hg in urban and non-urban streamstorm drain sediments (Gunther et al. 2002 & KU 2002):

**Non-urban = 0.12 mg/kg**

**Urban = 0.50 mg/kg**

- E. B. Calculate urban and non-urban Hg loads by multiplying associated sediment load and average Hg concentration for urban and non-urban areas:

**Non-urban:**  $516 \text{ M kg/yr} \times 0.12 \text{ mg/kg} = 62 \text{ kg/yr}$

**Urban:**  $191 \text{ M kg/yr} \times 0.50 \text{ mg/kg} = 95 \text{ kg/yr}$

Questions from calculations of Hg loads from urban and non-urban storm water (Steps A-B)

**Step A:**

1. Where does the estimate of total sediment from bay area watersheds come from? We have reviewed Davis et al. 2000 and Krone 1979 and not found the estimated load at 707 M kg/yr.
2. Was the % of land upstream of dams taken out of these calculations? If not, the a significant portion of the sediment (and mercury) load might currently be removed by reservoirs (e.g., Davis et al. 2000).

**Step B:**

3. Where did the % for urban and non-urban areas originate? Was the % of land upstream of dams taken out of these calculations?
4. Should the current removal of sediment from flood control channel dredging projects and catch basin cleaning taken into consideration when developing the total sediment load estimates from urban and non-urban watersheds, as was done in the dredging allocation?

**Step C:**

5. Why are we assuming that the volume of sediment originating from a given area of urban landscape is equal to the same area of non-urban landscape? What is the rationale?

**Step D:**

6. Are these concentrations means or medians? What are the uncertainty and variability in sediment loads and Hg concentrations.

**Step E:**

7. Was future growth considered in the calculations? We realize that the New Development Provision (C.3.) will likely reduce a portion of mercury latent sediment entering the bay,

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but it is certainly not assumed that 100% of mercury originating from new development (future growth) will be removed in the future, is it?

### **Dividing up the Urban SW Load:**

The following %'s of the urban load allocation should be determined prior to submittal/approval of the Implementation Plan:

- % to Caltrans
- % to automobile wreck yards (i.e. potentially cover under the new permit)
- % to Port of Oakland
- % reduced by Flood Control Sediment Control
- % reduced by catch basin cleaning
- % air deposition (outside of municipalities jurisdiction)

### **III. Linkage Analysis**

1. The current linkage analysis and assumptions of a 1:1 relationship between total mercury concentrations in sediment entering the bay and fish tissue concentrations is inadequate. As mentioned in the our opening comments, a more detailed conceptual model of mercury cycling in the system is needed. This should include a quantitative analysis of the following:
  - % of Hg in sediment transported to methylating regions in the Bay;
  - % and rates of Hg in methylating regions converted to methyl Hg;
  - %, rates, and risks of Hg entering food web at various trophic levels; and,
  - Bioaccumulation rates of methyl Hg in various species in the food web.

What are the plans and schedule for completing such a conceptual model?

### **IV. Load Reductions**

1. What rationale was used to determine the load reductions for all sources. Why 5% CV, 60% urban storm water, etc....
2. Is the atmospheric deposition component (what ever it is) of the storm water load actually “controllable”? If so, who has the jurisdiction to control inputs from atmospheric deposition? If not should this load be excluded from the storm water allocation?

Alameda Countywide  
Clean Water Program

Contra Costa  
Clean Water Program

Fairfield-Suisun  
Urban Runoff  
Management Program

Marin County  
Stormwater Pollution  
Prevention Program

San Mateo Countywide  
Stormwater Pollution  
Prevention Program

Santa Clara Valley  
Urban Runoff Pollution  
Prevention Program

Vallejo  
Sanitation and Flood  
Control District



B A S M A A

July 22, 2003

Bill Johnson and Richard Looker  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: Mercury in San Francisco Bay Total Maximum Daily Load (TMDL)  
Project Report**

Dear Bill and Richard:

This letter is submitted on behalf of the Bay Area Stormwater Management Agencies Association (BASMAA) in response to the invitation to submit comments on the *Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Project Report (Report)*, dated June 6, 2003.

BASMAA member agencies would like to thank you for this opportunity to comment on the Report and commend each of you for your hard work in finalizing the document. We also recognize the staff to, and participants of, the Regional Monitoring Program for Trace Substances (RMP) and Clean Estuary Partnership (CEP) for their contributions to this milestone.

Impairments to beneficial uses of water bodies in the San Francisco Bay Area are of utmost importance to BASMAA. Furthermore, we agree that reducing impairment of beneficial uses by mercury in the Bay should be a high priority for all Bay Area public agencies and citizens. For storm water programs, concern for elevated mercury concentrations in the San Francisco Bay biota have caused us to refocus a portion of our public resources over the past few years towards reductions of mercury levels in urban runoff that may be contributing to beneficial use impairment in the Bay. BASMAA member agencies plan to continue allocating valuable resources towards regional collaborations such as the CEP and RMP, designed to collect scientific information necessary to develop cost effective measures aimed at improving water quality in Bay Area water bodies. We, as public agencies, take this task very seriously. Therefore, we believe a fair, objective and transparent TMDL and related Basin Plan Amendment based on the best available information and sound science, which states its assumptions and uncertainties throughout the document, is important to its legitimacy, legality, and public confidence.

The preliminary comments contained within this letter are designed to be constructive in nature. Comments are provided to address what BASMAA member agencies regard as unresolved issues related to the content of the Mercury TMDL Project Report. Comments are arranged in three sections: comments on the public review process and stakeholder involvement, general comments on the Report, and comments specific to sections within the Report. As requested by Regional Board staff, specific suggested improvements are

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provided for each issue discussed. Most of the suggested improvements entail a change in the text to clarify language within the Report, thus reducing public misconceptions and false expectations by instead stating assumptions and uncertainties in a transparent and clear manner.

It is our understanding that comments such as these will be considered by Regional Board staff prior to developing amendments to the Water Quality Control Plan for the San Francisco Bay Region (Basin Plan), which are tentatively scheduled for adoption later this year. While we believe our exchange of information at this point in the process may be useful, we want to emphasize that notwithstanding this and prior public outreach efforts, the Regional Board needs to provide sufficient time for a meaningful official public comment and scientific peer review process once a proposed Basin Plan Amendment is prepared.

Because of the significant implications of such a Basin Plan Amendment, the demands it will impose, and the amount of time and public resources it will likely consume, we want to emphasize that our current exchange of information will be no substitute for providing adequate time (in our estimation at least 6 to 9 months rather than the typical 4-8 weeks) for meaningful peer review of and public comment on an actual Basin Plan Amendment.

In addition, even though the Regional Board is exempt from certain provisions of the California Environmental Quality Act ("CEQA") with respect to Basin Plan amendments, the Regional Board is still obligated to consider the potential environmental impacts of the proposed amendment. CEQA policy demands that the Regional Board make available information relevant to the proposed amendment's impacts "as soon as possible" and consider comments "at the earliest possible time in the environmental review process." (See Public Resources Code § 21003.1.) However, the Regional Board's June 6, 2003, transmittal states that the required CEQA analysis will not be provided until the release of the staff report supporting the proposed amendment. This simply does not allow us, or other members of the public, sufficient time to provide comments that will be meaningful or useful to the Regional Board.

Finally, as you know, the proposed implementation plan has many new proposed requirements that storm water programs may be required to implement. Therefore, we ask that the suggested improvements contained within this comment letter be incorporated into a revised TMDL Mercury Project Report and staff recommendations for the proposed Basin Plan Amendment. To clarify these suggested improvements and proposed requirements, we request that Regional Board staff from the TMDL section and storm water permitting section meet with BASMAA representatives during the preparation of Basin Plan amendments and associated staff reports to discuss our concerns and work together to incorporate the suggested changes to the TMDL Project Report and implementation plan into a revised TMDL Project Report and proposed Basin Plan Amendment.

#### **STAKEHOLDER AND PUBLIC REVIEW PROCESS:**

As you know, BASMAA supports a transparent stakeholder and public review process and we believe that involving all stakeholders throughout the process is a goal the Regional Board should strive for during the development of all TMDLs and associated Basin Plan amendments. Therefore, the lack of: 1) more meaningful communication between Regional Board staff and stakeholder representatives regarding specific aspects of the Report relevant to those stakeholders, and 2) assurance of a full, adequate, and meaningful peer review and public review process for a proposed Basin Plan Amendment, are of substantial concern.

The lack of meaningful communication from Regional Board staff is evident in the new language and calculations that are apparent throughout the Report. When compared to the draft version (2000) and the presentation by Regional Board staff to the Mercury Council, on October 31, 2002, many differences are of concern. For example, estimates of total sediment loads used to calculate current mercury loads from urban and non-urban storm water runoff have changed. These changes have created a greater proposed load reduction allocation for urban runoff programs. These changes were not discussed with municipal storm water program representatives prior to the release of the TMDL Project Report.

Issues like this could have been clarified and resolved early in the process if the quantity and quality of communication between the Regional Board staff and stakeholders (storm water program representatives in this case) was improved. In fact, in a meeting between Regional Board staff and BASMAA representatives on November 19, 2002, we suggested that a process for ongoing discussion and review should be established. Regional Board staff agreed to try to distribute timely updates that affect storm water programs. Unfortunately, the aforementioned process and timely updates never materialized. Quite the opposite, comments on the TMDL Report were requested, but as indicated in Tom Mumley's letter, dated June 6, 2003:

*"...staff do not intend to formally respond to comments received or revise the report."*

In other words, the message to us has been "the Report is finalized". In our opinion, this is not an adequate, meaningful, nor transparent stakeholder or public review process. If a *draft* Report had been released to stakeholders and an opportunity for input provided before its finalization, we believe the report could have adequately addressed many of these issues.

**Suggested Change** – We strongly suggest that the Regional Board improve the public review and stakeholder process for the development of future TMDLs (e.g., PCB TMDL for the San Francisco Bay). To improve this process, Regional Board staff should provide updates to relevant stakeholders before a TMDL Report is finalized. Likewise, we strongly suggest that stakeholders be allowed to review and provide comment on the Staff's version of a Basin Plan Amendment *before* it is officially "proposed" and released for public comment. This will allow stakeholders to comment on documents before they are likely institutionalized. Additionally, this will allow stakeholder representatives to better prepare constituents for proposed requirements and implementation actions that will require an increased allocation of limited resources.

### **Lack of Response to Comments**

Many of the comments presented in this document were previously communicated to Regional Board staff by BASMAA member agencies (SCVURPPP 2002 and BASMAA 2002). However, on most issues no response was given by Regional Board staff. We are cognizant of the fact that State resources are limited at this time; however responding to comments and concerns of stakeholders that will be directly affected by the proposed TMDL is an important task and there is little incentive or point in commenting if our input is ignored or no feedback or dialogue will be forthcoming prior to release of the proposed Basin Plan Amendment. For example, one of the major points that was made in previous comments by BASMAA member agencies was that large areas of uncertainty, including the calculations used in the source assessment and the controllability of air deposition included in the urban storm water load, were not adequately addressed in the draft TMDL Report or presentations by Regional Board staff. After review of this TMDL Report, it appears that it still does not adequately address the uncertainties behind loading calculations and the controllability of indirect air deposition.

**Suggested Change** – We suggest that the Regional Board respond to comments received, in a timely manner and in a format that is directly responsive to the input provided, during the development of future TMDLs and in advance of the release of proposed Basin Plan amendments. If stakeholders know their comments will be addressed and expect to see direct responses to them, they will likely have comments and concerns that are of interest and useful to staff.

## GENERAL COMMENTS:

### Definition of “Controllable” and Responsible Parties

The term “controllable” is used throughout the report. Staff’s use of the term appears to be based on what regulatory mechanisms are currently available to the Regional Board rather than on whether the actual source of the pollutant is actually subject to regulatory control by the discharger or whether the resultant amount of loading can be subject to technically feasible and economically reasonable management or treatment. For example, as described later in this letter, a significant portion of the estimated current urban storm water load and proposed allocation is likely attributable to indirect air deposition onto the watershed. BASMAA believes that this portion of the urban runoff load is likely to continue for many years to come, begging the question of whether this portion of the urban runoff load can be controlled by urban runoff programs in any meaningful, let alone technically feasible and economically reasonable, manner.

In contrast, we have faith that the total load of mercury originating from sources that are truly controllable by urban runoff programs will be reduced over time through pollution prevention activities. However, neither local municipalities (nor the Regional Board) have jurisdiction to regulate the mercury continuously deposited onto the watershed from global or local atmospheric sources, and therefore it makes no sense to assign/allocate these sources as the legitimate responsibility of urban runoff programs.

In fact, atmospheric deposition directly to the Bay is considered elsewhere in the Staff Report to be “uncontrollable”, according to the proposed implementation plan for atmospheric deposition:

*“In view of the degree to which uncontrollable sources appear to dominate Bay Area air concentrations and presumably deposition, load reductions do not appear feasible at this time.”*

This is just one example of how the terms controllable and uncontrollable sources are inconsistently used and misused to establish waste load allocations. We find that the lack of a formal definition of these terms and analysis concerning the legitimacy of their application causes confusion and results in the significant misallocation of the waste loads set forth in the Report. Therefore, we believe that it would be hard to show beyond a reasonable doubt that any of the sources is more or less controllable than any other, particularly with the relatively limited data currently available regarding controllability early in a 120-year TMDL implementation period.

**Suggested Change** – For the purposes of this TMDL Report, which assigns preliminary load and waste load allocations, we suggest using a more objective, scientific, and prudent approach of assuming that all sources have the same level of controllability or uncontrollability unless scientific evidence is developed to the contrary. Prior to the adoption of other TMDLs, we suggest that when calculating current loads and waste load allocations the Board should adopt a definition of controllable and uncontrollable sources based on factors such as feasibility,

economic capacity, and legal jurisdiction of the dischargers. As part of the adaptive implementation plan, these definitions should be used when revising preliminary load and waste load allocations that were assigned in the Mercury TMDL Report. Furthermore, the responsible parties for which the loads originated, should only be assigned the loads that are controllable; allocations should not be assigned to dischargers just because the parties happen to be subject to the Regional Board's jurisdiction.

### **Need for Sensitivity Analysis and Description of Uncertainties**

As described in the Report, water and sediment circulation patterns, biological interactions, and contaminant transport processes, are complex in the San Francisco Bay estuary. We acknowledge that adequate data is currently not available to estimate current loads from most sources and predict the recovery of the Bay with certainty. Therefore, we believe it is important to state inherent assumptions and uncertainties throughout the Report and illustrate these uncertainties in projected recovery simulations.

One way to illustrate uncertainties is by conducting a sensitivity analysis of estimated mercury loads from particular sources. Therefore, scenarios could be developed which could be displayed in projected recovery curves under different assumptions based on the sensitivity of recovery curves as a result of changes in the estimated load from a particular source(s).

This type of analysis would better explain the uncertainties with load calculations and demonstrate how the Bay would respond under a variety of different assumptions.

***Suggested Change*** – Revise the source assessment and load allocation sections of the Report to include ranges of estimated current loads and waste load allocations, instead of single values. Single values typically are institutionalized quickly and may give the public significant misconceptions regarding the mercury load from particular sources. Additionally, perform a sensitivity/uncertainty analysis on the projected recovery curves based on a variety of scenarios. The ranges of estimated current loads and waste load allocations would aid in this exercise. Once completed, the recovery curves under a variety of scenarios should be illustrated in the Report. The selection of such scenarios should reflect the model parameters with greatest uncertainty (e.g., loading due to bed erosion).

### **Accounting and Allocations**

Full accounting of sources AND losses (as shown in table 4.1 and figure 4.1) should be carried through the entire TMDL. There is no scientific basis and it is not prudent to stop accounting for all known sources and assumed losses (as shown in table 7.1 and figure 7.1) This jeopardizes any reasonable assurance that implementation of the TMDL will attain water quality standards. The values shown for the sources and losses could and most likely will change over the course of the planned multi-decadal TMDL implementation period.

As pointed out in the Project Report, mercury loads are equal to sediment loads times sediment concentrations. Yet the approach used later in the Report to determine TMDL allocations varies depending on the source. Sometimes the allocations are based on mercury loads but often they are driven by only one of these factors – sediment concentrations. We believe TMDL allocations should be established on a consistent basis – one based on mercury loads.

Given the high level of uncertainty, and the current inconsistent and highly subjective definition of controllable (as discussed above), the science does not support any other preliminary allocation scheme than one based on requiring each source AND loss to be the same

proportion of the solution as it is of the problem. That is, for a given source, its percent of the solution (i.e., allocation or reduction) should be equal to its percent of the problem. Losses should be zero percent of the solution since they are equal to zero percent of the problem. However, it is important that their negative loads are maintained so their allocations should remain equal to or less than their current negative loads. Re-calculating the values in table 7.1 based on these concepts yields allocations:

- that are objective, acknowledge the lack of scientific evidence of controllability or uncontrollability, and are established on a consistent basis – mercury loads;
- that are more evenly distributed where the burden on any one source is reduced; and
- in which all sources (including those that need further investigation) and losses remain accounted for in one place.

**Suggested Change** – Table 7.1 and figure 7.1 should be expanded to include all “sources” and “losses” (i.e., same as table 4.1 and figure 4.1). In addition, based on the concept that “percent of the solution” = “percent of the problem,” Table 7.1 (and similarly figure 7.1) should be modified as follows:

**TABLE 7.1: Proposed Load and Waste Load Allocations**

Sources	Current Load Hg kg / yr	Percent of Problem	Allocation Hg kg / yr	Reduction Hg kg / yr	Percent of Solution
Bed erosion	460	38	266	194	38
Central Valley watershed	440	36	254	186	36
Urban runoff	141**	12	79	62	12
Guadalupe watershed	92	8	54	38	8
Atmospheric deposition					
Direct	27	2	16	11	2
Indirect	55	5	32	23	5
Non-urban runoff	<0**	TBD	TBD	TBD	TBD
Wastewater	19	2	11	8	2
Local mines	TBD	TBD	TBD	TBD	TBD
Contaminated Bay margin sites	TBD	TBD	TBD	TBD	TBD
Subtotal	≈1,219	>100	705*	514	>100
<b>Losses</b>					
Transport out Golden Gate	(1,400)	NA	(1,400)	0	NA
Dredging and disposal	(150)	NA	(150-430)	0	NA
Evaporation	(190)	NA	(190)	0	NA
Subtotal	(1,740)		(1,740)	0	
Total	(521)		(1,035-1,315)	514	

All values rounded to nearest integer

\* Based on proposed total allocation presented in TMDL Project Report

\*\* Estimated indirect air deposition (55 kg/yr) removed from estimated urban and non-urban storm water runoff current load. See specific comments on p. 9 of this comment letter, and allocations, pp. 10-11

TBD = To be determined

NA = Not applicable

**SPECIFIC COMMENTS:****Problem Statement (Section 2)**

Although the document is specific to the mercury pollution in the San Francisco Bay (Bay), it would be useful to include a statement regarding the issue of mercury pollution worldwide. Context is important when stating an environmental issue such as mercury pollution in the Bay. Readers should know that San Francisco Bay is not the only water body containing elevated levels of mercury. Mercury pollution has recently been recognized as a global problem. In February 2003, the United Nations agreed that, "there is sufficient evidence of significant global adverse impacts from mercury and its compounds to warrant further international action to reduce the risks to human health and the environment."

**Suggested Change:** Include a statement or two indicating mercury pollution in surface waters is a global issue, and is not specific to the San Francisco Bay.

**Mass Budget Approach (Section 3)**

The text in the mass budget approach section of the Report states:

*"Mercury fate and transport processes within the bay vary significantly throughout time and space, and available data are insufficient to support detailed analyses without over-interpreting the limited data. Therefore, this report relies on a simple model to represent the San Francisco Bay and some of its basic processes. The advantages of simplicity—the ability to identify and prioritize reasonable actions without over-interpreting the data—outweigh the apparent realism that could be attainable with a more complex model (Harte 1988)."*

We agree that the Bay is a complex system and a simple (one-box) model has its advantages as described. However, a simple model also has inherent disadvantages that are not described in the Report. For example, sediment transport processes of the Bay can vary drastically between segments and with time, making the one-box model far too simple to accurately estimate mercury sources and losses over a given timeframe. Therefore, it is important to include language stating that the complexity of the system could greatly undermine the assumptions and calculations made using the one-box model. Simply stating the estimates made were based on available data does not go far enough to explain the uncertainty of the conclusions that are being drawn in the Report and upon which all load calculations are based.

**Suggested Change** – Include language indicating that using a one-box model incorporates great uncertainty in estimating mercury sources to, and losses from, San Francisco Bay. Additionally, we request that a discussion of the disadvantages of using a one-box model to the same extent the advantages were discussed.

**Source Assessment (Section 4)**

The following comments and suggested changes are related to sub-sections of Section 4, Source Assessment:

- **Calculations and Assumptions:**

- **Bed Erosion** – BASMAA agrees that bed erosion is likely the largest source of mercury to the bay, given past resource management history (i.e., mining) and the likelihood of bed sediments continuing to erode. Therefore, we believe providing the best estimate of bed erosion for the entire bay is of utmost importance when determining sources of mercury. The report's estimates do not attempt to include bed erosion from segments other than San Pablo and Suisun Bays. Although burial and erosion estimates have not been published for these segments, it appears that preliminary estimates could be calculated and included in this Report. A large amount of resources have been used to calculate load estimates from other sources, which are based on very little information, so why not attempt to assess potential bed erosion from the south, lower and central bays? BASMAA believes that without an assessment and quantitative estimate of bed erosion, the largest source of mercury to the bay may be grossly underestimated, potentially having great consequence on estimated recovery times and necessary load reductions assigned to other sources.

***Suggested Change*** – Include estimates of potential bed erosion from segments other than Suisun and San Pablo Bays when calculating the mercury loadings to the Bay. State assumptions and uncertainties related to these estimates.

- **Storm Water** – As indicated in previous comments from storm water agencies on the Mercury TMDL for the San Francisco Bay (SCVURPPP 2002, BASMAA 2002), BASMAA has many concerns regarding the calculations used to estimate current storm water loads. BASMAA continues to suggest that the methods and a portion of the data used to calculate urban storm water runoff mercury loads are inappropriate as a basis for establishing regulatory criteria or actions. In particular:
  - **Use of bedded sediment data** – As described in previous comments from BASMAA member agencies, we believe that the use of bedded sediment data from the Joint Stormwater Agency Project report to establish current loading estimates for urban and non-urban storm water introduces very high uncertainty. Loading estimates made in the Joint Stormwater Agency Project were very rough estimates based on available data collected for a different objective, and were only calculated at the request of Regional Board staff. The San Francisco Estuary Institute (SFEI) has more recently commented that it is not possible to determine the bias and error associated with loading estimates based on bedded sediment concentrations. The Clean Estuary Partnership/SFEI study to estimate pollutant loads from the Guadalupe River is designed to produce better loading estimates (at least for one local tributary) based on suspended sediments and demonstrate improved methodologies.

***Suggested Change*** - We suggest that the Report be revised to better identify and explain the ranges and associated uncertainties of storm water loading estimates. The text should also mention the issues regarding the compatibility of bedded vs. suspended contaminant concentrations used in the Report. We also suggest that procedures or criteria be outlined for refining these estimates during adaptive implementation process.

- **Atmospheric Deposition** – A previously mentioned, the Report includes estimates of dry and wet deposition of mercury directly deposited onto the bay. However, estimates of indirect deposition onto the watershed are included in the storm water load estimates, not in the atmospheric deposition load. As the TMDL Report states, as much as 55 kg/yr (nearly 30%) of the storm water mercury load could be from indirect atmospheric deposition onto the watershed.

**Suggested Change** – The estimated 55 kg/yr, attributable to indirect air deposition, should be removed from the storm water load estimate. This load should instead be included in the air deposition source category as “indirect atmospheric deposition” and itemized separately in Tables 4.1 and 7.1.

### **Linkage Analysis (Section 6)**

Comments regarding the linkage analysis were previously submitted by BASMAA member agencies (SCVURPPP 2002). We are disappointed that no response to these comments has been issued and that further dialogue on this critical component of the TMDL has not occurred. Therefore, because of their critical importance from our perspective, we are reiterating our prior comments here.

The report and previous presentation simply assume without justification that a linear relationship exists between changes in total mercury concentrations in bay sediments and changes in fish tissue and bird egg mercury concentrations. We believe a much more detailed linkage analysis is needed, which would be incorporated into an expanded conceptual model and analysis of mercury cycling in the system. This should include a more thorough quantitative analysis of the following:

- percent of mercury in sediment transported to methylating regions in the Bay;
- percent and rates of mercury in methylating regions converted to methyl mercury; and,
- percent, rates, and risks of mercury entering the food web at various locations in the bay and various trophic levels.

BASMAA will continue to support the efforts currently underway within the CEP, RMP and other scientific programs aimed at providing such analyses.

**Suggested Change** – We suggest that the Implementation and Adaptive Management sections of the Report include specific language stating that:

*The uncertainty associated with the current linkage analysis is extremely high due to limited data. The relationship between sources, loadings and wildlife endpoints is essentially unknown at this time. If new scientifically valid information is available in the future regarding the effects of load reductions in the Bay, load allocations, recovery projections, and requirements outlined in the implementation plan will be expeditiously and explicitly revised to reflect this current state of knowledge regarding sources of impairment and recovery of the Bay.*



- **Mercury Sources and Sediment** – The last paragraph at the bottom of page 36 states that:

*“...tributaries, such as the Sacramento and San Joaquin Rivers, the Guadalupe River, and other local tributaries carrying storm water runoff, are the largest sources of mercury to San Francisco Bay.”*

This statement is misleading, and should be qualified to acknowledge that the estimated relative contribution of mercury from local tributaries is small when compared to larger sources (e.g., Central Valley) and bed erosion may be the largest contributor to impairment of beneficial uses in the Bay.

**Suggested Change** – Change statement to appropriately qualify the relative contribution of mercury from local tributaries and to indicate that bed erosion is estimated to be the largest contributor to impairment of beneficial uses in the Bay.

- **Methylmercury Production** – As described in the Report, methylation is a key pathway in the bioaccumulation of mercury in biota (i.e., fish tissue, bird eggs, and humans). Without mercury methylation, we would likely not have elevated mercury concentrations in these biota and therefore would not need a TMDL. Therefore, we believe it is critical not to downplay the importance of methylation in the Report. To meet the wildlife and fish tissue targets, the Report indicates that loading of mercury from “controllable” sources must be reduced (Section 7 – Allocations). However, the Report relies on only two citations (Rudd et al. 1983 and USGS 2001c) in developing the proposed linkage between total mercury concentrations in surface sediment (i.e., sources) and methylmercury production. Furthermore, based on this proposed linkage, the Report states definitively on page 38 that:

*“Reducing mercury loads will reduce methylmercury production”*

BASMAA agrees that reducing mercury loads is an important goal, but finds that this statement is misleading. As you know, the scientific community does not currently agree that this statement is in fact true for the Bay. Many scientists believe that methylmercury production may be better reduced through the management of methylating regions (e.g., wetlands). Therefore, it may give the public false expectations and misconceptions about whether reduction of sediment concentrations is accepted by the scientific community to be the most critical variable in reducing mercury impacts on biota.

**Suggested Change** – As recently suggested by Regional Board staff, the TMDL process should embrace the scientific method of stating hypotheses and testing these hypotheses through the adaptive management process. Therefore, in the essence of the scientific method, we suggest that this statement be revised to include language such as, “Based on these studies our working hypothesis is that reducing mercury loads will reduce methylmercury production in all segments of the San Francisco Bay”.

#### **Allocations (Section 7)**

- **Load and Waste Load Allocations** – The value (1,420 kg/yr) assigned to *Current Mercury Load (Total)* in Table 7.1 is inconsistent with the rounded value (1,220) in Table 4.1. Additionally, no reductions are assigned to air deposition or non-urban storm water.

**Suggested Change** – Revise Table 7.1 current load column and the text under point 1. on page 50 to be consistent with the above comments and Table 4.1.

- **Urban Storm Water Runoff** – The following concerns are related to the proposed load allocations for urban runoff:
  - **Controllable vs. Non-Controllable** – The Report suggests that “controllable” sources of mercury are in part responsible for mercury in sediments from urban storm water. Furthermore, it states that:

*“Atmospheric deposition and natural background also contribute to the mercury in urban runoff. These contributions are assumed difficult to control”.*

BASMAA appreciates the acknowledgment that these sources are hard to control. However, that acknowledgement has not been accounted for in the allocation. Since we have heard no response to questions posed by SCVURPPP in response to the Regional Board’s presentation at the October 31<sup>st</sup>, Mercury Council meeting, we reiterate those questions here:

1. Is the atmospheric deposition component (estimated to be 55 kg/yr) of the storm water load actually controllable? If so, on what basis has that conclusion been reached?
2. Who, if anyone, has the jurisdiction to control inputs from atmospheric deposition?

As you know, storm water programs do not have the jurisdiction to control atmospheric deposition of mercury onto local watersheds. Regulatory control of atmospheric metal deposition is the responsibility of international, national, state and local air quality agencies. Therefore, it is inappropriate to include the estimated 55 kg/yr of mercury from indirect deposition in the storm water runoff load estimates.

**Suggested Change** - Remove the estimated 55 kg/yr of mercury from the proposed storm water runoff loads estimated to be 160 kg/yr for urban and 25 kg/yr for non-urban, and assign the load to the air deposition source category. The resulting estimate of mercury from urban storm water runoff would be 141 kg/yr for urban and < 0 kg/yr for non-urban, based on the percent of urban land area and non-urban land area (KLI 2002). If implementation activities by urban storm water programs are found to control part of the mercury from air deposition or non-urban sources, these reductions can be addressed through the adaptive implementation process.

- **Thermometers as an urban runoff source** – There is no evidence to suggest that thermometers are a source of mercury to urban runoff.

**Suggested Change** – Remove references to thermometers in two places in the Report:

- (p. 44, *Urban Storm Water Runoff, second sentence*) - ...such as improperly discarded fluorescent lights, ~~thermometers~~, other ...
- (p. 56, *Urban Storm Water Runoff, third sentence*) -...including fluorescent light bulb ~~and thermometer~~ collection and disposal programs,...

**Use of population as a load allocation scheme** – When assigning individual waste load allocations to urban runoff programs, we are uncertain as to whether the service area population of each urban runoff management program should be used. Individual waste load allocations

could instead be assigned on the basis of other parameters, such as the percent of Bay Area urbanized land area within each storm water program service area, or some combination of population and urbanized land area.

**Suggested Change** – We suggest that the Regional Board work with urban runoff management programs to reconsider the allocation basis and scheme for the individual waste load allocations for urban runoff, and revise table 7.2 as needed and appropriate.

- **Projected Recovery** – Two different values of “total current mercury inputs” are used in the Report and in the supporting document (i.e., SFBRWQCB 2003g). The Report uses the value of 1,420 kg/yr, while the supporting document appears to mention both 1,420 and 1,220 kg/yr. As previously discussed in the Source Assessment-Mercury Source Assessment and Methodology Section of this document, the estimated total should be 1,219 kg/yr, not 1,420 kg/yr.

It is not clear which of these values was used to predict the long-term response with and without proposed implementation measures. It is important to mention that if the 1,420 kg/yr was used in any of the modeling scenarios for projected recovery, the recovery time could be drastically affected. For example, if the recovery curve for current loads, with bed erosion phase-out (Figure 7.2) was presented in error using the 1,420 kg/yr value, the slope of the curve may be steeper than estimated.

**Suggested Change** – Review the values for total current mercury loads used to calculate the recovery curves for mercury in San Francisco Bay. Revise the text and tables of the above documents, and, if needed, the figures and projected recovery times.

### **Implementation Plan (Section 8)**

BASMAA has a variety of concerns related to the proposed implementation plan. As mentioned in the opening paragraphs of this document, BASMAA representatives request that a meeting(s) with Regional Board TMDL and Stormwater Permit staff be scheduled to further discuss our preliminary suggestions for improvements and clarification of the proposed implementation actions presented in the Report, as presented below.:

- **Objectives** – The objectives of the implementation plan state that:

*“In developing implementation actions for various sources, this plan takes into consideration the.....the feasibility and cost of control”.*

However, within the proposed urban runoff implementation plan, the consideration of feasibility and cost of control is non-existent. Many of the suggested actions (e.g., additional pollution prevention activities, capture and treating storm water) may be infeasible and/or cost prohibitive. An analysis of each and its feasibility and cost must be forthcoming.

**Suggested Change** – Include an analysis describing how feasibility and cost of control was considered when developing the proposed implementation actions.

- **Urban Storm Water Runoff** – The following concerns and suggested changes are related to the proposed urban storm water runoff implementation plan.

- **Lack of linkage between proposed actions and allocations** – Within the Report, no clear linkage is established between the proposed implementation actions for urban runoff (listed as proposed requirements on page 57), the associated proposed allocations and feasibility and cost. BASMAA agrees that pollution prevention activities and storm water treatment may reduce some of the estimated urban runoff mercury load. However, it is unclear as to what extent reducing controllable sources can help meet proposed allocations and to what extent feasible and economically reasonable storm water measures can be employed.

**Suggested Change** – Revise implementation requirements for urban storm water programs by identifying those proposed implementation activities that are technically feasible and economically reasonable as “early implementation actions” and include a statement that this list may be refined as part of continuing efforts by the storm water programs and other stakeholders. A preliminary draft model in Attachment 1 is intended to serve as a starting point to accomplish this task, and therefore, when finalized, will supersede the list of proposed requirements on page 57 of the Project Report.

- **Demonstrating Compliance** – Given the high uncertainties in current urban runoff load estimates presented in the Report and equivalent uncertainty regarding the feasibility, cost and effectiveness of storm water measures in reducing loads, BASMAA is very concerned about demonstrating compliance with the proposed requirements in the implementation plan in quantitative terms. Quantifying numeric load reductions via storm water control measures poses a significant problem for BASMAA member agencies, given the uncertainties and gaps in available baseline information. In addition, it is not clear how often the 5-year average is to be calculated, or how these results should be coordinated with the 5-year adaptive review of the TMDL. Furthermore, the first recommended method for storm water agencies to demonstrate compliance with proposed waste load allocations (i.e., quantify new mercury loads avoided through pollution prevention, sources control and treatment efforts) does not take into account that the data used to estimate current mercury loads is, at a minimum, two years old.

**Suggested Change** – Incorporate a table or listing similar to the *draft* preliminary model in Attachment 1, as a framework for coordinating the activities and reporting of the BASMAA agencies. This table is organized according to the main features listed for adaptive implementation on page 69. In addition, if asked to demonstrate load reductions in quantitative terms, BASMAA suggests that storm water programs should have the option to classify actions implemented after the data was collected (as early as the beginning of fiscal year 2001-2002), as “early implementation actions” for the purpose of complying with the urban storm water runoff allocation. (In practice, the feasibility of quantifying load reductions associated with actions implemented during the past two years will depend on the availability of appropriate data.)

- **Infeasibility of diverting flows to POTWs during wet weather flows** – The Implementation Plan for Urban Storm Water Runoff suggests that a portion of storm water during wet weather events could be diverted to Publicly Owned Treatment Works (POTWs) for treatment. However, the load allocations and Implementation Plan for municipal wastewater fails to include receiving these diversions, and past experience indicates that most plants will not accept wet weather runoff.

**Suggested Change** – Delete any reference to diverting storm water flows to POTWs or include it in both the Urban Storm Water Runoff and Municipal Wastewater sections of

the Implementation Plan as a possible action if determined to be feasible and cost effective and agreed to by the urban runoff program, POTW, and Regional Board.

o **Adaptive Implementation**

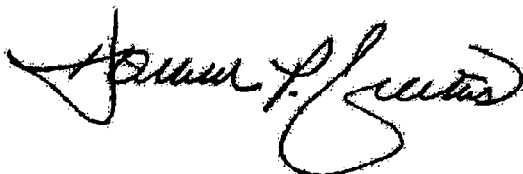
BASMAA agrees that an adaptive implementation process for the mercury TMDL is an integral part of TMDL process. Reviewing pertinent information collected during the implementation period on a consistent and rigorous timeline is critical to the success of the TMDL process.

**Suggested Changes** – We suggest the following revisions be made to the adaptive implementation section of the Report:

- o Revise the following to include a review of “immediate actions” (i.e., early implementation actions) as part of the 5-year reviews:
  - o (p. 69, last sentence) ...to evaluate findings from (immediate) actions, monitoring, special studies ...
  - o (p. 70, add to list of focusing questions):
    4. What reductions have been achieved or appear achievable based on evaluation of (immediate) actions? If the reductions / allocations do not appear achievable, how might the Regional Board implementation actions and/or allocations be modified?
- o Provide a more complete description and schedule for the planned 5-year reviews, at least during the initial 20-year implementation period. Many of the above comments, if not incorporated in the TMDL report, identify areas that BASMAA considers high priority for inclusion in this schedule.
- o Revise the Management Questions - TMDL Targets section (p. 76) to include a paragraph on the need for data to refine or validate sediment targets via studies associated with management question five (food web linkage).

We hope you find these preliminary comments and suggested improvements to the Mercury TMDL Project Report useful. As a next step, we suggest Regional Board staff from the TMDL section and storm water permitting section meet with BASMAA representatives during the preparation of the proposed Basin Plan Amendment and accompanying staff reports to discuss/clarify our concerns. In addition, we would like to work together to incorporate the suggested changes to the TMDL Project Report and implementation plan into a revised TMDL Project Report and proposed Basin Plan Amendment. Please contact me at (925) 313-2373 if you have any questions regarding the comments or suggested changes.

Sincerely,



Donald P. Freitas  
BASMAA Executive Board Chair

cc: Arleen Feng, BASMAA Monitoring Committee  
Jim Scanlin, ACCWP  
Kevin Cullen / Larry Bahr, FSURMP  
Bob Davidson, SMCSTOPPP  
Jack Betourne, VSFCD  
Liz Lewis, MCSTOPPP  
Adam Olivieri, SCVURPPP  
Bob Oller, SCWA  
Chris Sommers, CEP Mercury Work Group  
Geoff Brosseau, BASMAA  
Tom Mumley, SFBRWQCB  
Dyan Whyte, SFBRWQCB  
Ron Gervason, SFBRWQCB  
Bruce Wolfe, SFBRWQCB  
Dale Bowyer, SFBRWQCB  
Andy Gunther, Clean Estuary Partnership

**Attachment 1:**

*Draft* preliminary table to clarify the proposed NPDES permit requirements for Phase 1 urban runoff programs related to the proposed mercury TMDL targets (##-## = dates to be determined)

Aspect of adaptive implementation plan	Proposed urban runoff program actions	Reporting format and target date
<b>1. Take immediate actions to reduce mercury discharges (i.e., early implementation)</b>	A. Increase recycling of fluorescent bulbs & other products containing mercury, as appropriate (Adopt agency policies, promote outreach, coordinate with HHW, other partners and UWR timeline for full implementation in FY ##-##)	Provide format to report ongoing activities as part of annual reports, starting with reports for FY ##-##
	B. Regionally plan and implement pilot projects designed to evaluate the feasibility and effectiveness of approaches to urban runoff mercury controls (e.g., CEP Urban Runoff Implementation Actions Feasibility Study). Include pilot investigations at sites known to have relatively elevated levels of mercury in sediments (potential "low hanging fruit"). Include other pollutants of concern in studies, as appropriate.	Coordinate planning and design of pilot projects based on findings of feasibility study currently approved by CEP. Start pilot project implementation in FY ##-##
	C. Develop, implement, and/or update a mercury control program	Update existing mercury reduction plans by FY ##-##, thereafter review at 2 year intervals and update if needed and feasible.
<b>2a. Monitor immediate actions</b>	A. Compliance reporting for early implementation actions: <ul style="list-style-type: none"> <li>o Develop approaches to estimate and report new mercury loads avoided (considering annual rainfall)—coordinate with pilot feasibility studies</li> <li>o Incorporate estimates in annual reports</li> </ul>	Develop approach & incorporate estimates into FY ##-## annual reports. Preliminary summary report FY ##-## with 2-3-year average; review 5-year averages and rainfall at 2-3 year intervals.

	B. Analyze pilot implementation studies and recommend modifications or rankings for actions in "toolkit"	Progress report via BASMAA & CEP FY ##-##
<b>2b. Monitor progress towards targets</b>	A. Develop monitoring strategy through regional programs (e.g. CEP/RMP)	Report participation in annual reports
	B. Support monitoring towards targets, coordinated via CEP, RMP or similar stakeholder partnership	Incorporate appropriate activities in program monitoring plans after development of regional consensus on approach
<b>3. Refine and address management questions</b>	A. Participate in regional programs (e.g., CEP and RMP) and support studies on priority management questions (e.g., bioavailability, fate/transport/uptake processes in the Bay, etc.). Support review/evaluation of improved information from studies carried out or tracked through regional programs.	Report participation in annual reports
	B. Coordinate with regional programs (e.g., CEP and RMP) and other stakeholder groups to test and refine assumptions used for source assessment and allocations for urban runoff and related sources (e.g., air deposition, non-urban runoff)	Report participation in annual reports
<b>4. Refine mercury control program through process of adaptive implementation</b>	Incorporate new information into mercury control program gained from: <ul style="list-style-type: none"> <li>• Pilot implementation studies</li> <li>• Studies focused on priority management questions</li> <li>• Refined conceptual models</li> </ul>	Incorporate into mercury reduction plans by FY ##-##, at 5 year intervals thereafter



Alameda Countywide  
Clean Water Program

Contra Costa  
Clean Water Program

Fairfield-Subson  
Urban Runoff  
Management Program

Marin County  
Stormwater Pollution  
Prevention Program

San Mateo Countywide  
Stormwater Pollution  
Prevention Program

Santa Clara Valley  
Urban Runoff Pollution  
Prevention Program

Vallejo  
Sanitation and Flood  
Control District



B A S M A A

September 17, 2003

Richard Looker  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: Mercury in San Francisco Bay Total Maximum Daily Load (TMDL)  
draft Basin Plan Amendment (BPA)**

Dear Richard:

This letter is submitted on behalf of the Bay Area Stormwater Management Agencies Association (BASMAA) in response to the invitation to submit comments on the draft Basin Plan Amendment language for Urban Runoff, which we received on September 3, 2003.

BASMAA staff and member agency representatives would like to take this opportunity to thank you for the opportunity to meet on July 30 to discuss our comments on the Project Report and to receive some initial responses to our comments from you and other Regional Board TMDL and permitting staff. We appreciate your willingness to share with us this draft Basin Plan Amendment language and the opportunity to comment on it, despite the short schedule you are trying to meet. Please understand that two weeks is insufficient time to vet our comments with the more than 90 agencies represented by BASMAA so our comments should be considered preliminary staff comments and not necessarily comprehensive.

Overall, BASMAA is looking for sufficient flexibility in the Basin Plan language so that urban runoff programs can demonstrate reasonable progress toward meeting the allocations through reasonable efforts designed to address controllable water quality factors. BASMAA also expects wasteload allocations to be technically feasible and reasonably assured of being implemented in a reasonable period of time.

Our specific comments are provided in the attached mark-up of the preliminary draft language. We hope you find these preliminary comments and suggested improvements to the draft Basin Plan Amendment language for Urban Runoff useful. We look forward to reviewing the next draft as well as the draft Staff Report when they are released for peer review. Please contact me at (510) 622-2326 if you have any questions regarding the comments or suggested changes.

Bay Area

Stormwater Management

Agencies Association

1515 Clay Street

Suite 1400

Oakland, CA 94612

510.622.2326

www.basmaa.org

Sincerely,

*ORIGINAL SIGNED BY*

Geoff Brosseau, Executive Director

enclosure: Comments – Preliminary urban runoff language – draft BPA

## Preliminary Draft Urban Runoff Language

### Allocations

Tables 4.x through 4.y present load and wasteload allocations for San Francisco Bay's mercury sources. The allocations are expressed as annual mercury loads in kilograms per year (kg /yr). Table 4.x(1) presents load and wasteload allocations by source category along with current estimated yearly loads. Tables 4.x(2) through 4.x(4) contain load and wasteload allocations for individual urban runoff and wastewater discharges to San Francisco Bay. When summed, the individual allocations equal the category totals for urban runoff and wastewater shown in Table 4.x(1). Allocations for sources for which most of the mercury is attached to sediment were computed by applying the sediment target to the estimated sediment load from that source. Thus, the allocation may be achieved through a demonstration that sediment entering the Bay contains a concentration of mercury equal to or lower than the sediment target.

Currently, mercury inputs to the Bay total about 1200 kg per year. San Francisco Bay loses approximately 1700 kg of mercury each year as a result of transport through the Golden Gate, the net result of dredging and disposal, and evaporation. These losses will likely change over time as changes occur in mercury sediment concentrations in the Bay as the TMDL is implemented and inputs are reduced.

**TABLE 4.x(1): Load and Wasteload Allocations By Source Category**

Source	Current Mercury Load (kg/yr)	Allocation (kg/yr)
Bed Erosion	460	220
Central Valley Watershed	440	330
Urban Runoff	160	82
Guadalupe River Watershed (mining legacy)	92 <sup>1</sup>	2
Atmospheric Deposition	27	27
Non-Urban Storm Water Runoff	25	25
Wastewater (municipal and industrial)	19	19

<sup>1</sup> This load does not account for mercury captured in sediment removal programs conducted in the watershed.

**TABLE 4.x(2): Wasteload Allocations  
for Individual Urban Runoff Discharges**

<b>Urban Runoff Program</b>	<b>Percent of Program Area Population</b>	<b>Allocation (kg/yr)</b>	<b>Load Reduction Required (kg/yr)</b>
Santa Clara County	27.42	22.481	21.384
Alameda County	24.68	20.238	19.250
Contra Costa County	13.53	11.095	10.554
San Mateo County	10.22	8.384	7.975
Vallejo	2.00	1.637	1.557
Fairfield-Suisun	1.92	1.575	1.498
Sonoma County	0.87	0.715	0.680
Napa County	0.44	0.363	0.346
Marin County	0.98	0.804	0.765
Solano County	0.98	0.803	0.764
San Francisco	10.71	8.779	8.351 <sup>a</sup>
American Canyon	0.17	0.137	0.130
Belvedere	0.04	0.030	0.028
Benicia	0.46	0.377	0.358
Calistoga	0.09	0.073	0.069
Corte Madera	0.16	0.128	0.121
Fairfax	0.13	0.103	0.098
Larkspur	0.21	0.168	0.160
Mill Valley	0.23	0.191	0.181
Napa	1.24	1.018	0.968
Novato	0.81	0.668	0.635
Petaluma	0.93	0.765	0.728
Ross	0.04	0.033	0.031
San Anselmo	0.21	0.174	0.165
San Rafael	0.96	0.786	0.748
Sausalito	0.13	0.103	0.098
Sonoma	0.16	0.128	0.122
Saint Helena	0.10	0.083	0.079
Tiburon	0.15	0.122	0.116
Yountville	0.05	0.041	0.039
<b>Total</b>	<b>100</b>	<b>82<sup>b</sup></b>	<b>78<sup>b</sup></b>

<sup>a</sup> This load reduction does not account for treatment provided by San Francisco's combined sewer system.

<sup>b</sup> These totals may differ slightly from the column sum due to digit truncation from rounding to three decimal places.

## Implementation Plan

### *Urban Runoff*

The allocations shown in Table 4-x(2) will be implemented through the NPDES permits issued to urban runoff management agencies and the California Department of Transportation (Caltrans) or other regulatory mechanisms. The permits will require the adoption and implementation of best management practices (BMPs) and other urban runoff management measures/programs designed to address the wasteload allocations and load reductions derived from the allocations to the maximum extent practicable over time. The goal for this group shall be to collectively address and make reasonable further progress in achieving the allocation to the maximum extent practicable. As a way to identify, establish and assess progress towards the interim milestone of 120 kg/yr (halfway between the current load and the allocation), during the first 10 years, NPDES-permitted entities will demonstrate reasonable and measurable progress through the implementation of the dischargers' mercury reduction plans.

The following requirements have been or will be incorporated through NPDES urban runoff program permits or other regulatory mechanisms for entities conducting comprehensive control programs (i.e., Phase I storm water programs). Similar requirements will be put in place five years from the effective date of the amendment adding this section to the Basin Plan for municipalities conducting baseline programs (i.e., Phase II storm water programs).

- i) Evaluate and report on the spatial extent, magnitude and cause of pollution, for selected case study locations where elevated mercury concentrations exist;
- ii) Develop and implement a mercury reduction program for controllable sources that contribute significant loadings;
- iii) Develop and implement a mechanism to attempt to quantify either mercury loads or loads reduced/avoided through treatment, source control and /or other management efforts;
- iv) Support studies aimed at better understanding mercury fate, transport, biological uptake and/or potential discharge/loading reduction techniques/opportunities from all sources in San Francisco Bay; and
- v) Prepare an annual report that documents compliance with the above and attempts, to the maximum extent practicable, to estimate either mercury loads or loads avoided through ongoing pollution prevention and control activities.

Each urban runoff discharger allocation implicitly includes discharges from industrial and construction sites within each municipality. Municipalities have a responsibility to oversee these sources. However, if it is determined that such a source is substantially contributing to mercury loads to the Bay and is outside the jurisdiction or authority of a municipality or requires additional regulatory control and/or oversight, the Regional

Board will consider adopting additional requirements (e.g., individual NPDES permits, WDRs, CAOs, CDOs, etc.) for the industrial/construction source.

Within the jurisdiction of each urban runoff entity, Caltrans manages and is responsible for discharges associated with California highways and related facilities. The percentage of each urban runoff management agencies' mercury load for which Caltrans shall be responsible, and the reductions to be required from Caltrans runoff have not yet been determined. As an initial measure, each urban runoff entity may identify a reasonable allocation of load reduction expected to be addressed by Caltrans within their jurisdiction and provide the basis for such an estimate. In addition, to facilitate achievement of these estimated load reductions, the following elements shall be incorporated into the Caltrans' regional work plan for the San Francisco region:

- A) Quantify mercury loads associated with construction, maintenance, and use/operation of California highways and other facilities under Caltrans' jurisdiction;
- B) Develop and implement a system to control and reduce/eliminate such mercury loads and identify progress and load reductions expected to be achieved within 10 years; and
- C) Prepare an annual report that documents mercury loads or loads reduced or eliminated and ongoing source control activities.

Urban storm water management agencies and Caltrans shall, at least every five years, assess their progress in addressing, to the maximum extent practicable, the allocations shown in Table 4-x(2) using one of the methods listed below.

- 1. Provide a quantified estimate of the five-year annual average mercury load avoided by implementing pollution prevention, source control, and treatment efforts and the basis for the estimate. The Regional Board may recognize loads avoided resulting from activities implemented after 2001 as counting toward the load reductions consistent with the wasteload allocation.
- 2. Provide a quantified estimate of the five-year annual average mercury load using data on flow and mercury concentrations in water and suspended particulate matter.
- 3. Show through studies, models, and/or monitoring data that the mercury concentration of suspended sediment that best represents sediment discharged from program areas is below the sediment target.

#### ***Adaptive Implementation of the Mercury TMDL***

Within five years from the effective date of the amendment adding this section to the Basin Plan and every five years thereafter until the TMDL targets are achieved, the Regional Board will review the San Francisco Bay mercury TMDL to evaluate new information relevant to the mercury TMDL from monitoring, special studies, and the scientific literature. The reviews will be coordinated through the Regional Board's water quality Basin Planning Program and provide opportunities for stakeholder participation.

Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan through appropriate procedures during these reviews. It is recommended that the following focusing questions be used to conduct the reviews. Additional focusing questions will be developed in collaboration with stakeholders during each review.

1. Is the Bay progressing toward TMDL targets as expected? If it is unclear whether there is progress, how should efforts be modified to detect trends? If there has not been progress, how might the implementation actions or allocations be modified?
2. What has been learned about the loads for the various source categories and how have these loads changed over time?
3. Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, load allocations, or implementation actions? If so, how might the TMDL be modified?

The load and wasteload allocations were determined on the basis of currently available data, which is limited and are designed to achieve water quality standards. It is possible that a responsible entity, after exhausting all reasonably practicable remedies, may not achieve the required allocation and/or may need substantial additional time to make progress towards the ultimate allocation objective. In such a case, the discharger may prepare for Regional Board consideration and acceptance a detailed account of actions taken and the explicit rationale for why additional measures to control loads are either not practicable, will require more time, and/or would not result in meaningful load reductions. Such a petition may not be accepted unless the discharger can demonstrate that it has implemented practicable control measures and attempted to assess their effects on loads in good faith. If such a petition is prepared by the responsible entity and accepted by the Regional Board, the responsible entity will be deemed to be in compliance with Regional Board regulatory requirements relating to required allocations.

### **New Sources of Mercury**

As the TMDL is implemented, new sources of mercury may emerge either as the result of a new facility applying for a permit to discharge or as a result of a new source being discovered. The Regional Board will consider establishing a load or wasteload allocation for a new mercury source under the following circumstances:

- The load allocation from one or more existing sources of the same category (e.g., municipal wastewater) will be reduced by an amount equal to the new allocation; or
- The Regional Board finds that the magnitude of the new allocation is negligible compared to reductions in total annual mercury load from all sources that will have been realized at the time of consideration; or
- The allocation is for a previously unknown or unquantified discharge of mercury.

To: "Bill Johnson" <bjj@rb2.swrcb.ca.gov>  
From: Chris Sommers <csommers@eoainc.com>  
Subject: Draft Preliminary Urban Runoff Cost Estimates Re: Mercury  
Cc: adam olivieri <awo@eoainc.com>, arleen@acpwa.org, jon\_konnan@eoainc.com, fejarvis@eoainc.com  
Bcc:  
Attached:

Dear Bill,

As requested, here is our *preliminary draft review* of the cost of implementing the mercury TMDL by SCVURPPP. A portion of the rough cost estimates described below were originally included in the CEP's draft report for urban runoff implementation.

Please understand that two weeks is insufficient time to develop and provide accurate cost estimates. These estimates contained in this document should be considered very draft preliminary rough cost estimates from program staff and are not necessarily comprehensive.

Additionally, it is important to note that this preliminary draft review of cost estimates presented here are based on the following assumption:

*The adopted Basin Plan Amendment (BPA) language and associated permit conditions for urban runoff will look very similar to the revised preliminary draft BPA language for urban runoff (revised BPA language) submitted to Richard Looker (SFB RWQCB) by BASMAA on September 17, 2003.*

The 5 major requirements as described in the revised BPA language are:

- i) Evaluate and report on the spatial extent, magnitude and cause of pollution, for selected case study locations where elevated mercury concentrations exist;
- ii) Develop and implement a mercury reduction program for controllable sources that contribute significant loadings;
- iii) Develop and implement a mechanism to attempt to quantify either mercury loads or loads reduced/avoided through treatment, source control and /or other management efforts;
- iv) Support studies aimed at better understanding mercury fate, transport, biological uptake and/or potential discharge/loading reduction techniques/opportunities from all sources in San Francisco Bay; and
- v) Prepare an annual report that documents compliance with the above and attempts, to the maximum extent practicable, to estimate either mercury loads or loads avoided through ongoing pollution prevention and control activities.

To be consistent, I have broken out the estimated costs for complying with each requirement. It is important to note that only the costs associated with complying with requirement ii (as presented above) were included in the estimates presented in the CEP document. The additional costs related to complying with requirements i, iii, iv and v (as presented above) are included in our draft estimates below. All draft estimated costs are based on anticipated implementation by the SCVURPPP, not all bay area urban runoff management programs.

**Please note:** Total costs of implementing source control programs or treatment controls are not

included in these draft estimates. For example, the costs of developing outreach, collecting, storing, transporting, and disposing of florescent light bulbs are not included in these estimates. The costs of conducting activities such as these are believed to be substantially greater (10x) than the draft estimates presented here. Additionally, economies of scale and SCVURPPP's experience with the NPDES program may underestimate the true cost to newer and / or smaller programs.

#### **Preliminary Draft Cost Estimates:**

The following preliminary draft cost estimates are based on best professional judgment and should be considered rough preliminary estimates. Costs are broken down into four categories: 1) Direct Costs cost of hiring a consultant (including program staff) to conduct a study or implement/develop/oversee a program; 2) Indirect Costs based on the time co-permittee staff will spend on complying with a specific requirement; 3) Initial Costs the one time costs of developing/implementing a program or conducting an activity; 4) Annual Costs yearly costs of complying with a requirement.

**Requirement i :** *Evaluate and report on the spatial extent, magnitude and cause of pollution, for selected case study locations where elevated mercury concentrations exist*

This requirement is related to conducting case studies to further characterize areas where elevated concentrations/loads of mercury have been found. Draft direct and indirect costs are estimated to initially be roughly **\$10,000 each**. Additional annual indirect and direct costs associated with this requirement are estimated to be roughly **\$50,000 and \$20,000**, respectively.

**Requirement ii :** *Develop and implement a mercury reduction program for controllable sources that contribute significant loadings*

Estimated costs to implement this requirement are based on costs presented in the CEP's draft report for urban runoff implementation. Implementing a mercury pollution prevention program proceeds in two steps:

1) Set up the program. After developing a pollution prevention plan, this step primarily involves educating the co-permittees by getting individual stormwater managers to understand the need for the pollution prevention program and agree to participate. Direct costs to the SCVURPPP to set up the mercury pollution prevention program and perform the initial outreach was **\$25,000 initially**. Indirect costs to the SCVURPPP co-permittees to set up the program was approximately **\$120,000 initially**.

2) Implement the program. This step involves development of policies, guidelines, and model ordinances. The SCVURPPP has allotted **\$60,000 initially** as the direct cost for program implementation. In addition to direct costs to the Program, indirect costs are incurred by co-permittees through the use of their own staff time. We estimate that the implementation of the pollution prevention program costs SCVURPPP co-permittees **\$120,000 initially** and will cost an additional **\$240,000 annually**.

**Requirement iii:** *Develop and implement a mechanism to attempt to quantify either mercury loads or loads reduced/avoided through treatment, source control and /or other management*



efforts

The following estimate is based on quantifying mercury loads avoided/reduced, rather than mercury loads. The direct startup cost estimate for developing a load avoided quantification method is estimated to be roughly **\$100,000 initially**. This estimate is based on tasks such as the review/documentation of all current and potential BMPs implemented by SCVURPPP and the development of a tracking method. Implementation of the method will require staff training and ongoing support and documentation of loads avoided and new BMPs implemented. The ongoing indirect implementation cost is estimated to be roughly **\$200,000 annually**

It is important to note that if environmental monitoring is required to quantify loads, it is highly probable that cost would substantially increase.

**Requirement iv:** *Support studies aimed at better understanding mercury fate, transport, biological uptake and/or potential discharge/loading reduction techniques/opportunities from all sources in San Francisco Bay*

This direct cost estimate is based on SCVRUPPPs current contribution to the CEP. SCVURPPP contributes roughly \$100,000 to the CEP annually (not including program/co-permittee staff time). If approximately 20% of the CEP contribution is associated with funding mercury-related studies, plus the additional program staff time to participate in CEP mercury-related activities, the estimated direct cost is expected to be **\$40,000 annually**. The indirect costs are estimated to be roughly **\$20,000 annually**, based on the review of documents and coordination with Program staff to remain apprised of the CEP mercury-related activities.

**Requirement v:** *Prepare an annual report that documents compliance with the above and attempts, to the maximum extent practicable, to estimate either mercury loads or loads avoided through ongoing pollution prevention and control activities.*

The direct cost of preparing an annual reporting format is estimated to be **\$10,000 initially (direct cost)**. Preparation of reports annually by program and co-permittee staff that are intended to document mercury pollution prevention activities and loads avoided is estimated to cost roughly **\$50,000 annually** in direct costs and **\$100,000 annually** in indirect costs.

### Summary

Preliminary Draft Rough Estimated Costs for SCVURPPP to Comply with the Mercury TMDL .

Requirement	Direct Costs	Indirect Costs
i.	Evaluate and Report on Hg Sites \$ 10,000 (initial)	\$ 10,000 (initial)
ii.	Mercury Pollution Prevention Plan	\$ 50,000 (annual) \$ 20,000 (annual)
a.	Plan Development	\$ 25,000 (initial) \$ 120,000 (initial)
b.	Plan Implementation (initial)	\$ 60,000 (initial) \$ 120,000
c.	Plan Implementation (annual)	\$ 240,000

iii. Mechanism to quantify loads avoided	\$100,000 (initial)	\$ 200,000 (annual)
iv. Bay Scientific Study Support	\$ 40,000 (annual)	\$ 20,000 (annual)
v. Annual Reporting	\$ 10,000 (initial)	
	\$ 50,000 (annual)	\$ 100,000 (annual)
<b>Totals:</b>	<b>\$ 205,000 (initial)</b>	<b>\$ 250,000 (initial)</b>
	<b>\$ 140,000 (annual)</b>	<b>\$ 580,000 (annual)</b>

**Population of Santa Clara County 1,700,000 (approx.)**

**Per capita initial costs \$ 0.33**

**Per capita annual costs \$ 0.42**

Please let me know if you have questions.

Chris Sommers  
Senior Scientist  
Eisenberg, Olivieri & Associates Inc. (EOA)  
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Oakland, CA 94612  
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(510) 832-2856 (fax)

At 09:30 AM 9/18/03 -0700, you wrote:

Two weeks ago I requested a quick "confirm or deny" on the costs estimated in the CEP report (see attached). If I don't hear from you by early this afternoon, I'll just work with what I have.

Bill Johnson  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612  
(510) 622-2354  
bjj@rb2.swrcb.ca.gov Date: Wed, 10 Sep 2003 18:31:36 -0700  
From: "Bill Johnson" <bjj@rb2.swrcb.ca.gov>  
Cc: "Dyan Whyte" <DCW@rb2.swrcb.ca.gov>,  
"Richard Looker" <Rel@rb2.swrcb.ca.gov>  
Subject: Fwd: Urban Runoff Costs Re: Mercury  
Mime-Version: 1.0  
Content-Type: multipart/mixed; boundary="=\_37696CD4.C3A25C39"

Since I haven't heard from you yet, I was just wondering whether you think this is something you could look into this week. I'm just looking for a quick "confirm or deny" thing, and I know the costs addressed here

do not include many activities SW programs may find themselves doing pursuant to the Hg TMDL. I'm just taking one thing at a time at this point.

Bill Johnson  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612  
(510) 622-2354  
bjj@rb2.swrcb.ca.gov Date: Thu, 04 Sep 2003 15:32:24 -0700  
From: "Bill Johnson" <bjj@rb2.swrcb.ca.gov>  
Cc: "Dyan Whyte" <DCW@rb2.swrcb.ca.gov>,  
"Richard Looker" <Rel@rb2.swrcb.ca.gov>  
Subject: Urban Runoff Costs Re: Mercury  
Mime-Version: 1.0  
Content-Type: text/plain; charset=US-ASCII  
Content-Transfer-Encoding: 7bit  
Content-Disposition: inline

Hi Adam / Chris:

I'm pulling together whatever information I can find related to the costs of implementing the mercury TMDL. The CEP's draft report for urban runoff implementation includes some rough cost data. Since Khalil Abu-saba says the source of the information in the AMS report is EOA, I thought it might be wise to go directly to the source of the information and request confirmation. Would you mind reviewing this over the next few days and getting back to us next week with a response that says (1) yeah, this looks about right; (2) it's not quite right, but here's a fix; or (3) we've got better information, and here it is? Thanks for your help. The text from the CEP report is copied below.

#### **COSTS TO DEVELOP AND IMPLEMENT A MERCURY POLLUTION PREVENTION PROGRAM**

Implementing a mercury pollution prevention program proceeds in three steps:

- 1) Set up the program. After developing a pollution prevention plan (Appendix A), this step primarily involves educating the copermittees by getting individual stormwater managers to understand the need for the pollution prevention program and agree to participate. Direct costs to the SCVURPPP to set up the mercury pollution prevention program and perform the initial outreach was \$25,000.
- 2) Implement the program. This step involves development of policies, guidelines, and model ordinances, and training copermittee staff, as well as tracking and reporting the success of program implementation.

The SCVURPPP has allotted \$60,000 as the direct cost for program implementation.

In addition to direct costs to an urban runoff program, indirect costs are incurred by municipal copermittees through the use of their staff time. The SCVURPPP estimates that program development and implementation required 1/12 of a person year (160 hours) from each copermittee as a one-time cost, and will require an additional 160 hours / copermittee as an annual ongoing cost. Valuating staff time at \$100 an hour, this suggests that development and implementation of the pollution prevention program cost SCVURPPP copermittees \$240,000 initially and will cost an additional \$240,000 annually.

3) Monitor responses. A monitoring approach for mercury in Bay Area watersheds has been established by the Bay Area Stormwater Management Agencies Association (BASMAAA) to characterize mercury concentrations in sediments of urban and non-urban watersheds. This approach helps estimate mercury loads based on estimates of sediment discharged from urban and non-urban drainages. The total cost of the monitoring included costs for other pollutants of concern (e.g., PCBs, chlorinated pesticides). The SCVURPPP estimates that mercury monitoring costs amounted to \$50,000 for one year, including the cost of collecting samples, analyzing them for total mercury and grain size, and reporting the data. The response time of urban watersheds to implementation of pollution prevention measures is on the order of years to decades, so this type of monitoring should take place once every permit cycle (five years). Therefore, as an ongoing commitment, monitoring costs for a mercury pollution prevention plan are expected to amount to \$10,000 per year.

The total costs to develop and implement a mercury pollution prevention program consistent with the fulfillment of provision C.9.c in the SCVURPPP permit are summarized in Table 1, along with costs extrapolated to a population of 6.5 million. Although current NPDES stormwater programs do not currently cover that many people, 6.5 million is a reasonable upper estimate for the number of people affected once phase-II stormwater permits are issued to smaller municipalities. Based on these projections, the fiscal impact of mercury TMDL implementation in urban runoff programs is expected to be approximately \$1.2 million as a one-time cost and an additional \$1 million annually. Most of this cost is in the form of staff time for municipal workers (indirect costs).

TABLE 1: Estimated cost to develop and implement mercury pollution prevention plans for 6.5 million people, based on costs to the SCVURPPP. Direct costs refer to contracts, whereas indirect costs refer to city staff time valuated at \$100 / hour.

Start-up costs	Direct Costs	Indirect
Costs		

Plan Development (start-up)	\$ 25,000	\$
120,000		
Plan Implementation (start-up)	\$ 60,000	\$ 120,000
Plan Implementation (ongoing)		\$ 240,000
Monitoring	\$ 10,000	

Population of Santa Clara County	1,700,000
Per capita startup costs	\$ 0.19
Per capita ongoing costs	\$ 0.15

Startup costs for entire Bay Area	\$ 1,242,647
Ongoing costs for entire Bay Area	\$ 955,882

Economies of scale and SCVURPPP's experience with the NPDES program may underestimate the true cost to newer and / or smaller programs.

Bill Johnson  
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## **Appendix B**

U.S. Geological Survey Open-File Report 2004-1192. Version 1.0.  
Deposition, Erosion, and Bathymetric Change in South San Francisco Bay: 1858-1983



# **Deposition, Erosion, and Bathymetric Change in South San Francisco Bay: 1858-1983**

By Amy C. Foxgrover<sup>1</sup>, Shawn A. Higgins<sup>1</sup>, Melissa K. Ingraca<sup>1</sup>, Bruce E. Jaffe<sup>1</sup>, and  
Richard E. Smith<sup>2</sup>

<sup>1</sup> US Geological Survey Pacific Science Center, Santa Cruz, CA

<sup>2</sup> US Geological Survey Water Resources Division, Menlo Park, CA

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Open-File Report 2004-1192

**2004**  
**U.S. Department of the Interior**  
**U.S. Geological Survey**

**U.S. Department of the Interior**

Gale A. Norton, Secretary

**U.S. Geological Survey**

Charles G. Groat, Director

U.S. Geological Survey, Reston, Virginia 2004

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# Deposition, Erosion, and Bathymetric Change in South San Francisco Bay: 1858 - 1983

By Amy C. Foxgrover<sup>1</sup>, Shawn A. Higgins<sup>1</sup>, Melissa K. Ingraca<sup>1</sup>, Bruce E. Jaffe<sup>1</sup>, and Richard E. Smith<sup>2</sup>

<sup>1</sup> US Geological Survey Pacific Science Center, Santa Cruz, CA

<sup>2</sup> US Geological Survey Water Resources Division, Menlo Park, CA

## Abstract

Since the California Gold Rush of 1849, sediment deposition, erosion, and the bathymetry of South San Francisco Bay have been altered by both natural processes and human activities. Historical hydrographic surveys can be used to assess how this system has evolved over the past 150 years. The National Ocean Service (NOS) (formerly the United States Coast and Geodetic Survey (USCGS)), collected five hydrographic surveys of South San Francisco Bay from 1858 to 1983. Analysis of these surveys enables us to reconstruct the surface of the bay floor for each time period and quantify spatial and temporal changes in deposition, erosion, and bathymetry.

The creation of accurate bathymetric models involves many steps. Sounding data was obtained from the original USCGS and NOS hydrographic sheets and were supplemented with hand drawn depth contours. Shorelines and marsh areas were obtained from topographic sheets. The digitized soundings and shorelines were entered into a Geographic Information System (GIS), and georeferenced to a common horizontal datum. Using surface modeling software, bathymetric grids with a horizontal resolution of 50 m were developed for each of the five hydrographic surveys. Prior to conducting analyses of sediment deposition and erosion, we converted all of the grids to a common vertical datum and made adjustments to correct for land subsidence that occurred from 1934 to 1967. Deposition and erosion that occurred during consecutive periods was then computed by differencing the corrected grids. From these maps of deposition and erosion, we calculated volumes and rates of net sediment change in the bay.

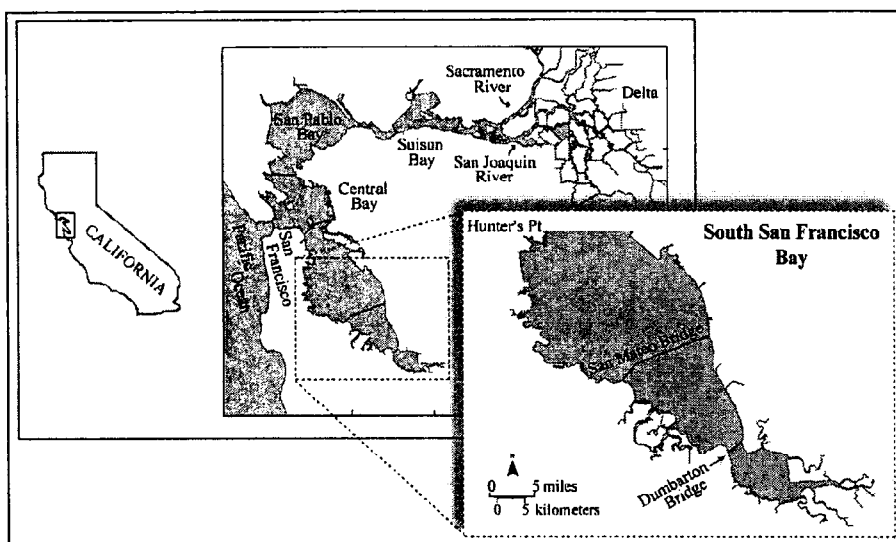
South San Francisco Bay has lost approximately  $90 \times 10^6 \text{ m}^3$  of sediment from 1858 to 1983; however within this timeframe there have been periods of both deposition and erosion. During the most recent period, from 1956 to 1983, sediment loss approached  $3 \times 10^6 \text{ m}^3/\text{yr}$ . One of the most striking changes that occurred from 1858 to 1983 was the conversion of more than 80% of the tidal marsh to salt ponds, agricultural, and urban areas. In addition, there has been a decline of approximately 40% in intertidal mud flat area. Restoration of these features will require a detailed understanding of the morphology and sediment sources of this complex system.

## Introduction

San Francisco Bay is centrally located along the California coast where the Sacramento and San Joaquin Rivers join to form the West Coast's largest estuary (Fig. 1). At the time that the first hydrographic survey was collected in South San Francisco Bay (1858), there were approximately 100,000 people living in the San Francisco Bay area; today it is home to nearly seven million. This rapid increase in population has placed a number of pressures upon the estuary. In addition to

natural processes such as sea-level rise, climatic influences on sediment delivery, and wind wave erosion, anthropogenic influences have altered patterns of sediment deposition and erosion throughout the estuary. Changes in bathymetry from 1858 to 1983 were documented by a series of hydrographic surveys. Utilizing Geographic Information Systems (GIS), we were able to conduct detailed analyses of these historical hydrographic surveys to assess not only spatial and temporal trends, but to quantify changes in net sediment volumes and rates over greater than decadal time scales.

This study is the third in a series that documents historical bathymetric change and the deposition and erosion of sediment in San Francisco Bay (Jaffe *et al.*, 1998; Cappiella *et al.*, 1999; United States Geological Survey San Francisco Bay Bathymetry Web Site). The study area for this report is South San Francisco Bay, which has been defined as the area South of Hunter's Point (Fig. 1). The National Ocean Service (NOS) (formerly the United States Coast and Geodetic Survey (USCGS)) collected five hydrographic surveys of South San Francisco Bay from 1858 to 1983 which serve as the basis for our models.



**Figure 1.** Location of study area.

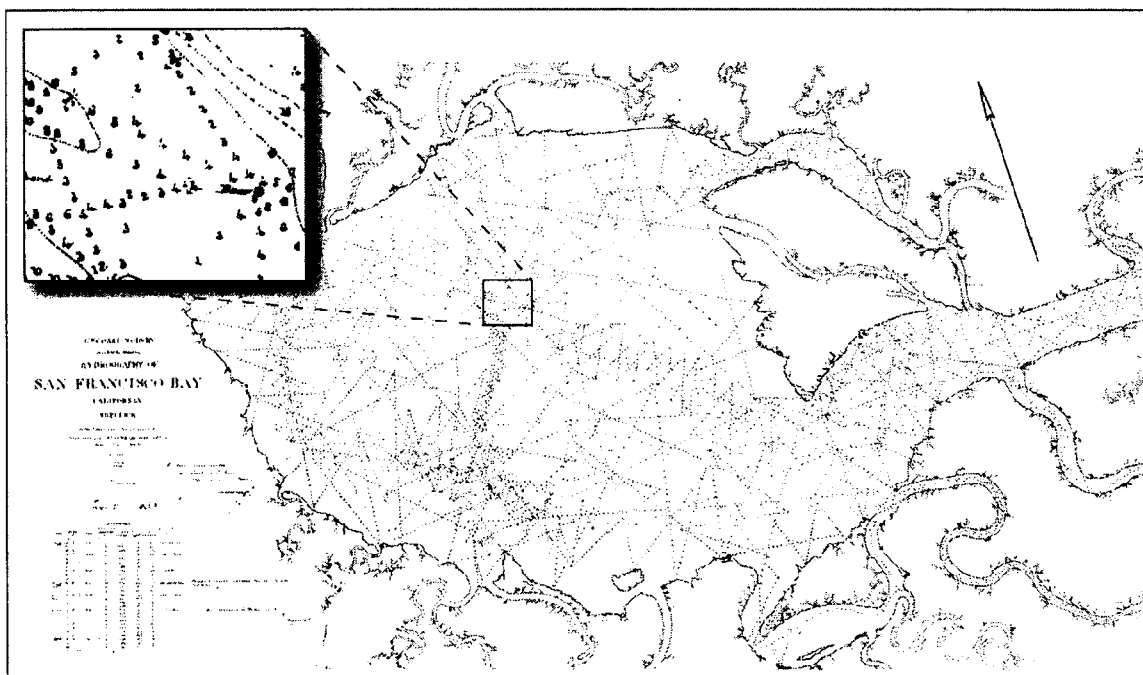
Compiling these data into a GIS was especially time consuming. Over 300,000 soundings, associated contours, and shorelines were analyzed to produce the bathymetric surfaces. However, analyses of long-term trends in the deposition and erosion of sediment provide insight into a dynamic system that is difficult to gain with short-term field studies. Using this data, we are able to investigate how the documented changes in bathymetry relate to changing biological communities, contaminant issues, and future development within this estuary.

## Methods and Data

Bathymetric soundings were obtained from the original USCGS and NOS hydrographic sheets (H-sheets) (Fig. 2). Bathymetric contours were digitized either from the H-sheets directly or based upon sounding values. Supplementary contours were manually added to the 1850's tidal flats where the original sounding values have been omitted from the H-sheets. An additional contour was added to all of the surveys, parallel to the shoreline, 20 m within the bay, to ensure realistic nearshore morphology in areas where soundings were not available (see contour section). Shoreline and marsh data were taken from topographic sheets (T-sheets). Once all of the

information was converted into a digital format, it was georeferenced, or assigned real world coordinates, and combined into a GIS. Continuous surface representations (bathymetric grids) with a horizontal resolution of 50 m were generated for each of the five hydrographic surveys using ArcInfo's TopoGrid module. TopoGrid is a modeling algorithm specifically designed to utilize both point and contour data to retain proper hydrogeomorphic properties. To ensure high-quality bathymetric grids, error checking techniques were applied at various stages of data processing.

Prior to conducting analyses of sediment deposition and erosion, we converted all of the grids to a common vertical datum to account for changes in sea level over the 125-year span of the surveys. In addition, we made adjustments to correct for land subsidence that occurred in the Santa Clara Valley from 1934 to 1967. Deposition and erosion that occurred within consecutive periods was then computed by differencing the corrected grids. The amount of sediment eroded and deposited between periods was calculated on a cell by cell basis to quantify net sediment volume change and rates of change throughout the bay.



**Figure 2.** Example of a historical 1858 H-sheet. The data distribution is typical of the 1850's hydrographic surveys.

## Bathymetric Time Series

### Input Data

#### 1850s

Soundings for the 1850's surveys were manually digitized from scanned images of H-sheets obtained from the Hydrographic Surveys Division of the NOS (Table 1). Hand-drawn depth contours were digitized based upon H-sheet data and supplemented manually as needed to maintain a consistent contour interval throughout all of the surveys (Fig. 3). The shorelines, as well as the

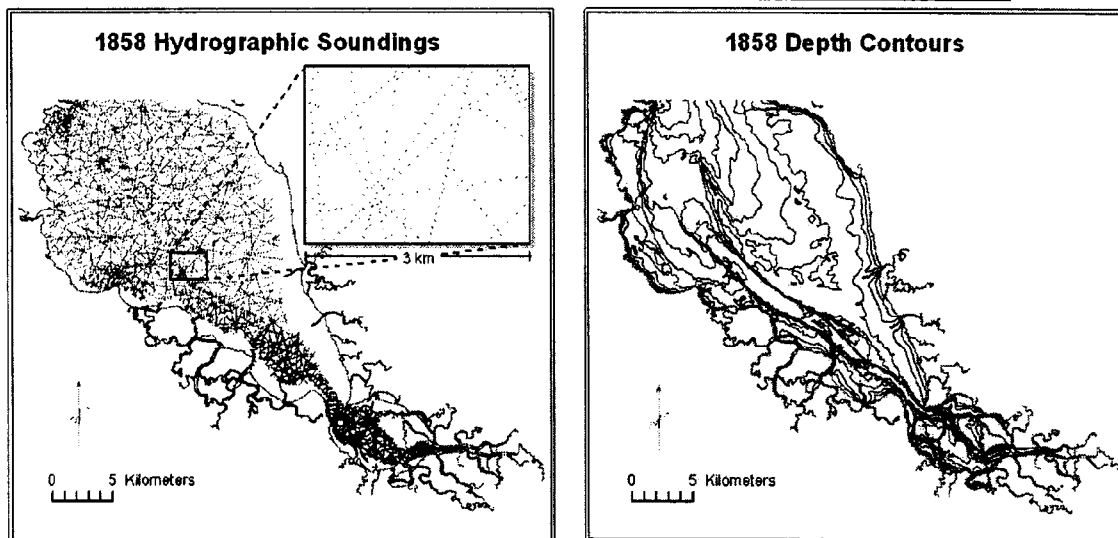
marsh boundaries for the 1850's surveys, were obtained digitally from the San Francisco Estuary Institute's (SFEI) EcoAtlas (1998).

It was common practice on the earliest H-sheets for all soundings above Mean Lower Low Water (MLLW) to be assigned a blanket value of zero (Dedrick, 1983). This was a result of USCGS plotting standards at that time and does not accurately reflect the slope of the tidal flats. To create a more realistic slope, we artificially generated contours at approximately  $\frac{1}{2}$  and  $\frac{1}{4}$  of the distance between the shoreline, represented by Mean High Water (MHW), and MLLW. These contours were assigned values of 25% and 50%, respectively; of Mean Tide Level (MTL) elevations (see contours section). All zero soundings between MLLW and MHW were removed from the gridding routine. This is a rough estimate of tidal flat slope based upon 1898 surveys in which soundings above MLLW were retained. Kent Dedrick and others with the CA State Lands Commission have replaced the zero values above MLLW with the reduced soundings derived from the original USCGS tidal observation books. It is our hope to incorporate these values into our work in the near future.

Due to the relatively sparse distribution of data in the 1850's surveys, it was necessary to add a limited number of supplementary soundings (based upon surrounding values) to narrow channels crossing the tidal flats in order to maintain channel connectivity through the mudflat.

**Table 1.** Table of 1850's H-sheets of South San Francisco Bay.

H-Sheet	Year	Scale	Soundings
H628	1857-58	1:20,000	9,898
H629	1857-58	1:10,000	2,250
H636	1857-58	1:10,000	6,373
H637	1858	1:10,000	1,003
H638	1858	1:10,000	512
			Total = 20,036



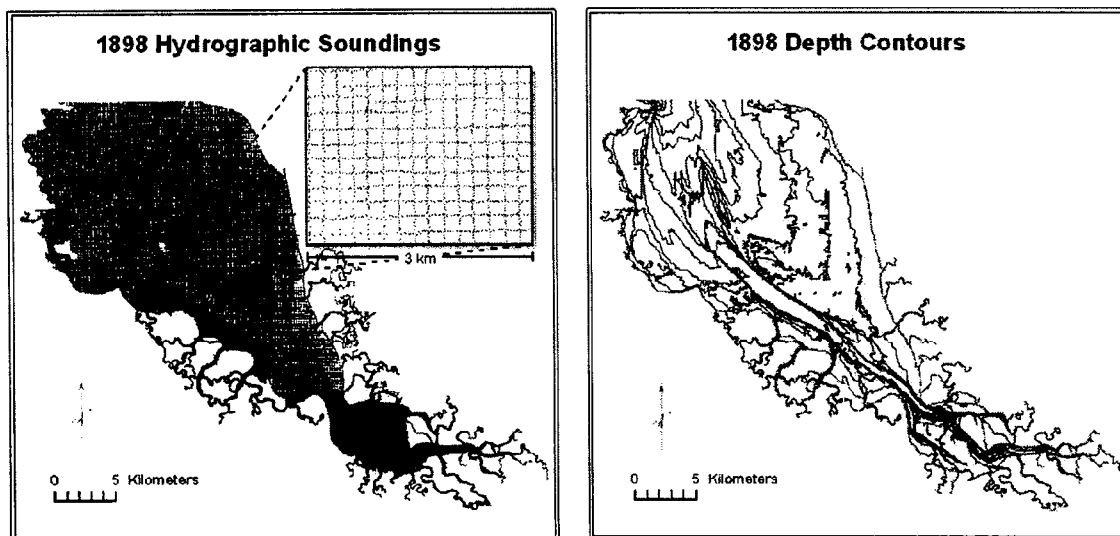
**Figure 3.** 1850's soundings and contours used for surface modeling.

## 1890s

Soundings for the 1890's surveys were manually digitized from scanned images of H-sheets obtained from the Hydrographic Surveys Division of the NOS (Table 2). Hand-drawn depth contours were digitized based upon H-sheet data and supplemented manually as needed to maintain a consistent contour interval throughout all of the surveys (Fig. 4). The shorelines and the marsh boundaries were digitized from scanned images of Topographic-sheets (T-sheets).

**Table 2.** Table of 1890's H-sheets of South San Francisco Bay.

H-Sheet	Year	Scale	Soundings
H2304	1897	1:20,000	10,839
H2315	1897	1:20,000	34,321
H2411	1898-99	1:20,000	16,206
H2412	1898	1:10,000	15,803
H2413	1898	1:10,000	5,418
H2414	1898	1:10,000	2,982
H2415	1898	1:10,000	13,830
			Total = 99,399



**Figure 4.** 1890's soundings and contours used for surface modeling.

## 1930s

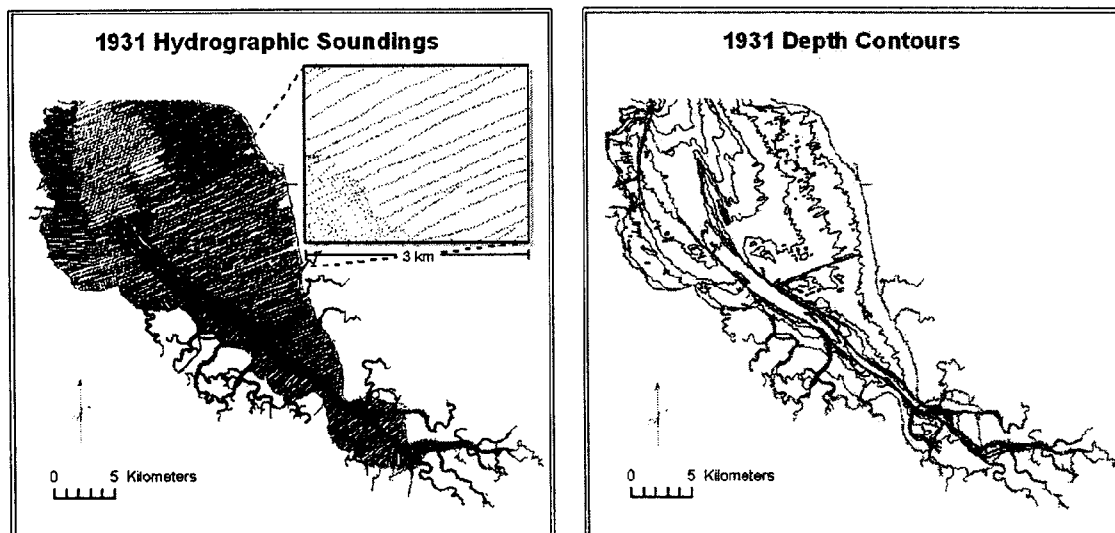
The majority of the 1930's depth soundings were obtained digitally from the National Geophysical Data Center's (NCDC) GEOPHYSICAL Data System (GEODAS) (1996) with the exception of H4137. Soundings from H4137 were manually digitized from a scanned image of the H-sheet obtained from the Hydrographic Surveys Division of the NOS (Table 3). Hand-drawn depth contours were digitized based upon depth soundings (Fig. 5). The shorelines for the 1931 surveys were obtained digitally from the National Geodetic Survey (NGS) NOAA Shoreline Data Explorer. The marsh extent was digitized from georeferenced, scanned images of T-sheets obtained from the NOAA National Ocean Service Coastal Services Center.

Although we label our bathymetric maps with a single year, hydrographic surveys customarily are conducted over the span of a few years. The year displayed on our maps is the year in which the majority of the surveys were conducted. There was an exceptional time lapse of

approximately ten years within the 1931 survey. The northernmost survey within the study area (H4137) was surveyed in 1919-20 while the remaining surveys were collected in 1931. There was a slight area of overlap between the H4137 (1919-20) and H5129 (1931) in the vicinity of San Bruno Shoal that indicated differences of one to three feet between sounding values. We did not feel justified in performing linear interpolations in an attempt to bring the data to a common date and rather decided to honor the original data. Overlapping soundings between the two time periods were removed, and rates of sediment volume change were calculated using separate regions to account for this disparity in time periods.

**Table 3.** Table of 1930's H-sheets of South San Francisco Bay.

H-Sheet	Year	Scale	Soundings
H4137	1919-20	1:20,000	23,509
H5129	1931	1:20,000	25,185
H5131	1931	1:10,000	10,313
H5133	1931	1:10,000	12,276
H5135	1931	1:10,000	8,409
H5139	1931	1:10,000	7,735
H5140	1931	1:10,000	5,024
			Total = 92,451



**Figure 5.** 1930's soundings and contours used for surface modeling.

#### 1950s

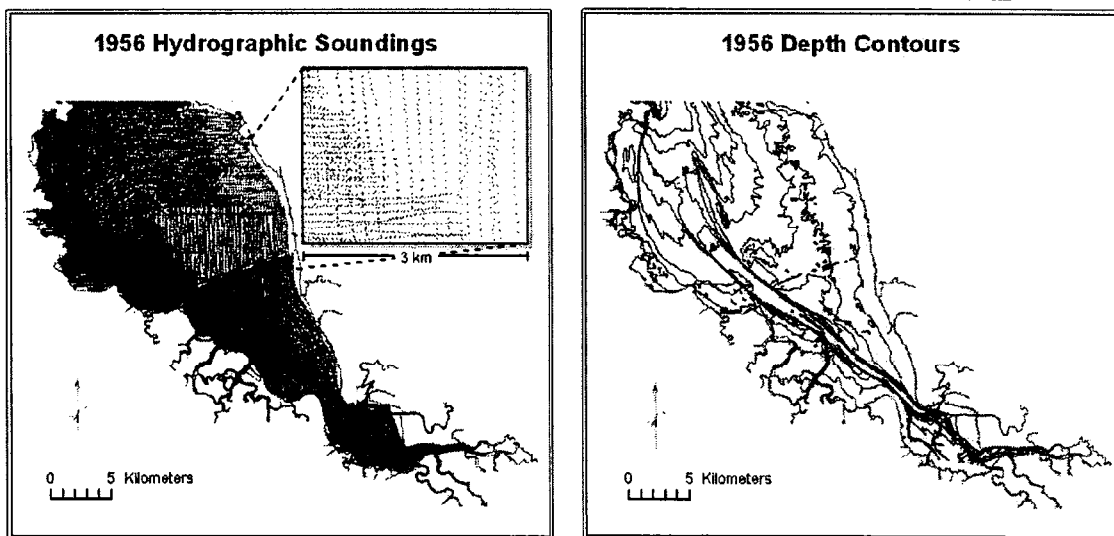
Depth soundings for the 1950's surveys were obtained digitally from NGDC's GEODAS database (1996) (Table 4). Hand-drawn depth contours were digitized based upon H-sheet data and supplemented manually as needed to maintain a consistent contour interval throughout all of the surveys (Fig. 6). The shorelines for the 1950's surveys were digitized from H-sheets. The marsh boundaries were digitized from scanned, georeferenced images of T-sheets obtained from the NOAA National Ocean Service Coastal Services Center.

GEODAS soundings for H8025 (near Hunter's Point) were missing some soundings that existed on the original H-sheet; these soundings were manually digitized.



**Table 4.** Table of 1950's H-sheets of South San Francisco Bay.

H-Sheet	Year	Scale	Soundings
H8023	1954	1:5,000	7,651
H8024	1954	1:10,000	20,123
H8025	1954-55	1:10,000	13,137
H8026	1954-55	1:10,000	14,174
H8027	1955	1:20,000	12,900
H8210	1956	1:10,000	4,683
H8275	1956	1:10,000	15,733
H8281	1956	1:10,000	9,429
H8282	1956	1:10,000	2,918
			Total = 100,748



**Figure 6.** 1950's soundings and contours used for surface modeling.

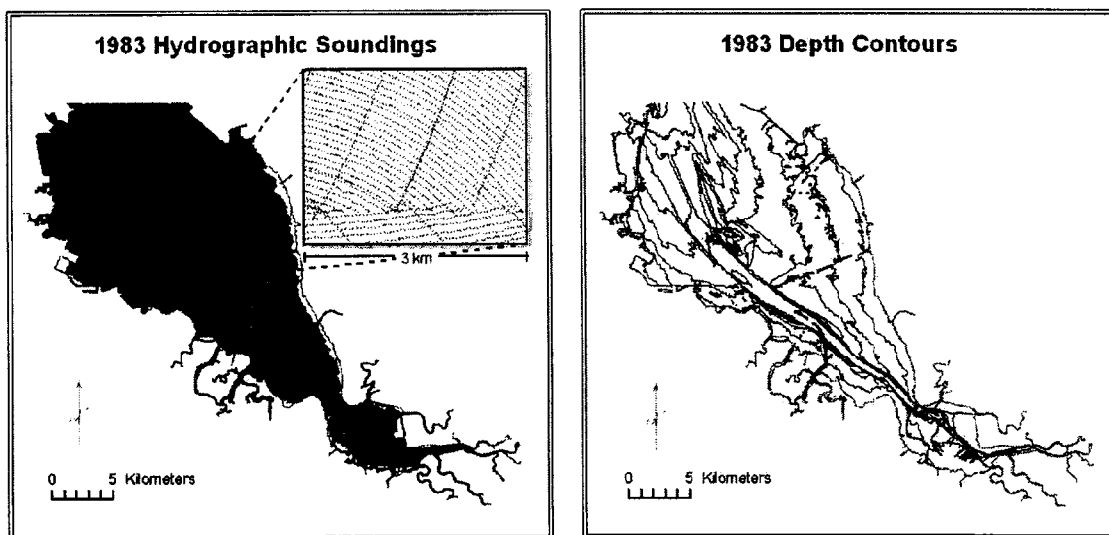
#### 1980s

Digital soundings for the 1980's surveys were obtained from NGDC's GEODAS database (1996) (Table 4). Hand-drawn depth contours were digitized based upon depth soundings (Fig. 7). The shorelines as well as the marsh boundaries were obtained digitally from SFEI's EcoAtlas (1998).

It was discovered that select soundings from H10132 (downloaded from GEODAS) were apparently assigned an incorrect depth code. Soundings above MLLW (intertidal soundings) appeared to be recorded in centimeters rather than decimeters. These points were selected and converted from centimeters to decimeters to match the rest of the data. There was an additional cluster of approximately 30 soundings within H10102 located near Redwood Creek whose values differed from their surrounding soundings by over an order of magnitude. No logical correction was evident, so these points were removed.

**Table 5.** Table of 1980's H-sheets of South San Francisco Bay.

H-Sheet	Year	Scale	Soundings
H9819	1979	1:5,000	19,645
H10102	1983-84	1:100,000?	12,600
H10158	1984-85	1:10,000	5,819
H9869	1980	1:10,000	12,726
H9872	1980	1:20,000	21,356
H9952	1981-82	1:10,000	22,439
H9984	1981-83	1:10,000	11,413
H10070	1982-83	1:10,000	12,227
H10132	1984-85	1:10,000	17,870
			Total = 136,095



**Figure 7.** 1980's soundings and contours used for surface modeling.

### Georeferencing

Georeferencing the early surveys was especially challenging because the 1850's hydrographic sheets contained no discernable coordinate information. The H-sheets were georeferenced using common shoreline features with SFEI's shoreline coverage. For each H-sheet several control points were placed along distinct shoreline features on the H-sheet that were also observable on the SFEI shoreline coverage. Coordinate information from the SFEI coverage was assigned to the control points and a best-fit transformation was performed to minimize error over the entire sheet.

The 1890's H-sheet and T-sheets contain graticules depicting longitude and latitude referenced to a localized datum. To determine the relationship of this local datum to the established North American Datum 1927 (NAD27), the sheets were registered using published coordinate values of four triangulation stations throughout the bay (Mitchell, 1936). Based upon

these coordinates a standard correction shift was calculated and applied to the graticule values on the published H-sheets and T-sheets.

Hydrographic data from the 1930's surveys were referenced to an earlier U.S. Standard Datum (soundings downloaded from the GEODAS database appeared to be incorrectly registered). We received the 1931 shoreline coverage and digital images of the corresponding topographic surveys from the NOAA National Ocean Service Coastal Services Center; georeferenced to UTM NAD83. Coordinate values from triangulation stations on the T-sheets were used to georeference the H-sheets. The digital GEODAS soundings were then adjusted to agree with the properly registered H-sheet.

H-sheets and T-sheets from the 1950's and 1980's surveys were properly referenced to NAD27 on the original maps.

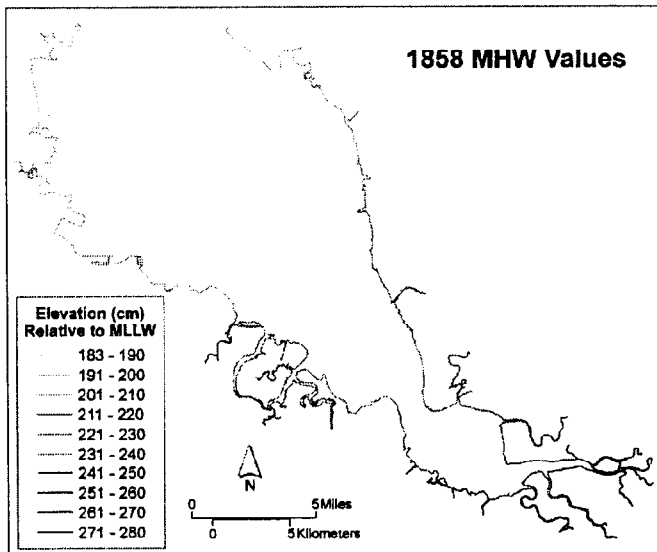
## Contours

Depth contours assist in defining the general morphology of the bathymetric grids and stabilize the model in areas of sparse soundings. Contours were digitized from H-sheets at MLLW, 3, 6, 12, 18, 24, 30, 36, 50, 60, 70, and 80 ft. Depth contours for surveys prior to 1930, and for the 1950's surveys were digitized from H-sheets and supplemented as needed to maintain a consistent contour interval throughout all of the surveys. Depth contours for the 1930's and 1980's surveys were added manually based upon sounding values. In general, depth contours were only drawn in areas supported by a minimum of three soundings.

In many areas there are gaps in excess of 150 m between the shallowest soundings and the shoreline. In order to best model the steep slope of the mudflat as it approaches the shoreline in areas where soundings do not exist within the first grid cell (50 m from shore) an additional contour has been placed parallel to the shoreline at a distance of 20 m within the bay and assigned an approximate value of MTL. The MTL values were derived from various tidal stations around the perimeter of the bay and interpolated between stations to assign a continuous elevation value to the shoreline buffer. This provides a means of modeling the steep slope of the nearshore morphology within the confines of a 50 m grid cell and may not be an accurate reflection of nearshore morphology.

## Shorelines

All of the shorelines used for this study were originally derived from T-sheets, and are defined as the MHW line. For modeling purposes it was necessary to assign an elevation to this boundary. Due to the large tidal range of South San Francisco Bay, MHW values vary significantly from north to south. In order to reflect this variation, MHW values were derived from various tidal stations around the perimeter of the bay and interpolated between stations to assign continuous elevation values to the shorelines (Fig. 8). It is important to note that while this assignment of shoreline elevations is sufficient for our modeling purposes, it is not intended to provide specific MHW values at any given location.



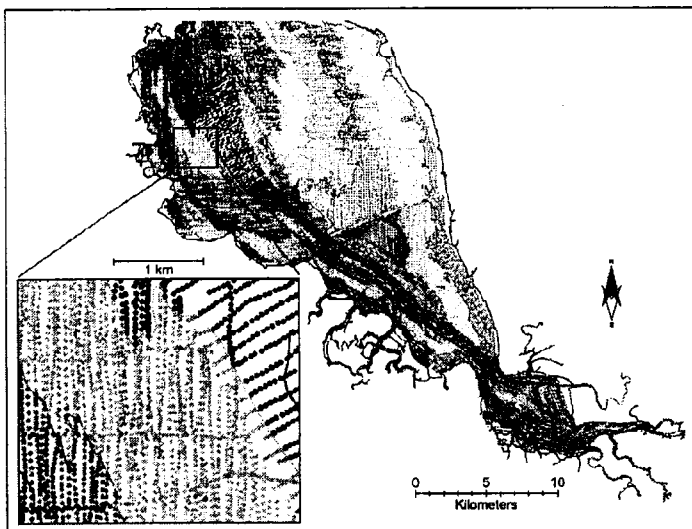
**Figure 8.** Mean High Water values assigned to shorelines.

### Surface Modeling

Once the data has been combined into a GIS, we used ArcInfo's TopoGrid module to generate a continuous surface representation (50 m horizontal resolution) of each bathymetric survey. TopoGrid is a gridding algorithm designed to utilize both sounding and contour data to generate a hydrologically correct Digital Elevation Model (DEM). TopoGrid uses an iterative finite difference interpolation technique in which the contours are initially used to build a generalized drainage model that is further refined using both soundings and contour values to determine elevation values at each cell. Each historical bathymetric survey is defined by over 160,000 grid cells. Bathymetry in tributary channels less than 150 m wide were excluded because they could not be accurately modeled at a resolution of 50 m.

### Error Checking

Error checking is an iterative procedure that took place at various stages of data processing. An initial round of error checking was conducted once all of the data has been combined into a GIS through visual inspection in ArcMap. Point data were classified by elevation in feet. Class boundaries are chosen to correspond with the contour interval (0 to 6, 7 to 12, 13 to 18, etc.). Contrasting colors were then used to shade the point data. Large errors (decimal point off, attribute typos, etc.) tend to stand out and can be detected in this way. Contours were also checked for agreement with the point data (e.g., all the red points should be on one side of the contour, all the blue points on the other) (Fig. 9).



**Figure 9.** Sample of visual error checking technique applied to both soundings and contours.

A secondary visual inspection was performed upon the first round of grid production. The bathymetric grid from each time series was hill-shaded to accentuate any abnormalities in the morphology of the bay floor. For example, erroneous soundings may appear as abnormal pits or mounds relative to the surrounding data. Erroneous soundings were either corrected or removed from the input data.

Errors were also evaluated statistically by comparing the value of each individual sounding to the cell value of the bathymetric grid at that specific location. The difference between soundings and corresponding grid cells is useful in identifying areas of error and also serves as a means for quantifying how well the surface represents the original point data (Table 6). The greatest differences in individual soundings and cell values occurred along the steep slope of the main channel where large gradients in bathymetry could not be resolved within a single 50 m grid cell.

**Table 6.** Table of grid bias, representing difference between sounding values and corresponding grid cells. This serves as a proxy for how well the surface represents the original sounding data.

Year	Frequency	Maximum		Minimum		Mean		Std. Deviation	
		(cm)	(ft)	(cm)	(ft)	(cm)	(ft)	(cm)	(ft)
1858	17,986	542	17.78	-707	-23.20	-8.6	-0.28	58.9	1.93
1898	87,273	617	20.24	-888	-29.13	-1.6	-0.05	39.2	1.29
1931	76,678	687	22.54	-890	-29.20	-1.9	-0.06	48.2	1.58
1956	77,397	654	21.46	-864	-28.35	-1.7	-0.06	48.2	1.58
1983	128,467	861	28.25	-748	-24.54	-0.3	-0.01	48.8	1.60

### Sediment Volume Change Analysis

Prior to conducting analyses of sediment deposition and erosion, some adjustments were made to the bathymetric grids. A vertical datum adjustment was applied to bring all of the surveys to a common vertical datum. It was also necessary to account for subsidence of the bay floor that occurred from 1934 to 1967. Once these adjustments were made, the corrected grids were differenced to reveal deposition and erosion that occurred during consecutive surveys.

## Vertical Datum Adjustment

The USCGS and NOS hydrographic surveys are relative to the MLLW vertical datum. MLLW is the average of the lower low water height of each tidal day observed at a given tidal station over the National Tidal Datum Epoch, a specific 19-year cycle (18.6 year tidal epoch rounded to a full year to minimize bias from seasonal variation). The MLLW tidal datum, therefore, varies depending upon the 19-year cycle used for measurement. Prior to generating sediment volume change calculations, all of the bathymetric grids were adjusted to a common vertical datum to account for changing survey datums accompanying fluctuations in sea level over the 125-year span of the surveys.

During the temporal span of this study (1856-1983), five tidal datum epochs were used for the tide station at San Francisco (Golden Gate). The 19-year cycle from 1960-78 was used to calculate MLLW values for the most recent (1983) hydrographic surveys in South San Francisco Bay. Earlier epochs used for San Francisco include: 1858-73, 1878-96, 1898-1916, 1924-42, and 1941-59. The epoch used as the vertical datum reference for hydrographic surveys was presumed to be the 19-year cycle most recently preceding the date of the survey with the exception of the 1850's surveys for which there was no previously established tidal epoch.

Assuming no change in the bathymetry, an increase in the height of the tidal datum between surveys would result in a sounding from the later survey appearing deeper than a sounding at the same location from the earlier survey. An adjustment was derived to bring the historical surfaces to the same vertical datum used for the 1983 surface by differencing the staff reading for MLLW corresponding to a historical survey from the staff reading for MLLW during the 1960-78 epoch (Table 7). This method could not be used to adjust the 1858 surface because there was not a 19-year period of records at the time the survey was collected. We were unable to find any documentation stating how these early surveys were referenced to MLLW. We have assumed these surveys were referenced to MLLW over the time in which they were collected. Using monthly MLLW values for Fort Point tidal station, we averaged the MLLW values for January, February, and March of 1857 and 1858 which represent the months in which these surveys were collected.

**Table 7. Vertical Datum Adjustments.**

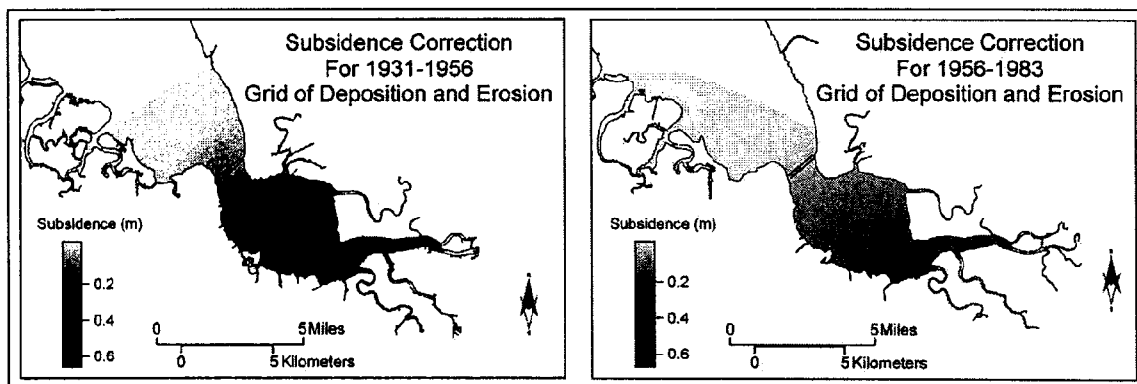
Survey Year	Presumed Epoch	MLLW on staff		Diff. from MLLW 1960-78	
		(m)	(ft)	(m)	(ft)
<sup>1</sup> 1858	N/A	1.62	5.31	0.14	0.46
1898	1878-96	1.72	5.65	0.04	0.12
1931	1898-16	1.67	5.49	0.09	0.28
1956	1924-42	1.71	5.61	0.05	0.16
1983	1960-78	1.76	5.77	---	---

<sup>1</sup>19 year tidal epoch not available for 1858 adjustment. MLLW value calculated by averaging monthly MLLW values over the time in which the surveys were collected.

## Subsidence Correction

In calculating net sediment volume change, it was necessary to account for land subsidence that occurred within the southern extent of South San Francisco Bay as a result of excessive ground water withdrawal from 1934 to 1967. Without correcting for subsidence, our grids of deposition and erosion would erroneously overestimate erosion during these time periods. The degree and spatial extent of subsidence was documented in Poland and Ireland (1988). The influence of subsidence extended from the Santa Clara Valley as far north as Ravenswood Point and ranged from 0 to 2.2 m (4 ft) within our study area from 1934 to 1967. The majority of subsidence was concentrated in San Jose, approximately 16.1 km (10 mi) south of our study area where subsidence reached a maximum of approximately 2.4 m (8 ft) from 1934 to 1967. Lines of equal subsidence

were digitized from two maps published by Poland and Ireland (1988); one depicting subsidence that occurred from 1934 to 1960 and a second map displaying subsidence from 1960 to 1967. These maps were used to generate a continuous surface of subsidence for each of the two time periods. Assuming linear rates for each map period, the proportion of subsidence that occurred from 1934 to 1956 was applied to the 1931 to 1956 grid of deposition and erosion, while the remaining proportion was applied to the 1956 to 1983 surface (Fig. 10). This subsidence correction accounts for approximately  $16 \times 10^6 \text{ m}^3$  or 24% of the net sediment volume change from 1931 to 1956 and  $9 \times 10^6 \text{ m}^3$  or 13% of the net change from 1956 to 1983.



**Figure 10.** Subsidence corrections applied to 1931 to 1956 and 1956 to 1983 grids of deposition and erosion.

Santa Clara Valley residents began to realize that the land was subsiding in the early 1900s and some limited leveling benchmarks were surveyed by the National Geodetic Survey beginning in 1912. It wasn't until 1933 that an extensive network was laid out to determine the extent, magnitude and rate of subsidence (Poland and Ireland, 1988). Since there were not reliable measurements of the subsidence that occurred prior to 1934 (although presumed to be minor), we were unable to account for subsidence that occurred during this time. As a result, it is possible that we have slightly underestimated deposition that occurred in the southernmost extent of the bay from 1898 to 1931. Significant subsidence has not occurred within the area since about 1969 (Ingebritsen and Jones, 1999).

### Sediment Volume Change Calculations

Once all of the adjustments have been made, maps of deposition and erosion were generated by differencing the corrected bathymetric grids. To improve comparability of sediment volumes for all surveys, maps of deposition and erosion were limited to only calculate values in tributary channels that contained bathymetric data for all five time periods. Multiplying the grids of deposition and erosion by surface area on a cell-by-cell basis resulted in volumetric measurements of sediment change.

### Summary of Observations

While the primary focus of our study is bathymetry and the deposition and erosion of sediment, we've also included an estimate of change in the area of tidal marsh. Marsh boundaries were used solely for display purposes and approximations of total marsh area. Changes in marsh are not accounted for in sediment volume change calculations.

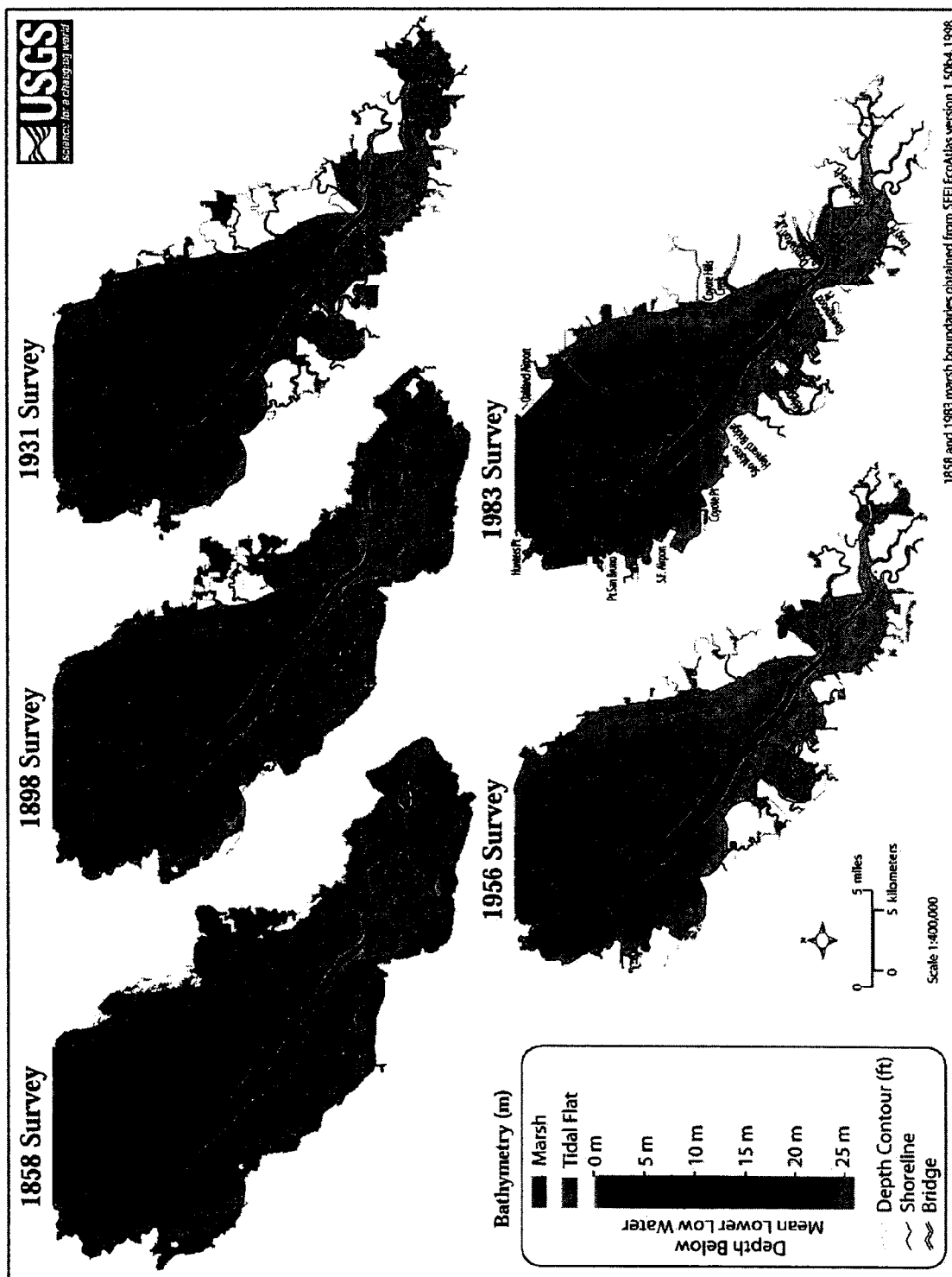
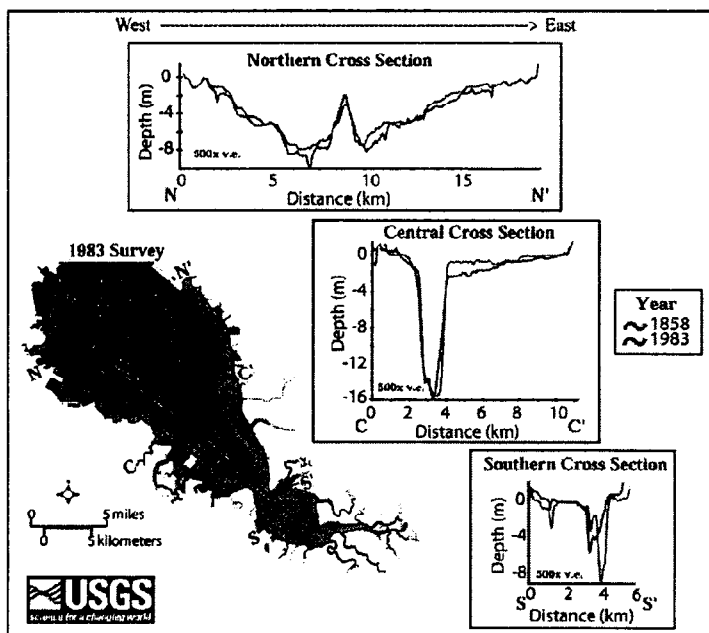


Figure 11. Preliminary bathymetry maps of South San Francisco Bay from 1858 to 1983.



## Bay Characteristics

Examination of the bathymetric surfaces revealed interesting characteristics of South San Francisco Bay's underwater topography. A main channel, approximately one kilometer in width, runs longitudinally down the majority of the bay. The average depth of the channel is approximately 11 m and is flanked on either side by expansive shoals. The morphology of the bay varies from north to south and, with the exception of the area south of the Dumbarton bridge, has remained relatively stable from 1858 to 1983 (Fig. 12).



**Figure 12.** Preliminary cross section profiles of the bay floor in 1858 and 1983.

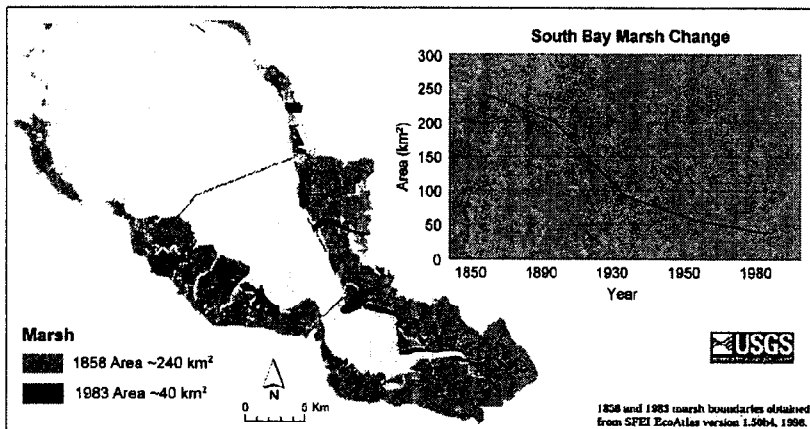
South San Francisco Bay is a relatively shallow estuary. While the average depth for all of San Francisco Bay is 6 m at MLLW (Conomos, 1979), the average depth within our study area is approximately 3 m at MLLW (this value is strongly dependent upon where our northern boundary was placed). Only 25% of the bay is deeper than 5 m at MLLW; the maximum depth is approximately 26 m (near Hunter's Point; see Fig. 1). The 1983 surface area of the bay is approximately 410 km<sup>2</sup>, down from approximately 430 km<sup>2</sup> in 1858.

**Table 8.** 1983 South San Francisco bay characteristics, values relative to MLLW.

statistic	value
Average Depth	3 m
Median Depth	2 m
Surface Area	410 km <sup>2</sup>
Tidal Flat Area	58 km <sup>2</sup>
Navigable Area (deeper than 30ft)	43 km <sup>2</sup>
Shallow Area (less than 6ft deep)	194 km <sup>2</sup>

## Area of Marsh

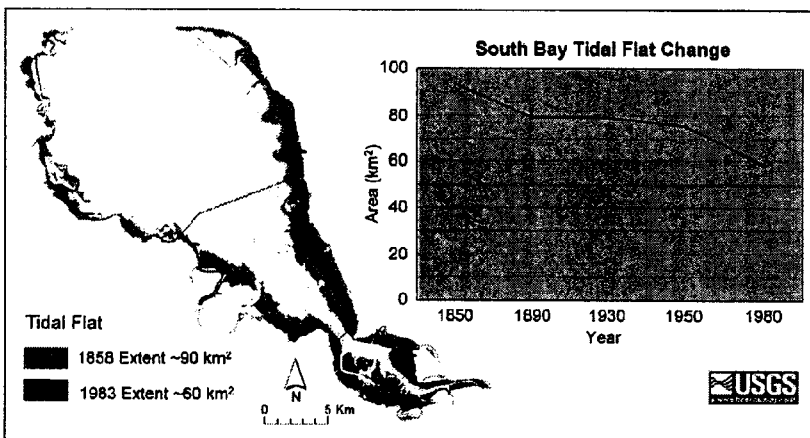
One of the striking features we observed in our time series of South San Francisco Bay is the dramatic loss of tidal marsh throughout the years (Fig 13). From 1858 to 1983 more than 80% of tidal marshes were converted to salt ponds, agricultural fields, and urban areas (the 1858 and 1983 marsh boundaries were obtained from the SFEI EcoAtlas, 1998). The California State Coastal Conservancy, the U.S. Fish and Wildlife Service and the California Department of Fish and Game are currently developing plans to restore 61 km<sup>2</sup> (24 mi<sup>2</sup>) of salt pond to mixed wetland habitat (see <http://www.southbayrestoration.org/index.html> for restoration details). If all 61 km<sup>2</sup> were to be successfully restored to tidal marsh, this would return the marsh to approximately 40% of its 1858 extent.



**Figure 13.** Preliminary change in area of marsh in South San Francisco Bay from 1858 to 1983.

## Area of Tidal Flat

Tidal flat area has decreased from  $92 \times 10^6 \text{ m}^3$  in 1858, to  $58 \times 10^6 \text{ m}^3$  in 1983, representing a 40% decrease in tidal flat area (Fig 14). The majority of this decline has occurred on the eastern shore, north of the Dumbarton Bridge (Fig. 1).



**Figure 14.** Preliminary change in tidal flat area in South San Francisco Bay from 1858 to 1983.

### Net Sediment Volume Change

South San Francisco Bay has experienced a net loss of sediment from 1858 to 1983; however within this timeframe there have been periods of both deposition and erosion. From 1858 to 1898 the bay experienced a small amount of deposition, approximately  $7 \times 10^6 \text{ m}^3$ , followed by an erosional period of  $91 \times 10^6 \text{ m}^3$  from 1898 to 1931. From 1931 to 1956 the system reversed, and  $66 \times 10^6 \text{ m}^3$  of sediment was deposited. From 1956 to 1983 an erosion of approximately  $71 \times 10^6 \text{ m}^3$  was measured.

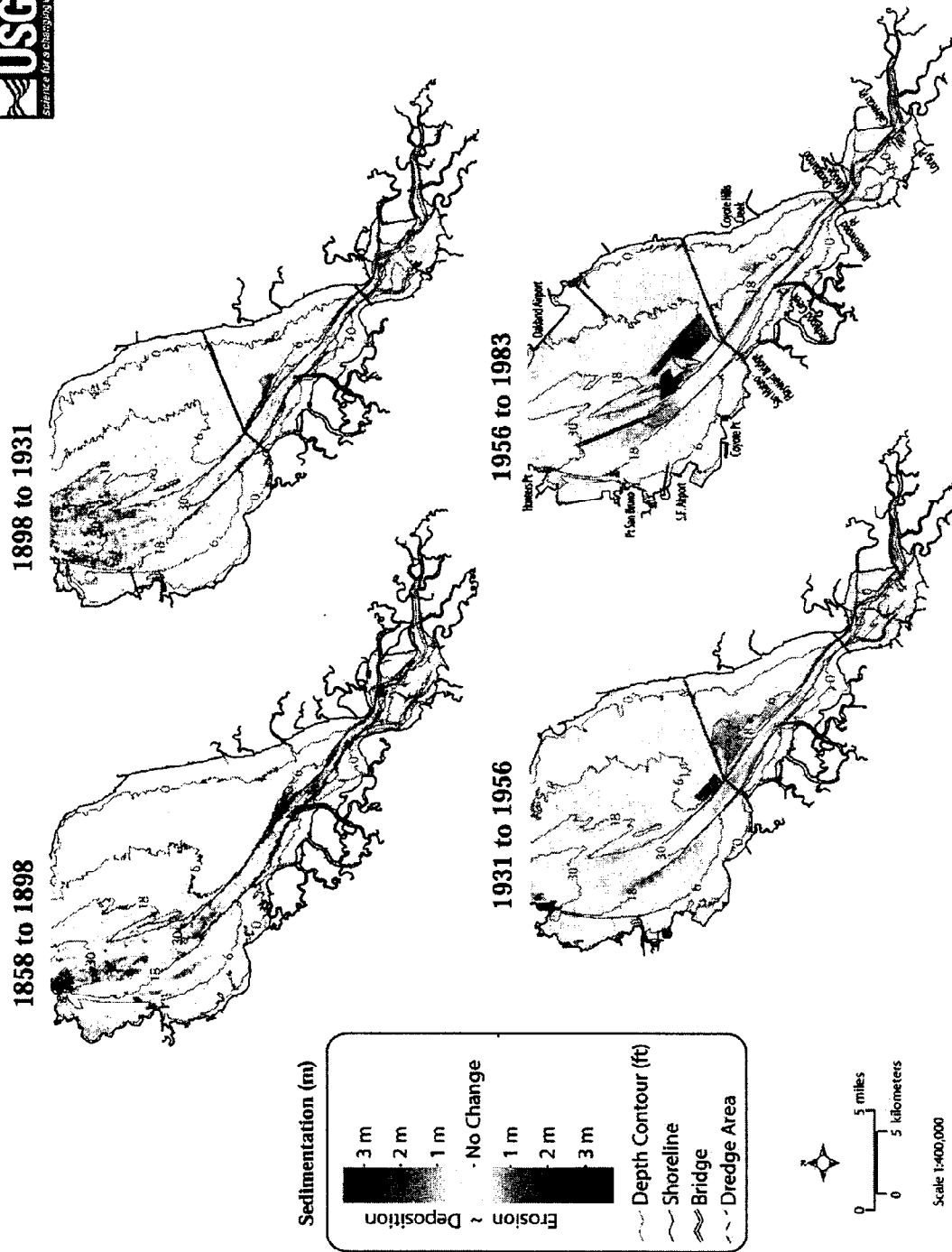
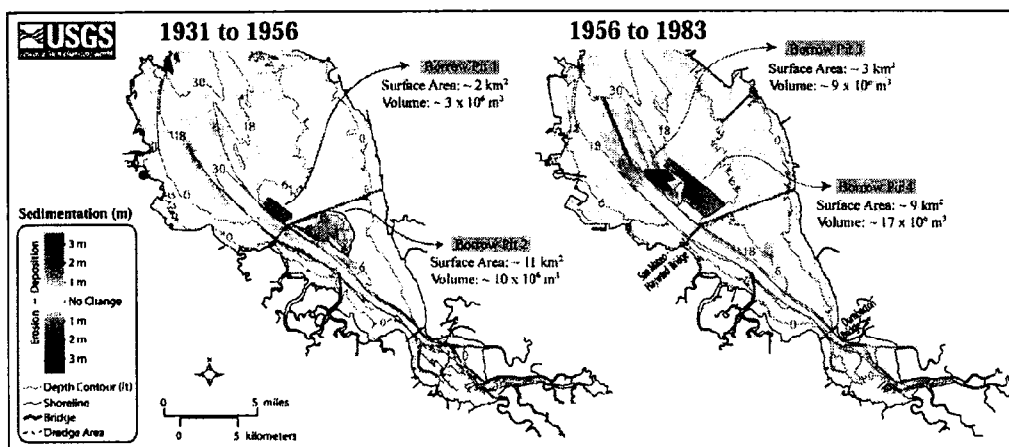
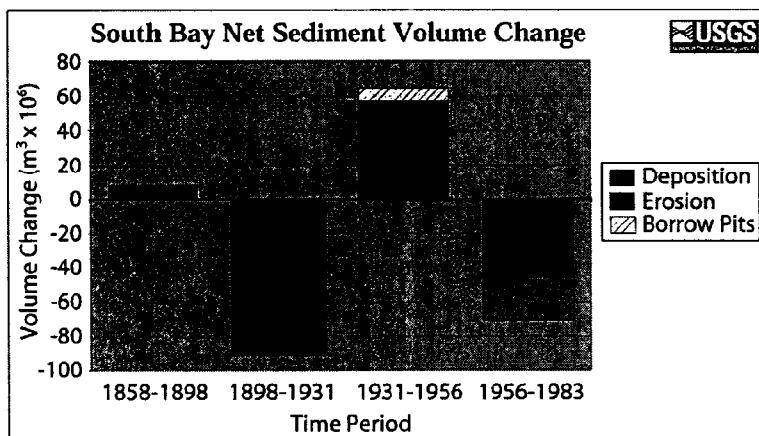


Figure 15. Preliminary maps of sediment deposition and erosion in South San Francisco Bay from 1858 to 1983.

When interpreting calculations of deposition and erosion, it is important to consider the impact that dredging has on the system. Many of the major harbors throughout the bay began routine dredging of sediment as early as the 1800s. Large areas in the bay (borrow pits) were also dredged for material used in bay fill and cement production. We identified borrow pits as areas with anomalous erosion volumes and patterns. The location of the four borrow pits shown in Figure 16 were confirmed by bay area scientists and managers. We can use our grids to estimate the volume of sediment removed by dredging. However, without accurate records of dredging activities (i.e., when dredging occurred, how much sediment was removed, and where sediment was deposited) it is difficult to separate the sediment volume change associated with anthropogenic activities from those associated with natural changes in deposition and erosion. Unless all of the dredging occurred just prior to the collection of the hydrographic survey (allowing no time for sediment to be redeposited at the site), the volumes shown in Figure 16 are minimum estimates. The relative proportion of sediment loss accounted for in these four borrow pits is shown in Figure 17.

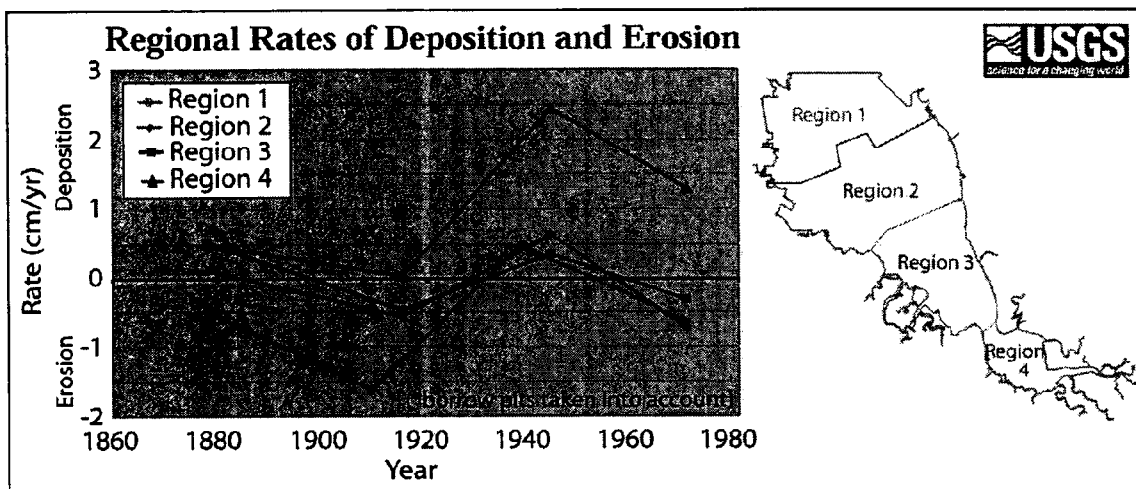


**Figure 16.** Location of sediment borrow pits seen in preliminary 1931 to 1956 and 1956 to 1983 maps of deposition and erosion. Approximate surface areas and volumes represent those at the time in which the hydrographic surveys were conducted (not necessarily equal to the areas and volumes of sediment originally removed).



**Figure 17.** Preliminary South San Francisco Bay net sediment volume change calculations. Our minimum estimates for the volume of sediment removed from borrow pits from 1931 to 1956 and from 1956 to 1983 are indicated by a hachured pattern.

We have calculated net sediment volume rates in four regions to determine how patterns of deposition and erosion vary spatially within the bay. Region 4, the area south of the Dumbarton Bridge, is the only region which has remained depositional over time (Fig. 18). The overall similarity in trends of all four regions, with an offset, is a signature of sediment redistribution from north to south within the bay in conjunction with a changing sediment supply (Jaffe, et al. submitted).



**Figure 18.** Preliminary rates of net deposition and erosion, by region (with borrow pits taken into account).

## Future Work

While this study has provided us with a preliminary look at the long-term patterns of sediment deposition and erosion within South San Francisco Bay, we intend to take a more in-depth look into what implications this may have for both physical and biological processes. As previously mentioned, we plan to improve our surface models by updating features such as shoreline values, 1858 tidal flat soundings, and nearshore morphology as the necessary data becomes available. A Light Detection And Ranging (LIDAR) survey of South San Francisco Bay is scheduled for May of 2004 enabling us to take a closer look at tidal flat geomorphology and document how the tidal flats have changed from 1983 to present. In addition, we would like to conduct a more detailed analysis of the relationship between marsh and tidal flat change and what implications that may have for marsh restoration. Errors in sediment volume change calculations are dependent upon sounding accuracies, uncertainties in determining the relationship of MLLW datums for different surveys, and from grid representations or the interpolation of the original point data (Table 6). These errors will be quantified and a confidence envelope applied to our sediment volume change calculations. We will further investigate what led to the large deposition noted in the 1920/31 to 1956 survey. We intend to continue this research by conducting a similar time series analysis of Central San Francisco Bay which may improve our understanding of trends in sediment deposition during this anomalous period. The completion of Central Bay analyses will allow us to improve estimates of a bay-wide sediment budget.

## Acknowledgements

This research was supported by the U.S. Geological Survey Priority Ecosystem Study of San Francisco Bay and the San Francisco Bay Regional Water Quality Control Board. This report was improved by reviews from Cheryl Hapke and Ann Gibbs.

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### Appendix C

#### Total Mercury Concentrations from Bedded Sediments Collected in Open Channel/Creek Substrate (KLI and EOA 2002; Gunther et al. 2001)

Site	Concentration (mg/kg)	Land Use	Site	Concentration (mg/kg)	Land Use
CCC001	0.47	Industrial	SMC005	0.2	Res/Com
CCC009	0.07	Industrial	SMC024	1.31	Res/Com
CCC020	0.14	Industrial	SMC029	0.63	Res/Com
CCC026	0.47	Industrial	SMC030	0.66	Res/Com
CCC029	0.07	Industrial	SMC031	0.18	Res/Com
CCC030	0.63	Industrial	VFC001	0.18	Res/Com
FSS001	0.06	Industrial	VFC002	0.15	Res/Com
FSS006	0.12	Industrial	VFC010	0.57	Res/Com
MCS009	0.22	Industrial	Arroyo Viejo	0.04	Mixed
MCS012	0.38	Industrial	San Lorenzo S.B.	0.13	Mixed
SCV044	0.05	Industrial	Castro Valley S-3	0.08	Mixed
VFC004	0.33	Industrial	Line 6-G,		
CCC016	0.15	Mixed	Chevron	0.14	Mixed
CCC017	0.11	Mixed	San Leandro		
CCC018	0.1	Mixed	Creek	0.26	Mixed
MCS002	0.36	Mixed	Seminary Creek	0.16	Mixed
MCS003	0.05	Mixed	Lion Creek	0.29	Mixed
MCS004	0.09	Mixed	Alameda Creek	0.11	Mixed
MCS006	0.27	Mixed	Laguna Creek	0.11	Mixed
SCV021	0.12	Mixed	Cabot Creek	0.11	Mixed
SCV024	0.05	Mixed	Aqua Caliente	0.17	Mixed
SCV041	0.03	Mixed	Castro Valley	0.06	Mixed
SCV042	0.06	Mixed	Cerrito Creek	0.34	Mixed
SMC010	0.06	Mixed	Glen Echo	0.17	Mixed
SMC012	0.05	Mixed	Sausal Creek	0.31	Mixed
SMC013	0.11	Mixed	Crandall Creek	0.12	Mixed
SMC028	0.05	Mixed	Scott Creek	0.15	Mixed
VFC009	0.42	Mixed	Strawberry Creek	0.05	Mixed
CCC012	0.03	Res/Com	Dry Creek	0.04	Mixed
CCC019	0.19	Res/Com	Balentine Drive	0.1	Mixed
FSS003	0.02	Res/Com	Codornices	0.49	Mixed
MCS013	0.21	Res/Com			

Average Hg Concentration in Open Channel Sites = 0.21 mg/kg  
 Median Hg Concentration in Open Channel Sites = 0.14 mg/kg



### Appendix C

#### Total Mercury Concentrations from Bedded Sediments Collected in Open Channel/Creek Substrate (KLI and EOA 2002; Gunther et al. 2001)

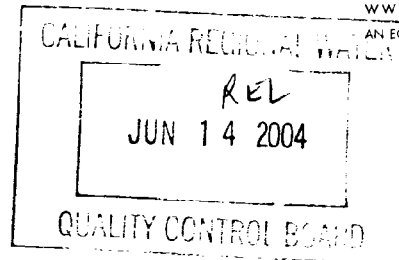
Site	Total Mercury (mg/kg)	Land Use	Site	Total Mercury (mg/kg)	Land Use
CCC001	0.47	Industrial	SMC005	0.2	Res/Com
CCC009	0.07	Industrial	SMC024	1.31	Res/Com
CCC020	0.14	Industrial	SMC029	0.63	Res/Com
CCC026	0.47	Industrial	SMC030	0.66	Res/Com
CCC029	0.07	Industrial	SMC031	0.18	Res/Com
CCC030	0.63	Industrial	VFC001	0.18	Res/Com
FSS001	0.06	Industrial	VFC002	0.15	Res/Com
FSS006	0.12	Industrial	VFC010	0.57	Res/Com
MCS009	0.22	Industrial	Arroyo Viejo	0.04	Mixed
MCS012	0.38	Industrial	San Lorenzo S.B.	0.13	Mixed
SCV044	0.05	Industrial	Castro Valley S-3	0.08	Mixed
VFC004	0.33	Industrial	Line 6-G,		
CCC016	0.15	Mixed	Chevron	0.14	Mixed
CCC017	0.11	Mixed	San Leandro		
CCC018	0.1	Mixed	Creek	0.26	Mixed
MCS002	0.36	Mixed	Seminary Creek	0.16	Mixed
MCS003	0.05	Mixed	Lion Creek	0.29	Mixed
MCS004	0.09	Mixed	Alameda Creek	0.11	Mixed
MCS006	0.27	Mixed	Laguna Creek	0.11	Mixed
SCV021	0.12	Mixed	Cabot Creek	0.11	Mixed
SCV024	0.05	Mixed	Aqua Caliente	0.17	Mixed
SCV041	0.03	Mixed	Castro Valley	0.06	Mixed
SCV042	0.06	Mixed	Cerrito Creek	0.34	Mixed
SMC010	0.06	Mixed	Glen Echo	0.17	Mixed
SMC012	0.05	Mixed	Sausal Creek	0.31	Mixed
SMC013	0.11	Mixed	Crandall Creek	0.12	Mixed
SMC028	0.05	Mixed	Scott Creek	0.15	Mixed
VFC009	0.42	Mixed	Strawberry Creek	0.05	Mixed
CCC012	0.03	Res/Com	Dry Creek	0.04	Mixed
CCC019	0.19	Res/Com	Balentine Drive	0.1	Mixed
FSS003	0.02	Res/Com	Codornices	0.49	Mixed
MCS013	0.21	Res/Com			

**Average Hg Concentration in Open Channel Sites = 0.21 mg/kg**

**Median Hg Concentration in Open Channel Sites = 0.14 mg/kg**



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June 10, 2004

Mr. Richard Looker  
Mr. Bill Johnson  
San Francisco Bay  
Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Subject: San Francisco Bay Mercury Total Maximum Daily Load Basin Plan Amendment

Dear Mr. Looker and Mr. Johnson:

The Santa Clara Valley Water District (District) staff is pleased to submit comments on the *Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment (BPA) and Staff Report*, dated April 30, 2004 (Regional Board Report). District staff supports your efforts to develop this TMDL and offers the following comments for the Board's consideration to help improve the implementation aspect of this effort.

First, the District supports and incorporates by reference the comments on the Staff Report and Proposed Basin Plan Amendment from our consultant, Exponent, Inc., the comments from Santa Clara Valley Urban Runoff Pollution Prevention Program and the comments of its legal counsel on these documents, each sent under separate covers.

However, while there are certainly technical issues that we should continue to discuss, our primary concern is that the implementation of this proposed Basin Plan Amendment could potentially result in our limited resources being used on control measures that aren't the most effective in terms of habitat benefits.

In our recent meeting with Mr. Bruce Wolfe, Mr. Tom Mumley and you, I was assured that the intent of the TMDL is to focus our resources on the most effective measures. I was further encouraged to know that Regional Board staff wants to work with us to ensure that the final Basin Plan Amendment language will ensure that implementation efforts rely on the development of a watershed-wide mercury management strategy which emphasizes the most effective control measures. District staff is committed to working cooperatively with Regional Board staff to develop that strategy, at a conceptual level, over the next couple months.

We believe the watershed based strategy can then be used to guide individual permitting actions by the board to help move us towards a watershed-wide permitting approach. This approach will not only make better use of the Regional Board staff's time but also better use of the resources available to address these environmental issues.



Mr. Looker and Mr. Johnson  
Page 2  
June 10, 2004

As you know, the District is working in partnership with the Regional Water Quality Control Board to implement a similar planning effort to address mercury in the Guadalupe River Watershed. We have mutually agreed to pursue a course that will ensure the Guadalupe River Watershed Mercury TMDL is based on sound science, measurable goals, and feasible implementation measures. As a result of this partnership, we have learned that methylation of mercury varies seasonally and spatially throughout the watershed, that implementation of control measures should be focused on reducing mercury methylation, and that atmospheric sources are significant and alone are likely to result in some species of fish exceeding applicable criteria. We have learned that reservoirs and lakes appear to be areas where methyl mercury is produced, while creeks appear to be where methyl mercury is removed. We have also learned of the role of wetlands in methyl mercury production, and the significance of the differences in the bioavailability of the sources of mercury (such as atmospheric, dissolved, adsorbed, and mineralized).

Based on the lessons learned to date in that effort, District staff believes the proposed Basin Plan Amendments place too much emphasis on controlling mercury in sediment entering the Bay. We recommend adding further text to recognize the importance of control of the upper watershed sources (mines and mining wastes), to encourage control of watershed processes that result in the production of bioavailable mercury, and to acknowledge the relatively greater bioavailability of atmospheric sources. We suggest that the Regional Board shift the emphasis from mercury in sediment to mercury in its methylated form, which has significantly greater bioavailability. By doing this, a more effective implementation plan can be realized.

We would like to work with you to incorporate the following elements in the proposed TMDL:

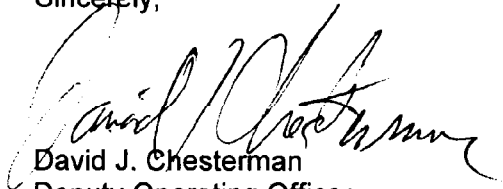
- Development of a watershed-wide mercury management strategy that will focus efforts on most effective control measures and guide individual future permitting actions,
- Encourage actions that reduce methyl mercury production in addition to or instead of mass removal of mercury in sediment,
- Provide flexibility for considering testing and evaluation of new techniques and control measures as a form of implementation to encourage innovation,
- Consider allowing equal credit for actions that isolate mercury sources from the Bay by eventual burial rather than by removal,
- Encouraging actions to address upper watershed sources (mines and mining wastes) of mercury as a priority, to avoid compromising actions taken in the lower watershed.

We understand that there is time, over the next few months, to explore and further develop these concepts and ideas with Regional Board staff before the Basin Plan Amendment is adopted.

Mr. Looker and Mr. Johnson  
Page 2  
June 10, 2004

The District appreciates the efforts of the Regional Board staff on this complex issue to date. We look forward to continuing to work together to develop TMDLs for Mercury based on sound science that address the Guadalupe River Watershed and the San Francisco Bay and provides the flexibility for effective implementation.

Sincerely,

A handwritten signature in black ink, appearing to read "David J. Chesterman", written over a horizontal line.

David J. Chesterman  
Deputy Operating Officer  
Guadalupe Watershed Division Manager

350 Frank H. Ogawa Plaza, Suite 900  
Oakland, CA 94612-2016

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[www.savethebay.org](http://www.savethebay.org)

June 14, 2004

Richard E. Looker, Water Resources Control Engineer  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Dear Mr. Looker:

Thank you for the opportunity to comment on the adoption of an amendment to the Water Quality Control Plan for the San Francisco Bay Basin to incorporate a TMDL for mercury in San Francisco Bay and an implementation plan.

Save The Bay represents 10,000 members who have a keen interest in water quality issues related to San Francisco Bay. Save The Bay also advocates for protection, enhancement, and restoration of the Bay's wetlands and associated wildlife habitat.

The proposed Basin Plan amendment and San Francisco Bay Mercury TMDL are supported by research and documentation incorporating the latest scientific understanding of the problem of mercury contamination in San Francisco Bay and identifying the sources of contamination. The proposed amendment to the Basin Plan also recognizes that control of mercury contamination in San Francisco Bay is an area of active research and that control strategies are being developed.

The evolving nature of technical and scientific knowledge related to mercury clean up in San Francisco Bay, and uncertainties in the assumptions about the time period before a reduction in mercury contamination will be seen, emphasize the importance of continuous monitoring and review of the proposed TMDL implementation measures. As proposed, review of the mercury TMDL, including evaluation of new and relevant monitoring data, special studies, and scientific literature is to be done every five years to determine if targets, allocations, or implementation actions need to be modified.

Considering the importance of new information and the potential of scientific data gathered to benefit, accelerate, or modify the proposed implementation actions, we suggest that a review schedule be devised that is more sensitive to the potential for new information related to mercury contamination and removal in San Francisco Bay. This could be accomplished by ramping the review over a twenty-year period (the time period assumed in the staff report to show significant change in sediment contamination levels), for instance, having more frequent review in the first ten years. Alternatively, instead of a set time period, the review could be triggered by new data of significance to the control of mercury in Bay sediments or, for example, to the process of mercury methylation in Bay wetland sediments. The current proposed review schedule, though seemingly

# SAVE THE BAY

Save The Bay comments 06-14-04

2

adequate, may be too rigid to provide timely response to new information that could be acted on relatively quickly with benefit to San Francisco Bay.

Thank you for consideration of these comments.

Sincerely,

A handwritten signature in cursive script that reads "David Lewis". The signature is written in dark ink and is positioned above the printed name and title.

David Lewis  
Executive Director

Writer's direct phone

(415) 544-1014

Writer's e-mail

tmaiden@sf.seyfarth.com

June 14, 2004

**VIA ELECTRONIC AND U.S. MAIL**

Bill Johnson  
Richard Looker  
California Regional Water Quality Control Board,  
San Francisco Bay Region (2)  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Re: Comments on April 30, 2004 Proposed Basin Plan Amendment and Staff Report re  
Mercury in San Francisco Bay

Dear Sirs:

On behalf of the Guadalupe Rubbish Disposal Company ("GRDC"), this letter provides written comments to the California Regional Water Quality Control Board, San Francisco Bay Region ("RWQCB")'s April 30, 2004 Proposed Basin Plan Amendment and Staff Report addressing a Total Maximum Daily Load ("TMDL") for mercury in San Francisco Bay (the "Draft TMDL").

**COMMENTS**

**1. The TMDL should consider the unique issues raised by significant "legacy sources" that may impact the Bay**

The Draft TMDL identifies numerous sources which result from "legacy problems." These include but may not be limited to historic mercury mining operations in the Guadalupe River watershed, gold mining operations in the Central Valley in which mercury was used and existing sediment deposits in the Bay. Unfortunately, the TMDL fails to adequately consider the difficulties (both in terms of costs and social disruptions) of addressing these legacy issues when setting and its (waste)load allocations.

The proximity of large cinnabar-producing lands in the Guadalupe watershed as well as decades, even centuries of sedimentation from mining activities in both the Central Valley and the Guadalupe River create an elevated "background level" for mercury, and must be considered in any

economic and feasibility analysis for meeting (waste)load allocations and water quality objectives. For practical purposes, the Draft TMDL treats the entire Guadalupe watershed almost as a single source and fails to adequately address the practical costs for the many potential upgradient point and non-point sources in trying to achieve the proposed allocation from current versus legacy sources.

Many potential “sources” today have never been involved in mining operations and never profited from such operations. There is no recognition in the Draft TMDL as to what constitutes an equitable allocation for currently existing entities who are being held responsible for alleged acts or omissions of up to 150 years ago.

Moreover, digging up and removing potential source areas may result in greater increases in bio-availability of contaminants as opposed to other control mechanisms. The impacts from likely upgradient mitigation measures to address legacy sources cannot be avoided by assuming that they will be addressed in a future TMDL for that local area.

Furthermore, the draft TMDL fails to require reductions in the largest source of mercury – the Bay sediments. Instead, the TMDL assumes no action will be taken to reduce this source other than what might be considered natural attenuation. There is no basis for the TMDL to impose stringent allocations and excessive source reductions on upstream sources while ignoring the single largest source of mercury in the Bay – the Bay sediments.

**2. The TMDL should consider the impacts of in-bay disposal of dredged material and regulate sediment disposal as a source of mercury.**

The Draft TMDL notes that of the three million cubic yard of material dredged from the bottom of San Francisco Bay each year, approximately 2.3 million cubic yards of this material is re-deposited back into the Bay. Draft TMDL at 31.

The dredging of material and the disposal of mercury laden sediments into the Bay expose huge swaths of otherwise covered and relatively “safe” sediments to open water, sunlight and possibly aeration, resulting in the increased risk of mercury methylation that otherwise would not occur. The RWQCB must view the uncovering of this material as the “generation” of mercury and take reasonable actions to regulate it as a source.

Of equal importance, the RWQCB must consider the impacts of the “disposal” of 2.3 million cubic yard of potentially mercury laden sediment into the Bay each year. Even if this sediment was dug from the Bay, once it has been dredged up, there is an opportunity to treat it or dispose it in other ways and in other places that could result in a net reduction of an additional 2.3 million cubic yards of sediment each year. The RWQCB should work with the U.S. Army Corps of Engineers and other interested agencies to require more stringent disposal standards for sediment containing unacceptable levels of mercury (especially in areas that are close to wetlands or other areas where methylation is more likely to occur). Alternatives, including but not limited to disposal outside the Bay, should be considered. This could dramatically decrease the methylation of mercury laden sediments in the Bay, the single largest “source” of mercury as noted in the Draft TMDL.



3. **The Draft TMDL fails to consider all relevant alternative wasteload allocation methodologies.**

An essential and critical element of any TMDL is the methodology used to establish wasteload allocations. Yet, the Draft TMDL provides no rationale, nor any analysis of why it has selected the proposed scheme for allocation. Guidance from the U.S. Environmental Protection Agency (“EPA”) Office of Water Regulations and Standards Assessment and Watershed Protections Division has identified numerous possible wasteload allocation schemes, including but not limited to:

- (1) Equal percent removal (equal percent treatment);
- (2) Equal effluent concentrations;
- (3) Equal total mass discharge per day;
- (4) Equal mass discharge per capita per day;
- (5) Equal reduction of raw load (pounds per day);
- (6) Equal ambient mean annual quality;
- (7) Equal cost per pound of pollutant removed;
- (8) Equal treatment cost per unit of production;
- (9) Equal mass discharged per unit of raw material used;
- (10) Equal mass discharged per unit of production;
- (11) Percent removal proportional to raw load per day;
- (12) Larger facilities to achieve higher removal rates;
- (13) Percent removal proportional to community effective income;
- (14) Effluent charges (dollars per pound, etc.);
- (15) Effluent charge above some load limit;
- (16) Seasonal limits based on cost-effectiveness analysis;
- (17) Minimum total treatment cost;
- (18) Best availability technology (BAT) (industry) plus some level for municipal inputs;

- (19) Assimilative capacity divide to require an "equal effort among all dischargers";
- (20) Municipal: treatment level proportionate to plant size;
- (21) Industrial: equal percent between best practicable technology (BPT) and BAT, i.e., Allowable wasteload allocation:  
  

$$(WLA) = BPT - x/100 (BPT - BPT) \quad ; \text{ and}$$
- (22) Industrial dischargers given different treatment levels for different streamflows and seasons.

EPA Technical Support Document for Water Quality-based Toxics Control, Office of Water (EN-336); EPA/505/2-90-001; PB91-127415, March 1991, Table 4-1, at p.69.

Notwithstanding this substantial number of alternative approaches, the Draft TMDL only considers one "proportional allocation" alternative methodology (see, Draft TMDL at 96-98). This allocation is grossly disproportionate in the way it treats identified sources of mercury and fails to consider the economic impacts on those sources.

The final TMDL should consider all reasonably relevant alternative allocation methodologies to the one currently chosen and discuss why the existing allocation methodology is superior to all other methodologies. A viable allocation scheme must address, among other factors: a) increased costs of mitigation in areas with elevated background levels of mercury due to naturally occurring mineral deposits that are linked to mercury; b) credits for recent and significant efforts to remove calcine deposits and other potential sources of mercury from the Guadalupe River watershed; and c) the unique differences between point and non-point sources in controlling legacy issues.

#### 4. **The Draft TMDL fails to comply with CEQA and the Porter-Cologne Water Quality Act by deferring an analysis of the economic impacts of its Implementation Plan**

Both CEQA and the Porter-Cologne Water Quality Control Act require the RWQCB to consider the economic costs of reasonably foreseeable methods of compliance with proposed performance standards or water quality objectives. As stated in the Staff Report, the Draft TMDL includes performance standards in the form of mercury concentration targets and reduction allocations. Draft TMDL at 101-02. However, despite the Staff Report's acknowledgment that implementation of the Draft TMDL "could place substantial economic burdens on the regulated community," the Draft TMDL provides only a cursory economic analysis of its economic impacts. Draft TMDL at p. 106.

(a) First, with respect to the Central Valley and Guadalupe River Watersheds, the Staff Report relies heavily on the Clean Water Act's requirement that separate TMDLs be implemented for those water bodies irrespective of whether the Draft TMDL for San Francisco Bay is approved.

In doing so, the Staff Report avoids a complete and thorough economic analysis by arguing, in part, that the cost of implementing the TMDLs for those two watersheds is unknown because they have not been drafted yet. Therefore, it is impossible to know whether implementation of the Draft TMDL will result in costs above and beyond those that will be incurred in the implementation of the TMDLs for the Central Valley and Guadalupe River Watersheds. Consequently, the Staff Report suggests that the costs of implementing the TMDLs for the Central Valley and Guadalupe River Watersheds will be considered when those TMDLs are drafted.

This analysis is faulty insofar as it is circular in logic. In essence, this approach amounts to a deferral of the economic impact analysis of the Draft TMDL until after it is adopted and subsequent TMDLs are proposed for the Central Valley and Guadalupe River Watersheds, because not enough specific information is known at this time to perform an adequate analysis. However, the Draft TMDL contains specific and substantial numeric reductions in the amount of mercury entering the Bay from those two watersheds, which will undoubtedly cost a great deal to implement. The fact that the Draft TMDL does not specify the exact measures that the individual stakeholders within those two watersheds must undertake to satisfy these numeric targets does not lessen their dramatic economic impact, particularly in the case of the Guadalupe Watershed which must reduce its mercury load by 98% in the relatively short period of 20 years (given the estimated 120-year time period needed to achieve the Draft TMDL's targets). Draft TMDL at p. S-2. Furthermore, the Draft TMDL for the Bay will likely have a substantial effect on the substance of the regulations imposed by the TMDLs for the Central Valley and Guadalupe River Watersheds when they are drafted. In sum, the economic impacts of the Draft TMDL are both real and substantial, and therefore, must be thoroughly addressed before the Draft TMDL is adopted, just like the economic impacts of the TMDLs for the Central Valley and Guadalupe River Watersheds will have to be assessed individually without simply piggybacking on the economic analyses in the Draft TMDL.

(b) Second, the discussion in the Draft TMDL regarding the various possible mercury reduction measures and their respective costs is too vague and broad to provide any meaningful sense of the overall cost to achieve the Draft TMDL's targets. There are seven such reduction measures mentioned, for which the cost varies widely. Draft TMDL at p. 103. For example, "Mercury Mine Site Cleanup" could cost as little as \$520 or as much as \$15 million per acre; "Mercury Site Cleanup" could cost from \$270 to \$3.1 million per cubic yard, and the Draft TMDL includes a caveat that as broad a range as that is, it may still "not be representative of mercury site cleanup costs." *Id.* An economic range of under one thousand dollars to many millions, possibly billions of dollars depending on the sizes of cleanup sites, is so broad that it is useless and provides no basis for a realistic estimate of the economic impacts of the Draft TMDL.

At the very least, an estimate of the number of sites involved, their approximate sizes and the precise cleanup methods or procedures contemplated at each and their respective costs are required to perform any kind of economic analysis beyond pure speculation. The Draft TMDL does not contain any such information, and furthermore, the titles used to describe the various mercury reduction measures, such as "Mercury Mine Site Cleanup" and "Ecosystem Modification" are so vague that stakeholders have no way of calculating the extent of cleanup activity expected of them or the cost.

(c) Third, with respect to bed erosion, the single largest source of mercury in the Bay, the Draft TMDL simply states that "Because bed erosion is a natural process due to uncontrollable factors, the Basin Plan Amendment does not prescribe any implementation actions to reduce the bed erosion mercury load. Therefore, there are no economic costs associated with reducing this load." Draft TMDL at p. 102. The Draft TMDL fails to account for 3 million cubic yards of dredging and 2.3 million cubic yards of sediment disposal within the Bay annually. This is a substantial factor that can and should be regulated and results in risks and related costs that can be estimated.

5. **The Draft TMDL places too much emphasis on "unknown" sources of mercury.**

The Draft TMDL sets exceedingly high "margins of safety" in part because "there *may* be other less well understood sources [of mercury] that are yet to be discovered. These *may* include mining sources . . . and other contaminated sites within and in the vicinity of the bay . . ." Draft TMDL at 33 (emphasis added). This statement, without any other support to back it up, is merely an excuse to support overly stringent margins of safety as an easy means of regulation. There are already numerous "margins of safety" built into other facets of the Draft TMDL, including but not limited to the fish tissue, bird egg and sediment concentration targets, so that additional margins of safety are not required in other portions of the document, including source assessment. Rather, the final TMDL should be based on existing and relevant information including reasonably identifiable sources. While it will always be possible that some additional source *may* exist, the TMDL must make a reasonable estimate of such sources, both in number and quantity, if it hopes to achieve the support of all stakeholders (including identified sources that must work within proposed (waste)load allocations).

6. **Acknowledgement of and reservation of rights relative to other commenters.**

GRDC has just received and is in the process of reviewing the comments of other stakeholders in this TMDL, including but not limited to the Santa Clara Valley Urban Runoff Pollution Prevention Program, the County of Santa Clara and Buckhorn, Inc. GRDC acknowledges these comments and reserves the right to adopt them, in whole or in part, at future public hearings and subsequently in the administrative process related to the adoption of a mercury TMDL for San Francisco Bay.

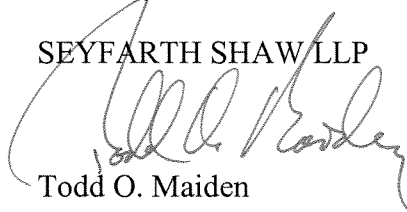
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### Conclusion

In closing, GRDC appreciates this opportunity to provide constructive comments so that the RWQCB can develop a final TMDL which not only achieves reasonable health and environmental objectives but does so in an equitable and cost effective manner. GRDC also intends to participate in the June 16, 2004 hearing on the Draft TMDL and to respond to any questions the RWQCB or its staff may have regarding the points raised in this letter. However, please contact the undersigned if you or your staff have any questions regarding the points raised in this letter.

Sincerely,

SEYFARTH SHAW LLP

A handwritten signature in dark ink, appearing to read "Todd O. Maiden", is written over the printed name and firm name.

Todd O. Maiden

cc: Andrew Kenefick, Esq.  
Eddie Pettit



## SOUTH BAYSIDE SYSTEM AUTHORITY

JOINT POWERS AUTHORITY

*A Public Entity*

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City of Belmont

City of Redwood City

City of San Carlos

West Bay Sanitary District

Dr. Thomas Mumley  
Planning and TMDLs Division Chief  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, California 94612

June 11, 2004  
13-80

Subject: Comments on the "Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report" dated April 30, 2004

Dear Dr. Mumley:

SBSA appreciates the opportunity to comment on the Mercury TMDL and proposed Basin Plan Amendments. The Mercury TMDL clearly articulates the science used to develop the TMDL and its limitations. We support the adaptive process to refine the TMDL as additional information becomes available. We encourage the Regional Board to work collaboratively with the stakeholders developing the mechanisms that will result in achieving the desired mercury reductions while not imposing permit conditions that are technically and/or economically achievable.

We are concerned with some of the changes in the implementation plan for point sources contained in the April 2004 draft Mercury TMDL as compared with the June 6, 2003 draft. Specifically, the reduction in Waste Load Allocation (WLA) for the POTW group from 17 kilograms per year (kg/yr) in the June 2003 draft to 14 kg/yr in the April 2004 version, and the change in averaging period for measuring compliance with the WLAs for point source discharges to an annual basis compared to the a five-year average basis that was contained in the June 2003 draft. The changes made in this last draft will have very little impact in attaining the mercury sediment targets, but could have significant impacts from the standpoint of NPDES permit compliance.

SBSA has a permitted average dry weather flow capacity of 29 MGD. This permit limit was based on the capacity needs identified in approved General Plans of the many planning jurisdictions in the SBSA service area, supported by substantial work in water quality analysis, facilities planning, and environmental review. The proposed allocation for mercury for SBSA in the April 2004 TMDL is insufficient to meet the anticipated annual average flow at the currently permitted capacity. The TMDL should explicitly acknowledge the need for future growth and development, and contain a WLA that can accommodate this.

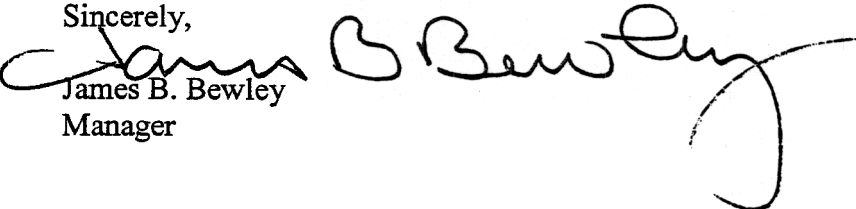
SBSA provides advanced level treatment with filtration following biological secondary treatment and is a partner with Redwood City in a major recycled water program. Mercury is identified as a "pollutant of concern" in our pretreatment and pollution prevention programs and we are participating in joint programs with the Bay Area Pollution Prevention Group and local efforts for reduction of mercury discharge to sewers in collaboration with City of Palo Alto. We have made progress over the past several years but are approaching the point where the ability for further reductions is uncertain.

Lowering the POTW WLA allocation and changing the averaging period from five years to one year greatly increase the likelihood that SBSA would be found exceeding the allocation while contributing little towards meeting the TMDL objectives. In SBSA's case these actions are clearly growth limiting.

SBSA recommends that the POTW WLA be kept as shown in the June 2003 draft, the averaging period for POTWs be set as five years, the Basin Plan amendments are clear that the water quality based effluent limits (WQBEL) for POTWs are to be established by a watershed WLA, not in individual NPDES limits.

Thank you for the opportunity to provide these comments. We look forward to your continuing to work with Bay Area Clean Water Agencies and Clean Estuary Partnership in resolving these issues.

Sincerely,

  
James B. Bewley  
Manager

# SBSA - Mercury Mass Emission - Cuurent and Projected

Existing Flows				Permitted Flow			
				32.9			
				Assumed future flow Annual Average			Annual Average Mass
Month	Monthly Average Flow MGD	Concentration ug/L	Annual Average kg/yr	MGD	Concentration ug/L	kg/yr	kg/yr
Feb-01	23.884	0.0156		32.9	0.0156	0.709	
Mar-01	21.565	0.0179		32.9	0.0179	0.813	
Apr-01	19.329	0.0204		32.9	0.0204	0.927	
May-01	18.461	0.019		32.9	0.0190	0.863	
Jun-01	18.239	0.01		32.9	0.0100	0.454	
Jul-01	17.295	0.014		32.9	0.0140	0.636	
Aug-01	16.467	0.014		32.9	0.0140	0.636	
Sep-01	16.153	0.014		32.9	0.0140	0.636	
Oct-01	16.136	0.015		32.9	0.0150	0.682	
Nov-01	18.210	0.0165		32.9	0.0165	0.750	
Dec-01	21.847	0.0068		32.9	0.0068	0.309	
Jan-02	19.400	0.013	0.383	32.9	0.0130	0.591	0.667
Feb-02	15.9	0.049	0.430	32.9	0.0490	2.227	0.794
Mar-02	16.8	0.015	0.414	32.9	0.0150	0.682	0.783
Apr-02	15.6	0.011	0.389	32.9	0.0110	0.500	0.747
May-02	14.9	0.013	0.371	32.9	0.0130	0.591	0.724
Jun-02	14	0.011	0.367	32.9	0.0110	0.500	0.728
Jul-02	16.4	0.018	0.374	32.9	0.0180	0.818	0.743
Aug-02	16.4	0.017	0.379	32.9	0.0170	0.773	0.755
Sep-02	15.2	0.014	0.378	32.9	0.0140	0.636	0.755
Oct-02	15	0.012	0.370	32.9	0.0120	0.545	0.743
Nov-02	16.2	0.012	0.358	32.9	0.0120	0.545	0.726
Dec-02	23.5	0.016	0.384	32.9	0.0160	0.727	0.761
Jan-03	18.2	0.010	0.376	32.9	0.0100	0.454	0.750
Feb-03	17.8	0.012	0.311	32.9	0.0120	0.545	0.610
Mar-03	17.7	0.013	0.309	32.9	0.0130	0.591	0.602
Apr-03	19.23	0.015	0.322	32.9	0.0150	0.682	0.617
May-03	17.7	0.0093	0.319	32.9	0.0093	0.423	0.603
Jun-03	16.7	0.0099	0.320	32.9	0.0099	0.450	0.599
Jul-03	16.1	0.011	0.307	32.9	0.0110	0.500	0.573
Aug-03	15.9	0.0079	0.289	32.9	0.0079	0.359	0.538
Sep-03	15.97	0.0072	0.278	32.9	0.0072	0.327	0.512
Oct-03	15.7	0.0095	0.274	32.9	0.0095	0.432	0.503
Nov-03	15.9	0.0120	0.274	32.9	0.0120	0.545	0.503
Dec-03	19.5	0.0096	0.252	32.9	0.0096	0.436	0.479
Jan-04	20.0	0.014	0.263	32.9	0.0140	0.636	0.494
Feb-04	21.0	0.0095	0.262	32.9	0.0095	0.432	0.484
Mar-04	18.1	0.012	0.260	32.9	0.0120	0.545	0.481
Apr-04	16.7	0.013	0.252	32.9	0.0130	0.591	0.473
May-04	16.4	0.011	0.254	32.9	0.0110	0.500	0.479
			MAX 0.43				MAX 0.79
							MIN 0.47
							Proposed Allocation 0.44





June 11, 2004

Mr. Bruce Wolfe  
Executive Officer  
California Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: COMMENTS ON APRIL 30, 2004 PROPOSED BASIN PLAN AMENDMENT AND  
STAFF REPORT, MERCURY IN SAN FRANCISCO BAY**

Dear Mr. Wolfe:

This letter contains the initial comments of the City of Sunnyvale on the *Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report* (TMDL Report), issued on April 30, 2004. The City's consultant EOA, Inc. provided comments on behalf of the City on the June 6, 2003 version of the TMDL report. Several of those comments are reiterated here since they were never responded to by staff and are still applicable to the current TMDL report version.

The current version of the staff report and TMDL has significantly and adversely changed from the prior version regarding POTW allocations as follows:

- (a) The pooled allocation to POTWs has been reduced from 17 kg/yr to 14 kg/yr. This is based on revised load calculations (adding in data from 2003) using a modified statistical approach developed by Regional Board staff.
- (b) The pooled allocation has been changed from a 5-year average value to an annual average value.
- (c) The individual load allocations to POTWs have been significantly changed. The current allocations are based on recent performance in terms of mass loads of mercury discharged to the Bay. This has significantly reduced the load allocations to facilities with advanced treatment, such as Sunnyvale, to the point that we will either have no increment for growth or will exceed the allocation when the economy rebounds based on historical loads.

The City has been actively tracking the mercury TMDL effort through participation in the Clean Estuary Partnership (CEP) and prior mercury workgroups. However, to the best of our knowledge, there was no stakeholder involvement in developing these changes, nor even advance notification of these changes. The TMDL report was simply released with these major changes unannounced on April 30<sup>th</sup>.

The City finds this particularly disturbing since it was just over one year ago, at the May 2003 RWQCB Board meeting, that the Board members directed staff to develop less onerous interim

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mercury mass limits that would not punish the POTWs for their excellent plant performance, pollution prevention activities, and water recycling efforts, and not put them at risk of non-compliance in the future. The proposed mass allocation for Sunnyvale does exactly the opposite. The proposed allocation is a factor of six times more stringent (0.083 vs 0.49 kg/yr) than the value developed by your permitting staff that is included in the City's current NPDES permit adopted in August 2003 (see attached June 18, 2003 RWQCB staff summary report for Items 8, 9, and 10 on the mass limit history and derivation). Sunnyvale had serious concerns about complying with even the 0.49 kg/yr permit limit in the future as flows approached design capacity.

To comply with this allocation Sunnyvale would be required to stay at or below the current exceedingly low average effluent concentration of 4 ng/l and to cap its flow and hence growth at the last seven year's annual average flow of 14.5 mgd. Flow in four of those seven years exceeded 14.5 mgd, reaching 18 mgd in 1998. When the local economy rebounds to those prior levels, and/or a high rainfall year occurs, Sunnyvale will exceed its proposed individual WLA.

To be allowed to make use of its permitted design capacity of 29.5 mgd, Sunnyvale would be required to reduce its effluent mercury concentration in half to 2 ng/L. This is approximately the background concentration in the potable water supply. The Sunnyvale POTW already performs at an extremely efficient level and removes over 98% of the influent mercury. As explained in the detailed comments attached, there are no known additional pollution prevention or plant optimization measures that could provide an additional 50% reduction in effluent concentrations.

Therefore, to be allowed to make use of its permitted design capacity of 29.5 mgd, Sunnyvale would be required to find some way to offset an additional mass of approximately 0.085 kg/year. The only known means to eliminate/offset mass in the discharge is to divert effluent flow from the Bay to water recycling. Sunnyvale is a strong water recycling proponent and has had an active water recycling program in place for over 10 years. The City has spent over \$20 million on its water recycling infrastructure and recycles about 1 mgd on an annual average basis.

The new pipelines and facilities to reach all those increasingly further away and smaller landscape irrigation sites would cost another \$20 million. However, an unfortunate Catch-22 with water recycling is that since the effluent mercury concentration is so low (4 ng/L), each million gallons of water recycled diverts only miniscule amounts of mercury from the Bay. In the case of Sunnyvale, each additional 1 mgd that could potentially be recycled would only remove 0.0055 kilograms per year (kg/yr) of mercury. This 0.0055 kg/yr represents about six percent of the offset needed to be able to accept new flows (of wastewater or possibly contaminated stormwater) up to the full permitted design capacity of 29.5 mgd.

Sunnyvale understands that the allocation is currently being proposed as a trigger, along with a performance based concentration trigger, both of which would have to be exceeded before additional special studies and/or enforcement would be initiated. While this may appear to be structured to avoid nuisance compliance issues, the underlying basis for the allocation is inequitable and contrary to the Board's frequently asserted position to encourage, not penalize the best performing facilities like Sunnyvale. Each time compliance with the individual allocations is evaluated, it will appear that Sunnyvale is a poorly performing POTW, either near,

structured to avoid nuisance compliance issues, the underlying basis for the allocation is inequitable and contrary to the Board's frequently asserted position to encourage, not penalize the best performing facilities like Sunnyvale. Each time compliance with the individual allocations is evaluated, it will appear that Sunnyvale is a poorly performing POTW, either near, or likely above its allocation. In reality, the opposite is the case. Sunnyvale effluent has one of the lowest mercury concentrations of any POTW in the region.

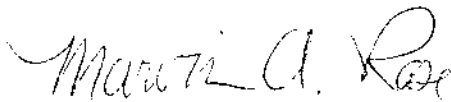
Sunnyvale respectfully requests that this mercury TMDL item be removed from the June 16, 2004 Board agenda to allow the stakeholders and the Regional Board time to develop a more appropriate and equitable approach for setting and implementing the POTW WLA. The City has great concerns that these inequitable and unnecessary individual POTW WLAs will be incorporated into NPDES permits and become semi-permanent due to anti-backsliding considerations. One potential solution to this concern would be to simply delete the individual WLAs but to continue to track individual POTW performance relative to the pooled WLA. This was the approach originally proposed by BACWA, and accepted by Board staff, for POTWs.

Sunnyvale, as a co-permittee of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) also has serious concerns about the technical basis for and the attainability of the stormwater load allocations. The City supports, and includes by reference, the comments provided by SCVURPPP, Mr. Robert Falk on behalf of SCVURPPP, and by the Bay Area Stormwater Management Agencies Association (BASMAA).

This mercury TMDL will set the precedent for how other upcoming legacy pollutant TMDLs (e.g., PCBs, pesticides) address de minimis POTW sources. It is critical that adequate time, resources, and a transparent and open process be provided to finalize this mercury TMDL in a manner so that it can serve as viable model for other TMDLs instead of a catalyst for litigation.

We appreciate the opportunity to submit these initial written comments.

Sincerely,



Marvin A. Rose  
Director of Public Works

ATTACHMENTS

**ATTACHMENT TO CITY OF SUNNYVALE COMMENT LETTER  
ON  
RWQCB APRIL 30, 2004 MERCURY TMDL REPORT**

This Attachment provides City of Sunnyvale detailed comments on the April 30, 2004 Mercury TMDL Staff Report and Basin Plan Amendment.

**1. Eliminate the individual mass “allocations” for POTWs.**

The mass “allocation” approach used in the previous version of the staff report relied upon the relative volumes of discharge to the Bay. The “allocations” presented in the April 30 staff report rely on current loadings. This approach is problematic for several reasons. First, it tends to penalize advanced secondary treatment plants which have the lowest loads per volume of discharge and also have less variable loads. Second, it also tends to penalize plants that have stepped forward to implement reclamation or aggressive pollution prevention and have reduced their loadings to the Bay, accordingly. Finally, it penalizes plants that have remaining un-utilized design capacity and gives extra capacity to plants that will never utilize the “allocation”. The prior allocation scheme tended to reward these advanced secondary plants (such as Sunnyvale’s), which is a more equitable approach.

The individual mass allocations create concern that they will be implemented directly into permits at some time in the near future. Therefore, individual POTWs are evaluating the individual mass allocations in terms of current and future mass loads. Situations are different for individual POTWs, depending on remaining unused permitted capacity, future growth projections, wet weather or economy-based impacts on flows, etc. It is difficult to derive a rational approach for individual mass allocations that is fair and equitable. Since these allocations are not essential to TMDL implementation, the most obvious option is to delete these individual allocations from the TMDL.

RWQCB staff in their February 14, 2004 response to EPA comments on the prior TMDL report, stated (page 8) that they were considering either concentration or individual WLAs as triggers. The report should stay with the original recommendation (below) to just use concentration triggers. Furthermore staff should proceed with the effort to “engage USEPA and stakeholders” in this decision making process as outlined in the response to comments below.

*“WQBELs can be numeric or narrative, or a combination of numeric and narrative requirements. We are not proposing triggers in lieu of WQBELs. We propose issuing a mercury-specific NPDES watershed permit to wastewater dischargers that implements the wasteload allocations. This permits would include a mass load numeric WQBEL equal to the aggregate wasteload allocation. We would also include a number of narrative provisions, as we do with our existing permits. **For added protection, we are proposing numeric***

*concentrations that will trigger certain narrative requirements. Alternatively, we are considering use of the individual WLAs as triggers. We believe this approach to WQBELs is acceptable and desirable, particularly in the context of solving a complex water quality problem. We will engage USEPA and stakeholders in development of permit specifications including consideration of individual numeric limits along with incentives and credits for offsets and protection against unwarranted enforcement. We propose to conduct this effort in parallel with moving forward with the proposed TMDL package.”(emphasis added)*

## **2. Revise the POTW Group Allocation to Include a Specific Allocation for Growth.**

It is important that the allocation contain an increment for community growth and development. From the standpoint of Bay impacts or the attainment of mercury sediment targets, a growth allocation will have a de minimus impact on the ultimate attainment of the targets set in the TMDL. From the standpoint of NPDES permit compliance, the magnitude of this allocation is vitally important. The current version of the staff report recommends a group allocation of 14 kg/yr, based on an annual average POTW mass load estimate of 10.8 kg/yr and an increment of 3.2 kg/yr (through use of a standard error statistic) to address interannual variability. As has been discussed with Regional Board staff, the annual average mass load value just to reflect current conditions should be increased to 11.4 kg/yr to correct mathematical errors. This estimate is approximately 1 kg/yr less than the estimate used to develop the 17 kg/yr pooled allocation in the last Regional Board staff report that included an increment to account for ABAG projected year 2025 growth.

The City also requests that the staff report and Basin Plan amendment specifically acknowledge that this pooled allocation is intended to address current loads plus a reasonable growth increment. Individual POTW service area growth estimates through 2025 were developed in a CEP funded technical report in September 2002 (*Technical Assistance in Support of Mercury TMDL Implementation Plan for SF Bay – Wastewater Facilities*, prepared by LWA for AMS). In that report, Sunnyvale’s population was projected to grow by 14% between 2000 and 2025, from 131,760 to 150,100. This is the same percentage growth rate as for the overall Bay area. Growth will likely continue beyond 2025 but no estimates were provided of that increment. Unless the Regional Board is able to overcome the anti-backsliding concerns expressed in our attorney’s comment letter, there must be a further allocation (or other appropriate means) to meet growth beyond the 2025 date.

It is an important policy precedent that the mercury TMDL explicitly acknowledge the need for a future growth increment for POTWs. This sends the message that the POTW loads are not significant and that minor increases in loads are allowable under the Clean Water Act. The current document indicates that future growth can be accommodated through offsets, signaling a return to the policy precedent that USEPA unsuccessfully tried to establish in NPDES permit that would restrict any increases in loads of any magnitude for 303(d) listed parameters. This approach is unacceptable, from a policy perspective, since offset feasibility is yet to be established.

The first bullet on the top of page 84 of the TMDL staff report appears to imply that growth related flow would be viewed as "new sources of mercury" and have to be offset. There is no offset program, only a discussion on p. 83 of potential elements of one and that interested parties "may submit detailed proposals for such an approach..." Until the science is better understood about relative bioavailability, localized impacts, etc., we foresee many challenges in developing appropriately conservative offset ratios and other fundamental aspects of an offset program that would have a hope of becoming a reality.

One of the independent peer reviewers (Dr. David Sedlak, UC Berkeley) of the TMDL technical report also suggested including a specific growth increment allocation:

*"The load allocations do not contain a term to allow for future growth, as often is done in TMDLs. One potential implication of this approach is that it could place caps on the volume of effluent discharged by wastewater treatment plants. Because the allocation for wastewater treatment plants is based upon current discharges, a treatment plant in a rapidly growing area might have to engage in water recycling or install advanced wastewater treatment processes to comply with this TMDL. Although water recycling and advanced treatment are reasonable objectives, I am not sure that it would be appropriate to require such measures as part of this particular TMDL program. Although the volume of wastewater discharged by the sum of all of the dischargers may not be increasing rapidly, I suggest that the authors address the issue of future increases in wastewater effluent flow in more detail. "*

The RWQCB staff response to Dr. Sedlak's comment inappropriately and without evidence dismissed the need for a growth allocation.

*"26. We chose not to allocate a portion of the TMDL for future growth. The Association of Bay Area Governments' year 2025 growth projections for the Bay Area suggests that there will be modest (~14% region wide) population growth over that period. We believe modest influent flow increases could be offset both by slight improvements in treatment efficiency and increased water re-use; therefore, the mercury allocations will not pose a compliance challenge to wastewater treatment plants or necessitate flow limitations. If growth becomes a concern, for example 15 to 20 years from now, we expect to know more about how our mercury control efforts are working and have a more solid basis for determining if modifications to the wastewater allocations are appropriate. "*

There is no evidence provided to support the assertion that increased treatment efficiency and increased water reuse are in fact achievable and that they are capable of fully offsetting increased loading from growth. The CEP report cited above did not include any assessment of potential reductions from treatment process optimization, presumably since most POTWs are normally operated to produce as high a quality effluent as they can with their existing facilities (to "comfortably" comply with all effluent limitations). Water recycling is expensive and individual projects still face institutional obstacles, not the least of which continuing lack of adequate public acceptance to easily expand recycled water systems. The CEP report estimated that 20,000 acre-feet were recycled region-

wide in 1999. That volume removed an estimated 0.1 to 0.4 kg/yr of mercury. A BARWRP proposed 125,000 acre-feet per year regional water recycling project would cost \$79 million per year and remove about 0.8 kg/yr if fully implemented.

Additional wastewater not accounted for in the above cited estimates is that generated by new jobs that are filled by non-bay area residents. A better economy may attract more tourists and associated wastewater. The movement towards "smart growth" may result in higher population densities and more population growth in the bay area than ABAG is now projecting.

Contrary to staff assertions, it is more likely than not that there is at least a one to one relationship between population growth and loading. Sunnyvale annually conducts wastewater collection system monitoring and prepares a report on the sources of copper, nickel and mercury. In 2003, the largest source of mercury was the residential section (73% of the total). The next largest source was commercial (15%), followed by industrial (8%), "other" (2.1%) and water supply (1.8%). Human waste, laundry grey water, and household products are major sources of mercury.

If the relative proportions of residential, commercial, and industrial wastewater remain as they are now, one would expect future influent mercury concentrations to remain about the same as it is now. Therefore, assuming that other known influent sources of Hg remain controlled, domestic wastewater flow and associated mercury loading will go up in proportion to the net population increase. If the percent residential flow increases, the concentration could increase. Effluent concentration is not expected to change, given that the WPCP already removes over 98% of the influent mercury. As noted in the CEP report cited above, it is an invalid, but commonly held assumption that a reduction in influent concentration results in an equivalent reduction in effluent concentration.

### **3. Use a 5-year averaging period to assess compliance with the POTW group allocation.**

The prior version of the staff report had a five-year averaging period for wastewater sources. The current version of the staff report and Basin Plan amendment has a one-year averaging period for wastewater but a five year averaging period to account for allocations for Central Valley and Guadalupe River watershed loads. No rationale was given for the change to a one-year averaging period. The use of the five year averaging period is to account for inter-annual variability in load due to rainfall-induced flow conditions. The five year averaging period is needed for POTWs to account for inter-annual variability of wastewater flows. Use of a five year averaging period to evaluate the load from POTWs is appropriate and is beneficial to eliminate concerns regarding wet season or economic driven fluctuations in plant flows. It is consistent with the calculation method used in the derivation of the current POTW load estimate. It is also consistent with the time-frame for recovery of the bay, a long term process, and as such the compliance method should not over react to one year's values.

#### **4. The Report Must Recognize That There are Very Limited if any Mass Reduction Options Available to Advanced Secondary Treatment Plants such as Sunnyvale**

There are no reasonably feasible options for reducing Sunnyvale's mass discharge of mercury given their significant past efforts at reducing overall metals discharges. Sunnyvale evaluated this same issue in an EOA October 18, 2002 memo titled "Draft Sunnyvale Mercury Mass Limit Calculations Case Study" (copy attached). This memo was provided to Board permitting staff as part of the 2003 NPDES permit reissuance process. Excerpts are provided below. The memo documented, and Board staff agreed, that there would likely be future exceedances of the current performance based mass limit under consideration at that time of 0.096 kg/yr. Note that exceedances were predicted for a value (later modified) that was 16% greater than the 0.083 kg/yr individual WLA now being proposed for Sunnyvale.

Studies in the region and nationally (e.g., by Palo Alto and by AMSA, as cited in the CEP report noted above) have typically found the majority of mercury to be coming from dental offices and from human waste (in food and from amalgam filling erosion). Sunnyvale found that 73% of the influent mercury loading was coming from residential sources in the City. Given the current low effluent concentrations it is unlikely that concentrations could be lowered significantly through further plant optimization. Sunnyvale effluent total suspended solids concentrations are in the 8 mg/l range (less than 50% of the monthly average effluent limit of 20 mg/L).

The City has mature pollution prevention and pretreatment programs. Sunnyvale began implementing its Federal Pretreatment Program in the mid-1980's. During 1990-1994 the City implemented increased waste minimization efforts following issuance on NPDES permit Order Nos. 88-176 and 90-70. This included implementation of Reasonable Source Control Measures (RSCMs) identified by industrial users in their Mass Audit Studies. The remaining RSCMs were implemented during 1995-1997. The City has already included dentists in its pollution prevention efforts and is continuing its efforts to deliver and redeliver BMP type information to dentists.

Work by AMSA, cited in the CEP report above, estimated that implementation of pollution prevention and source control measures might provide influent load reductions of 26 to 33 percent (perhaps less depending on the extent of control measures already in place). However, after full implementation, effluent concentrations were only predicted to be reduced by 2% to 3%.

The regression graph of Sunnyvale influent and effluent mercury concentrations in Figure A-2 of the EOA 10/18/02 memo cited above shows this same situation, that influent and effluent concentrations are not closely related. A decrease in influent concentrations, through pollution prevention, will not necessarily lead to a discernible decrease in effluent concentrations. Given that the POTW achieves approximately 98% mercury reduction, it would take approximately a 50 ng/L increase in influent concentration to result in a 1 ng/l effluent concentration decrease. A decrease in influent concentrations



could result in reduced biosolids mercury concentrations which would reduce loadings to landfills and landspreading operations and possibly the atmosphere via volatilization.

The City has been proactively pursuing water recycling as a means of reducing overall discharges to the Bay since the early 1990's. Sunnyvale has to date invested over \$20 million in water recycling production and distribution facilities. The City reports on its recycled water deliveries and efforts at expansion in its March 15 Annual Report, required as a condition of its water recycling permit. Recycled water production has exceeded 1 mgd during peak summer months and averaged about 304,000 gpd on an annual average basis during 2001.

The City has completed a Water Recycling Master Plan that it keeps updated and uses as part of its efforts to incrementally expand to additional urban irrigation sites within its core distribution network. The Master Plan found that it would cost the City approximately an additional \$20 million to extend its existing distribution system to the remaining major landscape irrigation sites in the City. That expenditure would achieve approximately an additional 1 mgd on an annual average basis. One mgd diverted, containing 4 ng/L mercury, would remove approximately 0.0055 kg/yr from the amount discharged to the bay. Note that the 0.0027 kg/yr in rainfall falling on the ponds that is removed by the secondary and tertiary treatment processes (at minimal incremental cost) is about 50% of the 5.5 grams/yr removed from the bay by this 1 mgd of additional water recycling.

The City already has a water conservation program in place and believes that most of the significant reductions have already been achieved. Recent activities include a showerhead/faucet aerator replacement program (free to residents), water-wise house call program (free to residents), residential clothes washer rebate Program-Energy Star®, commercial clothes washer rebate Program-Energy Star®, ULFT replacement programs (multi-family units, low income, elderly, disabled and commercial facilities), hotel water conservation program, irrigation technical assistance program and Project WET (Water Efficient Technologies) for industry.

The City has relatively low amounts of I/I, previously estimated to be only 5% of the City's effluent flow. The City completed a collection system evaluation survey in 2001 that identified potential projects for their capital improvement program.

While excessive I/I is not a problem, the City is adversely impacted by rainfall in another uncontrollable way. The SFEI San Francisco Bay Atmospheric Deposition Study Part I: Mercury (July 2001) estimated the average mercury concentration in precipitation in the Estuary to be about 8.0 ng/L (0.008 ug/L). The highest concentration monitored in the effluent during the last three years was 8 ng/L, while the average was less than half that contained in rainfall. The WPCP includes 400 acres of secondary treatment ponds. If the LSB receives approximately 12 inches of rainfall per year, that translates to an input of about 400 acre-feet or about 180 MG/year of flow containing 8 ng/L of mercury. Given the average effluent concentration of 0.0038 ug/L, about half of this rainfall induced

mercury loading (0.0027 kg/yr) that would otherwise go to the bay (if the ponds were absent) is removed by the WPCP treatment processes.

Since effluent concentrations appear unlikely to decrease further, and no other practicable options for mass offsets currently appear to exist, the only way to guarantee 100 % compliance with the proposed individual WLA appears to be to restrict flow by restricting wastewater producing growth.

#### **5. Provide Definitive and Retroactive Credit for Load Reduction Activities.**

The current document is non-specific regarding the framework or mechanisms for providing mass load credits/incentives to agencies that implement projects to reduce the mass input of mercury to the Bay (e.g. recycling, pollution prevention, etc.). The report requires POTWs to prepare an annual report “including mercury loads avoided through program activities unrelated to normal treatment” (page 75) but no corresponding link to how the avoided loads would be credited to the POTW. The report contains only a very weak section on potential pollutant trading (page 83): “Interested parties may submit detailed proposals for such an approach, ...” A mechanism should be provided whereby Sunnyvale could get credit for the mercury removed from incident rainfall by its secondary and tertiary treatment processes. Similar credits may be appropriate for POTWs that can demonstrate removals of rainfall induced I/I.

#### **6. Provide More Comprehensive and Quantitative Information on Economic Costs in the Regulatory Analyses Section**

The City believes that the TMDL report needs to include more information on the potential total regional costs for additional pollution prevention/source control, effluent filtration, effluent reverse osmosis treatment, and water recycling. This is necessary as part of the alternatives analyses to more clearly provide the public with a fuller appreciation of the magnitude of potential expenditure of public funds under worst case scenarios for POTWs. While use of filters and reverse osmosis on a Bay-wide basis is described as unlikely to be required, the public should be aware of the massive costs if it were to be required (\$909 million per year plus brine disposal). Much of the analysis was already developed for and included in a CEP September 2002 report (*Technical Assistance in Support of Mercury TMDL Implementation Plan for SF Bay – Wastewater Facilities, Table 1a-1. Matrix of Mercury Load Reduction Scenarios*, prepared by LWA for AMS).

STATE OF CALIFORNIA  
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
SAN FRANCISCO BAY REGION

STAFF SUMMARY REPORT (Linda Rao)  
MEETING DATE: JUNE 18, 2003

ITEM: 8, 9,10

SUBJECT: Cities of San Jose and Santa Clara, Water Pollution Control Plant,  
Santa Clara County- Hearing to receive testimony on reissuance of  
NPDES Permit

City of Palo Alto, Regional Water Quality Control Plant, Santa  
Clara County- Hearing to receive testimony on reissuance of  
NPDES Permit

City of Sunnyvale, Water Pollution Control Plant, Santa Clara  
County- Hearing to receive testimony on reissuance of NPDES  
Permit

CHRONOLOGY: May 2003 – NPDES Permit Reissuances Status Report to the  
Board  
June 1998 – Permits Reissued  
June 1993 – Permits Reissued

DISCUSSION:

Due to last minute meetings and negotiations with the Cities of San Jose, Palo Alto, and Sunnyvale, the Tentative Orders for each will be released in mid-June. The June Board Workshop will be continued for July, to allow adequate review time. We recommend that the Board receive testimony at the July Workshop, and take action on permit reissuance in August.

Process and Schedule

These permits were developed using the WMI stakeholder process which included participation in over 25 meetings, review by the WMI of two administrative drafts of NPDES permits for the three Cities, and additional meetings regarding discharger specific issues and complex technical topics.

At the May Board meeting, Board staff presented a status report of the reissuance of the three NPDES permits and identified three major outstanding issues (mercury, copper and nickel effluent limits and habitat mitigation). This summarizes progress achieved thus far.

Issues presently under discussion include mercury mass limits, copper and nickel limits, and a habitat issue unique to the City of San Jose's permit.

#### Mercury Mass Limits:

At the May Board meeting, the South Bay Dischargers proposed that mercury mass limits not be included at all. Instead they propose alternatives to the interim mass limit, such as a mass trigger paired with aggressive pollution prevention efforts and watershed-based mercury studies designed to address TMDL information needs.

Since the May Board meeting, Board staff have met with the South Bay dischargers and reached consensus on the approach for setting interim mass limits (see Table A). The new proposal to address interim mass limits include a mercury interim mass limit effective only during the dry weather, aggressive pollution prevention efforts, and implementation of a watershed-based mercury study.

#### Copper and Nickel Limits:

At the May 2003 Board Meeting, the Dischargers contended that effluent limits are not necessary. At present, Dischargers have tentatively agreed to the inclusion of effluent limits in the permits under the condition that with new information, the Regional Board will reevaluate the need for effluent limits for copper and nickel.

#### South Bay Habitat Issues:

Since January 2003, staff has coordinated meetings with the City of San Jose, U.S. Fish and Wildlife Service, California Department of Fish and Game, environmental groups and interested parties to bring closure to historical mitigation requirements unique to the City of San Jose. These meetings have been productive and will continue between agencies to ensure a permit consistent with the Endangered Species Act.

Staff are pleased that San Jose has offered an alternate wetlands mitigation proposal, and will require the City to continue working with the USFWS, CDFG and RB to finalize details. After permit adoption, Regional Board staff will present a resolution for an alternate wetlands mitigation project to the Board for its adoption.

RECOMMENDATION: Continue the Items for July

File Nos. 2189.8011, 2189.8014, 2189.8018 (LR)

Appendices:

#### Tables

Table A: South Bay Mercury Mass Limits

Table A: South Bay Mercury Mass Limits

<b>City Facility</b>	<b>Interim Concentration Limit (µg/L)</b>	<b>Current Mercury Mass Limit (kg/year)</b>	<b>Proposed Interim Mercury Mass Limit<sup>1</sup> at May Board Meeting (kg/year)</b>	<b>New Proposed Interim Mercury Mass Limit<sup>2</sup> (kg/year) (dry weather limit + pollution prevention + watershed based mercury study)</b>	
<b>San Jose and Santa Clara</b>  (Design Flow Capacity- 167 MGD)	0.012	32	0.72	2.77	Investigating sources of methylmercury within their treatment process, and feasibility analysis of reducing methylmercury
<b>Sunnyvale</b>  (Design Flow Capacity- 29.5 MGD)	0.012	25	0.12	0.50	Evaluation of treating stormwater elevated in mercury at their treatment plant
<b>Palo Alto</b>  (Design Flow Capacity- 39 MGD)	0.023	11	0.31	1.24	Implementation of advanced pollution prevention technologies at dentist offices

- 1 Calculated using the average plus 3 standard deviations (or the 99.87 percentile). The data set includes the past three years of effluent ultraclean mercury data and monthly average flows.
- 2 The new proposal includes an interim dry weather mass limit and a requirement to do a special pollution prevention project addressing mercury reduction within the watershed. The new limit is calculated using the dry weather design flow, multiplied by the interim mercury concentration. The design flow is different for each discharger, the interim mercury concentration is the more stringent of current plant performance or existing permit limitations.

**TO:** Lorrie Gervin/Dave Grabiec, City of Sunnyvale

**FROM:** Kristin Kerr/ Tom Hall

**DATE:** Initial Draft - October 8, 2002  
Revised Draft - October 18, 2002

**SUBJECT:** Draft Sunnyvale Mercury Mass Limit Calculations Case Study

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### Background

The current (1998) South Bay NPDES permits contain mass limits for several toxic constituents pursuant to SWRCB Order 90-05. That Order directed that:

“The limits should be calculated by multiplying the 1989 annual mean effluent concentration by the 1985 -1988 annual average flow. Because the dischargers will be using lower detection limits, they should be able to comply with mass loading limits, based on mean loading. Further, when evaluating compliance with these mass emissions, the Regional Board should consider variability due to wet and dry weather.”

The 1998 (and 1993) South Bay permits contained footnotes to the mass limits describing in more detail how they were to be calculated and reported. Footnote 2 to the mass limits addressed the issue in Order 90-05 about wet weather variability:

“For performance based mass limits: Because mass may increase during heavy rainfall years and wet year data were not considered in the development of these limits, exceedances during wet weather years will be evaluated separately.”

Citizens for a Better Environment, San Francisco BayKeeper, and CLEAN South Bay filed petitions for the SWRCB to review the three 1998 South Bay Permits. The SWRCB responded to the petitions in Order WQ 99-09 in October 1999. Order WQ 99-09 cited the following relative to establishing mass limits for POTWs:

“The EPA permitting regulations generally require permit issuers to express effluent limitations in terms of mass, but do not provide guidance on how to establish mass limits.[46] *For publicly-owned treatment works, like the South Bay dischargers’ treatment plants, the regulations only provide the general direction that effluent limitations be based on design flow.*[47] Thus, the permitting issuer can use best professional judgment to establish mass limits.[48]” (emphasis added)

{Footnote 46: 40 C.F.R. Section 122.45 (f)(1), Footnote 47: 40 C.F.R. Section 122.45 (b)(1), and Footnote 48: WL 433759 at 12 (EPA)}.

The 1998 South Bay permits included numeric effluent goals in lieu of WQBELs for several pollutants that had analytical detection limits above the WQBELs. Order WQ 99-09 upheld that “the RWQCB had discretion to decide that it could not determine reasonable potential for these pollutants.” The Order also stated that:

“The Regional Water Board’s approach is consistent with EPA guidance. EPA recommends, when a permitting authority is unable to determine reasonable potential based on effluent data, that the authority require further testing to develop the necessary data [71]. The State Water Board’s proposed policy implementing the CTR takes a similar approach in cases where effluent data are insufficient to determine whether an effluent limitation is needed to control a pollutant [72].”

{Footnote 71: See Technical Support Document, fn. 7, supra, p. 5; Guidance for NPDES Permit Issuance, fn. 36, supra, p. 10; Footnote 72: See Draft Statewide Policy, fn. 37, supra, proposed Section 2.2.A.}.

### **Current Performance Based Mass Effluent Limits**

The South Bay permits have included mass based limits for several toxics pursuant to SWRCB WQ Order 90-5. Interim performance-based mass limitations have been included in other NPDES permits for certain 303(d)-listed bioaccumulative pollutants, primarily mercury, since 1998 (for background history see EOA June 30, 1998 memo “Mercury Mass Loading and Trigger Issues” to Shin-Roei Lee, RWQCB). The interim mass-based loading limit (interim mass limit) for mercury has most frequently been calculated as the mean plus three standard deviations (99.87<sup>th</sup> percentile) of the 12-month moving average mass loading from the most recent three years effluent data. When these performance based limits were first calculated, the datasets often included some high detection limit and/or non-ultra clean values that tended to skew the mass limits higher. Near-term compliance was less of an issue with limits calculated with non-ultra clean data.

Currently, most POTWS, including the South Bay POTWS, have at least three years of ultra-clean mercury effluent concentration data. In these cases, a performance based mass limit represents true plant performance without any “buffer.” An interim mass limit was calculated for Sunnyvale using the RWQCB’s standard spreadsheet and effluent concentration and flow data from the 36 months April 1999 through March 2002. The flow used was calculated as the effluent discharged to LSSFB plus recycled water flow. Including the recycled water flow in the mass limit calculation has been done in the past to provide the discharger a “credit” for reductions in mercury mass discharged to the receiving water from proactively initiated water recycling.

The average monthly flow was multiplied by the average monthly mercury concentration and a conversion factor to yield an average monthly mercury mass. A 12-month moving average monthly mass was calculated from these values, and a performance-based mass limit was then determined based on the average plus three standard deviations of the moving average values. The mercury mass effluent limit calculated is 0.008 kg/month or 8 grams/month.

Sunnyvale effluent mercury concentrations ranged from 0.002 – 0.008 ug/L with an average concentration of 0.0038 ug/L and 99.87<sup>th</sup> percentile value of 0.010 ug/L. The very low values were also quite consistent, demonstrated by their standard deviation was 0.002 ug/l. Mercury concentration, effluent flow (not including recycled water) and mercury mass (monthly mass discharged) are shown below from April 1999 – March 2002 in Figure 1. These low concentrations and standard deviation reflect the existing high level of plant performance and an aggressive pollution prevention program. By

way of comparison, the RWQCB's June 2001 analysis of pooled mercury data from all secondary and advanced secondary treatment plants showed them to have 99.87<sup>th</sup> percentile mercury concentrations of 0.087 ug/L and 0.023 ug/L, respectively.

Using these same data the pooled mercury report estimated an annual average mercury mass loading from POTWs of approximately 15 kg/yr. The total loading to the bay is estimated in the Draft Mercury Source Assessment for San Francisco Bay (8/26/02) to be in the range of 940 kg/yr. By these estimates POTWs combined contribute about 1.6% of the total mercury loading to the Bay and Sunnyvale contributes about 0.01% of the total loading.

### **Potential to Exceed Possible Mass Limits**

A mathematical model was used to assess the potential for the City to exceed a mass limit of 0.008 kg/mo. Assumptions made for the modeling were as follows:

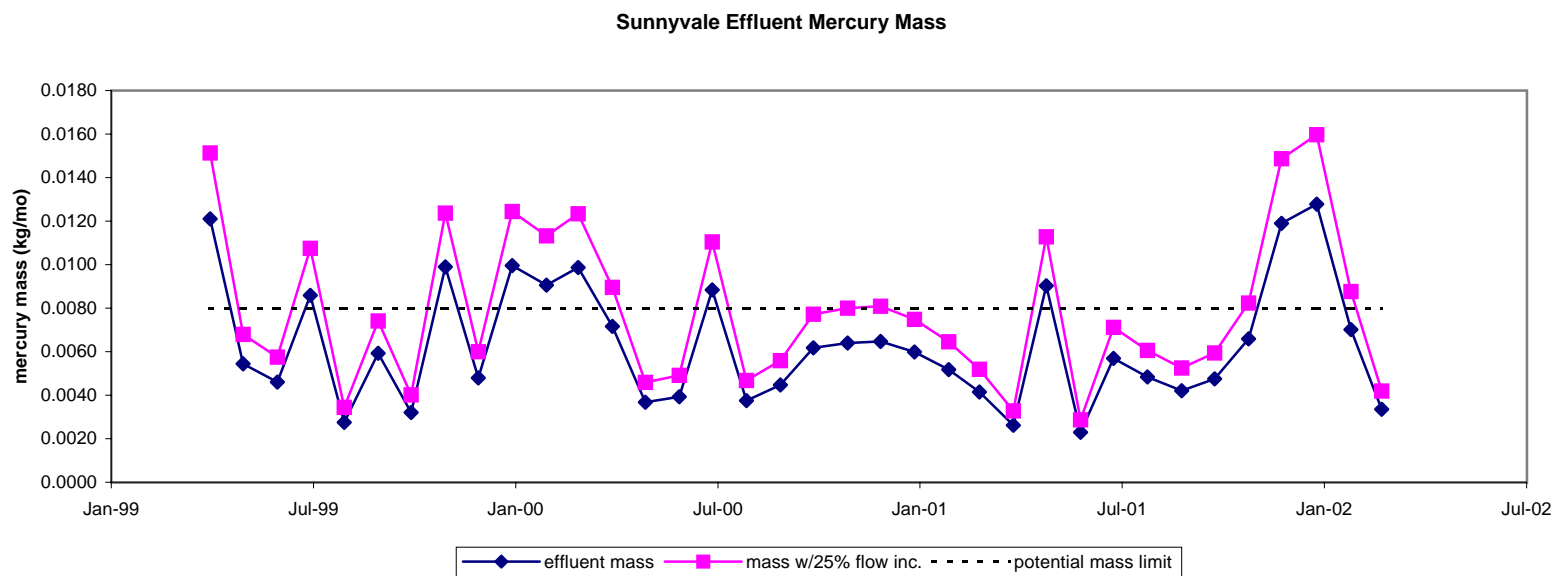
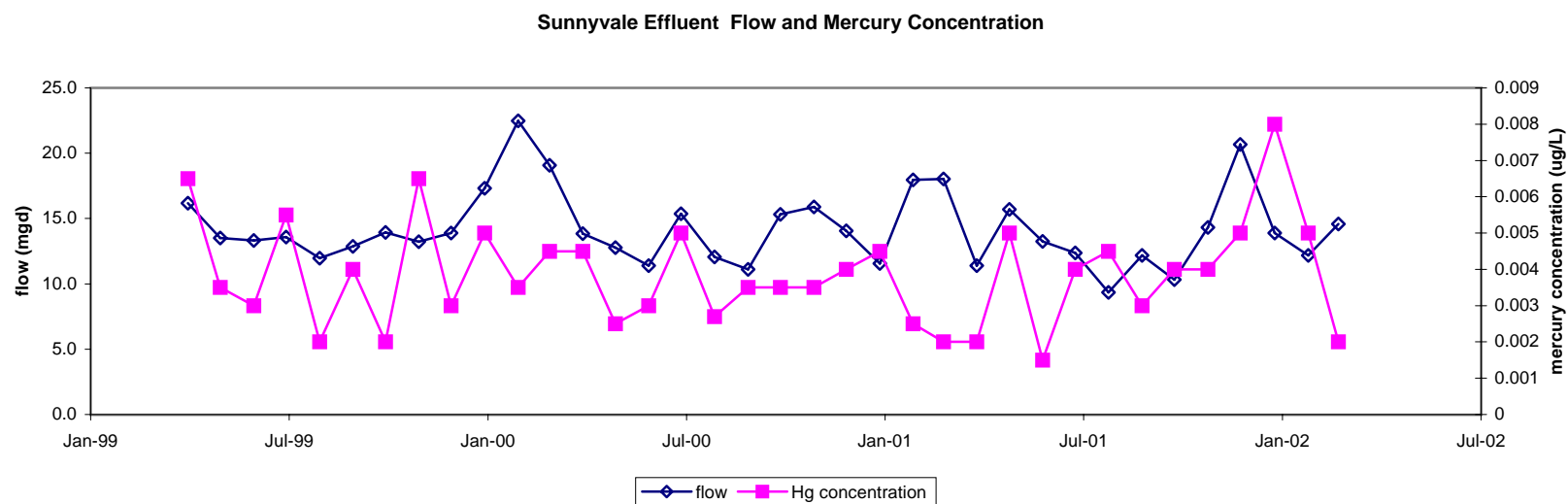
- "Moving averages" can be modeled using a normal distribution. From a theoretical point of view this is a reasonable assumption, and from a practical point of view the normal distribution provides the best fit of common continuous distributions;
- Flow and concentration data between April 1999 and March 2002 are representative of those which should be expected in the future;
- Flow and concentration data are independent; and
- Reported concentrations are accurate approximations of the true concentration in the effluent.

There are two main steps to this modeling assessment. First, the 25 12-month moving average effluent flow and concentration values from the "spreadsheet model" (Appendix A Table A-1) were input into a computer simulation model to generate distributions approximating the underlying 1) actual effluent (not including recycled water) moving average flow and 2) effluent moving average concentration data. Via a method of maximum likelihood, the model then fit a distribution (mathematical representation) to those data and generated a mean and standard deviation. In the second step, the user inputs the number of trials to run and the model then samples random pairs of flow and concentration values from the underlying flow and concentration distributions using a process called Monte Carlo simulation to calculate the distribution of mass values and the certainty (probability) in percent that the mass values will be below the specified maximum mass value (i.e. the potential mass limit).

This simulation approach is slightly different from the "spreadsheet model" approach that uses actual flow and concentration data and calculates moving averages of the resultant mass values. The simulation approach is believed to be equally or more conservative since it uses both moving average flow and moving average concentration values to derive the distribution of mass values. The use of one and particularly two moving averages reduces the effects of extreme individual values.



**Figure 1. Sunnyvale Effluent Flow, Mercury Concentration and Mercury Mass**



F:\SU32\SU32-29\RPA\effluent limits\[SU Effluent Limits.xls]Figure 1 (eff flow)

Results from the Monte Carlo simulations are shown graphically in a forecast chart that shows the range of possible outcomes (mass) and the likelihood and frequency of achieving each range (Figure 2). For each of the forecast charts shown below 1,000 random trials were run. The chart left hand Y-axis shows the probability of a value falling within a given mass interval normalized to the number of trials (1,000) run. The chart right hand Y-axis shows the frequency that a value within a given mass ranged occurred. The value at the top right of the chart labeled “outliers” is somewhat of a misnomer since it refers only to the number of values not shown on the chart based on the display range selected for the X-axis. No values (outliers) were censored from the dataset in any of these analyses.

At the bottom of the chart, the certainty of the generated mass values falling within a user specified range is given. For these simulations, the user range selected was from zero up to the previously derived mercury interim mass limit (the maximum of this range). The program then shows the certainty, in percent, that the distribution of mass values generated from the 1,000 trial runs will be below the mass limit value entered.

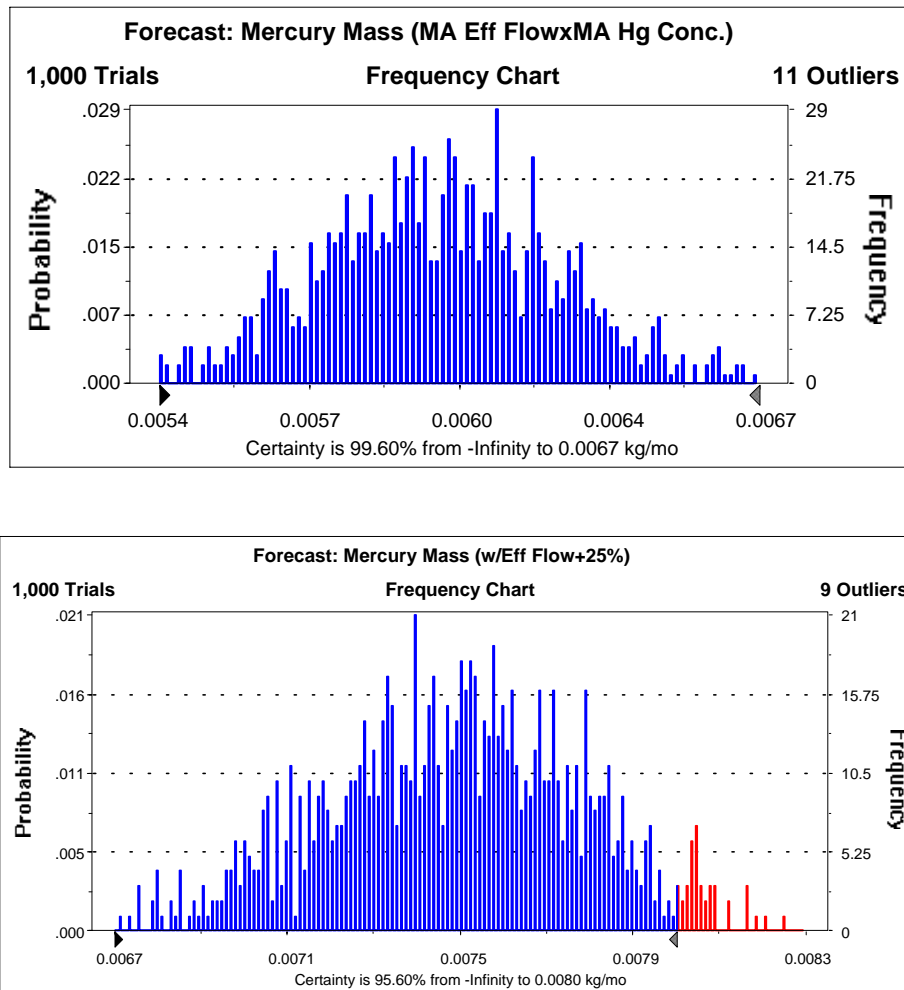
**Existing Conditions Simulation** The model was run as described above with the simulation randomly taking a value from the 12-month moving average flow distribution and multiplying it by a random value in the 12-month moving average mercury concentration distribution to determine a mass. This was done 1,000 times to produce the mercury mass frequency distribution shown in Figure 2. The top-most frequency distribution plot in Figure 2 shows that Sunnyvale would have a 0.4% probability of exceeding the potential 0.008 kg/mo mercury mass limit if similar effluent flow and concentration conditions occur in the future as represented by April 1999 to March 2002 conditions.

This modeling analysis does not take into account potential worse case situations such as where several wet weather high flow months might occur in a row with concurrent elevated I/I and reduced recycled water demand.

**25% Flow Increase Simulation** To determine how sensitive the possible mass limits are to increases in flow, a second set of simulations were generated based on an assumed 25% increase in flow. Each of the 25 12-month moving average flow values was multiplied by 1.25 and the resulting flows entered into the simulation model. The concentration values were not changed. The average effluent flow from April 1999 – March 2002 is 14.2 mgd. The simulated 25% increase in flow throughout the three year period would be equivalent to average flow of 17.8 mgd. Therefore, this simulation can be viewed as representing some unspecified three year time period in the future when the average flow was 17.8 mgd and the individual monthly moving average concentration values were the same as had occurred during April 1999 – March 2002. As shown in the lower plot in Figure 2, if flow increased by 25% the potential mercury mass limit would be expected to be exceeded about 4.4% of the time.

**Time Series Moving Average Mass Comparisons** Figure A-1 in Attachment A presents a time series plot of the actual 25 12-month moving average mass discharge values (i.e. with credit for reclamation). This represents how plant compliance would have been evaluated if the proposed limit had been in place during April 1999 – March 2002 (lower line). The actual flow values in the spreadsheet model were then multiplied by 1.25 to provide a projection of future performance and compliance on a moving 12-month moving average basis assuming no other changes occurred except for the assumed 25% increase in flow. The upper time series plot reflecting the 25% flow increase exceeds the 0.008 kg/mo limit in 10 out of 25 months and is just fractionally below the limit in two additional months.

**Figure 2. Mercury Mass Frequency Charts Simulated with 12-Month Moving Average Flow and 12-Month Moving Average Concentration**



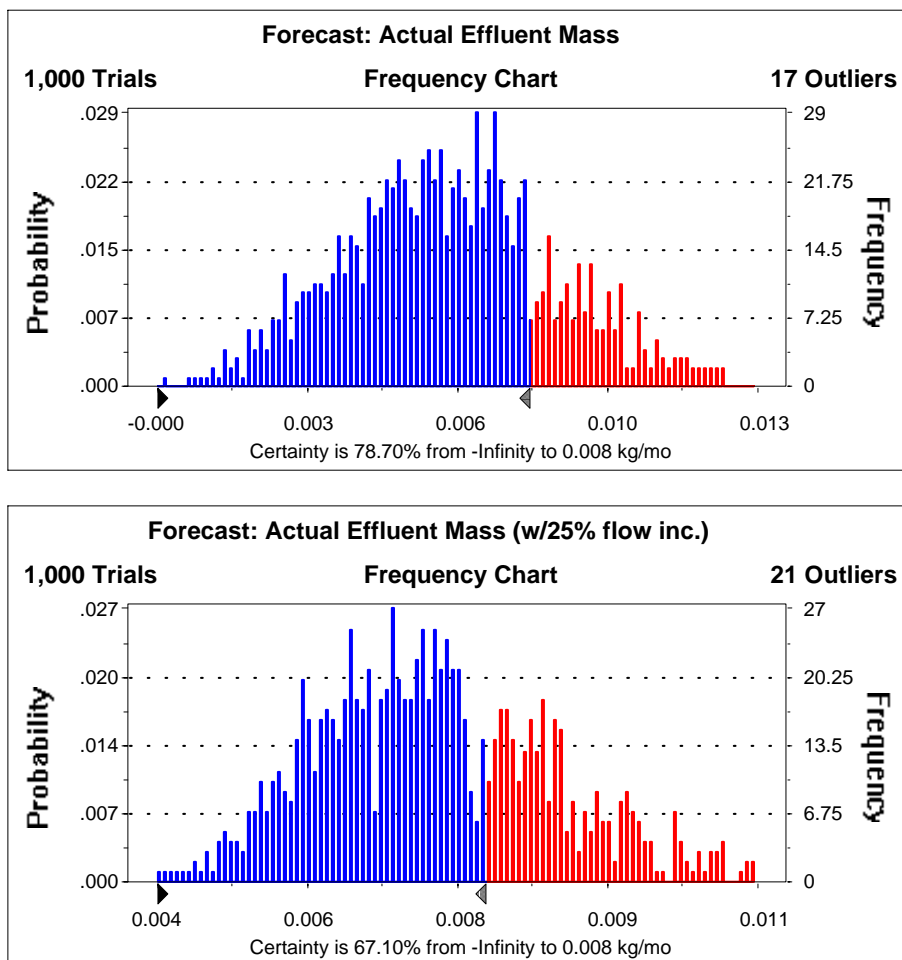
**Actual Flow and Concentration Simulation** The simulation was also run using actual effluent flow and mercury concentration distributions, instead of the 12-month moving average values used above, to calculate an effluent mass distribution. The intent was to generate an estimate of the actual underlying effluent mass distribution for comparison with the 36 actual measured values of monthly mass discharged as plotted in Figure 1 and shown in the mass limit calculation Table A-1 in Appendix A.

As shown in Figure 3, without the 12-month moving average “smoothing,” the simulation projects a 21.3% probability of exceeding the potential 0.008 kg/mo mercury mass limit if conditions remain the same as represented by April 1999 – March 2002 flows and concentrations. During these 36 months the actual measured mass discharged exceeded 0.008 kg/mo 10 times or about 27.8% of the time. This approach to mass simulation thus slightly underestimates, compared to the actual historic data, the frequency distribution of mass discharges greater than 0.008 kg/mo.

**Actual Concentration with Actual Plus 25% Flow Increase Simulation** To determine how sensitive this method of projecting actual mass discharges would be to increases in flow, the simulation was also

run based on an assumed 25% increase in the actual flow values. If flow increased by 25%, the potential mercury mass limit would be expected to be exceeded about 32.9% of the time if compliance were evaluated on a month by month basis (instead of a 12-month moving average basis).

**Figure 3. Mercury Mass Frequency Charts Simulated Using Actual Monthly Flow and Monthly Average Concentration**



**Concentrations Needed to Exceed Limit** Another method of intuitively investigating the potential for exceedance of the mass limit is presented in the Attachment A Table A-2 titled City of Sunnyvale Mass Limit Evaluation. There, the effluent flow values from April 1999 through March 2002 were ranked from the lowest to the highest. The mercury concentration required to generate a mass value equal to the mass limit was then determined for each flow value. These resultant concentration values ranged from 0.0031 – 0.0074 ug/L. Note that these concentration values fall within the range of actual concentration values measured from April 1999 through March 2002, of 0.002 – 0.008 ug/L. This indicates that on an individual monthly basis, concentrations could occur that would result in an individual mass discharge at or above 0.008 kg/mo.

**Effluent Flow vs Concentration** Figure A-2 in Attachment A plots effluent flow versus effluent mercury concentration. The regression line drawn through this scatterplot shows a very low correlation

coefficient ( $R^2$ ) value of 0.011. This indicates that there is essentially no relationship between effluent flow and concentration. A similar plot in Figure A-3 in Attachment A shows similar results when influent mercury concentration is plotted against effluent concentration. This plot has an even lower ( $R^2$ ) value of 0.003 indicating that within the range of values in the dataset, simply lowering influent concentrations will have no measurable effect on effluent concentrations.

An additional factor to consider in assessing the robustness of mass limits calculated using these data and the proposed approach is that most of the measured values are within a factor of three of the 0.002 ug/L detection limit. The precision and accuracy of analytical results typically decreases considerably as the concentration present approaches the detection limit.

One conclusion that can be drawn from the above observations is that it appears possible that certain flow and concentration pairings can occur just by random chance. During an extremely wet winter, several high flow months in a row could occur. Since flow and effluent concentration have been shown to be unrelated, if high concentration values (relatively speaking and within the range of those experienced in the past) were concurrently to occur due to chance, this in and of itself could potentially result in exceedance of the mass limit.

### **Mass Reduction Options**

There appear to be relatively few reasonably feasible options for reducing Sunnyvale's mass discharge of mercury given their significant past efforts at reducing overall metals discharges. Other studies in the region and nationally have typically found the majority of mercury to be coming from dental offices and from human waste (in food and from amalgam filling erosion). As noted above, given the current low effluent concentrations it is unlikely that concentrations could be lowered significantly through further plant optimization. Sunnyvale effluent total suspended solids concentrations are in the 8 mg/l range.

The City has mature pollution prevention and pretreatment programs. The City has already included dentists in its pollution prevention efforts and is continuing its efforts to deliver and redeliver BMP type information to dentists. The regression graph of influent and effluent mercury concentrations in Attachment A shows a low  $r$  squared value. This indicates that influent and effluent concentrations are not closely related and a decrease in influent concentrations, through pollution prevention, will not necessarily lead to a decrease in effluent concentrations. It would likely result in reductions in biosolids mercury concentrations.

The City already has a water conservation program in place and believes that most of the significant reductions have already been achieved. Recent activities include a showerhead/faucet aerator replacement program (free to residents), water-wise house call program (free to residents), residential clothes washer rebate Program-Energy Star®, commercial clothes washer rebate Program-Energy Star®, ULFT replacement programs (multi-family units, low income, elderly, disabled and commercial facilities), irrigation technical assistance program and Project WET (Water Efficient Technologies) for industry.

The City has relatively low amounts of I/I, previously estimated to be only 5% of the City's effluent flow. The City completed a collection system evaluation survey in 2001 that identified potential projects for their capital improvement program.

While excessive I/I is not a problem, the City is adversely impacted by rainfall in another uncontrollable way. The SFEI San Francisco Bay Atmospheric Deposition Study Part I: Mercury (July 2001) estimated the average mercury concentration in precipitation in the Estuary to be about 8.0 ng/L (0.008 ug/L).

The highest concentration monitored in the effluent during the last three years was 8 ng/L, while the average was less than half that in rainfall. The WPCP includes 400 acres of secondary treatment ponds. If the LSB receives approximately 12 inches of rainfall per year, that translates to an input of about 400 acre-feet or about 180 MG/year of flow containing 8 ng/L of mercury. Given the average effluent concentration of 0.0038 ug/L, about half of this rainfall induced mercury loading that would otherwise go to the bay (if the ponds were absent) is removed by the WPCP.

The City has been proactively pursuing water recycling as a means of reducing overall discharges to the Bay since the early 1990's. Sunnyvale has to date invested over \$20 million in water recycling production and distribution facilities. The City reports on its recycled water deliveries and efforts at expansion in its March 15 Annual Report, required as a condition of its water recycling permit, Order No. 94-069. The City has completed a Water Recycling Master Plan that it keeps updated and uses as part of its efforts to incrementally expand to additional urban irrigation sites within its core distribution network. As shown on the attached Mass Limit worksheet, recycled water production has exceeded 1 mgd during peak summer months and averaged about 304,000 gpd on an annual average basis during 2001.

Since effluent concentrations appear unlikely to decrease further, and no other practicable options for mass offsets currently appear to exist, the only way to guarantee 100 % compliance with a mercury mass limit calculated based on recent performance appears to be to restrict flow by restricting wastewater producing growth.

### **Mercury Regulatory Alternatives**

There are several variables that can be manipulated to craft a "limit". Dialogue is needed on what it is that the "limit" is really desired to achieve to help narrow the range of feasible alternatives.

- 1) Flow: existing, dry weather only, existing plus increment, design, ...
- 2) Concentration: existing, existing plus increment, regional, ...
- 3) Mass: existing, existing plus credits, watershed, regional, with or without concentration, ...
- 4) Offsets: local recycling, regional recycling, local/regional mines, ...
- 5) Action Plans: monitoring/goals, baseline activities (P2), triggers, phased actions, ...
- 6) De Minimis: concept, thresholds, ...
- 7) Others

Table 1 presents some of these options for calculating interim mass limits.

**Table 1. Interim Mass Limit Options**

	<b>Calculation</b>	<b>Mass (kg/mo)</b>
Current Average	Avg (effluent flow x Hg conc.)	0.006
Current Maximum	max (effluent flow x Hg conc.)	0.013
Current 99.87th%ile	Avg (effluent flow x Hg conc) + 3 x st. dev. (effluent flow x Hg conc)	0.015
12-Month MA 99.87th%ile	Avg (12-month moving average mass) + 3 x st. dev. (12-month moving average mass)	0.008
Design Q x Avg Conc	29.5 mgd x avg Hg conc.	0.013
Design Q X Max Conc	29.5 mgd x max Hg conc.	0.027
Design Q x 99.87th%ile	29.5 x (avg Hg conc. + 3 * st. dev. Hg conc)	0.028
Design Q x Pooled (23ng/L)	29.5 mgd x 0.023 ug/L	0.078

Note: A conversion factor was used in the calculations to convert mgd/ug/L to kg/mo (3.785\*30.42/1000).

## **ATTACHMENT A**

**Table A-1 Effluent Mass Limit Calculation Worksheet**

**Table A-2 City of Sunnyvale Mass Limit Evaluation**

**Table A-3 Sunnyvale Effluent Mercury Data April 1999 – March 2002**

**Figure A-1 Moving Average Effluent Mass**

**Figure A-2 Effluent Flow vs Effluent Mercury Concentration**

**Figure A-3 Influent Mercury Concentration vs Effluent Mercury Concentration**



**Table A-1**  
**City of Sunnyvale - Mercury Mass Limit**

<b>Date</b>	<b>Effluent Flow</b>	<b>Recycled Water</b>	<b>Total Flow MGD</b>	<b>[Hg]; ug/l</b>	<b>Mass = Flow x [Hg]; g/d</b>	<b>12-Month Avg. Mass; g/d</b>
Apr-99	16.2	0.376	16.56	0.0065	0.407	
May-99	13.5	0.818	14.32	0.0035	0.190	
Jun-99	13.3	1.518	14.84	0.0030	0.168	
Jul-99	13.6	1.240	14.82	0.0055	0.309	
Aug-99	12.0	1.149	13.11	0.0020	0.099	
Sep-99	12.9	0.891	13.77	0.0044	0.229	
Oct-99	13.9	0.713	14.65	0.0020	0.111	
Nov-99	13.2	0.368	13.60	0.0065	0.335	
Dec-99	13.9		13.89	0.0030	0.158	
Jan-00	17.3		17.31	0.0055	0.360	
Feb-00	22.5		22.48	0.0035	0.298	
Mar-00	19.1		19.07	0.0045	0.325	<b>0.249</b>
Apr-00	13.8		13.84	0.0045	0.236	<b>0.235</b>
May-00	12.8		12.77	0.0025	0.121	<b>0.229</b>
Jun-00	11.4		11.39	0.0030	0.129	<b>0.226</b>
Jul-00	15.4		15.36	0.0050	0.291	<b>0.224</b>
Aug-00	12.1		12.05	0.0027	0.123	<b>0.226</b>
Sep-00	11.1	0.492	11.60	0.0035	0.154	<b>0.220</b>
Oct-00	15.3	0.341	15.67	0.0035	0.208	<b>0.228</b>
Nov-00	15.9	0.200	16.09	0.0035	0.213	<b>0.218</b>
Dec-00	14.1	0.123	14.18	0.0040	0.215	<b>0.223</b>
Jan-01	11.6	0.146	11.72	0.0045	0.200	<b>0.209</b>
Feb-01	18.0	0.102	18.07	0.0025	0.171	<b>0.199</b>
Mar-01	18.0	0.058	18.10	0.0020	0.137	<b>0.183</b>
Apr-01	11.4	0.157	11.55	0.0020	0.087	<b>0.171</b>
May-01	15.7	0.496	16.19	0.0050	0.306	<b>0.186</b>
Jun-01	13.3	0.533	13.79	0.0015	0.078	<b>0.182</b>
Jul-01	12.4	0.807	13.19	0.0040	0.200	<b>0.174</b>
Aug-01	9.4	0.846	10.20	0.0045	0.174	<b>0.179</b>
Sep-01	12.2	0.560	12.74	0.0030	0.145	<b>0.178</b>
Oct-01	10.3	0.195	10.52	0.0040	0.159	<b>0.174</b>
Nov-01	14.3	0.085	14.41	0.0040	0.218	<b>0.174</b>
Dec-01	20.7	0.170	20.85	0.0050	0.395	<b>0.189</b>
Jan-02	13.9	0.145	14.03	0.0080	0.425	<b>0.208</b>
Feb-02	12.2	0.069	12.25	0.0050	0.232	<b>0.213</b>
Mar-02	14.6	0.348	14.94	0.0020	0.113	<b>0.211</b>
<b>Count, n</b>						<b>25</b>
<b>Maximum Moving Average value, g/d</b>						<b>0.249</b>
<b>Maximum Moving Average Mass, kg/mo</b>						<b>0.008</b>
<b>Average Moving Average Mass, g/d</b>						<b>0.204</b>
<b>Standard Deviation Moving Average Mass</b>						<b>0.023</b>
<b>Ave + 3SD, g/d</b>						<b>0.275</b>
<b>Ave + 3SD, kg/mo</b>						<b>0.008</b>
<b>Mercury Mass Emission Limit =</b>						<b>0.008 kg/month</b>

**Notes:**

[Hg] is the concentration of mercury in micrograms per liter.

Mass in g/d is the product of Total Flow, mercury concentration and a conversion factor of 3.785.

Mass is converted from g/d to kg/mo by multiplying by (1kg/1000g) and (30.42 d/mo).

Example: 0.268 g/d (kg/1000g)(30.42 d/mo) = 0.008 kg/mo

Table A-2		
City of Sunnyvale Mass Limit Evaluation		
Mass Limit=	0.008 kg/mo	
DL =	0.002 ug/L	
Effluent Flow	Hg conc. needed to calc. mass limit	% above DL of 0.002 ug/L
9.4	0.0074	272
10.3	0.0067	237
11.1	0.0063	213
11.4	0.0061	205
11.4	0.0061	205
11.6	0.0060	200
12.0	0.0058	191
12.1	0.0058	188
12.2	0.0057	185
12.2	0.0057	185
12.4	0.0056	181
12.8	0.0054	172
12.9	0.0054	170
13.2	0.0053	163
13.3	0.0052	162
13.3	0.0052	161
13.5	0.0052	158
13.6	0.0051	156
13.8	0.0050	151
13.9	0.0050	150
13.9	0.0050	150
13.9	0.0050	149
14.1	0.0049	147
14.3	0.0049	143
14.6	0.0048	138
15.3	0.0045	127
15.4	0.0045	126
15.7	0.0044	122
15.9	0.0044	119
16.2	0.0043	115
17.3	0.0040	101
18.0	0.0039	93
18.0	0.0039	93
19.1	0.0036	82
20.7	0.0034	68
22.5	0.0031	55

**Table A-3**  
**Sunnyvale Effluent Mercury Data April 1999 - March 2002**

DATE	Mercury Conc (mg/L)	Monthly Average	
		mg/L	ug/L
04/09/99	0.000004		
04/23/99	0.000009	0.0000065	0.0065
05/07/99	0.000004		
05/21/99	0.000003	0.0000035	0.0035
06/04/99	0.000003	0.000003	0.003
07/09/99	0.000005		
07/23/99	0.000006	0.0000055	0.0055
08/02/99	0.000002	0.000002	0.002
09/01/99	0.000009		
09/16/99	0.000002		
09/20/99	0.000007		
09/23/99	0.000003		
09/24/99	0.000001	0.0000044	0.0044
10/11/99	0.000002		
10/15/99	0.000002	0.000002	0.002
11/04/99	0.000007		
11/23/99	0.000006	0.0000065	0.0065
12/03/99	0.000003	0.000003	0.003
01/11/00	0.000006		
01/25/00	0.000005	0.0000055	0.0055
02/09/00	0.000004		
02/24/00	0.000003	0.0000035	0.0035
03/08/00	0.000005		
03/26/00	0.000004	0.0000045	0.0045
04/13/00	0.000005		
04/18/00	0.000004	0.0000045	0.0045
05/11/00	0.000003		
05/25/00	< 0.000002	0.0000025	0.0025
06/14/00	0.000004		
06/27/00	< 0.000002	0.000003	0.003
07/18/00	0.000003		
07/25/00	0.000007	0.000005	0.005
08/08/00	0.000002		
08/15/00	0.000003		
08/29/00	0.000003	0.0000027	0.0027
09/20/00	0.000003		
09/26/00	0.000004	0.0000035	0.0035
10/12/00	0.000004		
10/25/00	0.000003	0.0000035	0.0035
11/05/00	0.000003		
11/20/00	0.000004	0.0000035	0.0035
12/13/00	0.000002		
12/19/00	0.000006	0.000004	0.004
01/09/01	0.000006		
01/15/01	0.000003	0.0000045	0.0045
02/14/01	0.000002		
02/22/01	0.000003	0.0000025	0.0025
03/05/01	0.000002		

DATE	Mercury Conc (mg/L)	Monthly Average	
		mg/L	ug/L
03/12/01	0.000002	0.000002	0.002
04/02/01	0.000003		
04/24/01	0.000001	0.000002	0.002
05/01/01	0.000001		
05/14/01	0.000009	0.000005	0.005
06/07/01	0.000001		
06/26/01	0.000002	0.0000015	0.0015
07/11/01	0.000002		
07/17/01	0.000006	0.000004	0.004
08/07/01	0.000002		
08/23/01	0.000007	0.0000045	0.0045
09/05/01	0.000002		
09/20/01	0.000004	0.000003	0.003
10/03/01	< 0.000002		
10/23/01	0.000006	0.000004	0.004
11/13/01	0.000004	0.000004	0.004
12/04/01	0.000005	0.000005	0.005
01/10/02	< 0.000008	0.000008	0.008
02/08/02	0.000005	0.000005	0.005
03/07/02	0.000002	0.000002	0.002
<hr/>			
# values	68		36
minimum	0.000001		0.0015
maximum	0.000009		0.008
average	0.0000039		0.0039
standard dev.	0.0000020		0.0015

F:\SU32\SU32-29\RPA\effluent limits\[SU Effluent Limits.xls]Hg conc

**Figure A-1**  
**Moving Average Effluent Mass**

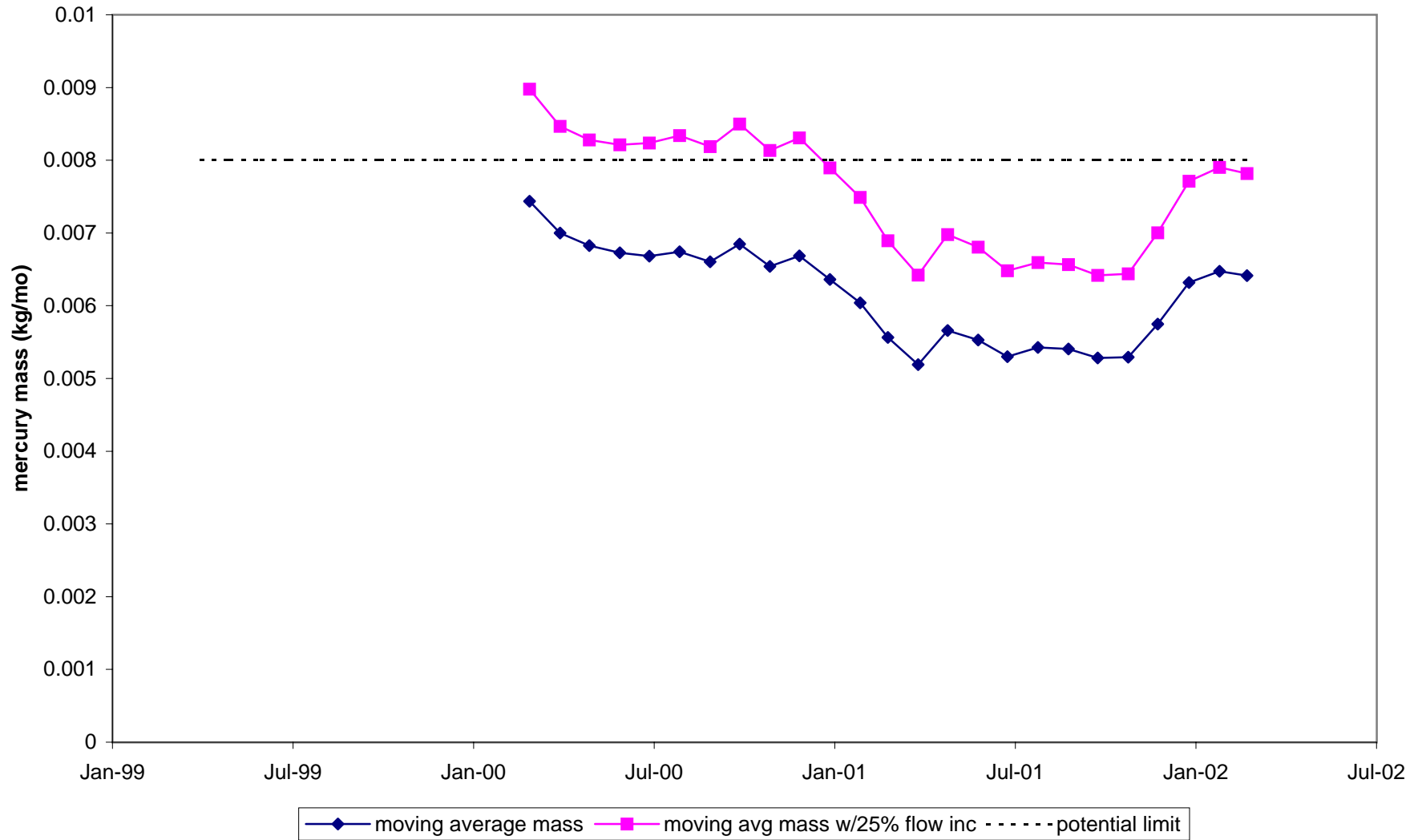


Figure A-2  
Effluent Flow vs Effluent Mercury Concentration

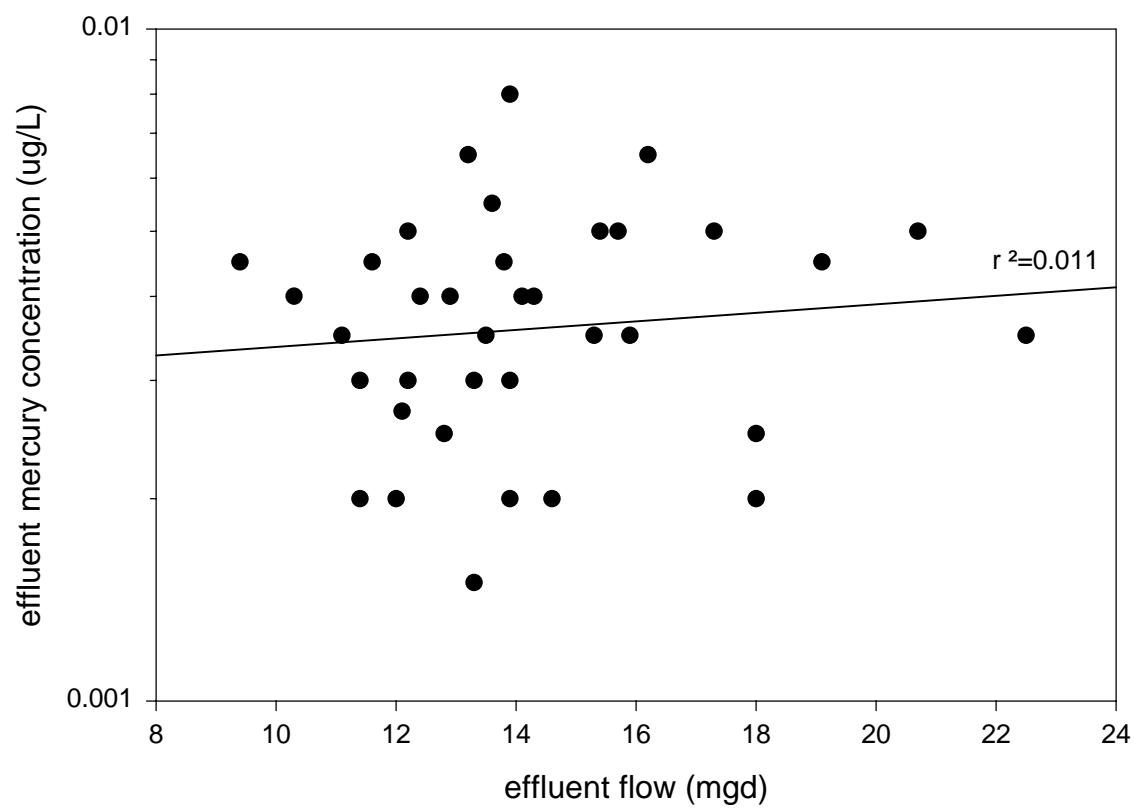
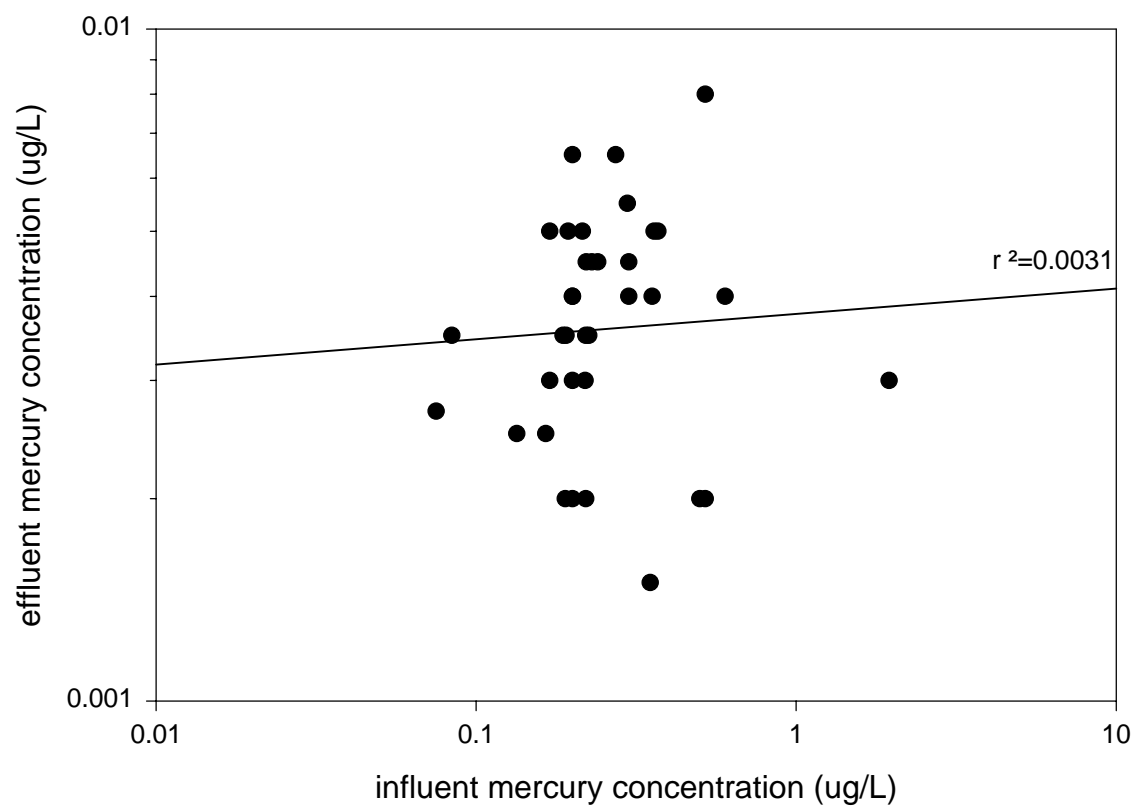


Figure A-3  
Influent Mercury Concentration vs Effluent Mercury Concentration



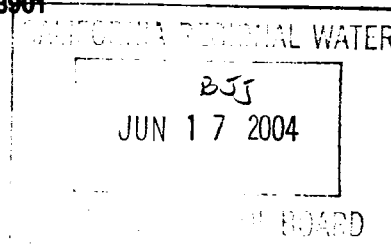


**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

**REGION IX**

**75 Hawthorne Street**

**San Francisco, CA 94105-3901**



Mr. Bruce Wolfe  
Executive Officer  
San Francisco Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Dear Mr. Wolfe:

Thank you for the opportunity to review and comment on the document entitled, "Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report," dated April 30, 2004. We reviewed the proposed TMDLs and implementation provisions in the staff report and proposed amendment to determine whether they are consistent with applicable federal regulations concerning TMDLs and NPDES permitting. This letter provides our comments.

We appreciate the Regional Board's hard work to develop the report and proposed amendment. We are pleased to see changes from the previous draft document, and believe the changes enhance the document's scientific basis and reasonableness. For example, the fish tissue numeric target of 0.2 mg/kg will be evaluated using striped bass whose current average concentration is at 0.36 mg/kg; and more and newer data were used to recalculate the waste load allocations for municipal wastewater and industrial dischargers.

However, we are concerned that in their current form, the TMDLs do not appear to meet all federal TMDL requirements. In addition, although we will not be approving or disapproving the implementation provisions for the TMDLs, we are concerned that the proposed implementation provisions addressing NPDES-permitted sources do not appear to be fully consistent with federal permitting requirements. It may be possible for the Regional Board to address some of these concerns by more clearly explaining the proposed decision and its analytical basis; however, some changes in the TMDL and implementation provisions appear to be necessary to ensure full compliance with federal regulatory requirements, as discussed below.

**Concerns About TMDL Provisions**

**1. Compliance with Numeric Water Quality Standards.** Section 303(d) of the Clean Water Act requires that TMDLs be "established at a level necessary to implement the applicable water quality standards." EPA's regulations at 40 CFR 130.7(c) state that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality



standards.” The staff report and proposed amendment do not sufficiently demonstrate that the TMDLs will result in attainment of all applicable water quality standards. The Basin Plan numeric water quality objectives for mercury in Table 3-1 indicate that the 0.025 ug/l objective applies as a 4-day average, based on EPA’s “Ambient Water Quality Criteria for Mercury” (EPA, 1984). The EPA guidance upon which this objective is based assumes that the 0.025 ug/l concentration is not to be exceeded more frequently than once every three years as a 4-day average (EPA, 1984, p. 23). The TMDL document does not demonstrate how the numeric Basin Plan objective of 0.025 ug/l as a 4-day average would be attained throughout the affected Bay segments.

**2. Individual Waste Load Allocations.** We are pleased that the proposed Basin Plan amendment appears to include individual waste load allocations (WLAs) for municipal wastewater dischargers, industrial non-refinery dischargers, refinery dischargers and municipal storm water dischargers. Please clarify in the Basin Plan amendment that these individual waste load allocations are being adopted. Inclusion of individual WLAs is a necessary component of a TMDL under 40 CFR 130.2(h), and we emphasize that individual WLAs must remain in the final Basin Plan amendment. We do not consider the inclusion of group WLAs in addition to the individual WLAs to be a barrier to approval of the TMDLs. We do, however, have serious concerns regarding how the Regional Board intends to implement the individual WLAs, which we discuss below under “Concerns About NPDES Permitting Provisions.”

**3. Apparent Allowance for Growth in Industrial Point Source Dischargers.** We understand the Board intends to limit waste load allocations for municipal and industrial wastewater dischargers to current performance levels. EPA supports this approach and believes this is essential since the TMDL document does not demonstrate that increased load can be assimilated.

With regard to refinery and industrial non-refinery dischargers, however, we are concerned that the allocations have been calculated at too high a level as a result of undue rounding. The recalculated refinery current performance level, 0.64 kg/year, was rounded to 1.0 kg/year, and the recalculated industrial non-refinery current performance level, 0.41 kg/year, was also rounded to 1.0 kg/year. The total of the two categories of non-municipal wastewater dischargers, prior to rounding, is 1.05 kg/year; we do not believe that rounding each of the categories to 1.0 kg/year for a total of 2 kg/year for both is necessary or reasonable. We recommend individual WLAs totaling no more than 1.1 kg/year for both categories combined.

Additionally, we reviewed the Board’s responsiveness summary in which the Board discussed several comments submitted by other commenters. In a response to the Waterkeeper’s comments, the Board stated that “Individual (discharger) loads can increase so long as the increase is consistent with the assumptions underlying the TMDL.” We request that the Board clarify the assumptions and requirements associated with the TMDLs and individual WLAs so that it is clear what specific environmental or discharge conditions would need to exist in order for the load from any individual discharge to increase.

The individual and group WLAs can be changed only through formal modifications adopted by the State and approved by EPA. Our expectation is that both the individual and group WLAs will be met.

### **Concerns About NPDES Permitting Provisions**

Although when EPA takes action on the TMDLs, we will not be approving or disapproving the implementation measures, we would like to bring to your attention in summary form, elements of the implementation measures in the proposed Basin Plan amendment with which we are especially concerned. These include:

**1. Absence of Individual Water Quality-Based Effluent Limitations.** It appears that permits will only include a grouped water quality-based effluent limitation (WQBEL), narrative requirements and triggers. Individual water quality-based permit limits are necessary, and if not included, the absence of individual WQBELs would be the basis of an objection to the proposed permit. Individual WQBELs must be enforceable, as discussed below.

NPDES permits must have enforceable WQBELs which ensure attainment of water quality standards. 40 CFR 122.44(d)(1), 122.41(a). WQBELs must be established for each discharge point covered by the permit. 40 CFR 122.45(a). Under 40 CFR 122.44(d)(1)(vii), these effluent limits must comply with all applicable water quality standards and must be consistent with the assumptions and requirements of the individual WLAs in the TMDL. We are concerned with the following language in the staff report, p. 74 (and similar language regarding industrial dischargers): “We propose to implement the total WLA as a group mass limit equivalent to the sum of the individual WLAs... If the annual load exceeds the group mass limit, we will consider enforcement against those facilities that exceeded their individual allocation.” EPA does not object to including a group WQBEL in the permits, as long as the permits also include individual WQBELs consistent with the individual WLAs in the TMDL document. In terms of enforcement, EPA would not object to a two-tier WQBEL enforcement provision under which individual dischargers were deemed to be in compliance with their permit as long as the group limit was met – provided that individual limits are in fact enforceable when the group limit is, if ever, exceeded. We see the Regional Board’s statement that it “will consider” enforcement if the group limit is exceeded as an articulation by the Regional Board of its own enforcement discretion, and we emphasize that this must not be intended or construed as a bar to the enforcement of the individual limits at that time by others, including EPA. We look forward to discussing and working with you on specific watershed permit language concerning this important issue.

**2. Storm Water Provisions.** The Regional Board is commended for establishing numeric WLAs for the urban storm water management agencies, and for setting load reduction targets associated with each of the WLAs. The Regional Board has also set a 20-year time frame for attainment of the WLAs with an interim group loading milestone of 120 kg/year to be attained in 10 years. EPA believes these provisions are consistent with the Clean Water Act and the time

frames appear to be reasonable. EPA does, however, have the following two concerns: EPA believes that allowing, as one of the alternatives for measuring compliance with the WLAs, the use of five-year rolling averages is not consistent with the NPDES regulations. This is discussed further below. The second concern is that the basin plan amendment indicates that only narrative requirements will be included in the implementing NPDES permits, but there is no information showing that these narrative requirements will lead to compliance with the WLAs. The narrative requirements include monitoring, conducting various studies and to "develop and implement mercury source control program." The Regional Board, however, has not identified best management practices (BMPs) nor made a showing the BMPs specified in the amendment are sufficient to implement the WLAs. In implementing numeric WLAs for municipal storm water sources, the Regional Board has the choice of establishing a numeric WQBEL or narrative BMP-based WQBEL. However, if the latter approach is chosen, the permit must show that the BMPs are expected to be sufficient to implement the WLA, and included in the fact sheet and administrative record for the permit. The alternative would be for the Regional Board to make such showing in this basin plan amendment, rather than in each adopted permit.

**3. Averaging Period for Municipal, Industrial and Storm Water Dischargers.** We are pleased to see that the proposed averaging period for compliance with the municipal and industrial wastewater WLAs has been changed from five years to one year. The averaging period for storm water dischargers, however, must be similarly changed from five to one year, as federal permitting regulations at 40 CFR 122.45(d) require compliance with limits based on monthly, daily, and weekly time frames, unless impracticable. There is no discussion in the staff report or proposed Basin Plan amendment of why it might be impracticable to use a shorter, more protective averaging period. There is also no discussion as to how such an averaging period will ensure compliance with the WLAs nor the effect of shorter term spikes that this longer averaging period may allow.

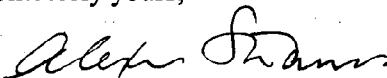
It is also unclear how the one-year averaging period will be assessed. The proposed annual permit limits may be appropriate so long as the permit contains a method for determining compliance with the annual limit. When expressing an effluent limit as an annual value, EPA recommends that the permit provide the ability to assess compliance at interim dates. Permit compliance is regularly determined on a monthly basis, and Discharge Monitoring Reports are prepared and submitted on a monthly basis. We recommend that the Board add specific language to assess compliance on a monthly (or weekly or daily) basis. We would be happy to work with you to develop appropriate language for use in a watershed permit for mercury.

**4. Pollution Prevention Language.** The staff report and proposed Basin Plan amendment indicates that permits will require dischargers to "Develop and implement effective mercury source control programs to minimize significant mercury sources (the level of effort will be commensurate with the discharge volume of the facility)." EPA believes that source control measures are cost-effective means for point sources to limit the discharge of mercury. EPA strongly recommends that all NPDES dischargers be required to implement all feasible source control measures for mercury, regardless of whether the source is "significant" (as you may

define it) or if the facility is a large-volume discharger. In this regard, we recommend the following language, "Develop and implement all feasible and effective mercury source control programs to minimize environmental contamination with mercury." Other areas can be similarly strengthened. We look forward to working with the Board on this and other specific pollution prevention language for the watershed permit for mercury.

In closing, we again commend your staff for their hard work on this particularly difficult project. We are committed to working with you to identify TMDL and implementation approaches that address our shared goals of accomplishing reductions of mercury levels in the Bay while ensuring that legal requirements are met. If you have any questions concerning these comments, please call me at (415) 972-3572 or refer staff to Diane Fleck at (415) 972-3480.

Sincerely yours,



Alexis Strauss  
Director  
Water Division

14 June 2007

**From:** <Smith.DavidW@epamail.epa.gov>  
**To:** <tem@rb2.swrcb.ca.gov>  
**Date:** 7/13/04 10:57AM  
**Subject:** Feedback on Remaining Issues Related to Hg TMDL

Dear Tom:

Thanks very much for meeting with us to discuss the San Francisco Bay mercury TMDL. I am writing to tie up a couple of loose ends concerning topics we discussed.

First, we had discussed the potential inclusion of pollutant trading-type language in the draft watershed permit (par. 8, Adjustment of Individual Mass Limitations). As you will recall, we discussed how that language might relate to the establishment of individual WLAs in the TMDL. Because permit limits need to be consistent with WLAs, changes in the individual mass limits in the permits would not be permissible absent changes in the individual WLAs in the TMDL, and, as we mentioned, any change in WLAs must be done through formal modification of the TMDL. We did mention the possibility that provisions could potentially be included in the TMDL to provide for WLA adjustments following TMDL approval (in order to minimize the workload burden of future basin plan amendments). We said that we would consider whether that might be workable in this instance.

We have carefully reviewed the EPA trading policy and noted EPA's position regarding trading of bioaccumulative toxins such as mercury. The policy states that "EPA does not currently support the trading of pollutants considered by EPA to be persistent bioaccumulative toxics (PBTs)." In light of this pretty unequivocal language, we would recommend against attempting to provide for post-approval adjustments of WLAs in the mercury TMDLs to accommodate trading of mercury discharges. The trading policy also states that "EPA would consider a limited number of pilot projects over the next two to three years to obtain more information regarding trading of PBTs....." (p. 4). As you know, the Sacramento mercury offsets project is underway to help develop this type of information. Perhaps this project will provide useful information to consider in crafting watershed permit provisions and evaluating whether the TMDLs and associated WLAs should be revised in the future.

In addition, you are aware of our concern that there is uncertainty regarding the state of knowledge concerning potential localized levels and effects of mercury in the Bay environment. Given this uncertainty, it probably makes most sense to carefully consider the overall effects of any future revision in the mercury WLAs in the context of the future scheduled overall reviews of the TMDLs that the Regional Board proposes to conduct.

Second, we mentioned that we have some questions and observations concerning the treatment of mercury associated with Bay dredging operations. Here is a brief summary of our questions and concerns, which we would suggest that you review as you consider potential

revisions to the draft TMDL:

1. It appears that the treatment of dredged deposits in the Hg TMDL is not consistent with treatment of dredged deposits in the PCB TMDL. The PCB TMDL sets the allocation for dredged deposits based on dredge spoil volumes projected in the LTMS and the sediment targets set by the TMDL analysis, an approach that appears to be more protective than the approach proposed in the mercury TMDL. The mercury TMDL appears to set a concentration based allocation based on undefined "ambient" concentration. We recommend that you consider whether the mercury TMDL and dredged material allocations should be modified to reflect the more protective approach proposed in the PCB TMDLs.
2. The PCB TMDL analysis properly raises the concern that that disposal of dredged material is likely to spread the previously buried sediments and may result in increased availability of the pollutant. This possibility should also be addressed in the mercury TMDL.
3. It is unclear what "ambient concentration" means in the mercury TMDL. This concept, if retained, should be more carefully defined in the TMDL documents so that it can be implemented effectively in the future.
4. It is unclear whether the treatment of the dredged deposits in the mercury TMDL is consistent with the LTMS.
5. The mercury TMDL appears to allow deposit of dredged material in concentrations greater than the TMDL's numeric sediment target. Why is this permissible and protective? How does this approach ensure that no adverse localized effects will occur in the future as a result of deposition of dredged materials containing mercury concentrations greater than the numeric target?
6. The proposed concentration-based allocation approach may not meet TMDL requirements because this source is not included in the formal TMDL load or wasteload allocations. Under EPA regulations, the TMDL (loading capacity) is the sum of the allocations. This source should be explicitly included in the allocations.
7. Treatment of dredged deposits in the Hg TMDL is not consistent with treatment of air deposition in the same TMDL (where the source is given a mass-based allocation and is included in the TMDL equation, even though evaporation is greater than deposition). Is this difference in approaches reasonable?

We would be happy to further discuss these issues and questions at your convenience if you wish. Thanks again for meeting with us and working to address our remaining concerns.

Best regards,

David Smith  
TMDL Team Leader

P.S. I had on my schedule a call this AM with you, Ken and Tom H. at 10, but nobody was on the line when I called in. Did I miss something here?

CC: <Fleck.Diane@epamail.epa.gov>, <Leith.Suzette@epamail.epa.gov>, <Eberhardt.Doug@epamail.epa.gov>, <Yoshikawa.Nancy@epamail.epa.gov>, <Oda.Terry@epamail.epa.gov>

**From:** "Alexander Wood" <awood@usgs.gov>  
**To:** <bjj@rb2.swrcb.ca.gov>, <rel@rb2.swrcb.ca.gov>  
**Date:** Wed, May 26, 2004 2:01 PM  
**Subject:** Correction to SF MErcury TMDL Report

Hello Bill and Richard,

I had a quick correction to the SF Mercury TMDL report. The reference to the CRWQB 2003 is incorrect. The title of the report by A.Wood, which is myself, is actually: "Cost Data for the Economic Analysis of the Sacramento-San Joaquin Delta Estuary Mercury TMDL". If you could make the correction, that would be great.

Thanks.

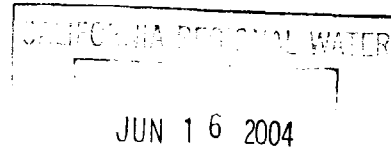
Regards,  
-Alex Wood

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Alexander Wood  
Center for Science Policy (CSP)  
Western Geographic Science Center (WGSC)  
U.S. Geological Survey (USGS)  
345 Middlefield Rd. MS-531  
Menlo Park, CA 94025  
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June 14, 2004

**Re: Comments On "Mercury in San Francisco Bay TMDL," Proposed Basin Plan Amendment and Staff Report (April 30, 2004).**

### **General Approach**

#### **Mass Budget Single Box Model**

It is not appropriate to use a single box model for such a complex hydrodynamic environment as San Francisco Bay to allocate loads. SF Bay may be characterized as two systems: a river delta-estuarine mixing zone in the North Bay (Suisun Bay, Carquinez Strait, and San Pablo Bay) and a tidally oscillating lagoon in the South Bay, with different sediment transport and mercury loads (Conomos, 1979). For example, in the TMDL Report, erosion of bed sediment in the North Bay and loads from the Central Valley comprise 900 kg/year or 74% of the total mercury input to the Bay.

While there is some exchange between the two systems, by treating the Bay as one system, the TMDL's analysis of and assumptions regarding of the assimilative capacity of the system and its response to loads, gives equal weight throughout the Bay to inputs to the North Bay that may only slightly affect the South Bay. Thus, it assumes loads from the North Bay are directly available to the ecology of the South Bay when in fact much of the sediment is released to the Pacific Ocean before it can be transported to the South Bay. A more realistic model of the Bay is needed both to set TMDL targets and to develop an effective implementation program.

#### **Assimilative Capacity and Linkage Analysis Not Adequate**

The TMDL Report assimilative capacity analysis is overly simplified and not adequate to justify expending large amounts of resources on removal of total mercury from discharges to the Bay. Background levels and site-specific properties in the Bay receiving water environment need to be taken into account using a realistic Bay Model when determining assimilative capacity and setting load allocations. Further, allocations should reflect achievable levels that account for the influence of historical activities, sources, the technical and economic feasibility of control, and the influence of downstream processes on production of methyl mercury.

#### **Estimated Loss through the Golden Gate**

The TMDL's estimate of mercury loss through the Golden Gate (the largest sediment and mercury sink) was developed by estimating inputs, assuming a mass balance in Bay sediment and assuming that the flux across the Golden Gate would be the difference between sources and the mass balance. The sediment flux was then multiplied by the average mercury concentration in suspended sediment for the entire Bay.



This approach is problematic for two reasons. The other sediment inputs are poorly known and understood. Accordingly, there can be little confidence in an estimate of sediment loss calculated by using the difference between those assumed inputs and the levels in the Bay.

In addition, the TMDL uses Bay-wide average suspended sediment mercury concentrations to represent the flux of sediment across the Golden Gate, although several of the Regional Monitoring Program stations are located in the Central Bay. The Report authors justify this by indicating, "sediment is assumed to come from all over the Bay." However, geochemical processes occur during sediment transport to the Golden Gate that may affect the concentration of mercury on the sediment. Therefore, a better method of obtaining an approximation of the volume of mercury moving through the Golden Gate would be to use mercury concentrations on suspended sediment near the Golden Gate.

#### **Sediment Discharges from Local Tributaries**

The report presents estimates of sediment discharges from local tributaries (urban and non-urban loads) based on data collected by the USGS from 1909 to 1966 (USGS 1980). These loads may not reflect the current loads of sediment discharging to the Bay due to changes in land use and percent imperviousness that have occurred in the Bay Area since the monitoring period 1906-1966.

In a recent study and publication (McKee, L., Leatherbarrow, J., Eads, R., and Freeman, L., 2004) staff from the San Francisco Estuary Institute (SFEI) and USGS collected detailed turbidity and suspended sediment and mercury data in the Guadalupe Watershed. The suspended sediment data indicated that since 1957-1962 (following completion of the reservoirs), the sediment concentrations in the Guadalupe River Watershed have decreased by approximately 15%. It is likely that changes in the sediment concentrations have been even greater in the period since the data collection period used to develop the sediment loads in the TMDL report (1906-1960).

#### **Mercury Discharges from Local Tributaries**

The TMDL Report developed estimates of mercury discharges from local watersheds by relying on samples of benthic sediment collected in local tributaries at the mouths and upland locations and multiplying the tributary sediment load estimates (USGS 1980) by the average concentration in benthic sediment collected from urban and non-urban locations. This calculation assumes that the concentration in the suspended sediment that is actually transported to the Bay is the same as in benthic sediment that was deposited in upland creek locations. The accuracy of this assumption is questionable and should be verified. In addition, if the urban sediment load estimated by USGS in 1980 is inflated in relation to that reflected in current conditions, due to urbanization, the urban tributary mercury load will also be inflated over actual values.

The TMDL report uses benthic sediment data collected between 1980 and 1989 to estimate the load of mercury from the Guadalupe watershed. Accordingly, sediment and mercury loads from the Guadalupe

watershed presented in the report would not reflect the results of remediation activities conducted in Almaden Quicksilver County Park in the late 1990's, which removed over 100,000 cubic yds of calcine deposits located along the waterways surrounding the Park. Even more recent sampling might not reflect those improvements, since sediment transport processes and reservoir operations can slow the delivery of sediment to the lower watershed stations where monitoring data are collected.

#### **Target for Mercury in Bay Suspended Sediment**

Control of total mercury in suspended sediment discharged to San Francisco Bay may not result in reductions in methylmercury concentrations in fish and prey in the Bay. Production and accumulation of methylmercury in the food chain through bacterial methylation and demethylation of mercury is a complex and poorly understood process that appears to be a function of several competing parameters. However, it is understood that bacterial methylation requires that mercury be soluble, i.e., pass through the cell membrane to be acted upon by intracellular enzymes (. If suspended sediment mercury is not soluble, then it cannot be bacterially methylated. Control of total mercury may not result in improvements to the Bay if the mercury removed is not bioavailable or not discharged to a methylating environment. In fact, remedial activities addressing reductions in total mercury loads, as contemplated by the proposed TMDL, could result in releases or dissolution of formerly sequestered mercury increasing the load of bioavailable mercury to the Bay. Thus, setting a suspended sediment target based on the assumption that mercury in suspended sediment is directly proportional to mercury in fish and bird eggs could result in misspent public resources if processes that control the production and accumulation of methylmercury are not taken into account in assessing the relative merit of implementation activities.

The reference that the TMDL Report provides as evidence of a direct relationship between suspended sediment total mercury and methylmercury concentrations in fish tissue does not support the hypothesis that control of total mercury in suspended sediment will result in decreases in methylmercury in fish tissue (USGS 2003). The USGS report indicates benthic sediment methylmercury concentrations are related to benthic sediment total mercury concentrations in the Everglades, when total mercury concentrations are less than 1 ppm. Suspended sediment in San Francisco Bay is in a much different biogeochemical environment than the benthic sediment in a wetland, which was the focus of the referenced study. Further, the USGS report does not provide evidence for the linkage between sediment methylmercury concentrations and mercury concentrations in fish tissues.

Respectfully submitted:

Terrence D. Cooke  
Senior Project Chemist  
URS Corporation

URS Corporation  
1333 Broadway  
Oakland, CA 94612

**REFERENCES**

Conomos, T.J. 1979. "Properties and Circulation of the San Francisco Bay Waters." In *San Francisco Bay: The Urbanized Estuary*, T.J. Conomos (ed.), pp. 47-84. Pacific Division of the American Association for the Advancement of Science, San Francisco.

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McKee, 2004. McKee, L., Leatherbarrow, J., Eads, R., and Freeman, L., 2004. Concentrations and loads of PCBs, OC pesticides, and mercury associated with suspended sediments in the lower Guadalupe River, San Jose, California. A Technical Report of the Regional Watershed Program: SFEI Contribution #86. San Francisco Estuary Institute, Oakland, CA, Draft Report Jan 2004.



Oakland, CA 94612



**Western States Petroleum Association**  
Credible Solutions • Responsive Service • Since 1907

Kevin Buchan  
Environmental Coordinator

June 14, 2004

Thomas Mumley  
Planning & TMDLs Division Chief  
California Regional Water Quality Control Board, San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

RE: WSPA Comments on the Proposed Basin Plan Amendments to  
Incorporate the Mercury TMDL

Mr. Mumley,

The Western States Petroleum Association (WSPA) is a non-profit trade association representing a full spectrum of companies which explore for, produce, refine, transport, and market petroleum products in the six western states.

We offer the comments below on the proposed Basin Plan amendment (BPA). These comments are preliminary and may be augmented by additional comments at a later time due to the continued development of the TMDL and its associated wasteload allocations.

#### **Wasteload Allocation for Industrial Dischargers**

We are concerned about the proposed wasteload allocation (WLA) for the industrial discharger group. The mercury loading contribution by the refiners is insignificant as shown the TMDL. At this time, it is not clear to our members how the proposed aggregate WLA may impact or limit their ability to produce and deliver petroleum fuel products to meet the current and future demand of the California marketplace. As the gap between increasing demand and limited supply widens, both our members and the California Energy Commission are concerned. As a result, we are in the process of developing mercury WLAs for the refiners that we will propose as changes to those found in the Basin Plan amendment. When completed, we will contact you and make arrangements to present our aggregate WLA.

### **Study Requirements**

The requirements and conditions for the refiners as proposed in Appendix A of the BPA seem rather onerous considering that their mercury loading in aggregate is insignificant. We have previously expressed our concerns during public workshops and other meetings on these issues. We believe these requirements are excessive and warrant further discussion between the RWQCB and the refiners. We will be in contact with you to make arrangements for those discussions.

We appreciate the opportunity to provide these comments and look forward to collaborating with you and your staff as the BPA moves forward.

Sincerely,

s/Kevin Buchan  
(sent via email)