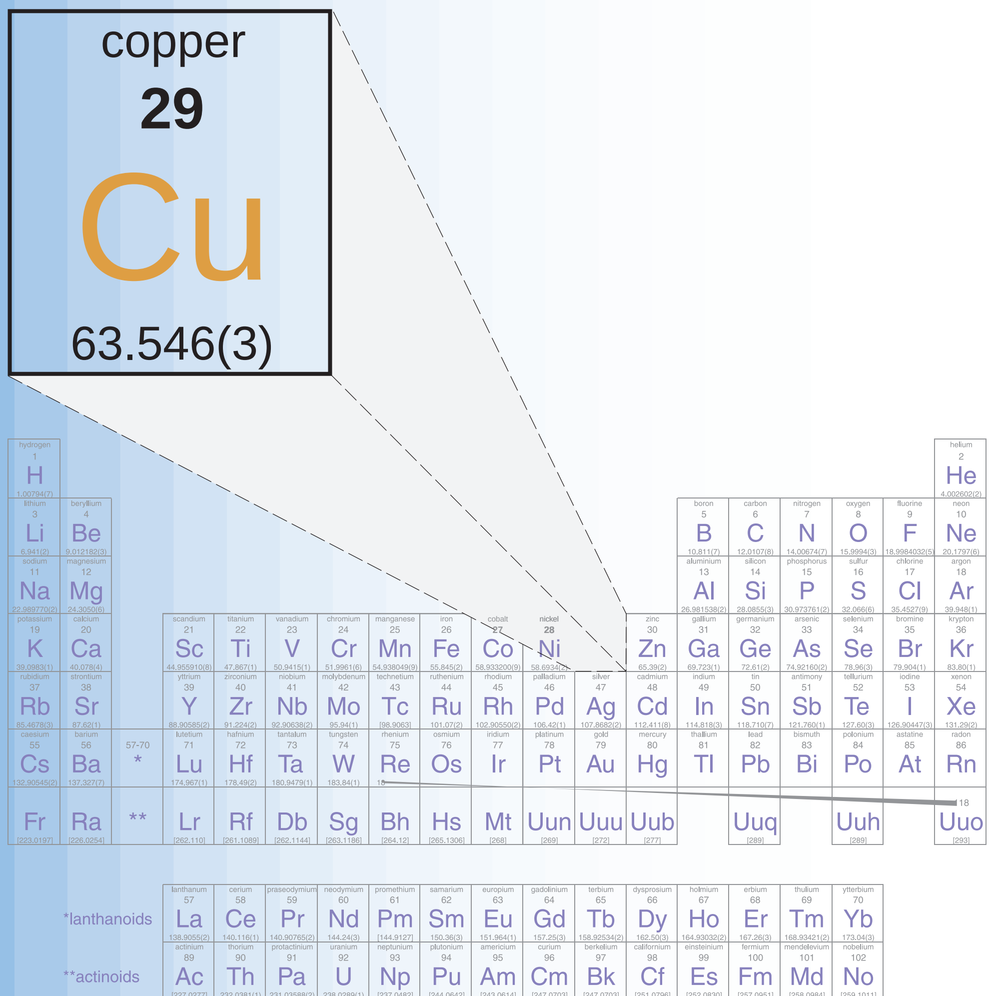
TASK 10
COPPER ACTION PLAN



Final Report - June 2000
(Revised February 2001)

Prepared by

TETRA TECH, INC.

ROSS & ASSOCIATES
ENVIRONMENTAL CONSULTING, LTD.

EOA, Inc.

Sponsored by

CITY OF SAN JOSE
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ADDENDUM

A principal feature of the Copper Action Plan (CAP) is the identification of specific actions that will be taken to ensure that existing water quality is maintained, beneficial uses are protected, and exceedances of the site-specific water quality objectives for copper do not occur in Lower South San Francisco Bay. At the time the final report was completed (June 2000), the TMDL Work Group unanimously agreed that the CAP should be moved forward to the Bay Monitoring and Modeling/Regulatory Subgroup (BMM/RS) of the Santa Clara Basin Watershed Management Initiative for further development of these actions. The final revisions to these actions were made by the BMM/RS by August 23, 2000, and the results are presented in Tables 4-1, 4-2 and 4-3 of this document.

The California Regional Water Quality Control Board, San Francisco Bay Region incorporated these specific actions into the Waste Discharge Requirements issued to the Cities of San Jose, Sunnyvale, and the Palo Alto on October 18, 2000. A copy of the order amending the Waste Discharge Requirements is included as Appendix 3 of this revised document.

1.0 BACKGROUND AND ASSUMPTIONS

In January 1998, the *Calculation of Total Maximum Daily Loads (TMDL) for Copper and Nickel Project* was initiated by the San Francisco Regional Water Quality Control Board with funding from the City of San Jose. The TMDL project is being carried out through the TMDL Work Group (TWG) using a stakeholder process operating as part of the Santa Clara Basin Watershed Management Initiative's Bay Monitoring and Modeling Subgroup.

The initial step in the TMDL process was the assessment of whether designated beneficial uses are being protected and whether applicable water quality objectives are being attained and, if they are not, the site specific objectives (SSO) that must be achieved to protect the beneficial uses. The key findings of the TWG's Impairment Assessment Report[1] are:

- Impairment to the beneficial uses of the Lower South San Francisco Bay (LSSFB) due to ambient concentrations of copper and nickel is unlikely

- The current state of scientific knowledge is sufficient to establish a SSO for dissolved copper in the range of 5 to 12 ug/L

The purpose of the Copper Action Plan (CAP) is to serve as a non-degradation plan to ensure that 1) existing water quality is maintained, 2) beneficial uses are protected, and 3) exceedances of the site-specific water quality objectives for copper do not occur in the LSSFB.

Significant reductions to pollutant loading have been accomplished through the improved treatment technologies implemented at wastewater treatment facilities, industrial pre-treatment programs, basinwide pollution prevention efforts, and actions taken by urban stormwater programs. For example, between 1980 and 1989, the amount of copper entering the Palo Alto Water Quality Control Plant decreased from 35,000 lbs/yr to approximately 4,000 lbs/yr. During this same period, the copper discharged in the plant's effluent declined by an even larger factor from about 9,500 lbs/yr to 382 lbs/yr due to improved treatment operation and technology (Peters, 2000). In addition, between 1982 and 1999, the amount of copper entering the City of Sunnyvale's Water Pollution Control Plant decreased from 36, 354 lbs/yr to approximately 1800 lbs/yr. During this same period, the copper discharged in the plant's effluent declined from approximately 3300 lbs/yr to less than 200 lbs/yr (Goebel, 2000).

The objective of the CAP is to 1) identify the current control measures/actions being used to minimize copper releases to the bay, 2) identify "triggers" that would initiate additional measures/actions, and to set forth a proactive framework for addressing increases to future copper concentrations in LSSFB, if they occur.

[1] "Task 2. Impairment Assessment Report for Copper and Nickel for South San Francisco Bay". January 2000. Tetra Tech, Inc., EOA, Inc., Ross & Associates.

Elements of the Copper Action Plan

There are four elements to the Copper Action Plan:

1. **Definition and Approach.** This section outlines the purpose of the Copper Action Plan, describes the approach for tracking changes in environmental concentrations of copper, and implementation plan.

2. **Description of Ambient Conditions and Copper Sources.** Section 2 provides a summary of existing knowledge on copper concentrations in LSSFB as well as information on loadings. This section contains the technical basis for predicting changes in ambient concentrations of copper resulting from changes in source loading (i.e., background, point sources, tributaries, and internal cycling).

3. **Recommended Indicators, Triggers for Actions, and Monitoring Options.** Section 3 evaluates possible indicators and recommends triggers, future indicators, and monitoring activities that together form the basis for implementation of actions contained in Section 4.

4. **Identification of a Set of Actions and a Plan for Implementation.** Section 4 sets forth 1) existing baseline activities, 2) phased activities to be taken in the event that environmental conditions trigger these phases.

Definition and Approach

There are two parts to the Copper Action Plan. The first part describes the Copper Action Plan implementation steps. The second part describes the CAP update process.

Copper Action Plan Implementation Steps. Seven steps have been identified for the implementation of the Copper Action Plan (Figure 1):

Step 1. The first step is the creation of the Copper Action Plan (this document). A summary of actions already underway, action items necessary to address uncertainty, and additional action items that can be taken if warranted are described in Section 4 of this plan. They are also assigned a priority level that determines under what conditions and the order in which actions will be undertaken:

- **Baseline Actions:** These actions (see Table 4-1) include 1) programmatic actions by public agencies, 2) tracking special studies that address specific technical areas of uncertainty identified in the Impairment Assessment Report and the Copper Conceptual Model Report, 3) planning-type studies to track, evaluate, and/or develop additional indicators to use and future potential indicators and triggers (i.e., indicators for growth, development, or increased use or discharge of copper in the watershed).

- **Phase I Action:** Phase I Actions (see Table 4-2) are implemented when the value of selected monitoring parameters exceeds specified criterion values (referred to as the Phase I Trigger Levels as described in Section 3). The exceedance of Phase I Trigger Levels indicates a negative trend in water quality, not actual impairment. Phase I Actions consist of both specific remedial actions and the planning for the implementation of further actions if Phase II Trigger Levels are exceeded. Phase I Actions will fulfill the requirements and demonstrate consistency with existing anti-degradation policy.

- **Phase II Action:** Phase II Actions (see Table 4-3) are implemented when the value of selected monitoring parameters exceeds a second-level criterion value (referred to as the Phase II Trigger Levels as described in Section 3). These actions are intended to reduce controllable sources further to maintain compliance with site-specific water quality objectives.

Step 2. Two fundamental components of the Copper Action Plan are monitoring and pollution prevention actions. Two types of monitoring are included: ambient water quality monitoring and source monitoring. The water quality monitoring component is intended to provide a baseline to ascertain changes in water quality, to reduce uncertainties regarding copper concentrations in the LSSFB and its tributaries, to provide adequate information for future impairment assessments, and to provide a sound scientific basis for future regulatory actions. The purpose of the source monitoring is to better identify the sources of copper to LSSFB and to ascertain changes in these sources. Existing pollution prevention source control programs will continue as part of baseline actions.

Step 3. The Executive Officer and staff of the Regional Water Quality Control Board working in conjunction with NPDES permittees will review the monitoring program results annually and determine whether the trigger values have been exceeded. The Executive Officer will report findings to the Regional Board and will notify interested agencies and interested persons of these findings and will provide them with an opportunity for a public hearing and/or an opportunity to submit their written views and recommendations. The Executive Officer and staff of the Regional Board are strongly encouraged to utilize the collaborative, stakeholder process embodied in the Santa Clara Valley Watershed Management Initiative in the review process.

Step 4. If the trigger values for ambient copper concentrations, or other indicators subsequently developed, have not been exceeded, the monitoring program will continue to provide information for the next review period. Performance of the monitoring program will be evaluated during the annual review to determine if the necessary information is being provided. If ambient concentrations exceed Phase I trigger levels, the process proceeds to Step 5.

Step 5. If Phase I trigger levels are exceeded, affected parties, as directed by the RWQCB will develop work plans and implement Phase I actions and begin planning for Phase II actions.

Step 6. If ambient concentrations do not exceed the Phase II Trigger Levels, the monitoring will continue while the action items identified in Step 5 are being implemented. If the ambient concentrations exceed Phase II Trigger Levels the process proceeds to Step 7.

Step 7. If Phase II Trigger Levels are exceeded additional control measures must be adopted to further reduce copper loading and reverse trends in ambient copper concentrations. The Regional Board will notify affected parties of the necessary changes in their annual work plans and permits. If the Phase II action items involve organizations that are not subject to a water quality permit program the Regional Board will enter into an educational and negotiation process with the potentially affected parties for the purpose of implementing Phase II action items.

Copper Action Plan - Update Cycle. The CAP must be updated to incorporate lessons learned from action items that have been implemented and scientific and technical information from other sources. The CAP update process is described below and illustrated in Figure 2. The update process makes use where possible of existing processes and forums. The process is based on the procedures developed for the WMI's Copper/Nickel TMDL Workgroup. The update of this plan can be completed as part of the regular review of conditions in LSSFB at the time NPDES permits are reissued. The CAP would be updated every five years if the NPDES schedule is adopted. The update process would begin 360 days prior to NPDES permit reissuance for the SCVURWD program and 180 days prior to NPDES permit reissuance for POTWs so that the updated results could be incorporated into the reissued permits. It is important to note that if revisions are needed prior to the five-year update the Regional Board can amend the CAP through permitees annual work plans or other regulatory actions.

The updated CAP will be evaluated within the context of the technical products used to develop it, including the TMDL loading analysis, conceptual model, and impairment assessment. The Regional Board is strongly encouraged to utilize the collaborative, stakeholder process in the CAP update process.

1. The CAP will be reviewed every five years as part of the NPDES permitting process.

2. The review will be based on an examination of the TWG reports for the Copper and Nickel TMDL Project and the CAP. The purpose is to evaluate and refine the findings of these documents for ongoing modification of the recommended actions. The uncertainties of the loading analysis, conceptual model, and impairment assessment will be reviewed as additional monitoring and scientific studies become available for LSSFB. CAP control measures will be evaluated using criteria which include effectiveness, cost, and uncertainty as more experience is gained from regional and national application of existing and proposed control measures.

3. Information for the review will come from the dischargers through their monitoring programs and other information gathering requirements of their NPDES permits, and from other public sources such as the WMI.

4. An information clearinghouse will be identified for organizing and maintaining the accumulated information. The information clearinghouse set up by the Initiative to support it's Watershed Action Plan will be considered to fulfill this function.

5. The review will be conducted using a collaborative stakeholder process. A workgroup similar to the Copper/Nickel TMDL Work Group should be formed to undertake the five-year CAP update. Like the TMDL Workgroup it would be a temporary assignment lasting only the length of time necessary to develop recommendations for RWQCB consideration. The CAP Work Group would be charged by the Initiative to evaluate the compiled information. The review will be based on the TMDL technical reports. The purpose of the review is to incorporate the latest scientific and technical information to continue to reduce uncertainties identified in the TMDL technical reports. The five-year CAP update process ensures that triggers and indicators are consistent with the latest scientific understanding available for LSSFB.

   The five-year CAP update will also review the phase priority assigned to each copper loading control measure. The purpose of the phase priority is to assign each control measure (i.e., action item) to a trigger value that will determine when either planning or implementation will proceed for that measure. The phased priorities are adjusted by the workgroup based on the latest information available on the effectiveness, cost, and uncertainties associated with each control measure.

   The workgroup consensus recommendations on the TMDL technical reports, trigger levels, and action item priorities will be forwarded to the RWQCB for their consideration and action (e.g., modification of NPDES permits and or the Basin Plan).

6. The RWQCB will evaluate the CAP Work Group recommendations for revisions of the CAP that would then be incorporated into NPDES permits and the Basin Plan.

7. Affected parties would then implement the CAP control measures. Revisions to control measures may include the modification or elimination of existing control measures that have proven to be ineffective in reducing copper loading or not cost-effective. Also, new control measures may be added to those that are already in existence.

The updated CAP would include an optimized set of control measures to be implemented for baseline water quality maintenance, Phase I action items, and Phase II action items. This edition of the CAP assigns a priority to each of the control measures included in the initial review (Section 4).

Definitions Used in the Copper Action Plan

Adaptive Management Process - Adaptive management is a systematic approach to improving management by implementing policies experimentally, learning the outcomes of management interventions, and documenting the results (Taylor et al. 1997). It isn't simply changing management policies when they don't work. Rather, it is a planned approach to reliably learn why management actions or strategies (or critical components of them) succeed or fail.

Cost: One of three criteria used to evaluate CAP control measures and to determine phase priority status. Cost evaluation is based on both the overall control measure cost and the cost per unit reduction in copper loading to LSSFB.

Effective: One of three criteria used to evaluate CAP control measures and to determine phase priority status. Effectiveness is based on the ability of a control measure to make significant reductions in copper loading to LSSFB. Significant reduction is one that when combined with other control measures would lead to a measurable reduction in dissolved copper concentrations in LSSFB.

Indicator–a measurable quantity that is so strongly associated with particular environmental conditions that the value of the measurable quantity can be used to indicate the existence and maintenance of these conditions.

Trigger–the numerical value of the indicator that initiates a defined intervention or action.

Lower South San Francisco Bay (LSSFB)–that portion of the bay south of the Dumbarton Bridge.

Baseline Action: Copper source loading control measures that are already in place or will be initiated now as directed by permit requirements or pollution prevention policies.

Phase I Action: These actions are described in the CAP and are taken when the first trigger level is exceeded. These actions are designed to stop any further increase in ambient copper concentrations. Phase I actions generally have lower costs and less uncertainty that Phase II actions. Implementation planning for Phase II actions begins when the first trigger level is exceeded.

Phase II Action: These actions are described in the CAP and are taken when the second trigger level is exceeded. These actions are designed to reduce ambient concentrations of copper in LSSFB (i.e., return to baseline). Implementation planning for Phase II actions begins when Phase I Action levels are exceeded.

POTWs–publicly owned treatment works (wastewater treatment facilities) owned by the Cities of San Jose/Santa Clara, Sunnyvale, and Palo Alto.

Uncertainty: One of three criteria used to evaluate CAP control measures and to determine phase priority status. Uncertainty refers to lack of knowledge about specific factors, parameters, or models used in the decision-making process.

Urban Stormwater Program–Santa Clara Valley Urban Runoff Pollution Prevention Program.

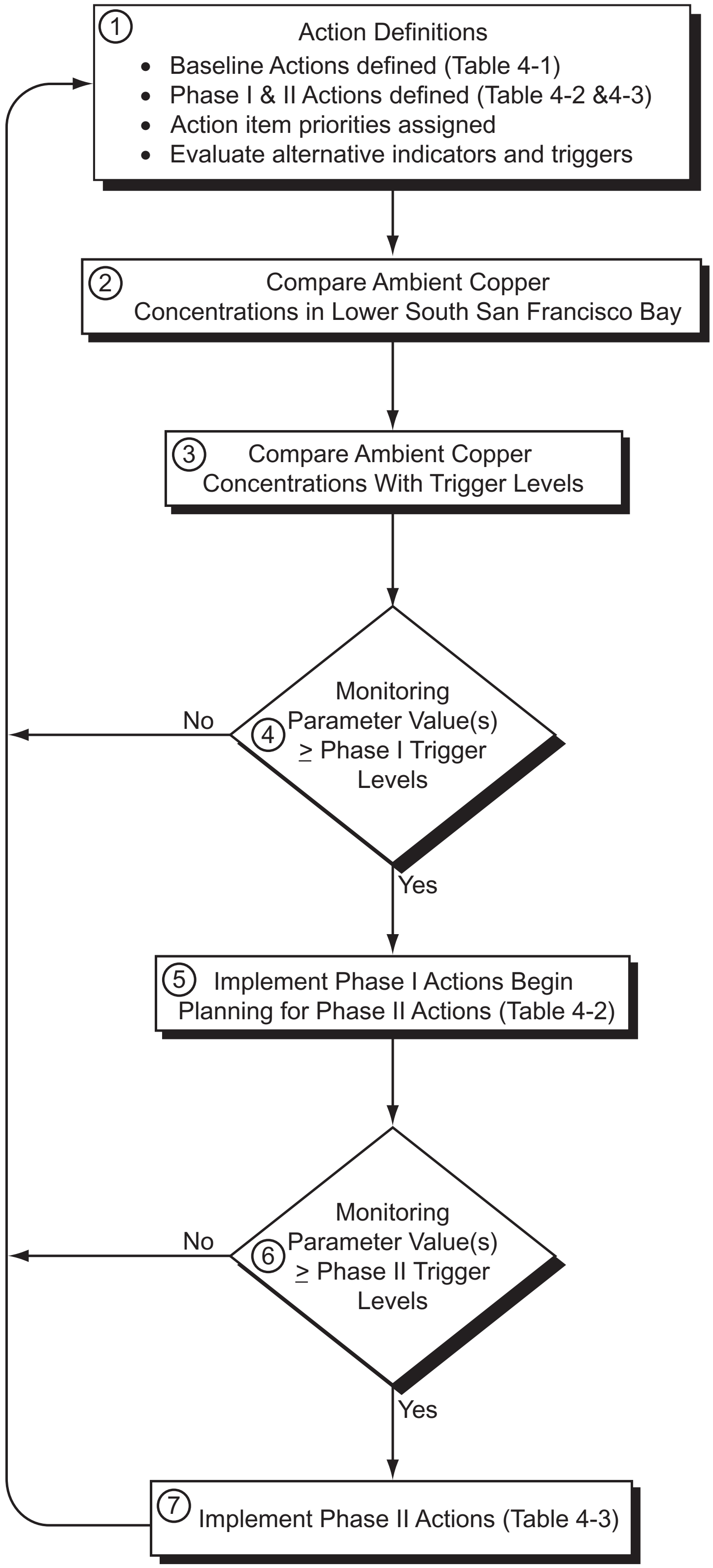


Figure 1-1. Implementation of the Copper Action Plan Annual Cycle.

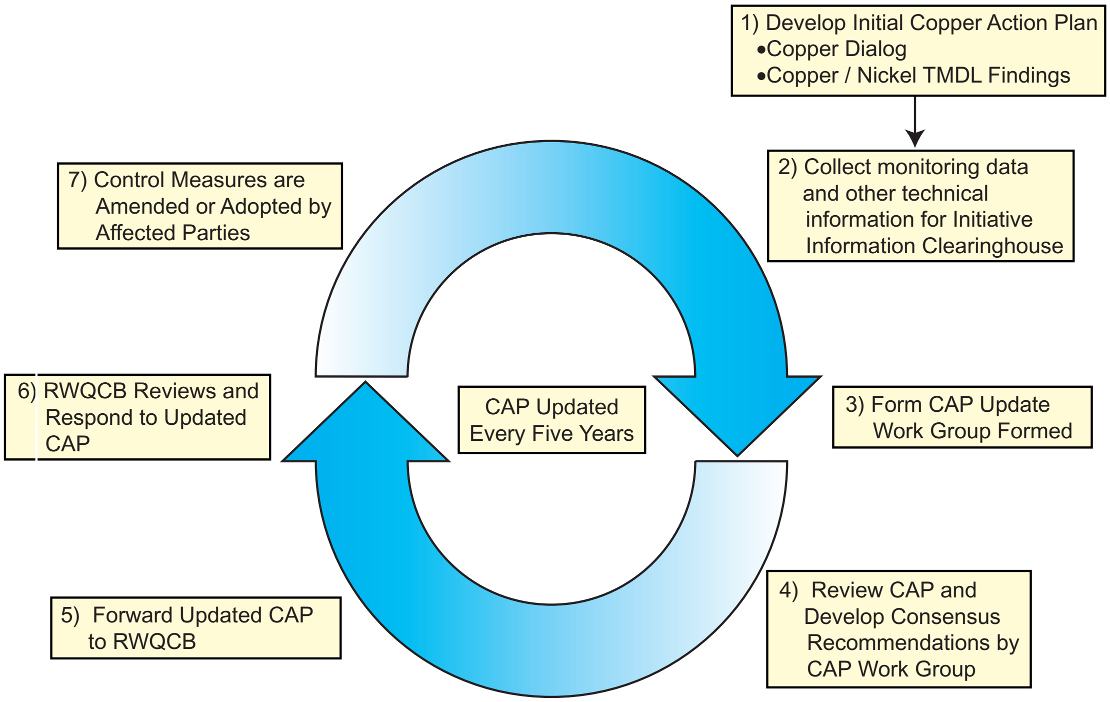


Figure 1-2. Copper Action Plan Adaptive Management Process.

2.0 DESCRIPTION OF AMBIENT CONDITIONS AND COPPER SOURCES

The analyses presented in this section summarize existing knowledge of the relative importance of individual copper sources to Lower South San Francisco Bay. The estimates focus on current loading rates from the watershed, since present day loading rates are different from those in the past. For example, over 20 years ago, POTWs contributed approximately 30,000 kg/yr of copper to Lower South San Francisco Bay. Today, the POTWs contribute 1100 kg/yr, about three percent of the loadings 20 years ago. This section of the CAP also includes estimates of changes in ambient dissolved copper concentrations for various inputs from POTWs and urban runoff. The results were obtained using a mass balance model. Finally, the relationship between growth measures (e.g., population in Santa Clara County, registered automobiles in Santa Clara County, automobile miles traveled, etc.) and estimated loading is discussed. The ability to use growth measures as "leading indicators"/environmental sentinels is also discussed.

2.1 Copper Sources to Lower South San Francisco Bay

Table 2-1 summarizes estimated loading rates of copper into Lower South San Francisco Bay. Estimates are provided from the Metals Control Measures Plan (Woodward-Clyde et al, 1996) and from the Conceptual Model Report (Tetra Tech, 1999). For simplicity, the table does not detail the components of the source loads, such as brake pad contributions in runoff from tributaries. Also shown are several supplemental estimates that have been generated as part of the Copper Action Plan development. Generally speaking, the supplemental loading estimates are similar to or less than previous historical estimates. More detail on how those estimates were made is provided below. The Metals Control Measures Plan provides estimates on an annual basis only, and it does not consider the estimates of sources from the bay's deposited sediments or from the atmosphere.

The largest total copper load originates from within the bay itself as particulate copper from the sediment bed. It should be noted that this load has not been directly measured, but has been estimated using a mass-balance model described in the Conceptual Model Report, and thus it is subject to a large uncertainty.

The supplemental loading estimates shown in Table 2-1 use recently collected data to provide comparisons with previous estimates. Thus, those estimates serve primarily as a crosschecking tool. The supplemental estimates were made as follows:

- Total and dissolved loads from tributaries were made using copper concentration data collected at SB12 on the Guadalupe River by the City of San Jose from 1997-1999, and flow data at the USGS gauging station on the Guadalupe River near San Jose. These estimates were scaled up to the entire watershed using the loading ratio (0.311, Guadalupe River watershed loading to total watershed loading) generated from the loading estimates in the Copper Source Characterization Report (URS Greiner Woodward-Clyde and Tetra Tech, 1998). The Guadalupe River results are shown in

Table 2-1
Summary of Estimated Total and Dissolved Copper Loading to the Lower South San Francisco Bay

Total Copper Loadings						
		Conceptual Model Report Estimates (Tetra Tech, 1999)				
Copper Source	**Metals Control Measures Plan Estimates (Woodward-Clyde et al 1996), kg/yr**	**Dry Season, kg/dry-season**	**Wet Season, kg/wet-season**	**Annual, kg/yr**	**Supplemental Estimates**	**References**
POTWs	1117	500	700	1200	1051 kg/yr (calendar year 1998)	Source Characterization Report (1998)
Tributaries	2900	160	3600	3760	For water years (Oct 1 - Sept 30) 1998 and 1999: 360-390 kg/dry-season; 610-2840 kg/wet-season; 970-3230 kg/year	Copper data from SB12, Guadalupe River near San Jose; Flow data from USGS gage Guadalupe River
Atmospheric deposition	–	60	60	120	14 kg/dry-season (Aug 31-Dec 22, 1999) 20 kg/wet-season (Sept 14-Dec21, 1999)	SF Bay Atmospheric Deposition Pilot Study
Diffuse flux from sediments in Bay	–	110	110	220	–	
Net particulate flux from sediments in Bay	–	6300-7100	5200-5900	11500-13000	–	
Internal Cycling within water column	–	0	0	0	–	

Table 2-1 (continued)
Summary of Estimated Total and Dissolved Copper Loading to the Lower South San Francisco Bay

Copper Source	Metals Control Measures Plan Estimates (Woodward-Clyde et al 1996), kg/yr	Conceptual Model Report Estimates (Tetra Tech, 1999): Dry Season, kg/dry-season	Conceptual Model Report Estimates (Tetra Tech, 1999): Wet Season, kg/wet-season	Conceptual Model Report Estimates (Tetra Tech, 1999): Annual, kg/yr	Supplemental Estimates	References
Dissolved Copper Loadings						
POTWs	–	400	560	960	90 percent or greater may actually be dissolved	Personal communication with Dave Tucker
Tributaries	–	130	360	490	For water years (Oct 1 - Sept 30) 1998 and 1999: 40-64 kg/dry-season; 100-700 kg/wet-season; 140-764 kg/year	Copper data from SB12, Guadalupe River near San Jose; Flow data from USGS gage Guadalupe River
Atmospheric deposition	–	0	0	0	–	
Diffusive flux from sediments in Bay	–	110	110	220	–	
Net particulate flux from sediments in Bay	–	0	0	0	–	
Internal cycling within water column	–	540	-400	140	–	

Note:
– = no estimate

Figure 2-1, and the inset shows the loads estimated from the data. The concentrations used for the analyses are shown in Figure 2-2. The average flow between samples was used to generate fluxes.

- Atmospheric deposition estimates were made based on data provided by the San Francisco Bay Atmospheric Deposition Pilot Study, and collected from August to December 1999. The data provided were extrapolated to make estimates for Lower South San Francisco Bay by considering the surface area of the Lower South Bay, and the time period of the dry and wet seasons (assumed to be one-half year each). During the wet season the total atmospheric loading was assumed to be the sum of dry and wet deposition. During the dry season, only dry deposition was assumed to contribute. These supplemental estimates are about one-third of those provided in the Conceptual Model Report.

Table 2-1 also summarizes dissolved copper loading sources. In contrast to the total loads, the dissolved loads do not originate from a single dominating source. Estimates of internal dissolved copper cycling are provided in the table, and that flux is the same order of magnitude as the largest external dissolved sources during the dry season. The estimate of the internal source was made using the same mass balance approach described in the Conceptual Model Report, and is subject to uncertainty. Since copper loads are much lower than they were 20 years ago (see Section 1 for details) the large estimated bed particulate flux may actually be from copper that entered the system years ago and deposited in the bed with the sediments, or from precipitated copper, since no known sources today are large enough to explain the magnitude of this source.

The most recent data for copper loadings from POTWs are summarized in Figure 2-3 and detailed in Table 2-2, which also shows discharge, copper concentrations, and flow rates during both wet and dry periods. These data indicate that the contribution from the POTWs has remained relatively constant during the period 1994 – 1999. Wet season loads are typically higher than the dry season loads.

2.2 Copper Mass Balance Analyses in Lower South San Francisco Bay

A copper mass-balance model to support the development and implementation of the Copper Action Plan within the Lower South San Francisco Bay has been developed and is demonstrated below. Capabilities and limitations of the model are described in the table included in Appendix 1. Also included in the table are comparisons with two other models of increasing sophistication. The model used here is very simplistic and does not simulate copper cycling processes. The model can be used to estimate how changing the copper loading from any particular source would influence both dissolved and total water column copper concentrations. However, the model is no better than the loading data provided, and as discussed above, uncertainties exist with respect to some of the larger copper loads. The response of the Lower South Bay to changes in the external loads appears to be small, as shown below. Thus, loads could either increase or decrease and if concentration responses are small, such loading changes could go undetected.

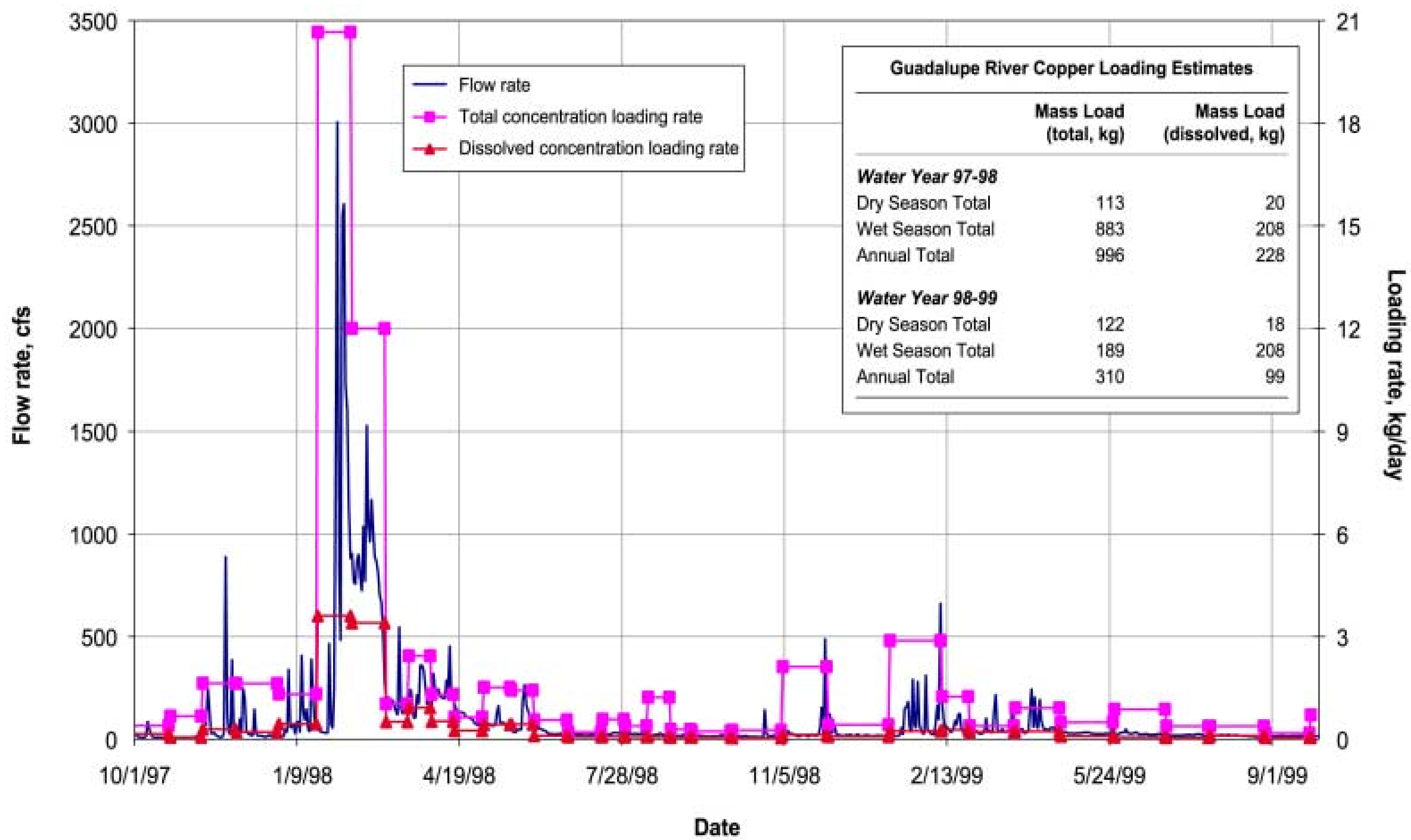


Figure 2-1. Flowrates and copper loading estimates, Guadalupe River near San Jose.

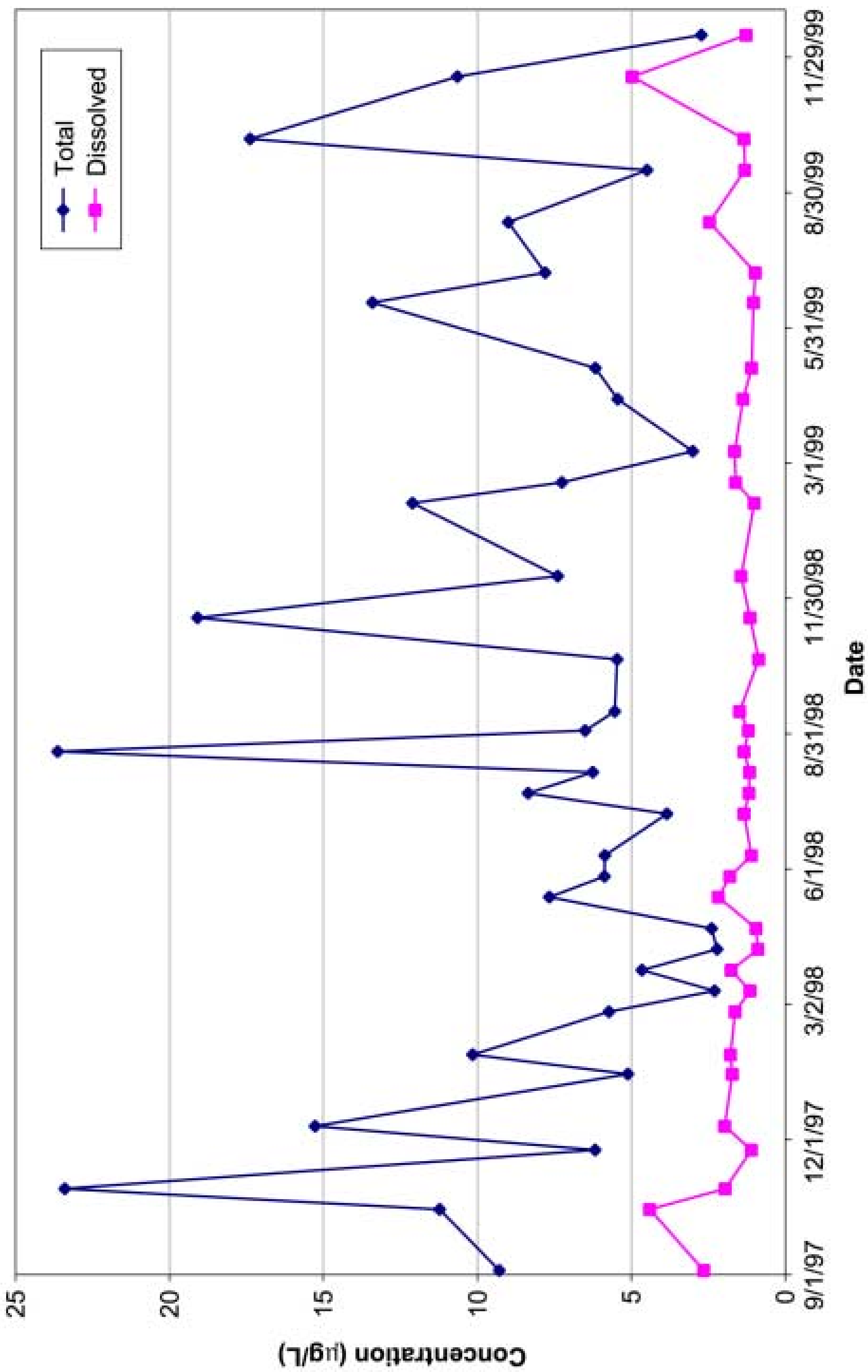


Figure 2-2. Copper concentrations in the Guadalupe River near San Jose.

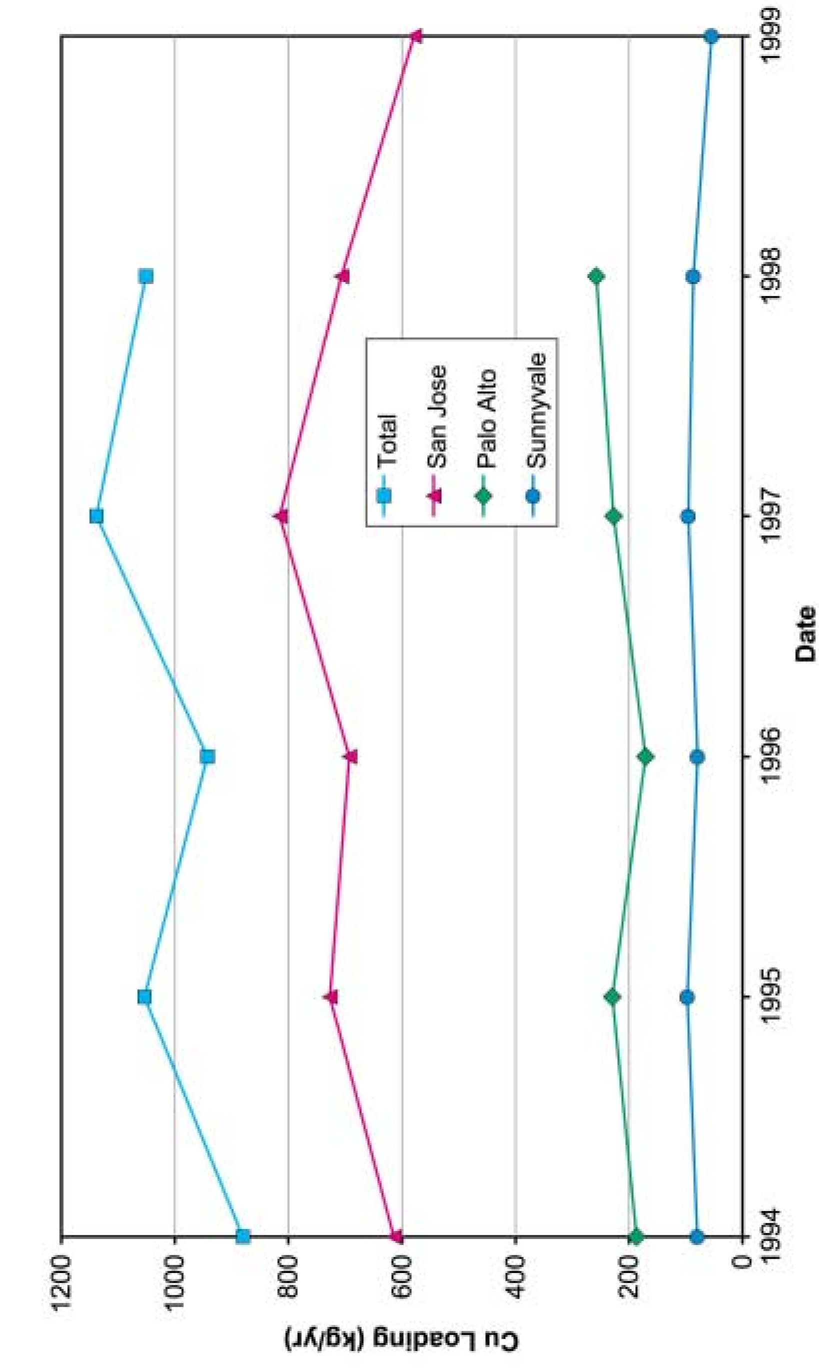


Figure 2-3. Annual copper loadings from POTWs.

Table 2-2

Copper Loading Estimates From POTWs, 1994-1999

	Average Flow, MGD					
	SJ		PA		S	
Year	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
1993-94 (Wet); 1994 (Dry)	105.29	106.46	21.78	22.28	13.26	11.54
1994-95 (Wet); 1995 (Dry)	123.51	123.48	26.00	24.47	16.65	12.58
1995-96 (Wet); 1996 (Dry)	131.87	130.56	27.01	24.55	16.30	14.01
1996-97 (Wet); 1997 (Dry)	132.43	121.90	28.15	24.22	17.62	14.50
1997-98 (Wet); 1998 (Dry)	148.13	127.52	31.25	27.40	19.90	15.49
1998-99 (Wet); 1999 (Dry)	115.12	109.90	no data	no data	16.42	13.15
	Average Copper, ug/L					
	SJ		PA		S	
Year	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
1993-94 (Wet); 1994 (Dry)	4.64	3.76	6.00	6.29	4.94	4.39
1994-95 (Wet); 1995 (Dry)	4.59	3.90	6.88	6.26	5.64	3.68
1995-96 (Wet); 1996 (Dry)	4.65	3.01	4.43	5.16	4.28	3.13
1996-97 (Wet); 1997 (Dry)	5.30	3.81	5.82	6.81	4.94	3.69
1997-98 (Wet); 1998 (Dry)	4.44	2.77	6.17	6.64	4.19	2.57
1998-99 (Wet); 1999 (Dry)	no data	no data	no data	no data	3.54	1.50
	Average Loading, kg/dry-wet season					
	SJ		PA		S	
Year	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
1993-94 (Wet); 1994 (Dry)	337.81	276.31	89.73	97.09	44.95	34.60
1994-95 (Wet); 1995 (Dry)	394.46	332.69	124.39	105.21	66.69	30.54
1995-96 (Wet); 1996 (Dry)	422.02	270.84	82.99	87.68	48.32	31.09
1996-97 (Wet); 1997 (Dry)	494.06	321.62	113.43	113.62	59.16	36.46
1997-98 (Wet); 1998 (Dry)	460.49	246.19	132.46	125.02	59.46	27.41
1998-99 (Wet); 1999 (Dry)	333.39	245.39	no data	no data	40.59	13.85

Copper Mass Balance Model and Example Application

The copper mass balance model uses information on measured water column copper concentrations, loads of copper to the Lower South San Francisco Bay, and system geographic information to predict copper fluxes into and out of Lower South San Francisco Bay, including exchange with the bed, and fluxes past the Dumbarton Bridge. The model is based on mass balance principles, and assumes that the total and dissolved loadings (both internal and external) are balanced by the net loss past the Dumbarton Bridge. The most important information needed to implement this model are loading rates and flushing time estimates. Loading rates have been estimated, as described above, and flushing time estimates for dry weather conditions have been estimated by modeling studies conducted by Stanford University. At present, flushing time estimates for wet weather conditions are not known, and this is a limitation of using the mass balance model with confidence during the wet season. The model can also estimate how each source contributes to the observed concentration in the water column. An example is shown in Table 2-3 shows an application of the model for the dry season. In that table dissolved and total concentrations contributions are shown by source. These contributions are predicted by the mass balance model.

For dry season conditions, the average dissolved and total concentrations are 3.3 µg/L and 12.3 µg/L, respectively. The contributions by source type are shown, add up to the average dissolved and total concentrations. Note that the largest contribution is from the background source, or the concentration that would exist in the Lower South San Francisco Bay in the absence of the remaining sources shown in Table 2-3.This concentration was estimated originally in the Conceptual Model Report, and is the concentration in the central portion of South San Francisco Bay that is uninfluenced by the loads in the table. The background contribution is the largest contributor to the dissolved concentration of 3.3 µg/L, and the second largest contributor to the total concentration (the copper from resuspended sediments is the largest contributor).

Note especially the predicted copper concentrations from the POTWs and the tributaries. Relative to the observed concentrations, these contributions are small. This means that the individual contributors to those sources (such as from brake pads, copper pipe corrosion, pesticide use) are even smaller since these individual sources are accounted for by the POTWs and tributaries. Thus, the response of the water column concentrations is expected to be small when those loads change, either increase or decrease, within a fairly large range. To express this in another way, if POTW and tributary sources of copper cease altogether, the dissolved and total concentrations would only change from about 3.3 µg/L and 12.3 µg/L to about 2.6 µg/L (1.8 + 0.14 + 0.7) and 11.5 µg/L (2.2 + 0.02 + 0.14 + 9.1), respectively.

To illustrate that the response of the water column copper concentrations are insensitive to changes in present day loadings, suppose the dissolved loads were increased by 250 kg/dry-season. This is equivalent to half the point source loading. The results are shown in Table 2-4. The concentrations respond by increasing by about 0.2 µg/L. The 0.2 µg/L change would be apportioned over the sources affected as indicated in the table. This analysis assumes the internal cycling rate of dissolved copper remains the same, as in the base case shown previously in Table 2-3. In actuality, it might change to compensate future loading increase, so that the water column response might be slightly different from the 0.2 µg/l shown.

A parallel set of tables is prepared for the wet season (Tables 2-5 and 2-6). The copper concentration contributions shown in Table 2-5 add up to the average dissolved and total concentrations for the wet season. In this case the tributaries contribute more than for the dry season, as expected. Note that the responses of water column concentrations are the same as the dry season. This is because the flushing time is assumed to be the same as in the dry season. In actuality, the flushing times could change during storm events, or approach dry season conditions during protracted dry periods.

An alternative to asking "What is the response of the ambient concentration to a loading increase?" is to ask "For a specified concentration increase, what is the increased load that

Table 2-3
Estimated Contributions of Each Source to Typical Dry Season Dissolved and Total Concentrations in Lower South San Francisco Bay

Source	Dissolved Concentration Contribution, µg/L	Total Concentration Contribution, µg/L
Background	1.8	2.2
POTW	0.51	0.64
Atmospheric	0.00	0.02
Diffusive	0.14	0.14
Tributaries	0.17	0.20
Particulate copper flux from bed	0.00	9.1
Internal cycling	0.70	0.0
AVERAGE	**3.3**	**12.3**

Table 2-4
Response of Dry Season Copper Concentration Contributions to 250 kg increase in Dissolved Source Loadings

Source	Dissolved Concentration Contribution, µg/L		Total Concentration Contribution, µg/L	
Background	1.8		2.2	
POTW	0.51	Plus: Total change = +0.2 (POTW through Tributaries)	0.64	Plus: Total change = +0.2 (POTW through Tributaries)
Atmospheric	0.00		0.02	
Diffusive	0.14		0.14	
Tributaries	0.17		0.20	
Particulate copper flux from bed	0.00		9.1	
Internal cycling	0.70		0.0	
AVERAGE	**3.5**		**12.5**	

Table 2-5
Estimated Contributions of Each Source to Typical Wet Season Dissolved and Total Concentrations in Lower South San Francisco Bay

Source	Dissolved Concentration Contribution, µg/L	Total Concentration Contribution, µg/L
Background	1.6	2.1
POTW	0.71	0.89
Atmospheric	0.00	0.08
Diffusive	0.14	0.14
Tributaries	0.46	4.58
Particulate copper flux from bed	0.00	7.48
Internal cycling	-0.51	0.0
AVERAGE	**2.4**	**15.3**

Table 2-6
Response of Wet Season Copper Concentration Contributions to 250 kg increasein Dissolved Source Loadings

Source	Dissolved Concentration Contribution, µg/L		Total Concentration Contribution, µg/L	
Background	1.6		2.1	
POTW	0.71	Plus: Total change = +0.2 (POTW through Tributaries)	0.89	Plus: Total change = +0.2 (POTW through Tributaries)
Atmospheric	0.00		0.08	
Diffusive	0.14		0.14	
Tributaries	0.46		4.58	
Particulate copper flux from bed	0.00		7.79	
Internal cycling	-0.51		0.0	
AVERAGE	**2.6**		**15.5**	

effects such a change?" An example would be, a 0.8 μg/L concentration increase can be related to a load increase of 650 kg/dry-season, based on the mass-balance model predictions.

2.3 Use of "Leading Indicators" and Other Measures to Show Responses of the Bay to Copper Loading Changes

As discussed in Sections 2.1 and 2.2, the concentration of copper in the Lower South San Francisco Bay is relatively constant from year to year, with some differences noted between dry and wet seasons. Consequently, it is expected that dissolved copper concentrations, under present day conditions are relatively insensitive to changes in loadings, as described previously. Hence, there does not appear to be a simple, straightforward approach that would conclusively be better than all others in relating loading changes to responses in the bay. Rather, three alternatives appear as possible candidates, and could jointly be used together. They are:

- Expanding sampling of upland tributaries to provide updated nonpoint source loading estimates, and

- Using leading indictors to qualitatively or quantitatively estimate loading changes. Use of quantitative estimates could involve watershed modeling. In bay modeling of the response of the Lower South San Francisco Bay to loading changes.

The first alternative is to expand sampling and monitoring efforts to better estimate tributary source loads, and their variability from year to year. (As shown for the Guadalupe River loading estimates provided previously, the variations between the two years 1997-98 and 1998-99 are considerable.) This information would have direct value because tributary source loadings could be directly calculated from the data collected. Eventually it is expected that relationships between subwatershed loadings would be developed, and the sampling program streamlined. Also, this information would be useful in more sophisticated modeling efforts, should the need for such efforts become apparent.

The second approach is to use leading indicators to forewarn of copper loading increases. This could be done either in a qualitative sense or in a quantitative sense. Qualitatively, a group of indicators would be chosen such that directions of loading changes would be known for each indicator. The changes in these indicators would be monitored over time. In a purely qualitative fashion, such changes in the indicators may be of limited use. For example, the locations of changes that would go into the indicators (such as locations of new housing starts) would also be needed. Thus, quantitative relationships would be required in conjunction with the use of indicators. Using a watershed model or subwatershed monitoring data would allow for the quantification of the influence of leading indicators, as well as all other processes that affect runoff within the watershed. The EPA's SWMM model has previously been applied to the watershed, and that work could be used as a starting point for future watershed modeling efforts. Over the past few years since the SWMM model was used, significant advancements in watershed modeling have been made.

Modeling of the bay waters is discussed third as this could be the most complex of the three alternatives (depending on the modeling approach used), and could benefit from the prior implementation of the other two candidate approaches. Modeling is intended to predict how copper concentration changes are related to loading changes, and can also be used to evaluate response times ("how long will it take for concentrations to respond to loading changes?"). Appendix 1 summarizes alternative modeling strategies, with the simplest ranging from the mass balance model previously discussed to a complex numerical model. The biggest drawback to the complex models is that they would require more detailed loading information than is now available and a better understanding of the processes occurring within the bay (such as internal cycling processes and bed-water column exchanges). At the other extreme of modeling is the present copper mass balance model. With some straightforward modifications, this tool could be used in a two-step process. Step one would be to use the model as it now stands. This would be as a calibration mode to provide estimates of internal cycling and net copper flux from the sediment bed. Step two would be to predict the response of the copper water column concentrations to changes in loadings, keeping the internal cycling and bed exchange constant or changing it in some justifiable manner. An example of such an application would be to start at an existing dissolved copper concentration of 3.3 μg/L, as in the previous example. Then reduce the dissolved copper loadings by 250 kg/dry-season. By reapplying the model (step two), the new predicted copper concentration would be 3.1 μg/L if the internal cycling were kept constant.

Based on the above discussion there does not appear to be a single best approach to address the issue of loadings and responses. In the short term, modifying and using the mass balance model is possible and straightforward. However, its predictions depend on the loading information provided it and it is the most simplistic of the three model types compared in Appendix 1. A parallel step could be to develop better nonpoint source loading estimates on a year to year (dry and wet season) basis. In the long term, a watershed model linked with a more process oriented model of the bay could provide a valuable tool for assessing changes in the Lower South Bay in a detailed manner. However, such a tool would require significant amounts of input data not yet available, as well as a long-term effort to set up and verify the model. The use of leading indicators is a straightforward approach to help determine how copper loadings are likely to change, even if such indicators do not make prediction of the actual loads themselves. The development of leading a 'sentinel indicators' is included as a baseline action in Section 4 and should serve to integrate work on indicators being developed for the beneficial use analysis of the WMI.

3.0 RECOMMENDED INDICATORS, TRIGGERS, AND MONITORING OPTIONS

An objective of the Copper Action Plan is to establish an indicator or indicators that can be used to ensure that existing water quality is maintained, beneficial uses are protected, and that exceedances of the copper site specific objective do not occur. The purpose of this section is to provide a basis for using this so called ***'indicator strategy'***. The objective of this strategy is to identify a method or methods that would allow regulators and stakeholders to understand trends in water quality, related to copper in the LSSB. Where such measures or indicators show a trend toward increased copper concentrations, future activities (beyond the Baseline actions described in Section 4, Table 4-1) would be initiated in phases.

One or more of the indicators must have an agreed upon measurable point or level that 'triggers' the next set of actions. These 'Phase I and II actions include additional programs, studies or monitoring identified in Section 4, Tables 4-2 and 4-3.

For an indicator to be a useful in this process it should have the following characteristics:

- Indicator data collection must be relatively cost-efficient and provide a strong certainty of the water quality conditions in the Bay.
- The linkage between the indicator data and the SSO allows a trigger value to be set that is well understood and scientifically accepted.
- The indicator data provides a sound basis for allocating actions to responsible permit holders, i.e., POTWs or urban runoff permittees.
- Three indicators are proposed: 1) dissolved copper concentrations in LSSFB; 2) point source loading of total copper; and 3) total and dissolved copper runoff.

The results of the copper mass balance analyses presented in Section 2 indicate that the copper concentrations in LSSFB are insensitive to changes in point and non-point loading and that the concentrations of both dissolved and total copper will remain relatively constant in the foreseeable future. The proposed monitoring effort is intended to confirm these model predictions and to ensure that copper concentrations do not increase significantly.

Several indicators were discussed during the development of the CAP, but dissolved copper concentrations in the water column was the most quantifiable indicator on non-degradation available to date and was therefore deemed as the most appropriate on to use as a trigger. Tracking the other two selected indicators will provide the ability to see if loading to the system is increasing, remaining relatively constant, or decreasing. Together these three indicators provide the ability to monitor inputs to the system and changes in ambient concentrations.

The selection of these indicators represents a starting point for the CAP. As scientific insight progresses, additional indicators may be identified and incorporated into the monitoring effort. Of particular interest is the development of direct measures of eco-system health and the tracking of so-called leading or sentinel indicators on the composition and magnitude of sources. The efforts to identify and evaluate other indicators are addressed under baseline activities in Section 4.

3.1 Dissolved Copper Concentrations

The measurement of dissolved copper concentrations in LSSFB is proposed as the key monitoring parameter to trigger Phase I and Phase II Actions. The information used to select the proposed monitoring strategy as well as the trigger values associated with the monitoring data are described below.

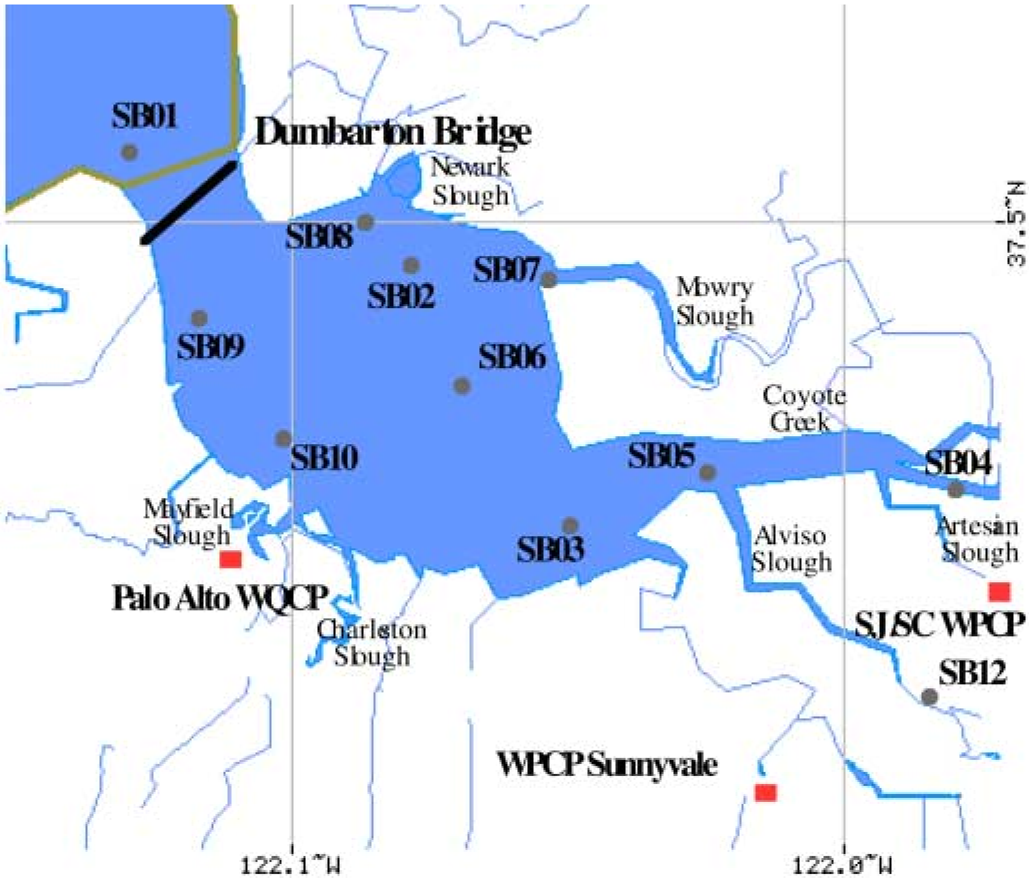
Evaluation of Existing Data

Both total and dissolved copper concentrations have been systematically measured in the LSSFB since 1989. The most recent data from the City of San Jose's South Bay Monitoring Program were used in the evaluation of existing data and as the basis for evaluating the performance of alternative indicator values. The data included in this analysis were collected bi-weekly at twelve stations in the South Bay (Figure 3-1); triplicate samples were collected at each sampling location and sampling event. The copper concentrations at Stations SB11 and SB12, located in Coyote Creek and Guadalupe River, were distinctively different from the concentrations at the stations in LSSFB, and they were not included in the subsequent analyses described below.
In evaluating these data, the first thing that was noted is that there is a statistically significant difference between the mean values of dissolved copper measured in the wet season (December – May) and the dry season (June – November). Evidence for this can be seen in summary statistics presented in Table 3-1. The dissolved copper concentrations measured in the dry season are greater than those measured in the wet season at all stations, and all observed differences are statistically significant (Wilcoxon Rank Sum Test, $p < 0.05$). Based on these findings, the dissolved copper concentration measured in the dry season was used as the indicator in subsequent analyses.

Evaluation of Proposed Monitoring

The use of an indicator requires the specification of a trigger value: the stimulus or value of the quantity (i.e., dissolved copper concentration) that initiates environmental intervention/action. The first step in specifying a trigger value is the evaluation of the expected performance of the indicator. The evaluation presented below was based on the proposed monitoring effort and the specification of a statistical testing procedure.

The proposed monitoring program would consist of the measurement of dissolved copper at the 10 stations each month. This would result in six measurements made during the dry season at each station each year. Stations SB11 and SB12 should continue to be monitored, since they provide valuable information on the contribution of copper from the tributaries.



SBS SITES	REFERENCE LOCATIONS	LONGITUDE	LATITUDE	RMP SITES
SB01	Channel Marker #14	122.08.60W	37.30.48N	BA30
SB02	Channel Marker #16	122.05.04W	37.29.59N	BA20
SB03	Channel Marker #18	122.03.01W	37.27.27N	BA10
SB04	CC Railroad Bridge	121.58.64W	37.27.59N	C-3-0
SB05	LEM site in Coyote Creek	122.01.48W	37.27.84N	
SB06	Between Channel Markers #17 & 18	122.04.30W	37.28.52N	
SB07	Mouth of Mowry Slough	122.03.27W	37.29.54N	
SB08	Mouth of Newark Slough	122.05.41W	37.29.92N	
SB09	Mouth of Mayfield Slough	122.07.08W	37.27.06N	
SB10	Mouth of Charleston Slough	122.05.99W	37.28.19N	
SB11	Standish Dam in CC	121.55.29W	37.27.10N	BW10
SB12	Alviso Yacht Club Dock	121.58.45W	37.25.34N	BW15

South San Francisco Bay site map showing the location of 11 of the 12 stations sampled in the South Bay Study (SBS). Site SB11 located at Standish Dam in Coyote Creek is not within the range of the map presented. The above table indicates analogous sites from the Regional Monitoring Program.

Figure 3-1. Map of monitoring station locations in Lower South San Francisco Bay.

Table 3-1
Descriptive Statistics for Dissolved Copper Measurements (µg/l) in the South Bay During: a) Wet Season (December – May), and b) Dry Season (June – November). Measurements Made Between June 1997 – November 1998.

a) Wet Season (December – May)

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Coef. Var.
SB01	1.958	.426	.095	20	1.410	2.670	.218
SB02	2.084	.516	.118	19	1.510	3.400	.247
SB03	2.346	.683	.153	20	1.260	3.910	.291
SB04	2.414	.521	.119	19	1.560	3.230	.216
SB05	2.436	.702	.157	20	1.540	3.580	.288
SB06	2.257	.622	.139	20	1.470	3.840	.276
SB07	2.539	.730	.163	20	1.490	4.150	.287
SB08	2.372	.544	.122	20	1.500	3.310	.229
SB09	2.356	.586	.131	20	1.520	3.410	.249
SB10	2.512	.711	.155	21	1.600	4.050	.283

b) Dry Season (June – November)

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Coef. Var.
SB01	2.928	.435	.095	21	1.990	3.590	.148
SB02	3.092	.477	.110	19	2.100	4.240	.154
SB03	3.289	.445	.105	18	2.540	4.050	.135
SB04	3.117	.806	.190	18	1.710	4.260	.259
SB05	3.153	.677	.155	19	1.550	3.890	.215
SB06	3.372	.456	.108	18	2.520	4.330	.135
SB07	3.197	.612	.140	19	1.750	3.980	.191
SB08	3.283	.571	.125	21	2.060	4.420	.174
SB09	3.169	.552	.120	21	1.820	4.180	.174
SB10	3.496	.586	.128	21	1.960	4.630	.168

Examination of the data in Table 3-1 indicate that the variability of dissolved copper between stations is extraordinarily low. For example, the range between the lowest mean value (2.9 μg/l at SB01) and the highest mean value (3.5 μg/l at SB10) is 0.6 μg/l. Additionally, the coefficients of variation at all 10 remaining stations is extremely low (< 0.26 or 26 % of the mean value).

In these analyses, a further step was taken to examine the inherent variability in these measurements and to evaluate alternative indicator values. All ten stations were ranked by dissolved copper concentration from lowest to highest value. Then, the stations with the two lowest and two highest values were removed. This resulted in six stations (SB02, SB04, SB05, SB07, SB08, and SB09) with mean values between 3.1 and 3.3 μg/l, and coefficients of variation between 0.15 and 0.25. These stations are referred to as the Indicator Test Stations. It is envisioned that the measurements at these locations would be pooled for statistical comparisons between a baseline year (e.g., 1997) and each subsequent year. Pooling the samples would give a sample size of approximately 30.

These preliminary analyses indicate that the dissolved copper concentrations in the South Bay exhibit characteristics that are requisite for indicators: low variability both temporally and spatially. The use of dissolved copper concentrations in the dry season has the added benefit that the measurements are less likely to be influenced by natural phenomena. For example, it seems likely that the concentrations of dissolved copper in the wet season are influenced by the occurrence and magnitude of storm events.

Evaluation of Indicator Performance

To evaluate the expected performance of the proposed indicator, statistical power analyses were conducted. These analyses provide estimates of the minimum, statistically-significant differences that can be detected between measured values. There are several required specifications for these analyses that are a fundamental part of the indicator definition. The first of these is the proposed testing procedure, i.e., statistical test that will be used and the level of sampling effort.

In the proposed testing protocol, the Wilcoxon Rank Sum Test (WRS) would be used to test for differences between the mean values at the Indicator Test Stations. The WRS can be described by a shift model which assumes that the two populations from which the dissolved copper measurements were made differ by or are shifted by an amount Δ, which is constant (i.e., independent of the magnitude of the measured values). The WRS can be viewed as a test for the existence of a shift (Δ) between two populations or a test for differences in the central tendency of the distribution (mean or median) of the dissolved copper concentrations measured at the end of each dry season sampling period. These comparisons would be made to determine if an increase in the ambient dissolved copper concentrations has occurred.

Statistical power analyses were conducted to determine the power of the WRS test, i.e., the ability to detect specified level of shift (Δ) between the underlying sample distributions under selected test conditions. Monte Carlo simulation methods were used to conduct the power analyses. In these analyses, level of shift (Δ) was specified as a proportion of the value of the mean under existing conditions (μ_1). For selected values of the coefficient of variation and sample size (n_1 and n_2), the values of the means from the two distributions were set at μ_1 and $\mu_2 = \mu_1 + \Delta$, where $\Delta = 0.2, 0.4, 0.6, 1.0$, or 1.2. These test conditions were then repeated in power analyses (100,000 simulations were run for each test case) to determine the probability of detecting a shift (Δ) of the specified magnitude.

The results of these analyses are presented in Tables 3-2 to 3-4. In each table, the power or probability of detecting a specified change in the dissolved copper concentration is shown for different numbers of samples and different levels of change. The difference in these tables is that the level of variability (coefficient of variation) in Table 3-2 is 0.20 and in Table 3-4 is 0.35.

The results in both tables can be used to bracket the expected performance of dissolved copper concentrations as an indicator. For example, using the results in Table 3-2: with equal sample sizes of 30, the probability of detecting a shift in the concentration of dissolved copper concentration of 0.8 μg/l is 1.0 (results rounded: 0.99 < actual probability <1.0). That is, if the mean concentration at an individual sampling station is 3.2 μg/l in 1997, an increase of greater than 0.8 μg/l to 4.0 μg/l in any subsequent year is virtually certain to be detected. Referring to the results in Table 3-4, the probability of detecting the same level of change, when the coefficient of variation is increased from 0.20 to 0.35, is 0.85, i.e., there is an eighty-five percent chance of detecting this level of change.

The results presented in Tables 3-2, 3-3, and 3-4 demonstrate the ability to predict the likelihood of detecting specified levels of change that might occur on an annual basis. Based on this information, the proposed Phase I and Phase II trigger levels described in Section 1 are 4.0 ug/l ($\Delta = 0.8$) and 4.4 ug/l ($\Delta = 1.2$), respectively.

Application of Indicators

There are two key elements of the indicator-trigger strategy. The first is the process by which established indicators are monitored and triggers employed. The second element is the process for establishing additional indicators and trigger levels.

The recommended monitoring program for dissolved copper concentrations in the LSSB would be conducted at the Baseline level. If annual monitoring results show that the first trigger level is reached (i.e., mean concentrations of dissolved copper at the six Indicator Test Stations increase by 0.8 ug/l or more), this would indicate that the trends in the LSSB are of concern, and the Phase I activities identified in Table 4-2 would be initiated. Such activities would include recommended additional measures or “indicator” development that should be tracked for establishing additional triggers that would initiate Phase II activities. If the recommended monitoring program shows that Phase II trigger levels are present then it is assumed that the beneficial uses in the LSSB are threatened. This initiates a much higher level of program activities shown in Table 4-3.

Table 3-2
Results of Power Analyses for
Wilcoxon Rank Sum Test:
Coefficient of Variation = 0.20

n_1	n_2	Δ	Power
15	15	0.2	0.19
20	20	0.2	0.25
25	25	0.2	0.27
30	30	0.2	0.33
40	40	0.2	0.41
15	15	0.4	0.49
20	20	0.4	0.61
25	25	0.4	0.68
30	30	0.4	0.76
40	40	0.4	0.86
15	15	0.6	0.78
20	20	0.6	0.89
25	25	0.6	0.94
30	30	0.6	0.96
40	40	0.6	0.99
15	15	0.8	0.95
20	20	0.8	0.98
25	25	0.8	1.00
30	30	0.8	1.00
40	40	0.8	1.00
15	15	1	0.99
20	20	1	1.00
25	25	1	1.00
30	30	1	1.00
40	40	1	1.00
15	15	1.2	1.00
20	20	1.2	1.00
25	25	1.2	1.00
30	30	1.2	1.00
40	40	1.2	1.00

Table 3-3
Results of Power Analyses for
Wilcoxon Rank Sum Test:
Coefficient of Variation = 0.25

n_1	n_2	Δ	Power
15	15	0.2	0.16
20	20	0.2	0.19
25	25	0.2	0.21
30	30	0.2	0.23
40	40	0.2	0.28
15	15	0.4	0.37
20	20	0.4	0.47
25	25	0.4	0.54
30	30	0.4	0.60
40	40	0.4	0.70
15	15	0.6	0.61
20	20	0.6	0.74
25	25	0.6	0.80
30	30	0.6	0.86
40	40	0.6	0.95
15	15	0.8	0.81
20	20	0.8	0.92
25	25	0.8	0.96
30	30	0.8	0.98
40	40	0.8	1.00
15	15	1.0	0.94
20	20	1.0	0.99
25	25	1.0	9.90
30	30	1.0	1.00
40	40	1.0	1.00
15	15	1.2	0.99
20	20	1.2	1.00
25	25	1.2	1.00
30	30	1.2	1.00
40	40	1.2	1.00

Table 3-4
Results of Power Analyses for
Wilcoxon Rank Sum Test:
Coefficient of Variation = 0.35

n_1	n_2	Δ	Power
15	15	0.2	0.12
20	20	0.2	0.13
25	25	0.2	0.14
30	30	0.2	0.16
40	40	0.2	0.20
15	15	0.4	0.24
20	20	0.4	0.30
25	25	0.4	0.35
30	30	0.4	0.39
40	40	0.4	0.46
15	15	0.6	0.40
20	20	0.6	0.47
25	25	0.6	0.57
30	30	0.6	0.64
40	40	0.6	0.76
15	15	0.8	0.58
20	20	0.8	0.68
25	25	0.8	0.78
30	30	0.8	0.85
40	40	0.8	0.92
15	15	1.0	0.73
20	20	1.0	0.85
25	25	1.0	0.91
30	30	1.0	0.96
40	40	1.0	0.99
15	15	1.2	0.88
20	20	1.2	0.95
25	25	1.2	0.98
30	30	1.2	0.99
40	40	1.2	1.00

The incorporation of indicators and triggers into the monitoring program is part of the overall adaptive management strategy adopted by the CAP. As noted in the CAP Update Cycle (Section 1), the CAP will be updated to incorporate lessons learned from baseline action items and scientific and technical information from other sources. New indicators can be added, new trigger values can be selected, and the monitoring strategy revised.

4.0 IDENTIFICATION AND EVALUATION OF ACTION ITEMS

The purposes of this section of the Copper Action Plan are:

1. Identify control/pollution prevention measures that have previously been implemented, are currently being implemented, or are currently under investigation for potential implementation by South Bay POTWs, the SCVURPPP, and/or other organizations to reduce copper loading to the Lower South San Francisco Bay

2. Identify those potential control/pollution prevention measures that should be investigated and potentially implemented based on the results of the Copper Action Plan monitoring program.

3. Identify monitoring/data collection measures that should be further developed to provide for future alternative control/pollution prevention related triggers that are linked to a specific source.

A summary of previously identified copper control measures and various actions implemented by local entities are contained in Appendix 2. This summary table is not only a list of actions but also a screening tool. Based on the information summarized in the table and discussed in Section 4.1, each potential action item is evaluated in terms of the effectiveness in reducing copper input to Lower South San Francisco Bay.

The summary table contained in Appendix 2 is substantially based on the controls identified in the 1994 Copper Dialogue and efforts conducted by the South Bay POTWs as part of their source control, recycling and plant optimization programs. The summary provides the following information:

- identification of the control measure,

- identification of the various activities that have or are occurring that are directly related to the control measure (activities may occur regardless of the relationship to the reduce of copper load),

- identification of how effectiveness was evaluated

- identification of the need for additional effectiveness evaluation, possibility of and uncertainty of conducting the evaluation, and the relative benefit of the effort for copper load reductions

Baseline control measures are identified in Table 4-1. The Baseline control measures represent those measures/actions that are currently ongoing and/or under investigation. It is assumed that these Baseline measures will continue to be implemented through current storm water and POTW programs. Improvements in the measures/actions are anticipated to occur through routine operations. Reporting on the result/effectiveness of these measures will occur through routine permit reporting mechanisms noted in the table.

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
B-1 (2 & 4)	-------	Vehicle washing consistency in level of implementation	SCVURPPP & Co-permittees	FY99-00 Car Wash Education Outreach (March – July 2000) Outreach Ongoing	Urban Runoff and Industrial Storm water Permits Reporting conducted as part of SCVURPPP and Co-permittees Annual Reports	Address mobile cleaners and vehicle washwaters; anticipated to be very small source of loading
B-2 (6)	-------	Continue to Track Copper Sulfate Use by Water Suppliers (includes State & Federal Water Project)	SCVWD	Track and Report as part of Annual Urban Runoff Report (depending on available data; start with FY 99-00 Annual Report)	Urban Runoff Permit Report tracking results as part of SCVWD Co-permittee Annual Report	Address Copper Sulfate (use has been discontinued by SCVWD); continue t o track and confirm
B-3 (11 & 35)	C-13 & C-35/ IND-1 & IND-2	Complete Industrial- 2: investigations (based on MCMP), identify and implement reasonable controls in conjunction with industry (older printed circuit board manufacturers with copper platting) to reduce elevated levels in runoff from targeted industry including development/implementation of education and outreach plan Clarify linkage with POTW Pretreatment Programs	SCVURPPP & Co-permittees & industry Possibly POTW permits (clarify need by March 2001 as part of SCVURPPP Work Plan)	Complete IND-2 Technical Report – August 2000 Conduct Pilot Outreach Campaign FY99-00 & 00-01 (4/13/00 Work Plan scope)	Urban Runoff and Industrial Storm water Permits Reporting conducted as part of SCVURPPP and Co-permittees Annual Report. (SCVURPPP and Co-permittee FY 99-00 Work Plan contains Industrial-2 scope. Future Work Plans will contain description of additional tasks based on Industrial-2 results.) Develop approach to implement Area-Wide as part of March 2001 Work Plan (tied to Pilot Results)	Address portion of industrial load; very small (<1-2% of copper from urban runoff)

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	**Continuos Improvement[3] /Metals Control Plan[4]**	**Description**	**Lead Party**	**Implementation Time-Frame**	**Implementation Mechanism**	**Source (s) Addressed; Potential Effectiveness**
B-4 (16.1 & 34)	------/AUTO-1, 2 & 3	1-Provide appropriate level of local support for agreed upon quantification studies to:	SCBWMI/SCVURPPP (lead party may change depending on quantification study identified)		SCVURPPP Continuous Improvement Process and Annual Work Plans and/or SCBWMI Core Group/Subgroup work plan task	Evaluation of source loadings, potential control measure/pollution prevention effectiveness
		2 Investigate and/or track quantification studies for a wide range of existing copper control/pollution prevention measures and sources loadings (update copper pie charts contained in MCM based on data from B-6 and B-16)	SCVURPPP	Include updated information provided by BPP and any other information which has become available as part of next Storm Water Permit Application Cycle (6 months ahead of application date)	SCVURPPP Work Plan (include as part of 5-year vision)	
		3-Collect data and prepare annual reports on the following potential indicators • Copper content in new auto brake pads • Total population in basin • Auto/truck vehicle traveled in basin • Copper sulfate (e.g. algaecide, pesticide, industrial; chemicals) sales in basin (aggregate basis-scaled to basin level estimate) • Copper content in macoma tissue at San Point (Palo Alto)	City of Palo Alto	February POTW Annual SMR (start with February 2001 report)	POTW permit amendment	Effectiveness to indicate future copper impairment changes is unknown

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		• Reproductivity index for macoma at Sand Point • Benthic community assemblage at Sand Point 4-Prepare issue paper on feasibility of potential field investigation to monitor long-term trends between copper from brakepads and concentration in water.	RWQCB/SCVURPPP	FY 01-02		
B-5 (15) (Trish priority – High)	------/AUTO-1, 2 & 3	Provide appropriate level of local support for agreed upon BPP activities consistent with MCM. 1-Review/assess/provide input on BMC/BPP brakepad wear debris research & brakepad content data. 2-Ensure that other local state and federal players are involved appropriate on brakepads issue as it is a widespread urban concern.	1-SCVURPPP currently tracking with funds designated in FY 99-00 & FY 00-01 Work Plans; funding June 16, 2000 BPP conference 2-BASMAA & SWQTF involvement on BPP may be needed as a Task of Regional Benefit	SCVURPPP participation in BPP funded FY 99-00 SCVURPPP FY 99-00 funding of BPP conference SCVURPPP participation in BPP funded for FY 00-01 SCVURPPP request BASMAA and SWQTF participation FY00-01	1-SCVURPPP Continuous Improvement Process and Annual Work Plans (will utilize conference results to lay out potential future direction/needs) BASMAA Task of Regional Benefit (SCVURPPP recommend BASMAA consider funding TRB to support Regional involvement with BPP including investigation of fate and transport) 2- BASMAA Task of Regional Benefit	Brake pad wear debris is a source

Table 4-1 Summary of Baseline Copper Control Actions[1]						
Baseline Number (Dialogue[2]**)**	**Continuos Improvement**[3] **/Metals Control Plan**[4]	**Description**	**Lead Party**	**Implementation Time-Frame**	**Implementation Mechanism**	**Source (s) Addressed; Potential Effectiveness**
		3-Assist in making research data that are in the public domain accessible	3- WMI data management system	SCVURPPP incorporate initial efforts into FY00-01 Work Plan	(SCVURPPP recommend BASMAA & SWQTF consider funding to support State and Regional involvement with BPP including investigation of fate and transport) SCVURPPP via data management efforts and in conjunction with WMI efforts incorporate BPP and other related and readiably available into metadata database	
B-6 (17) (Trish priority – High)	C-31/AIR-1 and AIR-2	Review appropriateness of transportation control measures, prioritize reasonable measures and identify potential efforts for further development as part of Phase I and implementation as part of Phase II	SCBWMI (SCVURPPP take lead on preparing short-term issue paper as part of LUS that begins to investigate the role of storm water management agencies in regional congestion management planning and implementation)	Issue paper Fall-Winter 2000	CORE GROUP short-term issues (SCVURPPP to consider possible early measures as part of developing FY 01-02 Work Plan)	Vehicles; unknown effectiveness
B-7 (17.27)	------	Establish transportation/impervious surface "forum" • Consider results of VMT and	SCBWMI (incorporate as part of short-term issue paper on B-6)	See B-6 above	CORE GROUP short-term issue	Vehicles; unknown effectiveness

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		imperviousness load estimates and control effectiveness evaluation; identify potential control efforts for further development as part of Phase I and implementation as part of Phase II				
B-8 (18 and 25[5])	C-16, C-19 & C-31	Continue to implement watershed classification and assessment efforts of SCBWMI and improve institutional arrangements for watershed protection (review Vol. II Chapter 6/CCMP/CONCUR findings for relevance and possible gaps as part of C-31)	SCBWMI (with assistance from the SCVURPPP and Co-permittees) Issue being addressed as part of SCVURPPP permit, see Table 3 permit issue)	Ongoing	SCVURPPP Continuous Improvement Process and Annual Work Plans and/or SCBWMI Core Group/Subgroup work plan task	NA (WMI efforts have resulted in moving issue beyond CONCUR findings)
B-9 (20)	------	Continue current efforts and track corrosion control opportunities: • Continue educational outreach, within the City of Palo Alto, to plumbers and designers to reduce corrosion of copper pipes via better design and installation • Track developments in (a) alternatives to copper piping (b) corrosion inhibitors, and (c) other methods of reducing copper corrosion	City of Palo Alto Environmental Compliance Unit (track and report developments to the SCBWMI)	Ongoing (start reporting as part of 2000 Annual Report)	POTW permit Reporting conducted as part of annual Pretreatment Program report.	Corrosion related copper; limited effectiveness
B-10 (22)	C-6 & C-21	Utilize results of SEIDP[6] Indicator #5 (Sediment Characteristics and Contamination) to investigate development of an environmental	SCVURPPP & Co-permittees (being addressed as part of SCVURPPP permit, see Table 3)	SCVURPPP FY 01-02 Work Plan and 5-Year Monitoring Plan	SCVURPPP & Co-permittees as part of Permit Annual Work Plan and Annual Report	SEIDP Indicator #5 examining relationship between sediment quality and urbanization;

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		indicator and investigate the linkage with SFEI sources and loading work effort.				unknown effectiveness
B-11	C-29	Consider need for Continuous Improvement of street sweeping controls and storm water system operation & maintenance controls (key emphasis is to develop SOP for disposal of collected materials)	SCVURPPP (being addressed as part of SCVURPPP permit, see Table 3)		Consider need for improvements as part of SCVURPPP Continuous Improvement Process	Additional effectiveness uncertain; evaluation of cost-benefit and cost-effectiveness of additional controls necessary
B-12	------	Maintain existing education and outreach program for pool and spas	SCVURPPP & Co-permittees	Ongoing	SCVURPPP & Co-permittees implementation via URMP Performance Standards and modification via Continuous Improvement Process Ongoing Pool Magnet Project (see SCVURPPP FY 99-00 Work Plan)	Copper from water supply and algaecide use, probably extremely small load; effectiveness of BMPs good.
B-13 (35)	------	Track POTW Pretreatment Program efforts and POTW loadings	POTWs	Ongoing	POTW NPDES Permits (reporting part of Annual SMR and Pretreatment Program reports)	Tracking effort
B-14 (36)	------	Track and encourage water recycling efforts	POTWs	Ongoing	Reporting through POTWs Annual Water Recycling report and/or Annual SMR	POTW; cost-benefits need to be evaluated as part of considering additional efforts
B-15	C-6 & C-21	Utilize results of SEIDP to evaluate effectiveness of related SCVURPPP Performance Standards and identify cost-	SCVURPPP & Co-permittees (being addressed as part of SCVURPPP permit,	SCVURPPP FY 01-02 Work Plan and 5-Year Monitoring Plan	SCVURPPP & Co-permittees Continuous Improvement Process	NA (Potential Environmental indicator(s))

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		effective modifications	see Table 3)			
B-16	------	Establish Information Clearinghouse (Track & disseminate new scientific research on copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems for use in CAP update; provide stakeholder resource)	SCBWMI –CORE Group (assistance via SCVURPPP)	Ongoing –Annual	Implement through watershed measures element of SCVURPPP Permit and SCBWMI Long-term Data Management Plan (connected with resources for B-5.3) Reporting include as part of SCVURPPP Annual Report for FY 00-01	NA (Potential education/outreach and communication mechanism)
B-17 (Trish priority – High for Photo, Med. For sed., and low for loading)	------	Track and encourage investigation of several important topics that influence uncertainty with Lower South Bay Impairment Decision[7] • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty Encourage incorporation of appropriate bioassessment tools into ongoing monitoring programs to track presence of copper-sensitive taxa in LSB. Prepare issue paper on feasibility and cost of addressing phytoplankton toxicity questions	SCBWMI – Core Group (assistance via POTW and SCVURPPP and Co-permittees) RWQCB (Tom Mumley)		Track and encourage RMP, NOAA, USGS, etc.	NA (Special Studies)
B-18	------	Track and encourage investigation of important Factors	SCBWMI – Core Group (assistance via		Track and encourage RMP, NOAA, USGS,	NA (Special Studies)

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		that Influence Copper and Fate (Potential Reduction in Uncertainty is Moderate to High)[7] • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations • Investigate algal uptake/toxicity with competing metals	POTW and SCVURPPP and Co-permittees)		etc.	
B-19	------	Continue to promote industrial water use and reuse efficiency. These programs may include workshops, outreach, incentives, or audits. (see Appendix 4-1#35)	POTWs	Ongoing	POTW Permits	Unknown
B-20 (Trish priority – High)	------	Revise Copper Conceptual Model report findings and produce status report (revise conceptual model uncertainty table, appendix ___ based on available information)	SCBWMI (with assistance from POTWs and SCVURPPP & Co-permittees)	Permit Application	CORE GROUP short-term issue Update as part of NPDES Permit application process Possible linkage and assistance from North Bay effort as well as RMP and RWQCB TMDL efforts	Unknown
B-21 (26 & 31)	C-32	1-SCVURPPP & Co-permittees evaluate feasibility of discouraging architectural use of copper & explore feasibility of related policy 2-Promote Green Building	Palo Alto SCBWMI (with assistance from the SCVURPPP and Co-	FY 00-01 Work Plan City of San Jose – Explore feasibility of Policy as part of FY	CORE GROUP short-term issues (use SCVURPPP Continuous Improvement Process for agreed upon assistance)	Ornamental copper (roofs, gutters); probably very small (<1%) of load; effectiveness of BMPs probably good

Table 4-1
Summary of Baseline Copper Control Actions[1]

Baseline Number (Dialogue[2])	Continuos Improvement[3] /Metals Control Plan[4]	Description	Lead Party	Implementation Time-Frame	Implementation Mechanism	Source (s) Addressed; Potential Effectiveness
		principles and identify measures to investigate as part of Phase I	permittees)	02-03 Work Plan	SCVURPPP & Co-permittees Continuous Improvement Process	

1 Annual Reports of NPDES permitted agencies (POTWs and SCVURPPP) will contain a summary of the status of all CAP items.
2 Copper dialogue control measures numbered 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 21, 23, 24, 26, 28, 29, 31, 32, 33 are currently being conducted by the SCVURPPP & Co-permittees as defined within the URMP. The SCVURPPP & Co-permittees will continue to implement the controls as defined within the URMP and modify, as appropriate, through the SCVURPPP & Co-permittees Continuous Improvement process. (See Appendix 2 of the CAP for a summary of the current Program activities relative to dialogue measures.
3 Continuous Improvement activities identified by the Urban Runoff Permit Re-issuance Work Group as part of the SCVURPPP permit re-issuance are contained in Table 3 “Urban Runoff Permit Re-issuance Work Group --Box 3: Summary of Continuous Improvement Items”(dated June 23, 2000).
4 References refer to measures identified as part of the SCVURPPP Metals Control Measures Plan (MCMP, prepared by WWC/EOA, 1997). MCMP measures are part of the 1997 SCVURPPP Urban Runoff Management Plan (URMP).
5 These measures have largely been replaced by WMI activities. Specific implementation actions are planned for inclusion in the Watershed Alternatives report & Watershed Action Plan. The Watershed Assessment Subgroup of the WMI considered the CONCUR paper as input in drafting the Watershed Alternatives paper.
6 The Stormwater Environmental Indicators Demonstration Project (SEIDP) is part of USEPA’s Environmental Indicators/Measures of success project. The SEIDP is the third phase of EPA’s program that focuses on local demonstration projects and the testing of indicators in the Walsh Ave. catchment, water quality indicators, programmatic indicators, social indicators, and site indicators are being evaluated to gauge Program implementation. Twenty different indicators are under review.
7 See Table D “Task 1: Conceptual Model Report for Copper and Nickel in Lower South San Francisco Bay” final report, December 1999 Contained in Appendix 4-2.

Potential Phase I and II control measures are identified in Tables 4-2 and 4-3. The summary of potential Phase I and II control measures is based on the evaluation of the Baseline (ongoing) control measures contained in Appendix 2, the results of the technical analysis contained in Table D of the final Conceptual Model Report for Copper and Nickel and the results of the analysis contained in the Impairment Assessment Report.

As described in the Introduction (Section 1), the potential Phase I control measures have the following attributes:

- address those sources that might be controllable
- the feasibility of conducting a load and effectiveness evaluation relative to reducing copper loads is moderate to high
- the uncertainty of the estimates is moderate, and there is a water quality benefit (at least moderate) relative to the load reduction.

Those studies that were identified as having a “moderate to high” possibility of reducing the uncertainty associated in the conceptual copper cycling model were identified as Phase I measures.

The potential Phase II copper control measures are shown in Table 4-3. Potential Phase II control measures include those activities that require additional analysis as part of the Phase I control measure investigations and have a high degree of uncertainty relative potential effectiveness.

Table 4-2
Summary of Potential Phase I Copper Control Measures

Phase I Number (Dialogue)	Description	Lead Party	Implementation Mechanism	Source (s) addressed; potential effectiveness
I-1 (15)	Update findings and recommendations of BPP efforts and implement agreed upon Phase I measures and develop Phase II Work Plan	RWQCB – convene powers to be (see Finding 12 of the POTW permit amendment)	NPDES permits and other CWC regulatory mechanisms	Unknown at current time
I-2 (17.27)	Update findings and recommendations of transportation/impervious surface "forum" and implement agreed upon Phase I measures and develop Phase II Work Plan	RWQCB – convene powers to be (see Finding 12 of the POTW permit amendment)	NPDES permits and other CWC regulatory mechanisms	Unknown at current time
I-3 (19)	Update and re-evaluate source identification (MCMP for copper) and prioritize sources based on effectiveness evaluation of future potential control actions. Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	RWQCB – convene powers to be (see Finding 12 of the POTW permit amendment)	NPDES permits and other CWC regulatory mechanisms	Unknown at current time
I-4 (20)	Prepare and implement a Phase I plan for improved corrosion control based on evaluation of results of Baseline measures.	POTWs/SCVWD and other suppliers	POTW permits and other CWC regulatory mechanisms	Corrosion related copper; unknown at current time
I-5 (23 & 24)	Evaluate street sweeping and other design, operation and maintenance practices to identify potential improvements. Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process	Unknown at current time
I-6 (27)	Follow-up on relevance of copper in diesel exhaust	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process	Unknown at current time
I-7 (36)	Develop Phase II Implementation Plan for POTW expansion of water recycling	POTWs	POTW Permits	POTW; cost-benefits need to be evaluated as part of considering additional efforts

Table 4-2
Summary of Potential Phase I Copper Control Measures

Phase I Number (Dialogue)	Description	Lead Party	Implementation Mechanism	Source (s) addressed; potential effectiveness
I-8	Evaluate and investigate important topics that influence uncertainty with LSB Impairment Decision • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty	SCBWMI – Core Group (Assistance via POTW and /SCVURPPP and Co-permittees)	Encourage and identify resources (coordinate with other efforts/investigations such as those of RMP, NOAA, USGS, etc)	NA (special studies)
I-9	Evaluate and investigate important Factors that Influence Copper Fate (Potential Reduction in Uncertainty is Moderate to High)[1] • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations Investigate algal uptake/toxicity with competing metals	SCBWMI – Core Group (Assistance via POTW and /SCVURPPP and Co-permittees)	Encourage and identify resources (coordinate with other efforts/investigations such as those of RMP, NOAA, USGS, etc)	NA (special studies)
I-10	Evaluate results of tracking industrial virtual closed-loop wastewater efficiency measures and develop potential actions. Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	POTWs	POTW Permits	Unknown at current time
I-11	Develop Phase II Implementation Plan for POTW process optimization	POTWs	POTW Permits	Unknown at current time
I-12	Develop a Phase II Plan including a re-evaluation of Phase I actions	RWQCB – convene powers to be (see Finding 12 of the POTW permit amendment)	CWC regulatory mechanisms	Unknown at current time

Table 4-3
Summary of Potential Phase II Copper Control Measures

Phase II Number (Dialogue)	Description	Lead Party	Implementation Mechanism	Source (s) addressed; potential effectiveness
II-1 (12)	Reconsider usefulness of managing storm water through POTWs	POTWs (with assistance from SCVURPPP and Co-permittees)	CWC regulatory mechanisms	Unknown at current time
II-2 (17.27)	Implement agreed upon Phase II transportation/impervious surface control measures	RWQCB – convene powers to be	CWC regulatory mechanisms and possibly other regulatory agency mechanisms	Unknown at current time; cost-effective and cost-benefit analysis required
II-3 (20)	Implement plan for additional corrosion control measures	POTWs/SCVWD and other suppliers	POTW permits and other CWC regulatory mechanisms	Corrosion related copper; unknown at current time
II-4 (21)	Discourage use of copper-based pesticides	SCVURPPP & Co-permittees	SCVURPPP & Co-permittee Continuous Improvement Process	Copper-based pesticides (extremely small source per MCMP estimates); effectiveness of additional controls unknown
II-5 (27)	Implement control actions identified for copper in diesel exhaust	RWQCB –convene powers to be	Possible Regulatory and Legislative mechanisms	Unknown at current time
II-6	Implement Phase II POTW process optimization measures	RWQCB –convene powers to be	POTW permits	Unknown at current time; cost-effective and cost-benefit analysis required
II-7	Implement agreed upon Phase II expansion of water recycling programs	RWQCB –convene powers to be	POTW permits	Unknown at current time; cost-effective and cost-benefit analysis required
II-8	Re-evaluate Phase II Plan (developed as part of I-2) and finalize for implementation	RWQCB –convene powers to be	CWC regulatory mechanisms	Unknown at current time

Appendix 1
Evaluation of Alternative Modeling Approaches

Appendix 1 Evaluation of Alternative Modeling Approaches			
Category	**Box Model in Conceptual Model Report (Model #1)**	**Box Model with Process Representations (Model #2)**	**Numerical Simulation Model (Model #3)**
Model Description	Model described in conceptual model report, and exercised in Appendix B of that report. This is the most simple of the three models, and is a spatially lumped model.	Box model that predicts continuously the changing copper and nickel concentrations as a result of forcing functions and simplified metal cycling representations	Numerical model such as TRIM or EFDC that predicts copper and nickel concentrations throughout the Lower South Bay (LSB) using the state-of-the-art understanding of copper and nickel process representations
Spatial Resolution and Extent of Modeling Domain	The box model represents Lower South Bay south of the Dumbarton Bridge. No spatial variability is included in the model.	The box model represents Lower South Bay south of the Dumbarton Bridge. No spatial variability is included in the model.	The numerical model is likely to simulate a domain that has a boundary at the Bay Bridge. Detailed spatial resolution is provided in the model
Temporal Resolution	This model considers a dry season and a wet season; two sets of predictions are made, one for each season	The model makes predictions continuously in time over a user-specified period of simulation. Typically predictions will be made on the order of a daily time interval, or less.	The model makes predictions continuously in time over a user-specified period of simulation. Typically predictions are made on the order of an hourly time interval, or less.
Model Output	A single dissolved and total concentration for each metal simulated for the dry and wet seasons; total and dissolved metal fluxes into and out of LSB; estimated mass of metals in water and sediments; concentration contributions by each source.	Time series of dissolved and total metals concentrations in water column over simulation period (spatially lumped, as is Model #1); post-processing results can generate the same types of output as Model #1, but typically as time-series	Concentration distributions of metals simulated at many locations throughout LSB, both in water column and in sediments. Can make predictions at sensitive locations, as needed; post-processing of results can generate additional information, as for Models #1 and #2.

Appendix 1 *(continued)*
Evaluation of Alternative Modeling Approaches

Category	Box Model in Conceptual Model Report (Model #1)	Box Model with Process Representations (Model #2)	Numerical Simulation Model (Model #3)
Effort Required to Complete Data Input	Most data now available; will need to generate better estimates of dissolved metals loading	Same as for model #1; plus data for sediment modeling (e.g. settling velocities)	Location of northern boundary first must be decided; possible new data are loadings north of Dumbarton Bridge; process-oriented data; and data to calibrate/verify the model
Starting Point for Modeling	Conceptual model in Appendix A (Abiotic Component of Copper and Nickel Cycling and Speciation) of report; model has been reviewed by the stakeholders	Possibly start with the modeling work of Monismith at Stanford University; that work was presented at a conference in Monterey in February 1999	Both TRIM and EFDC have been applied to the LSB; and are likely the two best candidates. The applications were to flushing estimation; significant work required to set up these models for purpose at hand.
Effort Needed to Have Models Ready to Predict Responses of Metal Concentrations to Changes in Loadings	One to two months of effort	Three to six months of effort	Six to nine months of effort
Relative Advantages of Each Model	Easiest to use; least amount of input data; easiest to understand	Can predict metal responses to time-varying conditions at relatively small amounts of data requirements	Can be used to focus predictions on sensitive areas in LSB; Can predict responses to specific critical conditions
Relative Disadvantages of Each Model	Its simplicity may make its scientific validity questionable; does not predict spatially variable concentrations (may be able to show this is not important)	Does not predict spatially variable concentrations	Model may require data that are not available, and require simplifications;

Appendix 1 *(continued)* Evaluation of Alternative Modeling Approaches			
Category	**Box Model in Conceptual Model Report (Model #1)**	**Box Model with Process Representations (Model #2)**	**Numerical Simulation Model (Model #3)**
Special Features Possible in Each Model	Uncertainty analysis using Monte Carlo; correlation of variables in Monte Carlo simulations to mimic observed correlations; extended sensitivity analyses easy to implement	Simplified nature of model allows extended periods of analyses to be efficiently performed, but Monte Carlo may be feasible	State-of-the-art process understanding and algorithms can be represented; model can be calibrated/verified, at least to some extent, to demonstrate its applicability.
Applicability of Model to Other Chemicals/Metals of Concern	The concepts of this model are most directly transferable to other metals; for organics that may undergo unique transformation processes, the model is not as applicable	Model can be directly extended to other metals, and also modified to account for processes unique to organic chemicals	This model has a general enough framework to be applied to other metals or to organics; hydrodynamics and sediment transport would be unaffected; limited by process understanding and data availability

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
1	Control Copper Discharges from Agency Sponsored Construction Projects • Develop contract language • Include in standard procedures	• SCVURPPP Co-permittees[1] implementing via Planning Procedures (PP) Performance Standard[2] • SCVURPPP Program and Co-permittee Performance Reviews conducted FY 98-99 • Based on performance reviews improvements made to Co-permittee implementation plans	• Evaluated as part of Performance Reviews[6]	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports No change currently needed
2	Control Discharge from Building Maintenance Activities • Finish residential educational materials • Mobile cleaners BMPs • Create business educational materials • Prepare education plan • Distribute materials	• SCVURPPP Co-permittees implementing via Industrial/Commercial Discharger Control Program (IND) Performance Standard • SCVURPPP annual Work Plans and include Public Information and Participation Plans • BASMAA Regional Ad Campaign • BASMAA Media Relations Campaign • Numerous residential and business brochures developed and distributed via PI/P program (see Program's Annual Reports and annual Work Plans) • See BASMAA mobile cleaner work products and Program's FY 99-00 work plan Item #1i	• Effectiveness currently being evaluated as part of SEIDP[3] Indicator # 18 (Walsh Ave. Catchment/Cotoye Creek)	Need results of SEIDP Need results of mobile cleaner projects

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
3	Control Commercial Facilities Discharge	• SCVURPPP Co-permittees implementing via Industrial/Commercial Discharger Control Program Performance Standard (II.J.) • Inspections incorporated into POTW Pretreatment Program	Effectiveness currently being evaluated as part of SEIDP Indicator #s 1,2,3,4,18,22,23, & 26	Need results of SEIDP
4	Control Commercial Vehicle Services Facilities Discharge	• SCVURPPP implementing via Industrial/Commercial Discharger Control Program Performance Standard (II.J.) • Inspections incorporated into POTW Pretreatment Program	Evaluated as part of Performance Reviews , Annual Report & POTW annual report Measure Considered Effective BMP Quantification of effectiveness not conducted	Quantification not probable, uncertainty high, benefit small
5	Control Cooling Tower Discharge	• SCVURPPP implementing via Industrial/Commercial Discharger Control Program Performance Standard (II.H.) • Inspections incorporated into POTW Pretreatment Program	Evaluated as part of Performance Reviews , Annual Report & POTW annual report Quantification of effectiveness not conducted	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports Quantification possible, uncertainty high, benefit small

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
6	Reduce Copper Sulfate Use by Water Suppliers	• SCVURPPP implementing via Water Utility Operation and Maintenance Performance Standard which includes Water Utility Pollution Prevention Plan. • Investigation conducted as part of Jan. 1994 SCVWD report "Copper & Selenium in Water Supply of the Santa Clara Valley" submitted to RWQCB per CWC 13267 request.	Evaluated as part of Performance Reviews, Annual Report. Quantification of effectiveness not conducted	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports (SCVWD will include status as part of Annual Report). Quantification possible, uncertainty high, benefit small
7	Control Erosion	• SCVURPPP implementing via Construction Inspection Performance Standard • See Program and Co-permittee Annual Reports and performance reviews.	Evaluated as part of Performance Reviews and Annual Report. Measure Considered Effective BMP	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports Quantification possible, uncertainty high, benefit small
8	Control Copper Discharge from Food-Handling Establishments • Design, print and distribute BMP materials	• SCVURPPP implementing via Industrial/Commercial Discharger Control Program Performance Standard (II.K.) • See Co-permittee Annual Reports • See PI/P section of Program Annual Reports including training provided and BMP brochures.	Evaluated as part of Performance Reviews and Annual Report. Quantification of effectiveness not	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
			conducted.	Quantification possible as part of PI/P effectiveness survey, moderate uncertainty, moderate small
9	Control Discharge from Household Hazardous Waste Program	• See specific SCVURPPP Co-permittee URMPs and local jurisdiction programs (Palo Alto, Sunnyvale and Santa Clara have independent programs, all other Co-permittees go through County) • See Program FY 99-00 Work Plan item #1o.		
10	Conduct Industrial Inspections • Update and verify industrial facilities • Review industrial permits and annual reports • Walsh Ave. pilot studies and industrial inspection demonstration	SCVURPPP program includes: • Co-permittees implementing via Industrial/Commercial Discharger Control Program Performance Standard. • Inspections incorporated into POTW Pretreatment Program. • See POTW Pretreatment Programs for detailed facility updating procedures • See POTW 1993 NPDES & CDO requirements regarding flow and mass audits and subsequent annual reports • See SCVURPPP 1992 Walsh Ave. industrial inspection report and the updated 1999 technical memorandum conducted as part of the WERF Stormwater Environmental Indicators Project (SEIP). • See SCVURPPP Industrial-1 action item (URMP Table 2 incorporated from results of SCVURPPP Metals Control Measures Plan) final report (Annual	Evaluated as part of Performance Reviews and Annual Report. Measure Considered moderately Effective BMP Quantification of effectiveness being evaluated as part of SEIDP Indicator #s 1,2,3,4,18,22,23, & 26	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports Need results of SEIDP, prior to evaluating potential change(s)

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
		Report Table 4-2) entitled "Sunnyvale/San Jose Metals Control Investigation", September 4, 1998. • See SCVURPPP Industrial-2 action item described in FY 99-00 Work Plan (Table 3)		
11	Control Copper Discharge from Metal fabrication facilities • Conduct investigation • Develop BMPs • Adopt control measures • Education program	• SCVURPPP Co-permittees implementing via Industrial/Commercial Discharger Control Program Performance Standard. • Stormwater Inspections incorporated into POTW Pretreatment Program. • See SCVURPPP Industrial-1 action item (URMP Table 2 incorporated from results of SCVURPPP Metals Control Measures Plan) final report (Annual Report Table 4-2) entitled "Sunnyvale/San Jose Metals Control Investigation", September 4, 1998. • See SCVURPPP Industrial-2 action item described in FY 99-00 Work Plan (Table 3) • See Outreach Campaign for NOI Filers (#1n of FY 99-00 Work Plan) South Bay POTW programs include: • Pretreatment Programs include standard operating procedures for updating facility changes and additions	Evaluated as part of Performance Reviews and Annual Report. Industrial –1 report evaluated data and identified specific industry that required development BMPs and need for education and outreach Effectiveness evaluated as part of POTW Annual Source Control Report	Continue to evaluate as part of future SCVURPPP Performance Reviews and Annual Reports Industrial-2 project currently being conducted. Need results prior to evaluating need for change. Update of industrial loading possible, uncertainty moderate to high, low to moderate benefit

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
		• Pretreatment Programs are aggressive beyond normal federal and state requirements.	Measure considered effective	
12	Manage Stormwater through POTWs • Complete Palo Alto pilot project and develop appropriate implementation plan per results	Special Study Completed • Palo Alto pilot completed • Results indicate measure more feasible for new construction than retrofit	Effective for dry weather flows; Requires substantial maintenance & capital costs	No
13	Control the Discharge of Copper-Based Root Control Chemicals to Storm Drains	• Department of Pesticide Regulation banned copper-based root killers in the San Francisco Bay Area at the request of local government and legislators	Measure considered effective Quantitative evaluation Not conducted	Quantification possible as part of survey, moderate uncertainty, moderate benefit No need for further investigation; measure successfully accomplished.
14	Control Copper Discharge to Bay through Spill Response and Clean-up and through Follow-up Investigation to Recent Recurrence	• SCVURPPP Co-permittees implementing via Illicit Connection & Illegal Dumping Elimination Performance Standard. • See Program and Co-permittee Annual Reports	Effectiveness Evaluation conducted annually as part of Annual Report Measure Considered	Continue to evaluate as part of SCVURPPP Performance Reviews and annual report

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
			Effective BMP Quantification of effectiveness conducted as part of FY 98-99 SCVURPPP Annual Report-found frequency of incidents decreased	 Quantification of event possible, ability to quantify relative to copper high uncertain, benefit small
15	Reduce the amount of Copper Contained in Brake Pads Used in Santa Clara Valley (Although listed below, regulatory and legislative action is not anticipated at the present time) • Obtain US EPA/Cal EPA commitments • Complete SCVURPPP initial study • Investigate replacement pads • Conduct Phase I PI program • Conduct Phase II PI program • Secure legislation	• Brake Pad Partnership (BPP) established • SCVURPPP Participates and Tracks Brake Pad Partnership Progress (Elevated to National Issue) • SCVURPPP funding (past 3 years) to support development of and participation in Brake Pad Partnership • SCVURPPP "Contribution of Heavy Metals to Storm Water from Automotive Brake Pad Wear" 1994 • SCVURPPP "Source Identification and Control Report" 1992 • SCVURPPP FY 99-00 funding for participation and follow-up on industry studies as part of Brake Pad Partnership • See AUTO-1, AUTO-2, AUTO-3 & AUTO-4 (URMP) • Regulatory and legislative action is not anticipated at the present time	Quantification of loads evaluated as part of MCMP (better data anticipated from BPP via monitoring of copper use program) Brake Pad Partnership investigating brake pad wear debris (research currently underway Price and Associates 2/18/2000)	Continue to track Brake Pad Partnership investigations Potential need for new controls under evaluation, need BPP results
16	Quantification Activities	SCVURPPP program includes:	Quantification of	Additional

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
	• Quantification studies for a wide range of existing copper control measures (16.1) • Control waste oil collection (16.2) • Improve yard waste pick-up (16.3)	• Metals Control Measures Plan (MCMP,1997) completed per NPDES permit • Co-permittee implementing via IND and ICID Performance Standards • Education program via BASMAA Media Relations Campaign • Education and outreach via watershed action fund grants • SCVURPPP PI/P program (see Annual Report) • SCVURPPP Local Advertising Campaign and annual event participation (auto shows, earth day, etc.)	significant sources of copper considered as part of MCMP Quantification of load and effectiveness of reasonable controls for oil considered as part of MCMP (Section 5.6) Quantification and evaluation of effectiveness of controls related to VMT not conducted. Investigation of effectiveness of impervious controls currently underway as part of SEIDP	quantification possible for oil and yard waste, uncertainty moderate to high, benefit small Measures 16.2 and 16.3 dropped – reconsidered and determined to be ineffective for copper source control. Quantification of VMT possible: • Define baseline source loading and associated uncertainty for current ambient copper water

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
				quality concentrations in Lower South Bay • Estimate copper load (including uncertainty) to Lower South Bay associated with potential increase in VMT and increase in impervious surfaces from growth projections. • Estimate change (including uncertainty) in ambient copper water quality concentrations (annual and seasonal basis)

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
				in Lower South Bay Uncertainty of estimates moderate to high; benefit moderate
17	Transportation Related: Reduce Vehicle Miles Traveled and Mitigate Added Impervious Surface from Construction of Roads and Parking Facilities • SCVURPPP access to land use databases (17.1) • SCVURPPP coordinate transit system water quality monitoring (17.2)	SCVURPPP has conducted numerous activities as noted below: • See SCVURPPP report "Analysis of Existing and Projected Land Use in Santa Clara basin Watersheds" March 26, 1999 [prepared for the Watershed Management Initiative, Watershed Assessment Report Section 4.2] • See Water Quality in Walsh Ave. & San Carlos reports (see Program Annual reports 92-96) • See Characterization of Parking Lot Runoff –1996 manual; • See I-280/Montague Expy. 1991-1994 Brake Pad Report • See Co-permittee Corporation Yard SWMPPs • SCVURPPP monitoring program re-designed consistent with RWQCB 1996 letter	SEIDP (Indicator # 24) examining relationship between water quality & imperviousness Monitoring program redesigned	Need results of SEIDP prior to consideration of potential changes

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
	• CMA consider water quality in CMP (17.3 & 17.4)	• Potential WMI topic	Not done (see others noted with **)	Evaluation possible, uncertainty high, benefit small (see others noted with **)
	• SCVURPPP develop model language for CEQA relative to VMT and stormwater quality (17.5)	• Co-permittees implementing via SCVURPPP Planning Procedures for Private Projects guidance(II-3) 1996	**	**
	• SCVURPPP track 1992 FEPA (17.6)	• Potential WMI topic (See AIR-2 contained in URMP)	**	**
	• CMA members support trip reduction ordinances (17.7)	• Potential WMI topic	**	**
	• Co-permittees incorporate water quality impacts of VMT in General Plans (17.8)	• Potential WMI topic	**	**
	• Co-permittees develop policy re. Incentives to reduce VMT (17.9)	• Potential WMI topic • See SCVURPPP use of economic incentives (FY 99-00 Work Plan) for WMI	**	**
	• Co-permittees develop EIR language for local policy on impacts and mitigation re. increased VMT and storm water (17.10)	• Potential WMI topic via Land Use Subgroup	**	**
	• Co-permittees implement fuel/clean vehicle provisions of 1992 FEPA (17.11)	• Potential WMI topic • See AIR –2 (URMP)	**	**
	• SCVURPPP encourage CMA involvement in Program (17.12)	• Receive SCVURPPP mailings	**	**
	• SCVURPPP participate in CMA TAC in	• Review coordinated via Land Use Subgroup of WMI	**	**

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Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
	subregional deficiency plan (17.13) • SCVURPPP participate in CMA Stage II land use impact analysis (17.14 & 17.15))	• See SCVURPPP catalog of general plan and development polices, "Compare and Contrast Development Policies" and "Analysis of Existing and Projected Land Use in Santa Clara basin Watersheds" March 26, 1999 [prepared for the Watershed Management Initiative, Watershed Assessment Report Section 4.2],and "Effects of Land Use on Watersheds" June 30, 1999[Section 4.1 of WAR] • SCVURPPP chairs Land Use Subgroup of WMI	**	**
	• CMA and SCVURPPP work cooperatively to encourage infill and minimize impervious surfaces. (17.16)	• See SCVURPPP report "Analysis of Imperviousness in Basin Watersheds" June 30, 1999 [Section 4.3 of WAR]	**	**
	• Encourage CMA to participate in SCVURPPP PI/P activities (17.17)	• Invited to participate	**	**
	• SCVURPPP provide workshops to local government re. VMT and storm water quality (17.18)	• See Start at the Source I & II plus training workshops • See SCVURPPP for numerous other training workshops sponsored by Program	**	**
	• CMA participate in SCVURPPP preparation of URMP (17.19)	• 1997 URMP completed – invite to participate in revisions/updates	**	**
	• CMA members support, as appropriate, CMA site design guidelines (17.20)	• Potential WMI topic	**	**
	• Co-permittees incorporate stormwater	• Co-permittees implementing via Planning Procedures Performance Standard (including Attachment 3 Start	Evaluation conducted as part	**

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Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
	BMPS into transportation (roads and parking lots) (17.21) • Construct multi-modal transportation hubs (17.22) • Construct signal synchronization projects (17.23) • Public agencies sponsor VMT reducing projects (17.24) • Private development to incorporate standard VMT reduction measures (17.25) • Private development to incorporate storm water BMPs 17.26) • Convene transportation Task Force to review CMA, identify other transportation measures, develop recommendations to SCVURPPP(17.27)	at the Source I & II and Planning Procedures for Private Projects –1996) • See SCVURPPP report "Effects of Land Use Watersheds" June 30, 1999 and Appropriate WMI topic • Potential WMI topic • Potential WMI topic • Potential WMI topic • Co-permittees implementing via Planning Procedures Performance Standard and Planning Procedures for Private Projects –1996 • Potential WMI topic	conducted as part of Annual Report ** ** ** ** Evaluation conducted as part of Annual Report **	 ** ** ** ** ** NA
18	Strengthen Existing Institutional Arrangements for Watershed Protection	• Conducted as part of WMI activities[4]	NA	NA
19	Identify New Copper Sources for Control Measure Application	SCVURPPP conducted the following activities: • See SCVURPPP report "Metals Control Measures Plan", February 12, 1997 [prepared consistent with Permit Provision C.7]. • See SCVURPPP URMP Table 2, which incorporates recommendations of MCMP. Table 2 includes	Effectiveness evaluation conducted as part of MCMP, quantification of effectiveness	Additional quantification possible, uncertainty moderate to high, benefit small

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
		ongoing measures and new measures. • See Brake Pad Partnership work funded by SCVURPPP.	contained in Table 6-3	
20	Control copper corrosion from potable water discharges	SCVWD completed: • See investigation conducted as part of Jan. 1994 SCVWD report "Copper & Selenium in Water Supply of the Santa Clara Valley" submitted to RWQCB per CWC 13267 request.	Effectiveness relative to current load evaluated as part of SCVWD report and MCMP CDA estimates indicate that eliminating copper pipes from new homes over the next 20 years could reduce copper by approximately 2-4% as a percentage from all sources (Dale Peters, CDA 2000)	Additional efforts not effective
21	Control the Copper Discharged from Application of Copper Based Pesticides to Plants	• See SCVURPPP IPM program • See BASMAA Regional Ad Campaign • SCVURPPP UPC participation • SCVURPPP approved Pesticide Strategy and involvement in development regional strategy through BASMAA work group • See SCVURPPP PI/P program	Effectiveness surveys of Ad Campaigns (Pests Bugging You and Ant campaign) conducted as part of PI/P program	Additional effectiveness surveys planned, as part of all SCVURPPP campaigns, modification of outreach program

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Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
			Control measure BMP moderately effective for Pest Bugging You Ant Campaign currently being conducted	based on results of surveys Quantification of programmatic (behavior change) effectiveness relative possible and being conducted, Quantification relative to copper possible, uncertainty high, benefit small
22	Copper in Sediment	• See SCVURPPP sediment sampling report – report released October 1999 • Co-permittees implementing via Planning Procedures Performance Standard • SEIDP indicators currently under investigation (#15 related to sediment controls)	SEIDP (Indicator #5) examining relationship between sediment quality and urbanization (consideration of system O&M as effective control measure)	Need results of SEIDP evaluation
23	Conduct Street Sweeping	SCVURPPP Co-permittees routine program • Co-permittees implementing via Public Streets Roads and Highways Operation & Maintenance Performance Standard	Local Bay Area Quantification conducted as part of several special studies and national data	Additional quantification possible, uncertainty moderate to high, benefit moderate

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
			available (Will add info for SM, Alameda, and Fairfield)	
24	Improve Design, Operation and Maintenance Practices	• SCVURPPP Co-permittees implementing via Storm Drain System Operation and Maintenance Performance Standard • See SCVURPPP report "Catch Basin Retrofit Feasibility" July 12, 1999	Effectiveness of stormwater inlet retrofits evaluated; found effective in high litter areas, not cost-effective throughout drainage system Quantification relative to copper not done.	Additional quantification possible for copper, uncertainty moderate to high, benefit small
25	Watershed Classification for the South Bay	• See WMI assessment framework, selection of three watersheds, etc. • See WMI Land Use Subgroup work efforts (current and planned) • See SCVURPPP SEIP • See SCVURPPP support for San Francisquito CRMP		Evaluation currently conducted via WMI Potential additional new measures or modifications to current measures may be needed based on results of watershed

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Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
				assessments
26	Develop Controls for New Construction and Re-development	• Co-permittees implementing via Planning Procedures Performance Standard	Effectiveness evaluation conducted as part of Performance Reviews and Annual Reports Quantification of loads and effectiveness contained in MCMP (Section 5.4.2)	Additional quantification possible, uncertainty moderate, benefit small
27	Control Copper in Diesel Exhaust	• See MCMP (1997) • See AIR-1 (MCMP recommendation in URMP)	Quantification of load and effectiveness evaluated as part of MCMP (Section 5.5)	Additional quantification possible, uncertainty moderate, benefit small
28	Control Discharge from Very Small Quantity Generators	Unknown	Unknown	Unknown
29	Reduce Infiltration and Inflow into Storm Drains	SCVURPPP has conducted some activities on this control measure: • See Start at the Source Manual (1999 edition) section titled “Infiltration and the risk of groundwater contamination”	Unknown	Unknown

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
		• See Revised Industrial/Commercial Discharger Control Program Performance Standard – revised March 1, 1999 include in approved FY 99-00 Work Plan		
30	Improve Infiltration and Irrigation Systems (use of rubber gaskets)	Unknown	Unknown	Measure reconsidered and determined to be ineffective for copper source control.
31	Control Copper Discharge from Outdoor Use of Ornamental Copper	• Investigation and quantification of commercial applications conducted as part of MCMP • See Start at the Source documents	Quantification of load is possible, not done as part of MCMP	Quantification of ornamental use possible, uncertainty moderate, benefit small
32	Parking Lot BMP Study	• SCVURPPPP "Parking Monitoring Report", June 11, 1996 WWC; "Parking Lot BMP Manual, June 11, 1996, WWC. • See Start at the Source documents • See SCVURPPP Planning Procedures Performance Standard	Quantification load not significant and effectiveness of BMPs small relative to copper	Additional Quantification possible, uncertainty moderate, benefit small
33	Control the Discharge of Copper-Based Algaecides from Pools, Spas, and Fountains to Storm Drains	• See PI/P brochure • See SCVURPPP conditionally exempt discharge policy		Quantification possible, uncertainty moderate, benefit small

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
34	Quantify copper deposition in rainfall	• SFEI air deposition pilot study • Possible BASMAA investigation in conjunction with vehicle fuel analysis for mercury • See CAP Section 2, Table 2-1 for current estimates	Special Study	Special Study ongoing
35	POTW Source Control Programs • Palo Alto • San Jose/Santa Clara • Sunnyvale	Between 1980 and 1989 Influent copper reduced from 35,000 lbs/yr. To 4, 000 lbs/yr. ?? Between 1982 and 1993 Influent copper reduced from 36,354 lbs/yr. To approximately 2,900 lbs/yr Between 1993 and 1999 copper reduced from approximately 2,900 lbs/yr to 1,800 lbs/yr	86% Source Control Reduction ?? 92% Source Control Reduction 38% Mass Audit Reduction	Maintain current efforts
36	POTW Water Recycling Programs • Palo Alto • San Jose/Santa Clara • Sunnyvale	?? Current 1999 Dry Season recycling of ______ million gallons Current 1999 Dry Season recycling of 216 million gallons		
37	POTW Plant/Unit Process Optimization • Palo Alto • San Jose/Santa Clara	Average effluent copper concentration reduced from___ ppb in 1982 to ___ ppb in 1999 Nitrification converted into single stage BNR	BNR pilot test of process shows 0.6 ppb median copper	

Appendix 2
Summary List and Screening Evaluation of Copper Control Measures in Lower South San Francisco Bay

No.	Ongoing and Potential Control Measures as Described in Copper Dialogue[5]	Summary of Current Activities	Evaluation of Effectiveness	Need for Further Evaluation, Modification, or Deletion of Control Measure
			reduction	
		Terminate pre-filter chlorination to reduce solubilizing copper	Reduces copper solubilization	Scheduled for Spring 2000
		Average effluent copper concentration reduced from ___ ppb in 1982 to ___ ppb in 1999		
	• Sunnyvale	Average effluent copper concentration reduced from 6.8 ppb in 1982 to 2.6 ppb in 1999 Polymer project completed, filter optimization under consideration	62% reduction	

1 Fifteen agencies – Co-permittees under the stormwater discharge permit (NPDES Permit Order No. 95-180) issued by the SFRWQCB – comprise the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program). The SCVURPPP developed an updated Urban Runoff Management Plan (1997) consistent with NPDES permit provision C.2. The URMP has been approved by the RWQCB (see RWQCB letters dated July 10 and December 14, 1998).

2 NPDES permit Provision C.2.. The Performance Standards describe a specific result, or level of effort that constitutes the "maximum extent practicable" based on current technical knowledge, available resources and local conditions. The Co-permittees develop, adopt and implement local runoff management plans that include the Performance Standards, best management practices, standard operating procedures, annual work plans, and annual reports.

3 The Stormwater Environmental Indicators Demonstration Project (SEIDP) is part of USEPA's Environmental Indicators/Measures of success project. The SEIDP is the third phase of EPA's program that focuses on local demonstration projects and the testing of indicators In the Walsh Ave. catchment, water quality indicators, programmatic indicators, social indicators, and site indicators are being evaluated to gauge Program implementation. Twenty different indicators are under review.

4 A comparison of the SCVURPPP's 1995 SWMP and the 1997 URMP is contained in Attachment 1 of the September 1, 1997 URMP and Section D-1 of the Program's FY 97-98 Annual Report. The comparison illustrates how the SWMP watershed management measures, as well as other measures, have been incorporated into the 1997 URMP. The RWQCB approved the 1997 URMP, including incorporation of SWMP measures, on December 14, 1998. The 1997 URMP Watershed Management Measures element of the URMP has been continually improved

(consistent with Permit Provision C.7) as part of the FY 98-99 and FY 99-00 Work Plans. Both Work Plans have been approved by the RWQCB (FY 98-99: December 14, 1998 and FY 99-00: May 19, 1999). Refer to Program Annual reports of the status of the efforts.

5 Control measures (numbers 1 through 34) identified in this summary table were substantially based on the measures identified in the 1994 Copper Reduction Dialogue. This listing is only provided as a convenient mechanism to identify current and potential control measures. Unless specifically noted, use of the Dialogue numbering convention and descriptions does not imply agreement to implement the various measures.

6 Number 18 and 19 tie to WMI, considered part of WAR

7 The SCVURPPP Urban Runoff Management Plan (1997) includes an Evaluation and Continuous Improvement Section 3G that initiated program reviews of the individual Co-permittee implementation of the performance standards starting in FY 97-98. RWQCB staff conducts the program reviews to identify areas for improvement with the assistance from Program staff and other interested parties (generally local environmental group members). Three rounds of performance reviews have been conducted to date.

Appendix 3
California Regional Water Quality Control Board, San Francisco Bay Region Order No. 00-109 Amending Waste Discharge Requirements

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER No. 00-109
NPDES PERMIT NOS. CA0037842, CA0037834, CA0037621

AMENDING WASTE DISCHARGE REQUIREMENTS FOR:

CITIES OF SAN JOSE AND SANTA CLARA
SAN JOSE/SANTA CLARA WATER POLLUTION CONTROL PLANT
SAN JOSE
SANTA CLARA COUNTY

CITY OF SUNNYVALE
SUNNYVALE WATER POLLUTION CONTROL PLANT
SUNNYVALE
SANTA CLARA COUNTY

CITY OF PALO ALTO
PALO ALTO REGIONAL WATER QUALITY CONTROL PLANT
PALO ALTO
SANTA CLARA COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter called the Board) finds that:

1. The Board issued the Cities of San Jose and Santa Clara, Sunnyvale, and Palo Alto (hereinafter the Dischargers) Waste Discharge Requirements, Order Nos. 98-052, 98-053, and 98-054 respectively, on June 17, 1998. Each of the Dischargers owns and operates a wastewater treatment plant which discharges into San Francisco Bay below the Dumbarton Bridge (the "Lower South Bay").

2. Provision 7 of Order No. 98-052 (for San Jose/Santa Clara) states:

   Special Studies Supporting SSO and TMDL Development

   The Discharger shall conduct the following technical work and special studies in support of the development of a TMDL for copper and nickel in the South San Francisco Bay. These special studies will assist the regulatory community to develop site-specific water quality criteria for copper and nickel in the South Bay. The Discharger will conduct the following technical investigations, as appropriate:

Assess Pollutant Levels and Levels of Impairment
Develop technical information to support a site-specific objective for copper and nickel
Assess ambient conditions and effluent levels. Evaluate whether discharge or ambient water exceeds proposed objectives; continue with remaining steps as necessary
Prepare a Conceptual Model of Pollutant Sources
Identify and Recommend Short and Long-term Studies and Implement Short-term Investigations
Evaluate Existing 2-D/3-D Models
Modify Selected Model (as appropriate)
Establish and Support a Stakeholder TMDL Group
Establish and Support a TMDL Technical Review Committee

The Discharger shall develop and submit a schedule and workplan to conduct the appropriate special studies in support of TMDL development that is acceptable to the Executive Officer within 60 days of adoption of this order. The Discharger shall report to the Executive Officer every six months, beginning January 31, 1999 as part of the watershed programs status update, describing its efforts for the prior six months.

3. Each of the Dischargers' orders contains a Provision (Provision 6 of Order No. 98-052, Provision 4 of Order No. 98-053, and Provision 5 of Order No. 98-054), which states:

Watershed Management Initiative Support

The Discharger shall participate with the Regional Board staff, other Dischargers in the Lower South Bay, representatives of the public and other concerned parties as described below in carrying out the Santa Clara Basin Watershed Management Initiative (WMI) tasks set forth in the Bay Monitoring and Modeling Workplan dated July 29, 1997 aimed at development of a TMDL. The Discharger shall participate in such a manner by attending through its representatives meetings of the Core Group of the WMI, as well as meetings of the Bay Modeling and Monitoring Subgroup and the Regulatory Subgroup. The Discharger shall review and comment upon all technical and other proposals developed by the foregoing groups of the WMI. The Discharger shall make technical information in its possession available to the appropriate groups of the WMI necessary to develop the watershed management reports. The Discharger shall report to the Executive Officer every six months, beginning January 31, 1999 as part of the watershed programs status update, describing its efforts for the prior six months in cooperating with the WMI[1].

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[1] This sentence in the Palo Alto permit reads: "The Discharger shall report to the Executive Officer every six months, in the annual and semiannual Pretreatment Program Reports, as part of the watershed programs status update, describing its efforts for the prior six months in cooperating with the WMI.

4. The WMI established the TMDL Workgroup (TWG) as a stakeholder group to advise Discharger TMDL development efforts. The TWG included representatives from the Dischargers, Regional and State Board staff, Santa Clara Valley Urban Runoff Pollution Prevention Program, US EPA, San Francisco Estuary Institute, Department of Fish and Game, environmental groups (CLEAN South Bay and Silicon Valley Toxics Coalition), business groups (Chamber of Commerce, Silicon Valley Manufacturing Group, and the Copper Development Association), Silicon Valley Pollution Prevention Center, and others.

At its April 14, 2000 meeting the TWG approved the following reports and forwarded them to the WMI: Impairment Assessment Report and Copper Action Plan. The TWG also approved an outline of a Nickel Action Plan.

6. The City of San Jose, working through the TWG, produced the following reports and studies in compliance with Provision 7 of Order No. 98-052:

Special Study/Technical Report (San Jose Provision E.7)	**Project Status/Report Title**	**Date San Jose Report Submitted To RWQCB**
Assess Pollutant Levels and Levels of Impairment	*"Task 2. Impairment Assessment Report for Copper and Nickel for South San Francisco Bay"	July 27, 2000
Develop technical information to support a site-specific objective for copper and nickel	"Development of a Site-Specific Water Quality Criterion for Copper in South San Francisco Bay "Acute and Chronic Nickel Toxicity: Development of an Acute-to-Chronic Ratio for West Coast Marine Species"	Copper – June 10, 1998 Nickel – February 18, 1999
Assess ambient conditions and effluent levels. Evaluate whether discharge or ambient water exceeds proposed objectives; continue with remaining steps as necessary	*"Task 2. Impairment Assessment Report for Copper and Nickel for South San Francisco Bay" "Task 2.1 Source Characterization Report"	July 27, 2000 NA
Prepare a Conceptual Model of Pollutant Sources	*"Task 1: Conceptual Model Report for Copper and Nickel in Lower South San Francisco Bay"	June 12, 2000

Special Study/Technical Report (San Jose Provision E.7)	**Project Status/Report Title**	**Date San Jose Report Submitted To RWQCB**
Identify and Recommend Short and Long-term Studies and Implement Short-term Investigations	NA	NA
Evaluate Existing 2-D/3-D Models	*"Task 4: Evaluate Existing 2 and 3 Dimensional Models", dated February 8, 1999	NA
Establish and Support a Stakeholder TMDL Group (TWG)	TWG initiated work on June 23, 1998_ and completed work on _April 14, 2000_____	NA
Establish and Support a TMDL Technical Review Committee (TRC)	TRC process initiated on September 21, 1998____ and completed on April 14, 2000______	NA
Anti-degradation Measures for Copper and Nickel	*"Task 10: Copper Action Plan" *"Task 10: Nickel Action Plan"	NA

7. The Impairment Assessment Report (dated June, 2000) concludes that impairment of the Lower South Bay due to copper or nickel is unlikely. The report also recommends that copper and nickel be removed from the 303d list of impaired water bodies (approved by US EPA on May 12, 1999). Finally the report recommends the establishment of site specific objectives for copper and nickel. The report recommends a range of 5.5 to 11.6 ug/l for dissolved copper and 11.9 to 24.4 ug/l for dissolved nickel as site specific objectives.

8. The Copper Action Plan (dated June, 2000) proposes monitoring to determine if copper is increasing in the Lower South Bay and triggers pollution prevention actions to control copper. For monitoring, the report recommends that copper loading from point sources and urban runoff be monitored. It also recommends that dissolved copper be monitored in the Lower South Bay during the dry season. If the mean dissolved copper concentrations measured at stations specified in this order increases from its current level of 3.2 ug/l to 4.0 ug/l or higher, Phase 1 actions would be triggered to further control copper discharges. If the mean dissolved copper concentration increases to 4.4 ug/l, Phase 2 actions would be triggered. Such incremental increases in mean dissolved copper concentrations

shall be used solely for triggering the aforementioned actions. If the Dischargers demonstrate that the increases in copper concentrations are due to factors beyond the control of the Dischargers, the Board will consider and determine reasonable control actions required under Phase 1 or Phase 2 of the Copper Action Plan.

9. The Copper Action Plan contains specific actions to be done by various entities as appropriate. Those actions applicable to the Dischargers include:

Baseline Actions: City of Palo Alto efforts to control corrosion of copper pipes (CB-9)[2]; POTW pretreatment programs (CB-13); POTW water recycling programs (CB-14); and Industrial water efficiency efforts (CB-19). In addition, the Dischargers will work with other entities to accomplish other Baseline actions: Industrial runoff reduction (CB-3); Track and encourage investigations of uncertainties in the Lower South Bay impairment decision (CB-17); Track and encourage investigations on factors influencing copper fate and transport (CB-18); and Copper Conceptual Model update (CB-20).

Phase 1 Actions: Identify copper source increases (CI-3)[3]; Evaluate corrosion controls (CI-4); Expand water recycling (CI-7); Evaluate industrial water efficiency efforts and develop additional actions (CI-10); Develop Phase 2 plan for POTW treatment optimization (CI-11); and Develop plan to re-evaluate actions (CI-12). In addition, the Dischargers will work with other entities to accomplish other Phase I actions: Evaluate and investigate uncertainties in Lower South Bay impairment decision (CI-8); and Evaluate and investigate copper fate (CI-9).

Phase 2 actions: Reconsider managing stormwater in POTWs (CII-1)[4]; Implement additional corrosion control measures (CII-3); Implement POTW process optimization (CII-6); and Expand water recycling programs (CII-7).

10. The Nickel Action Plan (dated August, 2000) proposes monitoring to determine if nickel is increasing in the Lower South Bay and triggers pollution prevention actions to control nickel. For monitoring, the report recommends that nickel loading from point sources and urban runoff be monitored. It also recommends that dissolved nickel be monitored in the Lower South Bay during the dry season. If the mean dissolved nickel concentrations measured at stations specified in this order increases from its current level of 3.8 ug/l to 6.0 ug/l or higher, Phase 1 actions would be triggered to further control nickel discharges. If the mean dissolved nickel concentration increases to 8.0 ug/l, Phase 2 actions would be triggered. Such incremental increases in mean dissolved nickel concentrations

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[2] Numbers reference Actions described in Table 4-1 (dated August 23, 2000) of the Copper Action Plan, and included in Appendix A to this Order.
[3] Numbers reference Actions described in Table 4-2 (dated August 23, 2000) of the Copper Action Plan and included in Appendix A to this Order.
[4] Numbers reference Actions described in Table 4-3 (dated August 23, 2000) of the Copper Action Plan and included in Appendix A to this Order.

shall be used solely for triggering the aforementioned actions. If the Dischargers demonstrate that the increases in nickel concentrations are due to factors beyond the control of the Dischargers, the Board will consider and determine reasonable control actions required under Phase 1 or Phase 2 of the Nickel Action Plan.

11. The Nickel Action Plan contains specific actions to be done by various entities as appropriate. Those actions applicable to the Dischargers include:

    Baseline Actions: POTW pretreatment programs (NB-3)[5]; POTW water recycling programs (NB-4); Industrial water efficiency efforts (NB-6); and Track and encourage a watershed model linked to a process oriented Bay model (NB-7).

    Phase 1 Actions: Expand water recycling (I-7)[6]; Evaluate industrial water efficiency efforts and develop additional actions (I-10); Develop Phase 2 plan for POTW treatment optimization (I-11); and Develop Phase I Plan (NI-3).

    Phase 2 Actions: Implement actions developed during Phase 1.

12. Some Phase 1 and Phase 2 actions in the Copper Action Plan and Nickel Action Plan may require the assistance of the Board to co-ordinate and assist in the efforts of the Dischargers and other entities to limit or reduce copper and nickel levels in the Lower South Bay. It is the intent of the Board that Board staff will, to the extent practicable, co-ordinate and assist Phase 1 and Phase 2 actions as identified in the Copper Action Plan and Nickel Action Plan

13. Based upon the information contained in the Impairment Assessment Report, the Board hereby concludes that the Lower South Bay is not an impaired water body for copper or nickel within the meaning of Section 303(d) of the federal Clean Water Act. Therefore, it is the intent of the Board to remove copper and nickel for the Lower South Bay from the 303d list of impaired water bodies the next time the list is updated (April 2002). The Board's conclusion is based on data collected in the Lower South Bay from 1997 to 1999 which show that the mean dissolved copper concentration was 2.7 ug/l (range 0.8 to 4.9 ug/l) and that the mean dissolved nickel concentration was 3.8 ug/l (range 1.5 to 10.1 ug/l). Data from the Lower South Bay are below the lowest end of the suggested range for site specific objectives in the Impairment Assessment Report of 5.5 to 11.6 ug/l for dissolved copper and 11.9 to 24.4 ug/l for dissolved nickel as site specific objectives.

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[5] Numbers reference Actions described in Table 4-1 (dated August 23, 2000) of the Nickel Action Plan and included in Appendix A to this Order.

[6] Numbers reference Actions described in Table 4-2 (dated August 23, 2000) of the Nickel Action Plan and included in Appendix A to this Order.

14. It is the intent of the Board to amend the Basin Plan to establish site-specific objectives for copper and nickel for the Lower South Bay. Information contained in the Impairment Assessment Report, along with other information, including information to be developed by the Dischargers for review and consideration by the Regional Board, will be used to establish the objectives. It is the intent of the Regional Board to establish appropriate site specific objectives using available state and/or federal water quality guidance and procedures. It is also the intent of the Board to use the site specific objectives, and all information generated in the process of establishing the site specific objectives, to develop new effluent limits, if needed, for copper and nickel concentration and mass when the dischargers' permits are next revised.

On March 2, 2000 The State Water Resources Control Board (State Board) adopted the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (State Implementation Plan – SIP). This Policy establishes procedures for implementing the US EPA's California Toxics Rule. In part, the SIP establishes procedures for Regional Boards to adopt site specific objectives. The following conditions need to be met for a Regional Board to initiate the development of site specific objectives: 1. A written request for a study, including funding commitments and workplans are filed with the Regional Board; 2. Either a. the receiving waters do not meet water quality objectives contained in the California Toxics Rule, or b. a discharger's effluent limits based on water quality objectives contained in the California Toxics Rule cannot be met; and 3. The discharger has demonstrated that effluent limits based on water quality objectives contained in the California Toxics Rule cannot be met by reasonable treatment, source control, and pollution prevention measures.

The Board finds that the conditions noted in the SIP have been met and therefore a site specific objective study can be initiated. Specifically: 1. The Impairment Assessment Report meets and goes beyond the first condition; 2. The second condition is met since the California Toxics Rule water quality objectives for dissolved copper (3.1 ug/l) and dissolved nickel (8.2 ug/l) are not achieved in the Lower South Bay at all times; and 3. The dischargers have previously implemented reasonable treatment, source control, and pollution prevention measures, without being able to meet potential effluent limits based on water quality objectives contained in the California Toxics Rule.

15. Pollution prevention and minimization are a significant part of the Dischargers' efforts to limit the discharges of copper and nickel.

a. The dischargers have approved Pretreatment Programs and have established Pollution Prevention Programs under the requirements specified by the Regional Board.

b. The dischargers’ Pretreatment and Pollution Prevention Programs have resulted in a significant reduction of toxic pollutants discharged to the treatment plant and to the receiving waters.
c. This reduction is reflected in influent and effluent data.

16. The Board staff has developed the following guidance for a pollution prevention program:

a. The discharger will continue to implement and improve its existing Pollution Prevention Program in order to reduce pollutant loadings to the treatment plant and therefore to the receiving waters. These guidelines are not intended to fulfill the requirements in The Clean Water Enforcement and Pollution Prevention Act of 1999 (Senate Bill 709).

b. The discharger will submit an annual report that includes the following information:

(i) *A brief description of its treatment plant, treatment plant processes and service area*.

(ii) *A discussion of current pollutant issues.* Periodically, the discharger shall analyze its own situation to determine which pollutants are currently a problem and/or which pollutants may be potential future problems. This discussion shall include the reasons why the pollutants were chosen.

(iii) *Identification of sources for pollutants identified in (ii).* This discussion shall include how the discharger intends to estimate and identify sources of the pollutants. The discharger should also identify sources or potential sources not directly within the ability or authority of the discharger to control such as pollutants in the potable water supply and air deposition.

(iv) *Identification of tasks to reduce the sources of pollutants of identified in (ii).*. This discussion shall identify and prioritize tasks to address the discharger’s pollutant issues. Tasks can target its industrial, commercial, or residential sectors. The discharger may implement tasks themselves or participate in group, regional, or national tasks that will address these issues. The discharger is strongly encouraged to participate in group, regional, or national tasks that will address its pollutants of concern whenever it is efficient and appropriate to do so. A time line shall be included for the implementation of each task.

(v) *Implementation and continuation of outreach tasks for City employees.* The discharger shall implement outreach tasks for City employees. The overall goal of this task is to inform employees about the pollutant issues, potential sources, and how they might be able to help reduce the discharge of these pollutants into the treatment plant. The discharger may provide a forum for employees to provide input to the Program.

(vi) *Implementation and continuation of a public outreach program*. The discharger shall implement a public outreach program to communicate pollution prevention to its service area. Outreach may include participation in existing community events such as county fairs, initiating new community events such as displays and contests during Pollution Prevention Week, implementation of a school outreach program, conducting plant tours, and providing public information in newspaper articles or advertisements, radio, television stories or spots, newsletters, utility bill inserts, and web site. Information shall be specific to the target audiences. The discharger should coordinate with other agencies as appropriate.

(vii) *Discussion of criteria used to measure Program and tasks' effectiveness*. The discharger shall establish criteria to evaluate the effectiveness of its Pollution Prevention Program. This shall also include a discussion of the specific criteria used to measure the effectiveness of each of the tasks in item b. (iv), b. (v), and b. (vi).

(viii) *Documentation of efforts and progress.* This discussion shall detail all of the discharger's activities in the Pollution Prevention Program during the reporting year.

(ix) *Evaluation of Program and tasks' effectiveness.* This discharger shall utilize the criteria established in b. (vii) to evaluate the Program and tasks' effectiveness.

(x) *Identification of specific tasks and time schedules for future efforts.* Based on the evaluation, the discharger shall detail how it intends to continue or change its tasks in order to more effectively reduce the amount of pollutants to the treatment plant, and subsequently in its effluent.

17. This Order serves to amend NPDES permits, reissuance of which is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code (CEQA) pursuant to Section 13389 of the California Code.

18. The Dischargers and interested agencies and persons have been notified of the Regional Board's intent to reissue the NPDES permit for this discharge and have been provided an opportunity to submit their written comments and appear at the public hearing.

19. The Board, at a properly noticed public meeting, heard and considered comments pertaining to the discharge.

IT IS HEREBY ORDERED that the Dischargers, in Order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted thereunder, shall comply with the following provisions:

Orders Nos. 98-052, 98-053, and 98-054 are amended to add the following provisions:

1. Baseline Actions to control copper and nickel, as described in Findings 9 and 11 and the Copper and Nickel Action Plans, shall be implemented immediately. The Dischargers shall submit annual reports to the Bay Monitoring and Modeling Subgroup of the Santa Clara Basin Watershed Management Initiative and the Board, either included in, or at the same time as, the annual pretreatment report, on the status of these actions. The reports shall be acceptable to the Executive Officer, who will consider comments from the Bay Monitoring and Modeling Subgroup and other interested parties.

2. Ten stations described in the Copper Action Plan shall be monitored monthly during the dry season (May through October) for dissolved copper and nickel. The results of this monitoring shall be reported in the monthly Self Monitoring Reports and in the annual Self Monitoring Report to the Board and to the Bay Monitoring and Modeling (BMM) Subgroup of the Santa Clara Basin Watershed Management Initiative. A Discharger may reference the monthly or annual Self Monitoring Report of another Lower South Bay Discharger to comply with this Provision.

3. If the results of the monitoring required in Provision 2 above for Stations SB03, SB04, SB05, SB07, SB08, and SB09 show that mean dissolved copper concentrations have risen to 4.0 ug/l, the Dischargers shall implement Phase 1 actions described in Finding 9 and report on the Phase 1 actions in the annual report required by Provision 1.

4. If the results of the monitoring required in Provision 2 above for Stations SB03, SB06, SB07, SB08, SB09, and SB10 show that mean dissolved nickel concentrations have risen to 6.0 ug/l, the Dischargers shall implement Phase 1 actions described in Finding 11 and report on the Phase 1 actions in the annual report required by Provision 1.

5. If the results of the monitoring required in Provision 2 above for Stations SB03, SB04, SB05, SB07, SB08, and SB09 show that mean dissolved copper concentrations have risen to 4.4 ug/l, the Dischargers shall implement Phase 2 actions described in Finding 9 and report on the Phase 2 actions in the annual report required by Provision 1.

6. If the results of the monitoring required in Provision 2 above for Stations SB03, SB06, SB07, SB08, SB09, and SB10 show that mean dissolved nickel concentrations have risen to 8.0 ug/l, the Dischargers shall implement Phase 2 actions described in Finding 11 and report on the Phase 2 actions in the annual report required by Provision 1.

7. Provision 6 of Order No. 98-052, Provision 4 of Order No. 98-053, and Provision 5 of Order No. 98-054 are hereby amended to read as follows:

Watershed Management Initiative Support

The Discharger shall participate with the Regional Board staff, other Dischargers in the Lower South Bay, representatives of the public and other concerned parties as described below in carrying out the Santa Clara Basin Watershed Management Initiative (WMI) tasks set forth in a workplan to be approved by the Executive Officer to be developed pursuant to Provision 8 of this Order aimed at assisting the Regional Board select and adopt site-specific water quality objectives for copper and nickel. In addition to conducting the work set forth in Provision 8, the Discharger shall participate in such a manner by attending through its representatives meetings of the Core Group of the WMI, as well as meetings of the Bay Modeling and Monitoring Subgroup and the Regulatory Subgroup. The Discharger shall review and comment upon all technical and other proposals developed by the foregoing groups of the WMI that are related to surface water quality in the Lower South Bay. These technical proposals include, but are not limited to: Track and encourage investigations of uncertainties in the Lower South Bay impairment decision (CB-17); Track and encourage investigations on factors influencing copper and fate and transport (CB-18); and Copper Conceptual Model update (CB-20), from the Copper Action Plan; and Track and Encourage a watershed model linked to a process oriented Bay model (NB-7) from the Nickel Action Plan. The Discharger shall make technical information that is considered public information, in its possession available to the appropriate groups of the WMI necessary to develop and conduct the work effort set forth in the workplan required per Provision 8 of this order. The Discharger shall report to the Executive Officer every six months, beginning January 31, 2001 as part of the watershed program status update, describing its efforts for the prior six months in cooperating with the WMI. The Dischargers shall, in conjunction with the BMM and/or Regulatory Subgroups, schedule semi-annual (twice per year) meetings to discuss tracking efforts and specific efforts that could be undertaken to look for opportunities to encourage specific activities, assign responsibility to execute such encouragement activities, and report on the implementation of previously assigned activities.

8. Provision 7 of Order No. 98-052 is deleted in its entirety. A new Provision is hereby added to each Discharger's permit as follows:

Technical Assistance to Support the Adoption of Site-Specific Objectives for Copper and Nickel

In support of the WMI's overall goal of developing and implementing site-specific water quality objectives for copper and nickel in the Lower South Bay, the Discharger shall participate with the other POTW Dischargers in the Lower South Bay to conduct the following work to assist the regulatory community to make a final selection of final site-specific objectives for copper and nickel in the Lower South San Francisco Bay and to issue waste discharge requirements to the treatment plants discharging into the Lower South Bay based thereon:

Draft technical and environmental support documents (FED) and summaries thereof for consideration and potential adoption by the Regional Board which are sufficient to enable the Regional Board to select final site-specific objectives for both copper and nickel from within the respective ranges specified in Finding 7 of this Order.

Draft analyses and plans as the Regional Board may need to consider and adopt pursuant to Sections 13241 and 13242 of the California Water Code, as appropriate to enable the Regional Board to comply with the requirements of such Sections in the adoption of site-specific objectives for copper and nickel.

Such further draft analyses and plans as the Regional Board may need to consider and adopt in order to comply with any other requirements of California law in order to adopt final site-specific objectives for copper and nickel and to issue waste discharge requirements to the treatment plants discharging into the Lower South Bay based on such objectives. Such further analyses and plans will be limited to the Regional Board's initial adoption of site specific objectives and waste discharge requirements and not for Regional Board actions in response to challenges of its determinations.

The Discharger shall develop and submit through the Bay Modeling and Monitoring Subgroup of the WMI a schedule and workplan, as part of an updated BMM workplan, to conduct the above work and prepare the above special studies that are acceptable to the Executive Officer within 60 days of adoption of this Order. Such workplan shall provide for a time schedule that will enable the Board to take final action to adopt the final site-specific objectives in as short a time as practicable, but in no case later than three (3) years from the date of adoption of the Order containing this Provision. Such workplan, when approved, shall become the workplan of the WMI. The Discharger shall report to the Executive Officer every six months, beginning July 31, 2001 as part of the watershed program status update (or in the annual and semiannual Pretreatment Program Reports), describing its efforts for the prior six months.

9. As part of the report of waste discharge required 180 days prior to permit expiration for reissuance of the NPDES permits, the Dischargers shall submit revised Copper and Nickel Action Plans. The Plans shall be revised as necessary based on initial data collected and information gained from the initial implementation of the Plans.

10. This Order expires on June 17, 2003.

I, Lawrence P. Kolb, Acting Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on October 18, 2000.

LAWRENCE P. KOLB
Acting Executive Officer