SECTION 4

MONITORING ACTIVITIES

4. MONITORING ACTIVITIES

INTRODUCTION

During FY 04-05, a considerable amount of water quality data and information was gathered and/or assessed by the Program through the direct implementation of and active participation in monitoring-related activities in the San Francisco Bay Area. The Program's monitoring resources were primarily spent preparing permit-required submittals, continuing to implement the Program's Revised Multi-Year Receiving Waters Monitoring Plan (Revised Multi-Year Plan), participating in regional monitoring-related programs, conducting special studies and implementing pollutant-specific control programs.

This section provides a brief background of the Program's monitoring and assessment program and summarizes significant monitoring-related activities conducted during FY 04-05. The activities described in this section are consistent with Provisions C.7 and C.9 of the Program's NPDES Permit. Each summary includes the following information, to the extent possible:

1) A description of the relationship to NPDES Permit requirement(s) and management question(s) the study was designed to address;
2) A brief description of subtasks and status of project/activity;
3) A brief description of the results;
4) A summary of findings to-date and recommendations (where feasible); and
5) A description of lessons learned and planned/recommended follow-up activities.

In addition, summaries of management activities conducted through the implementation of the Program's Pollutant of Concern (POC) Control Plans are provided for those POCs that do not have separate Annual Report sections (e.g., PCBs, Copper/Nickel and Dioxins). An effectiveness assessment of current monitoring activities is also provided at the end of the chapter.

The findings of many technical reports are briefly described within this section. To ensure public access to completed reports, work products and environmental data, the Program has placed the majority of its reports and work products on its website (www.scvurppp.org). The website is continually updated to include the latest reports and work products, data inventory sets and other pertinent Program information. When viewing the website, a large majority of the reports and work products are linked to downloadable documents. Reports and work products not available through the website may be obtained by submitting a request form to Program staff.

BACKGROUND

Multi-Year Receiving Waters Monitoring Plan

Consistent with Provision C.7.b and C.9 of its Permit, the Program developed (and submitted to the Water Board), a Multi-Year Receiving Waters Monitoring Plan (Multi-Year Plan) on March 1, 2002 that identifies Program monitoring activities in Santa Clara Basin Watersheds over an eight-year period. As new monitoring priorities were established, the Multi-Year Plan was revised in FY 03-04 (Revised Multi-Year Plan). This Revised Multi-Year Plan can be found under the Environmental Monitoring and Assessment Measures link on the Program's website (www.scvurppp.org).

The Revised Multi-Year Plan contains the following information: watershed location (prioritized based on SCBWMI and Program assessment priorities), data type (chemical, biological and physical), number and frequency of sampling events, fiscal years (eight years starting with FY 02-03 through FY09-10), rationale and lead agency. The information on data type uses a tiered monitoring approach discussed by the Water Board staff in its Regional Monitoring and Assessment Strategy (RMAS) memo (Draft Monitoring Design in Water Board-lead Pilot Watersheds, spring 2001) dated February 8, 2001. The following monitoring categories were included within the memorandum: screening level, detailed investigation, and status and trends. The field and analytical methods used in the Revised Multi-Year Plan are described in the Program's Draft Quality Assurance Project Plan (QAPP), which is consistent with the Water Board's Surface Waters Ambient Monitoring Program (SWAMP) Quality Assurance Project Plan.

The Revised Multi-Year Plan incorporates specific data needs that have been identified in Program activities relevant to watershed assessment and monitoring. For example, the Revised Multi-Year Plan incorporates future monitoring activities that will be implemented for sediment-related studies in Stevens and Coyote Creek watersheds. Tasks associated with these monitoring activities are identified in the Program's Work Plan entitled *Workplan for Conducting Watershed Analysis and Management Practice Assessment in Other Creeks Potentially Impaired by Sediment from Anthropogenic Activities* (dated August 30, 2002). A clear identification of the specific monitoring activities planned for each year is included as part of the Program's Annual Monitoring Plan submitted to the Water Board every March 1.

Annual Monitoring and Watershed Management Measures Work Plans and Watershed Characterization Memorandum

During FY 03-04, the Program developed the *FY 04-05 Annual Monitoring and Watershed Management Measures Work Plan* (FY 04-05 Monitoring Plan). The FY 04-05 Monitoring Plan was included in the Program's *FY 04-05 Draft Work Plan* (submitted March 1, 2004). The FY 04-05 Monitoring Plan identified monitoring and watershed assessment activities for five sites in the Adobe Creek watershed, eleven sites in San Tomas Aquino Creek watershed, six sites in the Matadero/Barron Creek watershed, three sites in the Sunnyvale East/West Channel watersheds and five sites in the Calabazas Creek watershed. The selection of these watersheds is consistent with the Program's *Watershed Management and Urban Runoff Management Integration Report* (dated June 29, 2001). The data type and sampling frequency were identified for each sampling site and accompanied by maps showing proposed sampling locations. The monitoring schedule is consistent with the sampling design presented in the Revised Multi-Year Plan (i.e., two sampling events per year representing different hydrological cycles). Information collected during implementation of the FY 04-05 Monitoring Plan is described in this Annual Report.

In preparation for Program-led receiving waters monitoring in FY 05-06, the Program developed the *FY 05-06 Annual Monitoring and Watershed Management Measures Work Plan* (FY 05-06 Monitoring Plan) in FY 04-05. The FY 05-06 Monitoring Plan was submitted to the Water Board on March 1, 2005 as part of the Program's *FY 05-06 Draft Work Plan*. Similar to past annual monitoring plans, the FY 05-06 Monitoring Plan describes planned monitoring that will be conducted in Santa Clara Valley creeks during FY 05-06. To provide additional details on the rationale for the selecting sampling site locations and parameters, the Program supplemented the FY 05-06 Monitoring Plan with a watershed characterization technical memorandum. This memorandum includes a summary of existing data and information resources; descriptions of

the relevant watershed attributes; and lists key issues relevant to the development of the proposed sampling design for Stevens and Permanente Creek watersheds that will be implemented in FY 05-06.

SUMMARIES OF FY 04-05 MONITORING AND ASSESSMENT ACTIVITIES

A summary of FY 04-05 monitoring and assessment activities is provided within Appendix C-1 and Table 4-1. Appendix C-1 provides a historical summary of all monitoring and assessment activities conducted by the Program. The following summaries highlight the objectives, results and conclusions of specific monitoring-related projects conducted during FY 04-05. Monitoring activities were generally aimed at developing and implementing programs/projects designed to assess the condition of water bodies using practical, implementable indicators and protocols. The implementation of these indicators and protocols are a necessary step toward establishing a sound regulatory basis for locally based watershed management.

Monitoring activities presented within this section, involve multiple tasks, subtasks, or coordinated activities that may take place over multiple years and at varying geographical scales (i.e., regional or sub-watershed). In addition, it is important to note that monitoring and assessment activities described within this section are not entirely independent from activities described in Section 5 – Watershed Management Measures. Information gained from conducting studies and implementing activities/measures described in both sections have been used (and will continue to be used) in concert to meet objectives outlined in Permit Provisions C.7, C.9, and C.10, which include; (1) characterizing watersheds and stormwater discharges; (2) assessing existing or potential adverse impacts to beneficial uses; (3) identifying potential sources of pollutants of concern; (4) aiding in developing and implementing strategies for controlling adverse impacts on beneficial uses; and (5) assessing the effectiveness of pollutant prevention/control measures.

FY 04-05 SCVURPPP Receiving Waters Monitoring and Assessment

In accordance with Provision C.10 (b), the Program developed a *Watershed Monitoring and Assessment Summary Report* (Summary Assessment Report) that summarizes the results and analyses of baseline data collected during the implementation of the Program's FY 04-05 Annual Monitoring and Watershed Management Measures Work Plan (FY 04-05 Monitoring Plan). The FY 04-05 Monitoring Plan included ambient surface water quality monitoring; and physical habitat assessment studies and bioassessment studies for the following watersheds:

- San Tomas Aquino/Saratoga Creeks;
- Adobe Creek;
- Matadero/Barron Creeks;
- Calabazas Creek; and
- Sunnyvale East/West Channels

The Summary Assessment Report provides information on possible beneficial use impacts to the extent possible (based on the study design and available data) and suggests next steps for monitoring/assessments and developing strategies to control potential impacts. The following paragraphs provide a brief synopsis of the information found within the Summary Assessment Report that is included within Appendix C-2.

Monitoring and Assessment Summary and Conclusions

In FY 04-05, the Program implemented the FY 04-05 Annual Monitoring Program Plan (Annual Plan) in fulfillment of Provision C.7 of its NPDES Permit. The Plan identifies monitoring activities that were implemented as part of the third year (FY 04-05) of the Revised Multi-Year Plan. This Watershed Monitoring and Assessment Summary Report discusses the results of FY 04-05 Watershed Monitoring and Assessment activities conducted in Adobe Creek, Matadero/Barron Creek, Calabazas Creek, Sunnyvale East/West Channel and San Tomas Aquino Creek watersheds.

During FY 04-05, water samples were collected during two events (one representing the dry season (June-October) hydrological cycle and the other the wet season (January-March) hydrological cycle) and analyzed for physio-chemical, chemical, aquatic toxicity and microorganism parameters. Benthic macroinvertebrate (BMI) bioassessments and physical habitat assessments (PHAB) were conducted during the spring/decreasing hydrograph season (April – May). Fish bioassessments were conducted during the late end of the dry season (October).

Field measurements and water samples were collected from three sites in the Adobe and Barron Creek watersheds; three sites in the Matadero Creek watershed; three sites in the Sunnyvale East/West Channels; three sites in the Calabazas Creek watershed; and four sites in the San Thomas Creek watershed, including Saratoga Creek (Figure ES-1). Site identifications, description of locations and parameter types that were measured for each site are listed in Table 3. BMI and PHAB assessments were performed in four sites in Adobe Creek watershed; two sites in Matadero Creek watershed; and eight sites in the San Tomas Aquino Creek watershed. Fish bioassessments were conducted during the dry season at one site in Adobe Creek watershed; two sites in the Matadero Creek watershed; and five sites in Saratoga Creek subwatershed.

The conclusions for each watershed are provided below. Specific recommendations are provided in the *Conclusions and Recommendations* Section within the Summary Assessment Report (Appendix C-2).

Adobe Creek Watershed

No beneficial uses have been designated in the Basin Plan for water bodies in the Adobe Creek watershed. The results of the two years of screening level indicators monitoring indicate that Adobe Creek is supporting WARM Uses in a limited area near A-3.5 (upstream of the Redwood Preserve). Water quality sampling results generally met all Basin Plan Water Quality Objectives and CTR criteria. However, water quality conditions may become unsuitable during the dry season at pools that act as refugia for warm water native fishes (due to low dissolved oxygen concentrations). The lack of deep pools, low flows during the summer and physical fish barriers are likely the biggest limiting factor for existing fish populations. The BMI bioassessment and physical habitat assessment indicate that Adobe Creek, downstream of Foothill Community College, is in poor condition. In contrast, the BMI community and habitat condition in Hidden Villa Farms was in good condition, despite intermittent flow conditions. Due to historically minimal disturbances in the headwater areas, site A-5 is a good candidate for representing reference conditions for intermittent creeks in the South Bay.

Beneficial uses for recreation have not been designated for this water body and limited bacterial indicator[1] data collected for total and fecal coliforms in FY 04-05 indicated that values were below Basin Plan water quality objectives for both REC-1 and REC-2 Uses. One sample analyzed for enterococcus[2] was above the USEPA's suggested bacteriological criteria for water contact recreation at "infrequently used areas". The site where indicator bacteria were collected appeared to have moderate potential for both public access and risk to exposure. Public access and risk for exposure upstream and downstream of this site appear to be low.

Matadero/Barron Creek Watersheds

The Basin Plan identifies several designated Uses in Matadero Creek associated with aquatic life uses, including COLD, WARM, MIGR and SPWN. The results from one year of screening level indicator monitoring indicate that WARM Uses are supported to some extent in the upper reaches of Matadero Creek (upstream of Bol Park). Although water quality sampling results met Basin Plan Water Quality Objectives, site M-3 exhibited poor water quality during the summer season (i.e., extremely high conductivity, total hardness, TDS and sulfate concentrations). The results were inconclusive to determine if these conditions were caused by runoff from adjacent and/or upstream land uses, or if they represented natural conditions during the dry season. The BMI bioassessment show upper reaches of Matadero Creek is in poor condition. These results, however, were not consistent with either the fish bioassessment data or physical habitat assessments, which showed relatively good habitat supporting a native fish population. One explanation for this discrepancy may be the approach used to sample the BMIs (i.e., CSBP high gradient riffles) was not suitable for the stream type observed in the upper reaches of Matadero Creek (i.e., low gradient with limited riffle habitat).

Both contact (REC-1) and non-contact (REC-2) beneficial uses for recreation are designated for Matadero Creek. The limited bacterial indicator data for total and fecal coliforms were less than both the Basin Plan WQOs for contact and non-contact recreation, with one exception (site M-2). In addition, enterococcus data collected at site M-2 was above the USEPA's suggested bacteriological criteria for water contact recreation at "infrequently used areas". Site M-2 is located at a city park and appears to have high potential for public access and exposure. There are several grade control structures that create water depths that are suitable for wading with evidence of contact water recreation along the banks (i.e., rope swing and well worn pathways to creek). Additional investigations relative to characterizing exposure and E. coli concentrations are needed to better determine waterborne pathogen-related risks at this site. Public access and exposure appear to be very low in the remaining creek areas. Upstream and downstream areas that are accessible to the public have limited flow during summer season and/or insufficient water depths (i.e., concrete channel) for contact recreation.

[1] Total Coliform and E. Coli are indicator organisms. Indicator organisms are organisms that co-exist with pathogens in the fecal environment and are easier and are less expensive to test for than pathogens. For this reason, indicators are often the focus of water quality analysis. However, there is little if any conclusive proof that disease risk are directly associated with large numbers of coliforms. Thus, traditional public health practices for regulating beach areas include conducting a sanitary survey in conjunction with water quality monitoring (i.e., includes statistically based sampling program as well as the collection and analysis of meteorological, water circulation and dilution data.) The assumption that exposure to potential pathogens occurs thru swimming (i.e., REC-1 full body contact activities) is key to analyzing the indicator data since it also implies that a relatively large population exists and that the indicator-to-pathogen relationship is relatively stable and thus the estimated "swimming-associated illness rate" is predictable. In situations where the population is small and exposure is very infrequent the relationships tend not to be reliable and predictable. Finally, the presence of the above bacterial indicator organisms may also indicate the presence of warm-blooded animals, especially along stream and creek habitats.

[2] Enterococcus is an indicator organism typically used in marine waters.

There are no designated beneficial uses for Barron Creek. The results from one year of screening level indicator monitoring were not conclusive for assessing support of aquatic life uses in this water body. The stream appears to be nearly dry during the dry season and does not appear to contain suitable habitat (i.e., deep pools or stream connectivity) to support a warm water native fish community. Water quality sampling results generally met all Basin Plan Water Quality Objectives. However, the CTR criterion for copper was exceeded at B-1 during the dry season.

Sunnyvale East/West Channel Watersheds

There are no designated beneficial uses for Sunnyvale East or West Channels in the Basin Plan. The results from one year of screening level indicator monitoring were not conclusive for assessing support of aquatic life uses in these water bodies. The upper reaches of the channels have intermittent flow during the dry season with unsuitable habitat (i.e., deep pools or stream connectivity) to support a warm water native fish community. Water quality sampling results generally met all Basin Plan Water Quality Objectives and CTR criteria. Given these results, no additional investigations are proposed for these watersheds at this time.

Calabazas Creek Watershed

The Basin Plan designates both COLD, WARM and WILD beneficial uses in Calabazas Creek. Results from one year of screening level indicator monitoring were not conclusive for assessing support of aquatic life uses in this water body. The upper reaches of the stream have intermittent flow during the dry season with unsuitable habitat (i.e., deep pools or stream connectivity) to support a warm water native fish community. Water quality sampling results generally met all Basin Plan Water Quality Objectives and CTR criteria. BMI bioassessment and physical habitat assessments indicate poor biological integrity and habitat condition for all of the sampling sites, including C-5, which was relatively rural. The poor conditions are likely to be the result of intermittent flow conditions and poor substrate quality and habitat complexity. The poor quality of the substrate may be a significant factor for limiting BMI community assemblages.

Both contact (REC-1) and non-contact (REC-2) beneficial uses for recreation are designated for Calabazas Creek. The limited bacterial indicator data for total and fecal coliforms were slightly above the Basin Plan WQOs for contact recreation. In addition, enterococcus data collected at sites C-3 and C-5 were slightly above the USEPA's suggested bacteriological criteria for water contact recreation at "infrequently used areas". Site C-3 appeared to have high potential for both public access and potential exposure, although activities appear to be associated with REC-2 rather than REC-1. Site C-5 appeared to be mostly on private property. As a result, there is a low potential for public access. Public access was also limited in the urban reaches of the stream channel due to fencing along the backs (e.g., Creekside Park). Additional investigations relative to characterizing exposure and E. coli concentrations are needed to better determine waterborne pathogen-related risks at this site.

San Tomas Aquino Creek Watershed (includes Saratoga Creek)

The Basin Plan designates both COLD, WARM and WILD beneficial uses in Saratoga Creek. The results of the two years of screening level indicators monitoring indicate that Saratoga Creek is supporting both COLD and WARM Uses, at least upstream of site S-4. Water quality sampling results met all Basin Plan Water Quality Objectives and CTR criteria for COLD Use. In addition, both the fish and BMI community assemblages appear to be in good condition. The results of the Unified Stream Assessment in the 2.4-mile reach showed good overall habitat and

buffer/floodplain condition and relatively few localized impacts. Embeddedness values measured during the physical habitat assessment may indicate a fine sediment supply in the upper reaches of the watershed. The data results were not conclusive for determining if the fine sediment observed in the streambed, or any other impacts to the habitat, are having an adverse affect on the fish or BMI community assemblages.

Both contact (REC-1) and non-contact (REC-2) beneficial uses for recreation are designated for Saratoga Creek. The limited bacterial indicator data collected at three sites for total and fecal coliforms were all below the Basin Plan WQOs for water contact and non-contact recreation, with the exception of fecal coliform concentrations at site S-1 that were slightly higher than WQOs for water contact recreation. In addition, enterococcus data collected at a high majority of Saratoga Creek sites were below USEPA's suggested bacteriological criteria for water contact recreation at "infrequently used areas". Although all Saratoga Creek sites did not appear to have much potential for access and/or exposure, additional investigations relative to characterizing exposure and E. coli concentrations are needed to better determine waterborne pathogen-related risks at sites in this watershed.

There are no designated beneficial uses for San Tomas Aquino Creek in the Basin Plan. Screening level monitoring results in San Tomas Aquino Creek indicate that WARM uses may be supported in areas that have suitable habitat. Water quality sampling results met all Basin Plan Water Quality Objectives and CTR criteria. However, habitat for WARM use is extremely limited due to highly modified channel in the system. Limited habitat was available in the upper reaches, however, BMI bioassessment results determined that physical habitat and the BMI community assemblage at ST-3 was in poor condition. The upper reaches of San Tomas Aquino appear to be affected by existing channel incision and potential unstable channel conditions upstream. No water samples collected in San Tomas Aquino were analyzed for bacterial indicators because public access and potential exposure appear to be very low in this system.

Quality Assurance Project Plan

During December 2-4, 2003, an independent evaluation of the Program's FY 02-03 monitoring program was administered by the United States Environmental Protection Agency and conducted by Tetra Tech, Inc. The purpose of the evaluation was to evaluate the overall monitoring program components and their respective contributions toward satisfying the requirements of the Program's NPDES Permit; and to evaluate the current implementation status of the Multi-Year Plan with respect to the overall purposes of the monitoring program.

As presented in Tetra Tech's *Program Evaluation Report- Santa Clara Valley Urban Runoff Pollution Prevention Program: Monitoring Evaluation* (Evaluation Report), dated January 19, 2004, data quality control and review procedures were identified as areas needing improvement. In response, the Program has developed a *Draft Quality Assurance Project Plan for SCVURPPP Receiving Waters Monitoring* (Draft QAPP) in FY 04-05 to ensure that data quality is being managed adequately. The Draft QAPP, which is included within Appendix C-3, is consistent with the Water Board's QAPP for the Surface Water Ambient Monitoring Program (SWAMP). In FY 05-06, the Program will respond to comments received, revise (as necessary), finalize and begin implementing the QAPP.

Regional Collaborative Monitoring Activities

Regional Monitoring Program for Trace Substances (RMP)

The Regional Monitoring Program for Trace Substances in the San Francisco Estuary (RMP) is a collaborative effort between the San Francisco Estuary Institute (SFEI), the Water Board and the regulated discharger community (including SCVURPPP). The RMP's goal is to collect scientifically valid information that allows movement towards understanding contaminant impacts on beneficial uses of the Bay. The RMP focuses on determining spatial patterns and long term trends through sampling of water, sediment, bivalves, and fish; effects on sensitive organisms; and chemical loading to the Bay. To provide the most complete assessment possible of chemical contamination in the Bay, the RMP seeks to synthesize RMP data with data from other sources.

The RMP is based on management questions and program objectives that are updated by the Water Board, RMP staff, RMP Technical Review Committee (TRC) and RMP Steering Committee (SC) every five years. The RMP recently updated its management questions and objectives in January 2005 (www.sfei.org/rmp/RMPproginfo.htm). However, during FY 04-05 the RMP objectives in effect were to:

1. Describe patterns and trends in contaminant concentration and distribution;
2. Describe general sources and loading of contamination to the Estuary;
3. Measure contaminant effects on selected parts of the Estuary ecosystem;
4. Compare monitoring information to relevant water quality objectives and other guidelines; and
5. Synthesize and distribute information from a range of sources to present a more complete picture of the sources, distribution, fates, and effects of contaminants in the Estuary ecosystem.

The Program actively participated and contributed approximately $161,000 to SFEI for FY 04-05 expenditures on the RMP. This funding to SFEI is in addition to funding provided by the three south Bay public owned treatment works (POTWs), which are also Co-permittees. In addition, Program staff actively participated on a variety of RMP committees and work groups that included the RMP Steering Committee, Technical Review Committee and the Sources, Pathways and Loadings Work Group (SPLWG). In addition, a City of San Jose staff member currently serves as the chair of the RMP TRC. In FY 05-06, the Program will continue to provide financial support for the RMP and actively participate in committees and workgroups.

The RMP budget is generally broken into two monitoring programs: Status and Trends; and Special and Pilot Studies. The following paragraphs provide a brief overview of these programs.

Status and Trends Monitoring Program

The Status and Trends Monitoring Program is the long-term contaminant-monitoring component of the RMP that was initiated as a pilot study in 1989. The Status and Trends Monitoring Program is comprised of four program elements that collect data to address the RMP objectives:

1. The *Status and Trends Monitoring Program* consists of long-term contaminant monitoring to characterize the status and trends for contaminants in water, sediment and biota (bivalves) in the Estuary (Objectives 1,3, and 4);

2. The *Sport Fish Contamination Study* is a triennial screening of fish tissue for contaminants of concern to human health (Objectives 1,3, and 4);
3. The *Episodic Toxicity Monitoring* component investigates potential toxic effects in Estuary tributaries (Objectives 1 and 2); and
4. The *USGS* conducts two long-term monitoring efforts partially funded by the RMP, including monthly water quality measurements in the deep channels of the Estuary (from the Lower South Bay to the confluence of the Sacramento and San Joaquin Rivers), and sediment transport monitoring and modeling in the northern Estuary.

The summaries provided within this section focus on the latest information available from the Status and Trends Monitoring Program (i.e., 2003). The 2003 information was the second year that the Status and Trends Monitoring Program collected water and sediment samples using EPA's Environmental Monitoring Program (EMAP) Generalized Random Tessellation Stratified (GRTS) sample design. This type of design is appropriate for addressing the RMP objective (Objective 1) to describe the spatial and temporal patterns of contamination in the Estuary. Monitoring data are available for downloading via the RMP website using the *Status and Trends Monitoring Data Access Tool* at www.sfei.org/rmp/data.htm.

Pilot and Special Studies

The RMP also conducts Pilot and Special Studies. Pilot Studies usually are designed to investigate and develop new monitoring measures related to anthropogenic contamination or contaminant effects on biota in the Estuary. Special Studies address specific scientific issues that the TRC, SC, or Water Board identify for further study. These additional studies are developed through an open application process, which starts with an applicant submitting a study idea to the RMP Program Manager for discussion at a TRC quarterly meeting.

Summaries of the most pertinent Pilot and Special Studies conducted in FY 04-05 are provided under each summary of pollutant-specific monitoring activities within this section. A summary of past Pilot and Special Studies conducted by the RMP is available on the RMP website (www.sfei.org/rmp/). In addition to providing funding for these studies, Program and Co-permittee staff provided in-kind support on the development, analysis of results and conclusions of each study summarized.

Clean Estuary Partnership

On August 6, 2001, a Memorandum of Understanding (MOU) regarding development of: 1) a Water Quality Attainment Strategy for San Francisco Bay-Delta and Tributaries; and 2) TMDLs for 303(d) pollutants (including mercury) was entered into by the Water Board, Bay Area Clean Water Agencies (BACWA) and Bay Area Stormwater Management Agencies Association (BASMAA). This group is referred to as the Clean Estuary Partnership (CEP).

The mission of the Clean Estuary Partnership (CEP) is to use sound science, adaptive management, and public collaboration to develop and implement technically valid and cost-effective strategies (including TMDLs) that result in identifiable, sustainable water quality improvements for San Francisco Bay. As a member agency of BASMAA, the Program contributed approximately $100,000 to the CEP in FY 04-05. In addition, Program staff participated in CEP Executive Management Board (EMB) meetings, CEP Technical Committee (TC) meetings, pollutant-specific workgroup meetings and CEP Mercury Risk Reduction Work Group meetings. A City of San Jose staff member also serves as chair of the CEP TC. The Program plans to continue to actively participate and contribute approximately $100,000 to the CEP in FY 05-06.

FY 04-05 accomplishments included (but are not limited to) the development of a variety of technical reports and projects. Summaries of information collected during these studies are included under each summary of pollutant-specific monitoring activities. In addition, CEP-approved projects that will be conducted in future years are also described. In addition to funding these studies, Program and Co-permittee staff provided in-kind support on the development, analysis of results and conclusions of each study summarized.

BASMAA Monitoring Committee

In FY 04-05, Program and Co-permittee staff continued to actively participate in the BASMAA Monitoring Committee (MC). The purpose of the BASMAA MC is to discuss and coordinate monitoring activities conducted by the Bay area urban runoff management programs. Although no environmental monitoring is currently being conducted by BASMAA (as a whole), the BASMAA MC provides a valuable forum to discuss monitoring related activities with BASMAA member agencies, Water Board staff, and other agencies and organizations. The Program will continue to actively participate in the BASMAA MC during FY 05-06.

Mercury Monitoring Activities (Provision C.9.c)

Permit Provision C.9.c. requires the Program to develop and implement a mercury pollution prevention plan. In response, the Program developed a Mercury Pollution Prevention Plan (Mercury Plan) consistent with the Provision. The Mercury Plan was submitted to the Water Board on March 1, 2002 as part of the Program's *FY 02-03 Work Plan*. The Mercury Plan identifies actions that will be implemented at the Program level, municipality level, or both; and provides the schedule for initiation and/or completion of Program-level actions. The details of municipality actions and schedules are included in the individual Co-permittee Work Plans and/or Annual Reports, as appropriate.

During FY 04-05, a variety of mercury-related monitoring activities occurred including sampling and analysis of mercury in water, sediment and biota in the Estuary and the Guadalupe River watershed; and water quality monitoring conducted by the Program under the Revised Multi-Year Plan. The following summaries briefly describe the results and conclusions of these efforts. A more detailed description of FY 04-05 accomplishments and the prominent mercury pollution prevention activities planned for FY 05-06 are provided within Section 7 - Mercury Pollution Prevention Activities.

Watershed Monitoring

In FY 04-05, the Program continued to analyze water samples collected in Santa Clara creeks through the implementation of its Revised Multi-Year Plan. Water samples were collected as screening level indicators of water quality at a variety of creek sites draining urban and rural land use areas. As described in the Program's Revised Multi-Year Plan, grab samples were collected during two seasons (wet and dry).

Mercury concentrations detected in Santa Clara creeks in FY 04-05 ranged between 5.0 ng/L and 18.0 ng/L, below the four-day average mercury water quality objective (25 ng/L) for freshwater bodies in the San Francisco Bay region. A full description of methods, results and conclusions are presented in the Summary Assessment Report (see Appendix C-1).

Mercury Atmospheric Deposition Monitoring

One pathway of pollutants to the Estuary is atmospheric deposition, which was examined in the RMP Atmospheric Deposition Pilot Study. One study site (i.e., San Jose) remains from this pilot effort. RMP and City of San Jose in-kind funding were used in FY 04-05 to continue mercury deposition monitoring. The following objectives were used:

- Evaluate concentrations of mercury in rainwater as part of TMDL refinement; and
- Contribute to the national database to evaluate contributions of mercury from large urban areas and long-range aerial transport from outside the region to surface waters.

The latest results available (from 2003) indicated that 3.6 ug/m^2 of mercury was deposited via wet deposition at the San Jose station. Wet deposition in 2000, 2001 and 2002 were 3.8 ug/m^2, 2.7 ug/m^2 and 1.7 ug/m^2, respectively. Mercury concentrations in rainwater averaged 0.013 ug/L in 2003, compared to 0.01 ug/L in 2000, 0.0095 ug/L in 2001, and 0.0069 ug/L in 2002. In addition, when compared to non-urban sites in California, mercury deposited via rainfall at San Jose is substantially higher.

Current plans call for the RMP and the City of San Jose to continue to fund the San Jose monitoring station in FY 04-05. Results from 2004 sampling will be included in the Program's *FY 05-06 Annual Report*.

Contaminant Loads from the Sacramento and San Joaquin Rivers

In FY 04-05, the RMP continued to collaborate with the USGS to monitor suspended solid concentrations at Mallard Island. Sampling will continue through 2005 and contribute to nearly ten years of continuous data when combined with data collected by the USGS from 1994-98. The RMP also collaborated with other groups conducting fixed-time and flood-response water sampling (Interagency Ecological Program) to collect sediment-related contaminant concentrations at Mallard Island for the purpose of developing statistical relationships between concentrations and optical backscatter measurements. These relationships can be used to estimate time-continuous concentration data, that when combined with estimates of discharge, can estimate sediment loads from the Delta and model contaminant loads entering the Estuary from the San Joaquin Valley.

The most recent data available from this study is from Water Years (WY) 2002 and 2003. Total mercury was measured in 30 water samples collected during these years. Total mercury concentrations ranged from 4 to 14 ng/L, whereas dissolved mercury concentrations in seven samples ranged from 0.8 to 1.6 ng/L. Despite dissolved mercury concentrations making up between 11 to 24 percent of the total mercury concentrations, a linear relationship was observed between instantaneous SSC and total mercury. The linear relationship allowed for estimation of annual loads for WY 2002 and WY 2003, which were 58(±20) and 97(±33) kg for total mercury. Extrapolation of mercury data (from WY 2002 and WY 2003) over a nine year period (WY 1995 to WY 2003) using SSC data resulted in long-term average annual load of 201(±68) kg total mercury entering the Estuary from the Sacramento and San Joaquin Rivers.

Current plans call for contaminant loading data collected from the Sacramento and San Joaquin Rivers to continue to be collected in WY 2005 and WY 2006 through funding from the RMP. In the future, long-term trends data collected at this station (used to estimate mercury loads) will be compared against TMDL Waste Load Allocations (WLAs) assigned to the Central Valley region to determine if required load reductions are evident.

Guadalupe River Contaminant Loading Study

During FY 02-03, the CEP approved and funded a project to begin measuring the loads of a variety of contaminants (e.g., mercury, copper, nickel and PCBs) from the Guadalupe River to the Estuary. The main objective of this project was to improve our knowledge on the magnitude of contaminant loads entering the Estuary from local tributaries. The San Francisco Estuary Institute (SFEI) managed the project. Sampling occurred during Water Year (WY) 2003 (November 2002 through May 2003). The study results were generally well accepted by CEP and RMP partners and funding through the RMP was allocated towards another year of sampling (i.e., WY 2004). The following is a summary of the draft results for mercury loads from the Guadalupe River watershed during water years 2003 and 2004.

During WY 2003, a total of 238 water samples were analyzed for SSC and four samples were analyzed for grain size. During WY 2004, a total of 226 water samples were analyzed for SSC and 105 samples were analyzed for grain size. These sample concentrations were combined with the turbidity measurements to estimate a continuous 15-minute SSC record. Water samples for analysis of mercury were collected in the thalweg within one meter of the turbidity probe using clean-hands protocols. Discharge during WY 2003 was 111 percent of the 1971 - 2000 normal.

During Water Year 2003, mercury concentrations varied from 0.18 to 18.67 ng/L. In 2004, mercury concentrations varied from 0.01 to 1.42 ng/L. The variation of mercury relative to SSC was distinctive when compared to the other trace elements. Mercury did not exhibit first flush characteristics and the highest concentrations were uniquely associated with the first year of observations. In WYs 2003 and 2004, the loads of total mercury were estimated to be 116 (± 37) kg and 14.8 (± 4.7) kg, respectively.

Contaminant loading data collected from the Guadalupe River continued to be collected in WY 2005 using similar methods. In addition, the Program provided supplemental funding towards sampling the concentrations of mercury in the bed load of the Guadalupe River during FY 04-05. Results from WY 2005 will be provided within the Program's *FY 05-06 Annual Report*.

Guadalupe River TMDL for Mercury

The Santa Clara Basin Watershed Management Initiative (SCBWMI) is serving as the stakeholder forum for the development of the Guadalupe River TMDL Report for Mercury. The Guadalupe River Watershed encompasses parts of San Jose, Los Gatos, Campbell, Monte Sereno and the unincorporated Santa Clara County. The Program is a stakeholder in the Guadalupe River TMDL. The Santa Clara Valley Water District (SCVWD) is taking a lead role in the TMDL development process by funding the $900,000 study and is participating as Co-Chair of the TMDL Work Group and Stakeholder Group. Program staff is also participating in the TMDL process. In addition, the SCVWD entered into a Memorandum of Understanding (MOU) with the Regional Board for Phase I and Phase II studies which were funded by the SCVWD.

Since FY 02-03, Program staff, along with other Co-permittee staff, have attended Work Group meetings and reviewed draft technical memoranda developed by the consultant (i.e., Tetra Tech). During July and August 2003, a synoptic survey and preliminary field sampling effort was conducted. The results of the synoptic survey were incorporated into the *Draft Conceptual Model Report* (Tetra Tech, October 2, 2003). Based on the information collected for the conceptual model, a *Data Collection Plan* (Tetra Tech, February 20, 2004) was developed. Sampling in the Guadalupe River watershed, which began in February 2004, included an element to compare total and methyl mercury in creeks draining urban watersheds unaffected

by mining (Ross, Canoas and Los Gatos Creeks) to those affected by mining (Alamitos, Guadalupe, Arroyo Calero, Canoas, Randol Creeks and Guadalupe River). Under a contract with the Water Board, the consultant has incorporated the data collection results into the *Final Conceptual Model Report* (Tetra Tech, May 22, 2005). The following paragraphs summarize the findings in this report.

Summary of Conclusions

The watershed has two distinct hydrologic seasons, a wet winter season and a long dry summer season. The winter season is punctuated by the storms that create large flows in the streams and in the main stem of the Guadalupe River. The large storms lead to flows on the main stem that may increase from 10 to over 1000 cubic feet per second (cfs) in less then 24 hours. In the upper part of the watershed, the reservoirs typically limit the variability of flow. The larger rain events, particularly those proceeded shortly in time by similar events; create conditions where large quantities of mercury-bearing solids are routed downstream. These solids are believed to originate from hillside drainage, stream sediments, banks, and in some cases flood plains. The larger-sized, mobilized solids in the streams are collected by impoundments created by drop structures and instream zones of aggregation. However, during large storms, flows can overtop these drop structures. Above the reservoirs, only suspended sediment is transported downstream since spilling is extremely rare. In summary, the wet season is largely a season of transport. Methylmercury concentrations are much lower than observed in the outlets of the reservoirs during the warm dry season. However, mercury is likely being transported to locations where under warmer conditions methylation can occur.

Biogeochemical reactions predominate during the warm dry season. The periodic high flows of winter are past and surface water temperatures increase to values of 65 to 85 F. Over the summer, the reservoirs become stratified. Settling of particulate organic matter in summer depletes the lower waters of dissolved oxygen. The reservoirs now are net methlyators of mercury. The methylmercury concentrations in the discharges of Almaden and Guadalupe Reservoirs are high, up to 12.8 ng/l. Methylmercury concentrations in the epilimnetic and upper hypolimnetic waters are less than in the discharge. Unlike the reservoirs, the creeks in the summer were net demethylators of mercury, with most of the methylmercury in the reservoir releases being lost from the stream water within the first few miles. Although the stream sediment methylmercury concentrations indicate that methylation is occurring at some locations in the creeks, the amount of methylmercury produced is not enough to offset the loss of methylmercury.

Mercury load estimates were made based upon flow and mercury data and modeled flows for selected subwatersheds. Findings from this effort are described below:

- Most of the total mercury is transported in the wet season, particularly during high flow events;
- Two major reservoirs, Guadalupe and Calero are sinks for total mercury; they release less total mercury than they receive;
- Inputs of mercury derived from mine wastes are substantially greater than atmospheric deposition inputs for Guadalupe and Almaden Reservoirs, and for Alamitos and Guadalupe Creeks;
- The urban creeks contribute less total and methylmercury than the mine influenced creeks;

- The total mercury loads from the Guadalupe River have high variability due to varying rainfall from year to year, as seen in the results of a Monte Carlo analysis of loads at the Highway 101 gauging station; and
- While there are multiple uncertainties in the sources of the total and methylmercury load from the Guadalupe River to San Francisco Bay, re-suspension of sediments along the main stem of the Guadalupe River and urban storm drains appear to be important contributors.

The *Final Conceptual Model Report* completes a series of documents developed in Phase 1 of the TMDL for Mercury in the Guadalupe River Watershed. Each document has summarized new information and contributed to the understanding of the biogeochemical processes controlling mercury transport and fate within the watershed. Several data gaps remain and additional data is needed to reduce uncertainties, including large uncertainties in the source of the mercury loads estimated for the Guadalupe River at the Highway 101 gauging station. Additional mercury sampling at high flows of the main tributaries and the main stem of the river are needed to refine the present estimate.

Water Board staff are currently developing a draft TMDL report. Program and Co-permittee staff will continue to participate in the development of the Guadalupe River Watershed TMDL for Mercury by attending meetings and reviewing/commenting on technical results and reports.

Pesticide Monitoring Activities (Provision C.9.d)

In response to Provision C.9.d of the Program's NPDES Permit, the SCVURPPP developed a Pesticide Management Plan consistent with the Provision. The Pesticide Management Plan, which has many components, is described in Section 6 of the Annual Report. Pesticide-related monitoring activities conducted during FY 04-05 are described below.

Watershed Monitoring Activities

SCVURPPP Annual Receiving Waters Monitoring

During FY 04-05, the Program continued to analyze water samples collected in Santa Clara creeks through the implementation of its Revised Multi-Year Plan. Water samples were collected as screening level indicators of water quality at a variety of creek sites draining urban and rural land use areas. Specific to pesticides, creek water was analyzed for organophosphate pesticide concentrations and aquatic toxicity. As described in the Program's Revised Multi-Year Plan, grab samples were collected during two seasons (wet and dry).

Organophosphate pesticides were not detected in any of the twenty samples collected from eight creeks in the Santa Clara Valley in FY 04-05. Specifically, diazinon was not detected above its reporting limit (0.036 ng/L) in any of the samples analyzed.

Results from three species chronic toxicity testing also indicated very few problems in Santa Clara Valley creeks. Six sites were sampled two times (wet and dry seasons) during FY 04-05. The survival and reproduction of test organisms *Ceriodaphnia dubia* and *Pimephales promelas* were slightly inhibited in 3 of 24 samples analyzed. Growth of the green algal *Selenasturm capricornutum* was inhibited in 2 of 12 samples analyzed.

A full description of methods, results and conclusions are presented in the Summary Assessment Report (see Appendix C-1). In future years, the Program will continue to

coordinate pesticide and toxicity monitoring activities with CEP monitoring efforts to ensure that useful and adequate information is being collected. This information should determine the impacts of pesticides on local water bodies.

CEP Urban Creeks Monitoring

In FY 04-05, the Clean Estuary Partnership (CEP) funded the development of an urban creeks monitoring program for pesticides of concern to supplement monitoring already being conducted by local agencies in the Bay Area (e.g., SCVURPPP). During FY 04-05 the CEP's focus was on performing wet weather, storm-event-based sampling and analysis of creek flows for diazinon and aquatic toxicity. This monitoring is intended to provide support for the adaptive implementation of the *Diazinon and Pesticide-Related Toxicity in Urban Creeks Water Quality Attainment Strategy and Total Maximum Daily Load*.

Seven creeks were sampled during WY 2005. These include:

1) Corte Madera Creek (Marin);
2) Blue Rock Springs Creek (Solano);
3) Rheem Creek (Contra Costa);
4) Castro Valley Creek (Alameda);
5) Calabazas Creek (Santa Clara);
6) San Francisquito Creek (Santa Clara/San Mateo); and,
7) Belmont Creek (San Mateo).

A total of nine creek samples were collected between January and May 2005. Field sampling was conducted (by City of Sunnyvale staff) at Calabazas Creek and samples were transported to contracted laboratories for analysis. Creek samples were analyzed for organophosphate pesticides (or diazinon only) and pyrethroid pesticides. Three species chronic aquatic bioassays were also performed using *Selenastrum capicornutum* (green alga), *Ceriodaphnia dubia* (water flea) with acute and chronic (reproduction) endpoints, and *Pimephales promelas* (fathead minnow) with acute and chronic (reproduction) endpoints.

Of the nine samples analyzed, diazinon was only detected in one sample (117 ng/L) above the suggested TMDL target (100 ng/L) for diazinon concentrations in Bay Area urban creeks. In addition, diazinon was detected in four samples at concentrations between 40 and 50 ng/L. Diazinon concentrations in all other samples were not detected above the reporting limit. Pyrethriods were not detected above the reporting limit in any samples analyzed in WY 2005.

Five chronic toxicity effects were exhibited in the nine samples collected. One sample had a significant reduction in fathead minnow growth and Ceriodaphnia reproduction was reduced in four samples. Only one sample caused an acute toxicity effect on Ceriodaphnia (50 percent mortality).

Preliminary results suggest that diazinon concentrations and acute aquatic toxicity are not widespread throughout Bay Area creeks. However, additional data is needed to validate this preliminary finding. Suggested next steps for CEP Urban Creeks Monitoring include: 1) revise site selection criteria; 2) selecting long term monitoring sites; 3) deciding if sediment toxicity and chemistry analysis if warranted; and 4) discussing funding for additional monitoring in WY 2006.

RMP Urban Creeks and Creek/Estuary Interface Monitoring

As part of the RMP's Exposure and Effects Pilot Study (EEPs), sediment toxicity monitoring was conducted in selected tributaries (above and below the tidal prism) during FY 04-05. Creeks sampled included:

1) Suisun Creek (Solano);
2) Napa River (Napa);
3) Petaluma River (Sonoma/Marin);
4) San Lorenzo Creek (Alameda);
5) Coyote Creek (Santa Clara); and,
6) San Mateo Creek (San Mateo).

Results were not available at the time this report was competed. They will be included in the Program's *FY 05-06 Annual Report*. Additional EEPs sampling is also expected to occur in FY 05-06.

Legacy Pesticide Monitoring

Sacramento and San Joaquin River Loadings

In addition to mercury, legacy pesticides were also monitored in the Guadalupe River watershed during WY 2003. From January 10, 2002 to May 6, 2003, 24 discrete water samples were collected for analyses of legacy pesticides (DDTs, Chlordanes and Dieldrin) during and after major storm events. Concentrations of legacy pesticides ranged from 240 to 1,600 pg/L of DDT, 40 to 180 pg/L of chlordanes and 60 to 250 pg/L of dieldrin. Pesticide concentrations were significantly correlated to SSC and displayed a first flush effect consistent with that found for sediment. Ratios of different DDT compounds showed that proportions of DDT and DDE (o,p' and p,p'-isomers), a major aerobic breakdown product of DDT, increased with increasing SSC and discharge, whereas proportions of DDD, an anaerobic breakdown product, decreased. This pattern presumably results from greater contributions of eroded watershed soils with increasingly fresh inputs of DDT residues in samples collected during higher flows.

Organic contaminant mass loads were estimated over the study period using available flow information for the Sacramento-San Joaquin Delta and time-continuous SSC data collected at Mallard Island. Correlations between SSC and pesticide concentrations were used to estimate daily concentrations and loads of these contaminants. Daily contaminant loads varied by one to three orders of magnitude; DDT (1.4 to 150 g), chlordanes (0.22 to 22 g) and dieldrin (0.37 to 56 g). Annual loads for WY 2003 were 9.7 (±3.7) kg DDT, 1.5 (±0.57) kg chlordanes and 3.0 (±1.3) kg dieldrin. Extrapolation of pesticide data (from W Y 2002 and WY 2003) over a nine year period using SSC data (WY 1995 to WY 2003) resulted in long-term average annual loads of 18 (±7.0) kg DDT, 2.7 (±1.0) kg chlordanes, and 6.2 (±2.7) kg dieldrin.

Legacy Pesticide Conceptual Model and Impairment Assessment Report

During FY 04-05, the CEP funded the development of the *Legacy Pesticides in the San Francisco Estuary - Conceptual Model and Impairment Assessment Report (CMIA)*. The CMIA report had several objectives, including:

- Evaluate the current level of impairment of beneficial uses, including description of standards or screening indicators and relevant data;

- Develop a conceptual model than describes the current state of knowledge for the pollutant of concern, including sources, loads, and pathways into and out of the Estuary and its water, sediment, and biota; and
- Identify potential studies that might reduce uncertainties associated with the report's conclusions.

The CMIA report examined legacy pesticides (i.e., pesticides that are no longer used but that persist) in San Francisco Bay. The pesticides of concern include DDTs, chlordanes and dieldrin.

The impairment assessment portion of the CMIA reviewed past information, which led the USEPA to determine that sport fishing in San Francisco Estuary was impaired by legacy pesticides. The assessment used the most recent, available data on concentrations of legacy pesticides in fish tissues, water, sediments, and bird eggs to determine whether sport fishing or other beneficial uses are impaired. The assessment compared the data to screening values and other criteria derived from regulatory standards and scientific literature to determine whether the weight of evidence indicates:

- **No impairment:** The available data demonstrates no negative effect on beneficial uses of the Bay, and there is sufficient information to make the finding.
- **Impairment unlikely:** The data indicate that legacy pesticides cause no impairment to the Bay. However, there is some uncertainty, due to lack of sufficient information or disagreement about how to interpret the data.
- **Possible impairment:** There is some suggestion of impairment, but the uncertainties preclude making a definitive judgment.
- **Definite impairment:** The data clearly demonstrate a negative effect on the beneficial uses of the Bay.
- **Unable to determine impairment:** There is insufficient information to make any determination.

The assessment found some indications that beneficial uses of San Francisco Estuary may continue to be impaired by legacy pesticides. In particular, water and fish data indicate impairment of the Sport Fishing Use. The level of impairment is not high when compared to other organochlorine compounds (e.g., PCBs). There is evidence of long-term declines in pesticide levels. There is less evidence of impairment of other uses of the Bay—preservation of rare and endangered species, fish spawning, or wildlife and estuarine habitat. Chlordane concentrations in sediments may, in some locations, affect animals living in the sediments, and DDT concentrations in bird eggs may be close to limits that would indicate impairment.

The conceptual model portion of the CMIA provides a framework for optimizing management decisions and actions for reducing contamination by legacy pesticides in San Francisco Bay. The conceptual model:

- Presents a simple one-box model of the Bay;
- Synthesizes information on the sources of DDTs, chlordanes, and dieldrin to the Bay;
- Estimates total loads to the Bay;
- Describes the chemical characteristics of the pesticides and the dominant processes that determine their fate within the Bay; and
- Uses the one-box model to facilitate understanding responses within the Estuary and estimating recovery rates.

The conceptual model also identifies areas of uncertainty, which limit the ability to quantify responses and rates.

Results from the conceptual model indicate that legacy pesticides enter the water and active sediment of San Francisco Estuary in runoff from the Central Valley and local watersheds, in municipal and industrial effluent, by deposition from the atmosphere, by erosion of historically contaminated sediment deposits, and through dredging and disposal of dredged material. Runoff from the Central Valley and local watersheds introduce the largest loads of legacy pesticides to the Bay.

There are many uncertainties and information gaps provided in the CMIA conclusions. They include the following:

- Uncertain understanding of the large runoff events from the Central Valley;
- Uncertain understanding of loads from small tributaries;
- Model uncertainties;
- Lack of established criteria for determining impairment;
- Uncertain understanding of trends in pesticide concentrations; and
- Lack of understanding of sediment "hot spots."

Future projects will obtain additional data and conduct more analysis of the sources, fate, transport and effects of legacy pesticides. During FY 05-06, appropriate strategies for addressing legacy pesticides in the Estuary and its watersheds will likely be addressed through CEP efforts. The CMIA suggested that future CEP data gathering and technical analysis should focus on determining the potential effectiveness and actual effects of actions to reduce or eliminate impairment; and to restore beneficial uses of the Bay.

Copper and Nickel[3] Control Measures (Provisions C.9.a and b)

Management Activities

Copper Action Plan and Nickel Action Plan Reviews

In FY 04-05, the Program assisted the SCBWMI Bay Modeling and Monitoring (BMM) Subgroup to conduct two semi-annual reviews of the Copper Action Plan (CAP) and Nickel Action Plan (NAP). These reviews occurred on November 10, 2004 and April 22, 2005. A focus of the November 2004 meeting was to review the current CAP using the adaptive management

[3] In response to Regional Board staff comments dated November 13, 2002 and June 26, 2003, the Program formalized the process in which the Program and Co-permittees identify specific baseline actions within their individual Cu/Ni Work Plans. Program and Co-permittee staff met on June 6 and July 8, 2003 to discuss and subsequently finalize proposed changes to the CAP/NAP reporting approach and format. On August 5, 2003, the Program and Co-permittees submitted a Revised FY 03-04 Copper/Nickel Work Plan consisting of the updated baseline activity tables for each copper and nickel action. Appendices B and C of the Program's 2001 NPDES permit were used as the starting point in developing the updated Cu/Ni baseline activity tables. The Revised FY 03-04 Copper/Nickel Work Plan also included clarifications and additions intended to address questions and concerns raised by Regional Board staff over the last year.

At the Regulatory Executive Forum meeting on September 26, 2003, Regional Board staff provided Program staff a one page document entitled *CAP/NAP briefing 9-23-03 CAP/NAP talking points only*. The document contained comments on several of the baseline activities contained in the Program's Revised FY 03-04 Copper/Nickel Work Plan. On November 21, 2003, Program staff provided Regional Board staff with some additional background information to clarify the baseline activities mentioned in the "talking points".

process built into the CAP. This process involved reviewing tables which described how each baseline activity had either been completed or been incorporated into another on-going Program or POTW activity. The tables also contained proposed revised CAP activities reporting approaches, describing where and how annual CAP activity information could be found within other reports. The goal of the effort was to reduce the increasingly voluminous and generally duplicative CAP reporting by changing to reporting by reference to other reports to the greatest extent possible. The tables also included a column with recommendations on whether or not each baseline activity would be appropriate to implement (or continue to implement) Bay-wide and how reporting might best be conducted. The subgroup agreed that the majority of baseline activities are being addressed by on-going stormwater program required activities or on-going POTW required activities. Agreement was not reached on what activities could be considered "completed" or how to move towards CAP reporting by reference. It was suggested that an actual Bay-wide Copper Action Plan would not necessarily need to be developed if all the pertinent CAP activities were otherwise included and conducted as stormwater and POTW NPDES permit conditions (e.g., pursuant to pollutant reduction plans). Water Board staff is in the process of reviewing the proposed revised CAP activities reporting approach tables and providing comments on the recommendations.

At the April 2005 CAP/NAP review meeting, discussions continued about how the transition would likely occur to a bay-wide Copper Management Strategy (CMS). Water Board staff would like a uniform level of effort bay-wide (by agencies) and an effectiveness level at least as great as that achieved in the CAP/NAP. Ambient monitoring and trigger criteria need to be revisited so that there is a consistent and equivalent level of effort expended North and South of the Dumbarton Bridge. The proposed approach North of the Dumbarton Bridge is to rely on RMP data that is collected once per year versus the monthly dry season data collected south of the Dumbarton Bridge. The City of Palo Alto proposed to convert its Copper Indicators Report to a model for a bay-wide indicators report, if provided the necessary information. New funding mechanisms will need to be identified for on-going implementation of these bay-wide CMS components (stormwater and POTW annual reporting, indicators reporting and ambient monitoring). CMS requirements may be implemented through a blanket (watershed) permit. Currently, timing is uncertain. It is believed that the Basin Plan Amendment adopting the North of Dumbarton Bridge Copper/Nickel (Cu/Ni) site-specific water quality objectives (SSOs) and the CMS would likely be completed and adopted before the Stormwater Regional Group Permit.

Implementation of CAP/NAP Baseline Activities

The majority of baseline actions are implemented at the Program level (except for those assigned to San Jose, Sunnyvale and Palo Alto), and are included in the Program's Annual Reports and Work Plans. In mid-2003, the Program identified the following copper control activities that were deemed appropriate to implement at the Co-permittee level:

- CB-1: Measures to reduce copper discharges from vehicle washing operations;
- CB-3: Measures to control copper in discharges of stormwater in targeted industrial sources;
- CB-6, 7: Measures to reduce traffic congestion/promote alternative transportation;
- CB-8: Measures to classify and assess watersheds and improve institutional arrangements for watershed protection;
- CB-11: Measures to improve street sweeping controls and stormwater system operation and Maintenance;
- CB-12: Measures to control copper discharges from pools and spas;

- CB-21: Measures to discourage architectural use of copper; and
- NB-1: Measures to control nickel discharges from construction sites (sediment).

The *FY 05-06 Copper/Nickel Work Plan* and summary of FY 04-05 accomplishments are provided within Appendix C-4. Currently, the Copper/Nickel Work Plan contains twenty-one copper and seven nickel baseline actions. During FY 04-05, some specific accomplishments included:

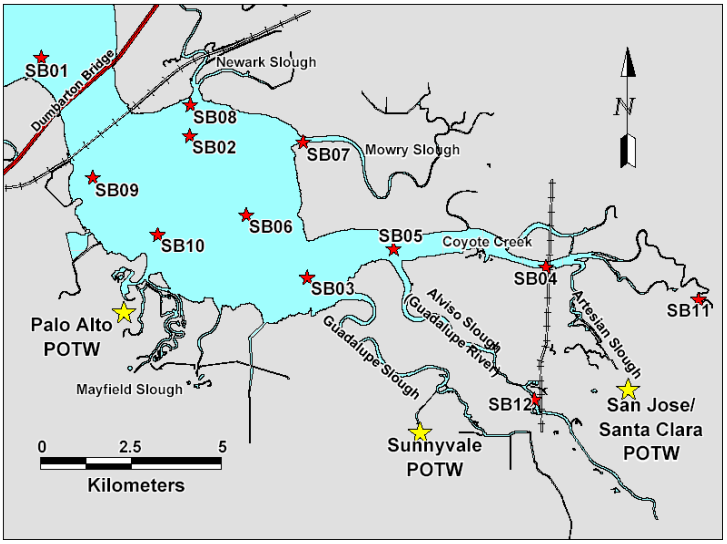
- Distributed approximately 2,068 English and 1,038 Spanish Watershed Watch (WW) campaign brochures that included outreach on car washing (aimed at reducing copper and nickel; and other pollutant inputs to stormwater). In addition, the Program distributed Watershed Watch campaign brochures at public events and worked with WW partner, Classic Car Wash, to do four promotional events in October and November 2004(CB-1);
- The City of San Jose conducted additional rooftop inspections of selected facilities that may be potential sources of copper. Contact letters and the stand-alone roof vent BMP information (prepared by the City of San Jose) were mailed to the selected facilities (CB-3);
- Completed the NOI Filers outreach project with the City of San Jose (CB-3);
- The City of Palo Alto prepared the fourth annual Copper Action Plan Report (CB-4.3);
- Continued to actively support the Brake Pad Partnership (BPP) (CB-5), providing resources to fund and advocate BPP through BASMAA, actively tracking activities of BPP and efforts under the Proposition 13 grant, and attending the annual BPP meeting on June 22, 2005.
- Established links/information relating to Bay copper impairment research data posted to a prototype SFEI-based web portal (CB-5, CB-16);
- Continued to work with and support the Land Use Subgroup (LUS). Tasks included finalizing two memoranda relating to transportation impacts on water quality. CB-6 and CB-7);
- Implemented the third year of the Multi-Year Monitoring Plan (Included specific water quality and sediment sampling and analyses for all metals including copper and nickel.) (CB-8.4);
- Continued to implement Co-permittee street sweeping and catch basin cleaning programs consistent with performance standards (aimed at reducing discharges of pollutants, including copper and nickel, to storm drains and receiving waters). Summarized the amount of material collected and miles swept within the Program's jurisdiction (CB-11);
- Continued distributing the updated brochure entitled Keep Pool, Spa and Fountain Water Out of Storm Drains, Creeks, and the Bay (aimed at reducing discharges of pool water, which can contain copper and nickel, to storm drains and receiving waters.) (CB-12);
- Implemented a web-based environmental clearinghouse on copper and nickel pollution prevention activities. (CB-16);
- Continued to track and report relevant activities related to water quality modeling to keep abreast of potential applications and to update the current impairment assessment box model (CB-18) and;

- The City of San Jose continued to monitor dissolved copper and nickel during the dry season (in Lower South San Francisco Bay) as part of their ambient monitoring program (additional information provided below).

Lower South Bay Ambient Monitoring

In February 1997, the City of San Jose, on behalf of all local agencies in the South Bay, began sampling total and dissolved copper and nickel concentrations at ten stations in the Lower South San Francisco Bay (LSSB). In October 1997, two fresh water stations were added, one each in the lower reaches of Coyote Creek and the Guadalupe River, bringing the total number of stations to twelve (Figure 4-1). The sampling design from the CAP/NAP requires monthly compliance sampling. Ten locations in South San Francisco Bay are monitored to compare mean dry season dissolved copper and nickel concentrations to respective trigger levels. Results from monthly monitoring at ten stations show ambient concentrations continuing to be well below the adopted SSOs of 6.9 ug/L and 11.9 ug/L for copper and nickel, respectively. Ambient concentrations have remained consistent (no upward or downward trend) and below the stringent Action Plan trigger values (established as NPDES permit requirements in 2000) of 4.0 ug/L and 6.0 ug/L for copper and nickel, respectively. The monitoring results are located on the City of San Jose's Environmental Services Department website (www.sanjoseca.gov/esd/pub_res.htm).

Figure 4-1: Map of monitoring station locations in LSSB (City of San Jose)



Future CAP/NAP Approach

In 2003, the BMM Subgroup determined that further efforts at fine-tuning the CAP baseline activities would likely be unproductive due to certain remaining inherent challenges with the original CAP/NAP language. To assist in the identification of key baseline copper control activities that are most effective in the removal of copper, the Program helped fund preparation of a Clean Estuary Partnership document entitled *Copper Sources in Urban Runoff and Shoreline Activities: Information Update*. This report was prepared as part of North of Dumbarton Cu/Ni SSOs project funded through the CEP and finalized in November 2004.

Additional information regarding this report is discussed below. The CEP also funded a follow-up project to prepare a draft reporting template and guidance on how the top priority stormwater CMS activities should be implemented and how the effectiveness of those activities should be assessed. The first source to be assessed is architectural copper. The draft CEP report is scheduled for Work Group review in September 2005. Depending on the success of this first effort, additional write-ups may be prepared for vehicle brake pads, copper pesticides and marine antifouling compounds. Other sources of copper in urban runoff would be addressed through existing permit requirements and public outreach.

The Cities of Palo Alto and San Jose are funding efforts to complete a mockup of the bay-wide POTW CMS Annual Performance Summary Report which consists of influent, effluent, and loading time series graphs. More specifically, the Report would include three rolling ~ ten year time series graphs on a single page with likely one page per POTW. At least ten years of data is needed to document the reductions already achieved by past actions. These graphs are designed to provide simple visual documentation of continued reasonable levels of pollution prevention and treatment plant performance by each POTW. Influent concentrations are used as an integrated indicator of the effectiveness of pretreatment, pollution prevention and water purveyors' corrosion control measures within individual POTW service areas. Effluent concentrations are a direct indicator of the effectiveness of plant performance.

As noted above under CAP/NAP reviews, efforts are continuing towards finalizing and implementing a coordinated equitable bay-wide CMS effort that minimizes redundant reporting. Based on these efforts and subsequent review and discussions with Water Board staff and Co-permittees, the Program will develop and submit future Copper/Nickel Work Plan which reflects focused copper control activities.

Monitoring Activities

Watershed Monitoring

During FY 04-05, the Program continued to analyze water samples collected in Santa Clara creeks through the implementation of its Revised Multi-Year Plan. Water samples were collected as screening level indicators of water quality at a variety of creek sites draining urban and rural land use areas and analyzed for total recoverable copper and dissolved copper concentrations. As described in the Program's Revised Multi-Year Plan, grab samples were collected during two seasons (wet and dry).

In FY 04-05, total recoverable copper concentrations ranged from 1.1 to 47 ug/L in twenty samples collected from eight creeks in Santa Clara County. At the same sites, dissolved copper concentrations ranged from 1.0 – 12.0 ug/L. Site B-1 (Barron Creek at Park Blvd.) exhibited the highest total recoverable (47 ug/L) and dissolved (12 ug/L) concentrations for both the dry and wet season sampling events. The median total recoverable copper concentration for all sites during dry season sampling event was 5.1 ug/L, as opposed to wet season sampling event median of 2.1 ug/L (n=20).

Dissolved copper concentrations were adjusted for hardness and compared to copper water quality standards for freshwater described in the California Toxics Rule (CTR). Analytical results indicated that only one sample exceeded the Continuous Concentration Criterion (CCC) for copper (n=20). A full description of methods, results and conclusions are presented in the Summary Assessment Report within Appendix C-1.

Urban Runoff Copper Source Assessment

As mentioned previously, the CEP provided funding during FY 04-05 for the development of a report entitled *Copper Sources in Urban Runoff and Shoreline Activities: Information Update*. This report was prepared as part of North of Dumbarton Bridge Cu/Ni SSOs project. The focus of this report is copper sources in urban runoff to San Francisco Bay. Two types of non-runoff Bay shore copper releases not previously investigated are also included—marine antifouling paint and copper algaecides applied to shoreline lagoons.

The information within this report was assembled from available data sources. Only existing information was used; sampling and chemical analysis were not conducted.
The purpose of this report is to summarize information on copper sources that are carried to San Francisco Estuary in urban runoff; and copper that is released directly into the San Francisco Estuary from shoreline activities. The report accomplishes the following:

- Provides estimates of the amount of copper released to San Francisco Estuary from each source;
- Estimates the relative degree of uncertainty in each copper release estimate and lists the sources of uncertainty for each estimate;
- Reviews available control measures for each copper source, providing control measure effectiveness information to the extent data are available;
- Identifies feasible control measures for copper sources in urban runoff and shoreline activities; and
- Identifies priorities for investigation of sources and control measures.

This report, Cu/Ni loading estimates and Cu/Ni control measures is provided on the Program's Copper *Sources and Management Strategies Clearinghouse Website* (www.scvurppp-w2k.com/cu_clearinghouse_web/cu_source.htm).

Brake Pad Partnership

The Brake Pad Partnership (BPP) is a multi-stakeholder effort to understand the environmental impacts of automobile brake pad wear debris (which contains copper). Manufacturers, regulators, stormwater management agencies (e.g., SCVURPPP) and environmentalists are working together to understand these impacts. BPP efforts are aimed at developing an approach for evaluating potential impacts of copper (from brake pad debris) affecting water quality in the South San Francisco Bay. Brake pad manufacturers have committed to adding this evaluation approach (to existing practices) for designing products that are safe for the environment while meeting performance requirements.

To understand the fate and transport of copper from automobile brake pad wear debris, the Program (through BASMAA) continued to financially support the BPP in conducting a set of interlinked laboratory, environmental monitoring and environmental modeling studies. BPP efforts include the following three environmental modeling studies:

- Air Deposition Modeling—To predict how much brake pad wear debris is released and deposited in the study watershed (Castro Valley);

- Watershed Modeling—To estimate how much copper from the deposited wear debris washes into the storm drainage system and eventually reaches the waters of the South San Francisco Bay; and.

- Bay Modeling—To determine whether and, if so, to what extent copper from brake pad wear debris affects short- and long-term concentrations of copper in the Bay.

In support of these modeling efforts, the BPP is conducting additional studies to develop accurate input data for the models. An air deposition monitoring effort will provide data necessary for comparison of the model results with the data values as a part of the air deposition model evaluation. Stormwater monitoring data is being collected to help calibrate and validate the watershed modeling. In addition, the BPP is conducting physical and chemical characterization analyses to determine model parameters specific to brake pad wear debris.

In FY 04-05, the BPP made substantial progress in its work on air deposition monitoring; generation and characterization of a representative sample of brake pad wear debris; estimating the amount of copper released to the watershed from brake and non-brake sources; water quality monitoring; and watershed modeling. The following are summaries of the findings:

Characterization of Airborne Brake Pad Wear Debris - The characterization of a representative sample of airborne brake pad wear debris has been completed and the BPP's Scientific Advisory Team conducted a stakeholder and independent expert review of their work. The researchers found that the generation of airborne brake pad wear debris varied significantly for the three different materials that comprise the representative sample. The material that generated the most airborne brake pad wear debris produced nearly fifteen times as much wear debris as the one that generated the least. The mass mean aerodynamic diameter of the representative sample of airborne brake pad wear debris was approximately 2.7 µm. A copy of the report can be found on the BPP's website at:
www.suscon.org/brakepad/pdfs/ADPSD%20Final%20Report%2001-28-05.pdf

PCBs and Dioxin Compounds Control Program (Provision C.9.e)

Provision C.9.e. of the Program's NPDES permit requires development of a control program to reduce or eliminate discharges of Polychlorinated Biphenyls (PCBs) and dioxin-like compounds from urban runoff conveyance systems from controllable sources (if any). As part of the PCBs/Dioxins Control Program, monitoring activities were conducted by the Program during FY 04-05. In addition, PCBs/Dioxins related management activities are described.

Polychlorinated Biphenyls

PCBs were manufactured in the United States from 1929 to 1977. They were widely used by many industries because of their low electrical conductivity, high boiling point, chemical stability and flame retardant properties. The largest use of PCBs was in electrical equipment, including transformers and capacitors. However, they were also widely used in a variety of other applications, including hydraulic fluids, dust control, flame retardants, lubricants, paints, sealants, wood preservatives, inks, dyes and plasticizers. PCBs have also been found in a variety of non-liquid materials, including construction materials (i.e., insulation, roofing and siding materials). In 1979, the USEPA banned the manufacture of PCBs in the United States. Their import, export and distribution in commerce were also banned and PCBs uses were restricted to totally enclosed applications. The USEPA has authorized other minor uses since that time but the unavailability of PCBs and health and safety concerns effectively ended their use in new applications. PCBs are often referred to as a "legacy" pollutant, meaning there are relatively few current uses, but past uses appear to have left large amounts in the environment.

All segments of San Francisco Bay were listed as impaired by PCBs in the 2002 Clean Water Act Section 303(d) list. The listing was in response to an interim advisory on the consumption of fish from the Bay issued by the California Office of Environmental Health Hazard Assessment. The advisory was issued after PCBs and other pollutants (e.g., mercury) were found in Bay fish tissue at levels thought to potentially pose a health risk to people consuming fish caught in the Bay. The Water Board has placed high priority on addressing PCBs in the Bay and is currently developing a PCBs TMDL.

The Program has provided leadership to Bay Area storm water management agencies in their efforts to assist the Bay PCBs TMDL. This included leading a regional study that characterized the distribution of PCBs concentrations in storm water conveyance sediments in Bay Area watersheds. The Program also performed PCBs case studies in selected areas where elevated concentrations of PCBs were found during the regional study and coordinated similar case studies by other Bay Area storm water management agencies. The case studies were aimed at identifying PCBs sources and controls. The Program also prepared work plans for the above regional and local field studies. The work plans included a preliminary list of known sites where PCBs were used, stored and/or released in Santa Clara County. To facilitate regional coordination, the Program led a work group of representatives from BASMAA and Water Board staff and provided a staff to represent BASMAA on the CEP PCBs workgroup.

The Program also completed a report on efforts to develop methods of controlling discharges of PCBs from Bay Area urban runoff conveyances. The study describes 1) past, current and planned efforts to identify PCBs control options in the Bay Area, 2) management practices currently implemented by Bay Area storm water management agencies that may reduce discharges of PCBs from urban runoff conveyances, and 3) potential additional PCBs storm water control options and some of their advantages, limitations and cost factors.

During FY 04-05, the Program continued to work with other Bay area dischargers and Water Board staff through BASMAA, the CEP and the RMP to coordinate and plan activities related to PCBs and other pollutants of concern. Efforts included providing funding to these organizations, participating in selected stakeholder meetings, committees and work groups and, as appropriate, reviewing and commenting on relevant documents prepared by the CEP, RMP and Water Board staff. Program staff continued to represent BASMAA on the RMP TRC, RMP SPLWG and CEP PCBs Work Group. CEP projects related to PCBs include the following:

PCBs Concentrations of Nearshore Sediments and Assessment of Data Quality

The primary objective of this project is to determine whether existing data are sufficient to quantify PCB concentrations in the nearshore sediments of central and south San Francisco Bay that are not directly impacted by local PCBs sources (i.e., the project aims to quantify PCB concentrations in nearshore sediments impacted primarily by regional or Bay-wide sources). If existing data are sufficient they may support selection of interim TMDL numeric targets for PCBs in sediments. A draft project report is currently undergoing scientific peer review.

PCBs TMDL Implementation Plan Development

This project will assist Water Board staff in developing an implementation plan for the PCBs TMDL. The project report describes identification and prioritization of PCBs sources, control strategies, and regulatory oversight and responsibility. One focus is municipal roles and responsibilities in the cleanup of PCBs “hot spots,” including on–land spill sites and accumulated sediments with PCBs in storm water conveyances. The first draft of project report

was released in June 2005 and is currently being revised in response to comments from BASMAA and other stakeholders.

Conceptual Model / Impairment Assessment Report on PCBs in San Francisco Bay

This project provides a detailed analysis of the status of the impairment of the Bay by PCBs and associated uncertainties. It also presents a conceptual model that describes sources, estimated loads, and processes that affect the fate of PCBs in the Bay. The first draft of the project report was released in October 2004 and is being revised in response to comments from BASMAA and other stakeholders.

San Francisco Bay Food Web Model

This project expanded an existing Bay food web model to include sensitive wildlife species as endpoints. The expanded model predicts the maximum concentration of PCBs in Bay sediments that result in safe levels of PCBs in Bay wildlife, in addition to the model's capability of predicting sediment concentrations associated with safe levels of PCBs in edible fish tissue for human consumption. These data may assist Water Board staff select numeric targets for PCBs in sediments for the Bay TMDL. A draft project report has undergone stakeholder and scientific peer review and is near finalization.

Multibox Bay PCBs Fate and Transport Model and Multi-year Sediment Sampling Program

This project is a multi-year program, building on model development efforts already underway, to construct a mechanistic model that will advance our understanding of pollutant behavior in the Estuary and provide a new tool for water quality management. The project goals include: 1) developing a better tool for predicting future pollutant concentrations and testing potential management actions; 2) clarifying the uncertainty of existing model predictions; 3) identifying key areas where fieldwork can reduce uncertainties; and 4) conducting key fieldwork, including sediment coring in the Bay to improve estimates of the PCB inventory and historic loads and tracer experiments to quantify flushing. The model is currently undergoing review and testing and a simulation framework for an uncertainty/sensitivity analysis is being built.

Dioxins

The term "dioxin-like compounds" typically refers to a group of chemical compounds with similar chemical structures that fall under three main categories: polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and certain polychlorinated biphenyl (PCB) congeners with dioxin-like potency that are often referred to as dioxin-like PCBs. Currently, the Program is addressing PCBs, including dioxin-like PCBs, as part of the separate program described above. PCDDs and PCDFs (collectively referred to as "dioxins") are not commercially produced but are unintentional by-products of combustion and chemical production processes. Contemporary sources of dioxins in the Bay Area may be primarily associated with combustion (e.g., residential wood burning and diesel exhaust). Dioxins may also remain in the Bay Area environment from practices potentially carried out more widely in the past. These practices include garbage burning, medical waste incineration and the use of chlorinated pesticides (e.g., pentachlorophenol).

All segments of San Francisco Bay were listed as impaired by certain dioxin compounds in the 1998 and 2002 Clean Water Act Section 303(d) lists. The impetus for the listing was an interim advisory on the consumption of fish from the Bay issued by the California Office of Environmental Health Hazard Assessment. As with PCBs, the advisory was issued after dioxin

compounds and other pollutants were found in Bay fish tissue at levels thought to potentially pose a health risk to people consuming them. The Water Board opposed the 1998 listing of dioxins in the Bay but was overruled by the USEPA. The 2002 303(d) list designates the TMDL priority for dioxins in the Bay as low, and a schedule for performing a TMDL is not included. The Program understands that the Water Board does not plan to perform a TMDL for dioxins in the Bay.

The Program has developed and implemented three work plans related to dioxins. In March 2002, the Program submitted an initial work plan. This work plan specified reviewing readily available data on methods used to characterize dioxins in storm water runoff and surface waters and concentrations typically found in the Bay Area and other areas. The completed review revealed that dioxins have been found in urban runoff in the Bay Area and other locations, and in sediments in the Bay and other estuaries. It was concluded that existing data are not sufficient to characterize the distribution in urban runoff among Bay Area land uses or calculate loadings to the Bay. The second work plan was completed in March 2004 and described the Program's collaboration with other Bay area storm water management agencies to develop an introductory report on dioxins. The completed report emphasized issues related to urban runoff in the Bay area, including regulatory context, impacts, sources, pathways, review of relevant Bay Area, national and international studies, and qualitative review of potential storm water controls. The third work plan was completed in March 2004. It specified that Program Staff will track regional, state and federal efforts to address dioxins and encourage Co-permittees to track, understand, and participate in these programs, as appropriate.

Summary of Selected Regional, State and Federal Efforts Relevant to Addressing Dioxins

In FY 04-05, Program Staff prepared a memorandum which:

- Provides some general and regulatory background information about dioxins;
- Summarizes recent SCVURPPP activities related to dioxins;
- Summarizes selected regional, state and federal efforts that address dioxins; and
- Recommends that the Co-permittees consider implementing dioxins pollution prevention options and/or encourage others to implement dioxins pollution prevention options through outreach and/or resolution adoption.

The memorandum describes programs by the Association of Bay Area of Governments (ABAG), California Environmental Protection Agency and USEPA to address dioxins in the Bay Area environment. In particular, the memorandum describes dioxins pollution prevention options developed by ABAG's Bay Area Dioxins Project in the context of potential implementation by municipalities. Municipal pollution prevention demonstration projects conducted by the Bay Area Dioxins Project are also described. The demonstration projects developed tools and resources intended to facilitate municipal implementation of practices that reduce the use of diesel fuel vehicles, chlorine bleached paper and PVC building materials.

The memorandum also indicates that Program Staff plan to survey all Co-permittees during FY 05-06 to identify dioxins pollution prevention actions currently implemented and formal policies already adopted. Based on the results of the survey, the Management Committee will consider next steps in encouraging dioxins pollution prevention at the municipal level. The Dioxins memorandum is included within Appendix C-5.

Conceptual Model/Impairment Assessment for Dioxins in San Francisco Estuary

In FY 04-05 the CEP funded the development of the *Dioxins in the San Francisco Estuary - Conceptual Model and Impairment Assessment Report (CMIA)*. The CMIA report had several objectives which include:

- Evaluating the current level of impairment of beneficial uses, including descriptions of standards or screening indicators and relevant data;
- Developing a conceptual model that describes the current state of knowledge for the pollutant of concern, including sources, loads, and pathways into and out of the Bay and its water, sediment, and biota; and
- Identifying potential studies that might reduce uncertainties associated with the report's conclusions.

The impairment assessment reviews past information, which led the USEPA to determine that sport fishing in San Francisco Bay was impaired by dioxins. The assessment uses the most recent, available data on concentrations of dioxins in fish tissues, water, sediments, and wildlife to make an independent assessment of the current level of impairment of sport fishing and other uses of the Bay. The assessment uses the data to determine whether there is a weight of evidence indicating:

- **No impairment:** The available data demonstrate no negative effect on beneficial uses of the Bay, and there is sufficient information to make the finding.
- **Impairment unlikely:** The data indicate that dioxins cause no impairment to the Bay. However, there is some uncertainty, due to lack of sufficient information or disagreement about how to interpret the data.
- **Possible impairment:** There is some suggestion of impairment, but the uncertainties preclude making a definitive judgment.
- **Definite impairment:** The data clearly demonstrate a negative effect on the beneficial uses of the Bay.
- **Unable to determine impairment:** There is insufficient information to make any determination.

Dioxins are present in the environment in very low concentrations, and chemical analyses are difficult and expensive. As a result, relatively few measurements have been made of dioxins in the water, sediments, and biota of San Francisco Bay. The majority of available data is difficult to interpret because many specific dioxin compounds are present at levels below analytical detection limits. These constraints make an impairment assessment nearly impossible. Nevertheless, the available fish and water data do indicate possible impairment of the Bay for sport fishing. However, the degree of impairment from dioxins and furans alone is small compared to impairment by the dioxin-like PCBs, which are being addressed by a separate TMDL. Since very little information is available, there is virtually no evidence of impairment of other beneficial uses.

The conceptual model provides a framework for prioritizing management decisions and actions for reducing contamination by dioxins in San Francisco Bay. The conceptual model:

- Presents a simple one-box model of the Bay;
- Synthesizes information on sources of PCDD/Fs to San Francisco Bay, including use of national and regional studies of PCDD/Fs to augment the limited available local data;
- Describes pathways and estimates loads from single-point and more diffuse sources;

- Describes the dominant local processes that determine the fate of PCDD/Fs in the Bay; and
- Presents inputs to and outputs from the one-box mass balance model of the current inventory, long-term change, loading estimates, and loss pathways.

The conceptual model also identifies areas of uncertainty, which limit the ability to quantify responses and rates.

Dioxins are mostly produced as by-products of combustion and as contaminant by-products of chlorinated-chemical processes (e.g., syntheses of organochlorine pesticides, pulp bleaching and manufacture of polyvinyl chloride (PVC). In the past, emissions from facilities (i.e., incinerators and smelters) were thought to be the largest sources of dioxins. These sources have been controlled, reducing the major historic sources of dioxins. More disperse sources (e.g., yard burning and vehicle emissions) remain uncontrolled and persist at levels similar to those in the past.

Since there is little local information, estimates of loads to the Bay are subject to great uncertainties. However, it is clear that the legacy of dioxins in the watershed and the sediments outweigh the other sources. Model estimates of the degradation and transport rates for dioxins suggest that current inputs of dioxins to the Bay may also be sufficient to continue the current level of estimated impairment.

There are many uncertainties and information gaps in this report's conclusions. Perhaps the greatest uncertainty is in dioxin measurements themselves—because so many compounds occur at extremely low concentrations. As a result, the available analyses include estimated and measured values. Dioxins are thought to be so toxic that these estimated values can affect data interpretation. Future projects will obtain additional data and conduct more analysis of the sources, fate, transport, and effects of dioxins.

Sediment Control Program (Provision C.9.f)

<u>San Francisquito Creek Sediment TMDL</u>

In response to a listing of impairment by sediment under section 303(d) of the Clean Water Act and a need to provide information for a TMDL assessment, two separate (but coordinated) projects have been developed. These projects are the San Francisquito Creek Watershed Analysis and Sediment Reduction Plan (Plan), administered by the San Francisquito Creek Joint Powers Authority (JPA); and the Aquatic Habitat Assessment and Limiting Factors Analysis, managed by the Santa Clara Valley Water District (SCVWD). The Plan fulfills Permit Provisions C.9.f.i and C.9.f.ii of the Program's NPDES permit.

The primary issues driving the TMDL are flooding and degradation of habitat, impacting steelhead trout and other threatened aquatic species. The approach adopted by the JPA and SCVWD in these projects is to assess factors limiting the threatened aquatic species, including but not confined to those related to excessive sedimentation caused by human land use activities. Project products are intended to produce information that will assist the Water Board to confirm or reject the validity of the sediment impairment listing and help identify other causes of impairment to aquatic species and their habitats in San Francisquito Creek.

There were two main objectives for developing the Sediment Reduction Plan. The first objective was to understand the erosion, transport and deposition of sediment in the San Francisquito

Creek watershed, focusing on human-related activities that modify hydrology, alter erosion rates or trap sediment. The second objective was to review existing sediment management policies and practices and recommend management measures to effectively reduce erosion and sediment transport in the watershed. The specific tasks for this project are:

1) *Historical Conditions Analysis:* Analyze historical conditions in the San Francisquito watershed, particularly sediment supply, transport, and deposition as they relate to stream and water character;
2) *Existing Conditions Analysis*: Analyze land use, biological resources, stream management and maintenance and designated beneficial uses;
3) *Watershed Sediment Analysis:* Develop a rapid sediment budget for the watershed, detailing sediment sources, sediment sizes, storage and sediment yield;
4) *Assessment of Existing Management Practices:* Assess existing policies and regulations that provide erosion control or channel protection, identified deficiencies and recommended improvements; and
5) *Watershed Analysis and Sediment Reduction Management Plan:* Incorporate all analyses completed in previous tasks and makes recommendations for measures to manage erosion of the identified human-related sediment sources and estimate reduction of sediment load from these measures.

The *Watershed Analysis and Sediment Reduction Management Plan* (Final Report) was completed in May 2004. The sediment study was funded under a Proposition 13 grant and administered by the JPA. This report can be found at www.cityofpaloalto.org/jpa/references.html.

The *Aquatic Habitat Assessment and Limiting Factors Analysis* is intended to characterize channel and habitat conditions with respect to factors that limit the steelhead population in the San Francisquito Creek watershed. Information for this analysis came both from direct data collection and analysis and from studies that have already been performed. Data collection and analysis evaluated stressors that limit: (1) aquatic habitat, (2) steelhead (*Oncorhyncus mykiss*), and (3) development of individuals in specific steelhead life history stages within the watershed. Extensive studies have already been conducted within the watershed. These studies provided a base for study design, and data from these studies were incorporated with new data for the current habitat assessment and the limiting factors analysis. A draft report on the results and conclusions of this project are expected in FY 05-06.

During FY 05-06, the Program will continue to follow and participate in the sediment-related activities within the San Francisquito watershed.

Stevens Creek Watershed Analysis and Sediment Management Practices Assessment

The Program developed a *Work Plan for Conducting a Watershed Analysis and Management Practice Assessment in Other Creeks Potentially Impaired by Sediment from Anthropogenic Activities (*Work Plan) in fulfillment of Permit Provision C.9.f.iii paragraph 2. The Work Plan identifies a two-phased approach to assess watersheds previously identified by the Program as high priority for watershed analysis due to the potential for anthropogenic sediment impairment. Phase 1 entails completing Tasks 1 through 3. The Program contracted with Stillwater Sciences to complete Task 1 of the Work Plan, Conduct Watershed Analysis using a Limiting Factor Analysis (LFA) Approach in the Stevens Creek watershed during FY 03-04. Program staff completed a sediment management practice assessment in the Stevens Creek watershed

to complete Task 2 of the Work Plan. Both the Draft LFA Technical Report and Draft Sediment Management Practice Analysis Report were released on July 7, 2004 for external review by the Watershed Analysis AHTG. The following are summaries of the results and conclusions that were presented in each report.

Stevens Creek LFA Results

The primary focus of the Stevens Creek LFA was to characterize the nature and degree of potential sediment-related effects on a selected indicator species (i.e., Steelhead Trout). The objectives of the LFA were to identify and fill information gaps related to physical and biological factors controlling population dynamics of steelhead and to determine to what degree human-related sediment impacts are key factors limiting steelhead production. Based on the available information and reconnaissance surveys, several focused studies were developed to test hypotheses on potential limiting factors for steelhead. The focused studies addressed the following factors: fish passage barriers, gravel permeability, pool filling, bed mobility, overwintering habitat and water temperature. The LFA was conducted using a weight of evidence approach that was based on best available information and the results from each of the focused studies. The findings of the Stevens Creek LFA included:

1. Barriers, both partial and complete, limit access to a substantial amount of stream habitat; effects of barriers on smolt production depend on the ability of fish to pass barriers (upstream and downstream);
2. Seasonal low flows downstream of Fremont Avenue may severely limit steelhead outmigration success in some years, especially if channel drying occurs before the end of the outmigration period (typically February–May).
3. Gravel permeability is low but not likely limiting smolt production;
4. Pool filling is low, indicating high sediment transport capacity relative to sediment supply;
5. Bed mobility (and therefore potential redd scour) is relatively low in upper reaches but increases downstream;
6. Overwintering habitat is likely the key limiting factor for steelhead prior to smolt outmigration; and
7. Water temperature is elevated but not likely to lethal levels and is not likely limiting fish growth, as evidenced by the size distributions of age 0+ and 1+ steelhead.

In summary, the results from the focused studies indicate that factors associated with fish passage and lack of overwintering habitat are likely to have the greatest influence on the existing and future steelhead populations. The combination of substrate embeddedness, lack of cobble and boulder aggregations of sufficient density and thickness, low amounts of unembedded cobble and boulder substrate, and a lack of other key habitat features such as large woody debris jams, root wads, and backwater habitat, appears to result in relatively low winter carrying capacity for juvenile steelhead. Because of the uncertainties regarding the degree to which specific barriers impede upstream migration and the specific relationship between stream flow and passability, the extent that barriers restrict habitat under existing conditions could not be identified. However, Stillwater maintained the hypothesis that identifying and removing high priority barriers to fish passage would likely lead to substantial increases in smolt production.

Sediment Management Analysis Results

The objectives of the sediment management practices assessment were to inventory and document management practices relevant to erosion processes and sediment transport and deposition within the Stevens Creek watershed; and to evaluate the effectiveness of these

practices to the extent possible. The assessment approach relied on available information identifying existing sediment management practices and policies implemented by Co-permittee that have jurisdictions within the Stevens Creek watershed. The evaluation component of the assessment summarizes the relevant issues related to potential anthropogenic sources of sediment found in the Stevens Creek watershed and identifies data and information needed to more effectively evaluate existing management practices. The following results from the assessment were based on the best available information:

1. A variety of policies and best management practices are currently being implemented in the upper watershed areas that are designed to reduce the impacts of anthropogenic activities on landslide, surface and stream erosion. Although limited information is currently available to determine the effectiveness of these practices, this assessment identified data and information gaps that would be useful to evaluate management practices in the future.
2. Anthropogenic activities may be affecting stream erosion and may be a relatively large source of sediment to Stevens Creek reaches below the dam. Activities that are hypothesized to be potentially causing stream erosion include, dam influences on downstream bank stability, hydromodification, channel modifications and urban encroachment.
3. Surface erosion is believed to be minimal in the Stevens Creek watershed. However, based on preliminary observations, it appears that the Stevens Creek Quarry may be contributing to the release of fine sediment to the lower watershed via the dam.
4. The Stevens Creek dam likely blocks all coarse sediment supply from the upper watershed drainage area. The lack of coarse sediment migrating from the upper watershed to the lower could significantly be affecting channel stability in the lower watershed.
5. Sediment removal in the lower watershed continues to be an effective way to reduce impediments to fish migration in the lower watershed. In addition, existing grade control structures are likely reducing stream erosion by creating depositional areas throughout the creek through the reduction of flow. However, these structures may also be barriers to fish migration.

Conclusions and Recommended Next Steps

Consistent with the findings of the LFA and Sediment Management Practices Assessment, the Watershed Analysis AHTG concludes that although anthropogenic activities may be affecting stream erosion, current data suggests that factors related to anthropogenic sediment inputs are not believed to substantially limit steelhead production. These conclusions are based on results indicating that spawning habitat quality and quantity, as related to sediment, are not limiting the smolt production in Stevens Creek. Furthermore, while the low quality of pools may be limiting the amount of juvenile steelhead habitat, filling of pools by fine sediment does not appear to be an important factor.

Although additional studies would be required to determine the exact mechanisms responsible for the embeddedness, the results of the study suggest that the underlying lithology of the Stevens Creek channel, rather than anthropogenic sediment sources, is the primary contributor. A stiff silty clay layer was observed periodically underlying the channel and in outcrops at the bank toe at various locations along the entire length of Stevens Creek below the dam. This layer, in combination with lack of sediment supply of large substrate, is likely the primary reason

for the embeddedness observed in Stevens Creek. In addition, local inputs of fine sediment from eroding banks in the unurbanized upper reach and sources above the dam may also contribute to surface embeddedness observed in the upper and transitional reaches. Fine sediment deposition on the channel bed is commonly observed in streams below dams when changes to the hydrologic regime reduce scouring flows. However, the study results show low pool filling suggesting that the sediment transport capacity of Stevens Creek is sufficient to transport the majority of fine sediment delivered to the channel.

Future management actions may choose to focus on the key limiting factors that were identified in the LFA. Examples include increasing the availability of overwintering habitat in the upper reaches and evaluating the effects of specific barriers on steelhead migration (upstream and downstream). Further investigation of the feasibility of implementing these management actions is beyond the scope of this study and may be better addressed through additional assessment efforts in the Stevens Creek watershed (e.g., SCVWD's Watershed Stewardship Program).

The Water Board submitted a letter on August 4, 2004 providing comments and recommendations in response to the LFA and Sediment Management Practice Assessment Draft Reports submitted on July 13, 2004. In response to Water Board staff comments, Program staff coordinated a field reconnaissance trip to Stevens Creek on August 25, 2004. Participants on the field trip included Program staff, Water Board staff, Stillwater Sciences staff and SCVWD staff. As a result of the field trip and further discussion, Water Board staff agreed with the conclusions provided in the Limiting Factors Analysis Draft report (i.e., sediment is not a significant limiting factor for steelhead).

Based on the results and conclusions of the LFA and further discussion with Water Board staff, the Program has developed recommended next steps. The following table briefly describes the next steps and their current status.

Recommendation	Current Status
Finalize Stevens Creek Limiting Factors Analysis and Sediment Management Practices Assessment Reports and submitting them to the Water Board in fulfillment of Provision C.9.f.iii paragraph 2	Final reports were submitted to the Water Board on December 8, 2004.
Develop outreach materials for residents in the Stevens Creek watershed that demonstrate ways to protect the current steelhead population.	In FY 05-06, the Program will develop an outreach piece that will be designed to inform the residents of Stevens Creek watershed about the steelhead trout population and recommend ways to protect the current population.
Begin implementation of Phase 1 of the Work Plan in FY 04-05 in the high priority watershed, Upper Penitencia Creek.	See Summary on Watershed Analysis and Sediment Management Practices Assessment in the Upper Penitencia Creek Watershed.

<u>Upper Penitencia Creek Watershed Analysis and Sediment Management Practices Assessment</u>

After completing the Stevens Creek Watershed Analysis and Sediment Management Practices Assessment in FY 04-05, the Program began to conduct an LFA in another high priority watershed, Upper Penitenica Creek. The Program contracted with Stillwater Sciences to

complete Task 1 of the Work Plan, Conduct Watershed Analysis using a Limiting Factor Analysis (LFA) Approach in the Stevens Creek watershed.

In FY 04-05, existing data was complied, analyzed and initial hypothesis and focused field studies were conducted as part of the LFA. The Draft LFA Technical will be released in early September 2005 for external review by the Watershed Analysis AHTG. Consistent with the Program's FY05-06 Work Plan, Program staff will complete a sediment management practice assessment once the LFA is completed.

Trash Characterization and Management Activities

On November 14, 2001, the Water Board released the document entitled *Proposed Revisions to Section 303(d) List of Priorities for Development of Total Maximum Daily Loads for the San Francisco Bay Region* Report. This report states that "between now and the next 303(d) listing cycle, municipalities will be expected to assess trash impairments in their jurisdiction …", Water Board staff will review information concerning trash in the next listing cycle to determine whether specific water bodies warrant 303(d) listing. In a proactive response to the 303(d) Staff Report, the Program's Management Committee formed a Trash AHTG (first meeting on February 21, 2002). The Trash AHTG developed a Work Plan (submitted March 1, 2003) to identify a strategy for addressing trash problem areas that occur in or near urban streams and waterways of the Santa Clara Basin.

During FY 03-04, the Program assisted Co-permittees in completing the following Work Plan tasks: 1) document existing trash management practices implemented by municipalities and agencies within the Program's jurisdiction; 2) identify and map high priority trash problem areas and sources of trash in Santa Clara Basin watersheds; 3) develop a strategy to conduct trash evaluations in or near creeks; 4) sponsor a training workshop on how to use existing trash assessment tools (i.e., RWQCB Rapid Trash Assessment Protocol (Version 7.0) and Keep America Beautiful (KAB) Litter Index); and 5) develop standardized reporting format for documenting and evaluating trash management and monitoring activities.

During FY 04-05, Co-permittee staff and volunteers from watershed stakeholder groups conducted trash evaluations at a subset of the identified trash problem areas. The RWQCB Rapid Trash Assessment Protocol (Version 7.0)[4] was used to qualitatively assess trash conditions in wadeable creeks and the Keep America Beautiful (KAB) Litter Index was used to evaluate trash problem areas not located in creeks. Summary results from Co-permittee trash evaluations conducted during FY 04-05 are provided within a technical memorandum entitled *Trash Problem Area Evaluation Results- FY 04-05* (see Appendix C-6). The table entitled *Trash Evaluation Area Results by Watershed*, which is attached to the memorandum, provides the following information: site ID, date, location of trash problem area, assessment tool, score, trash source, trash management activities and comments. The approximate physical location, score (for both KAB and RWQCB trash evaluations) and major watershed boundaries within the Santa Clara Basin are provided within Figures 1 through 6 of the memorandum. A summary of the trash evaluation results and conclusions are discussed below.

[4] On November 12, 2004, Water Board staff provided RWQCB Rapid Trash Assessment Protocol (Version 8.0) to Program staff. Version 8.0 includes revisions to the text for easier readability; no changes were made to the scoring. Co-permitees plan to use Version 8.0 for all future trash assessments.

Results

Co-permittees conducted a total of 193 trash evaluations within the Program's jurisdiction. Four evaluations consisted of a site visit with no actual evaluation being conducted due to restricted access or observation of a clean site. As a result, 189 sites were scored using one of the existing evaluation tools (see Figure 4-2). Co-permittees conducted 146 trash evaluations using the KAB Litter Index (i.e., non-creek sites) and 43 trash evaluations using the RWQCB Rapid Trash Assessment Protocol (Version 7.0) (i.e., creek sites). The table entitled *FY 04-05 Trash Evaluation Summary Results* provides scores (for both KAB and RWQCB trash evaluations) by watershed. In addition, thirty sites were evaluated more than once (i.e., two to four times) at different seasonal time periods. As a result, a total of 156 unique sites were scored. For sites evaluated more than once, there was no change in score for 45 percent of the sites. Subsequent evaluations indicated that higher scores occurred at 30 percent of the sites and lower scores occurred at 25 percent of the sites. The majority of trash evaluations were conducted in the Guadalupe River (n=35), Coyote Creek (n=28), Calabazas Creek (n=23) and San Tomas Creek watersheds (n=24). Guadalupe River and Coyote Creek watersheds represent the largest watersheds in the Santa Clara Basin.

Evaluation scores for each assessment tool (i.e., RWQCB Rapid Trash Assessment Protocol-Version 7.0) and KAB Litter Index) are provided within the table entitled *Trash Problem Area Evaluations Results by Assessment Tool* (see Appendix C-7). The following results were observed during FY 04-05.

KAB Litter Index – Non-Creek Sites

The KAB Litter Index uses a four-point scoring system to estimate the presence of litter within a specific area. To ensure consistent KAB Litter Index scoring between Co-permittees, Co-permittee staff reviewed materials developed by Keep America Beautiful. These materials included written descriptions (on how to score), photographs (which show conditions) and a training video (which detail how to conduct an evaluation). Several Co-permittees increased the resolution of the original KAB litter scale by assigning scores as fractions. The following describes the modified scoring system of the KAB Litter Index: 0 – 1.0 ("no litter"); 1.1 – 2.0 ("slightly littered"); 2.1 – 3.0 ("littered"); and 3.1 – 4.0 ("extremely littered").

- Seventy-five percent of the sites were scored as "no litter" or "slightly littered";
- Twenty-two percent of the sites were scored as "littered". Only three percent were scored as "extremely littered";
- Guadalupe River and Coyote Creek watersheds had twelve and eight sites, respectively, that were scored as "no litter";
- Guadalupe River and Adobe Creek watersheds had seven and six sites, respectively, that were scored as "littered";
- Coyote, San Tomas, Calabazas and Sunnyvale East watersheds had four, four, three and three "littered" sites, respectively;
- Guadalupe River watershed had three "extremely littered" sites; and
- Coyote Creek and San Tomas Aquino Creek watersheds each had one "extremely littered" site.

The most common trash items observed at the non-creek "littered" sites were beverage containers, food wrappers, paper and plastic bags (note: the actual number of trash items was not recorded). The most common trash source reported for these sites was litter from motorists

that accumulates along roadways. Other common trash sources reported include grocery and convenience stores (e.g., dumpsters and parking lots), fast food restaurants, schools and homeless encampments. Illegal dumping was infrequently reported as potential trash source. Potential management activities identified for these sites include: referral to outside agency (i.e., Cal Trans); inclusion into existing clean up programs (e.g., Adopt-a-Highway); conduct public education outreach to businesses and schools; and continue monitoring to determine trash source.

RWQCB Rapid Trash Assessment Protocol (Version 7.0) – Creek Sites

The RWQCB Rapid Trash Assessment consists of six assessment parameters (with narrative descriptions) that qualitatively rate the trash condition of each parameter on a scale of 0 – 120. The range of scores for each parameter is divided into four categories: "poor", "marginal", "suboptimal", and "optimal". The total site score represents the summation of the six individual parameter scores. For the purposes of this analysis, the total site score was divided into the same four categories: 0 – 30 ("poor"); 31 – 60 ("marginal"); 61-90 ("suboptimal"); and (91 – 120: "optimal").

- Twenty-three percent of the sites were scored as "optimal" or "suboptimal";
- Sixty-three percent of the sites were scored as "marginal" and fourteen percent as "poor";
- Three sites identified as optimal (scores of 91 to 120) were located in upper reaches of Stevens Creek (neither of which were originally identified as trash problem areas) and the Baylands;
- Seven sites identified as suboptimal (scores of 61 to 90) were located in tributaries to Coyote Creek and lower reaches of Sunnyvale East Channel, Barron Creek (near the Baylands), San Tomas Aquino Creek and San Francisquito Creek;
- Twenty-seven sites were identified as marginal (scores of 31 to 60); and
- Six sites identified as poor (scores of 0 to 30) were located in Coyote Creek, Guadalupe River mainstem and San Francisquito Creek mainstem.

The most common trash items observed at the creek sites scored as poor or marginal (i.e., scores ranging between 0 and 60) were plastic (e.g., bags, bottles, wrappers, Styrofoam). Other common items included biodegradables (e.g., paper, yard waste), metal, glass and miscellaneous wastes (e.g., cigarette butts, rubber). The most common trash sources reported for these sites were litter from adjacent land uses that accumulate within and along the creek area. Other important trash sources reported include homeless encampments, illegal dumping and trash accumulation from unknown sources upstream. A majority of the sites were reported to have ongoing clean up efforts related to channel maintenance activities. Potential management activities identified for these sites include installation of trash receptacles or fencing near creek; coordination with local law enforcement to address homeless issues; conduct public education outreach to businesses and schools that are adjacent to creeks; and continue monitoring to determine trash source.

Conclusions

KAB trash evaluation results for non-creek sites indicate that a large number of the originally identified trash problem areas have no or limited amounts of litter (i.e., seventy-five percent). The majority of sites characterized as "littered" or "extremely littered" are along roadways; several which are within Cal Tran's jurisdiction. A majority of the trash (beverage containers

and food wrappers) appeared to be from littering and not from illegal dumping. A data analysis of sites evaluated more than once indicated that there was no consistent pattern in changes of trash condition over time. However, these results do indicate that current trash management practices are maintaining low levels of trash for a majority of evaluated sites.

RWQCB Rapid Trash Assessment evaluation results for creek sites indicate that the majority of the originally identified trash problem areas were scored as "marginal" or "poor" (i.e., seventy-seven percent). These sites contained primarily plastic and paper items. Both waste types are highly mobile litter that can be transported by wind and water. Low trash scores were frequently found in areas with homeless encampments. Several sites also reported moderate amounts of metal and glass, which indicate a direct source of litter within the creek area. There were no apparent spatial patterns for trash conditions in creeks (i.e., optimal and suboptimal sites were located in both upper and lower reaches of watersheds). It is important to note that most Co-permittees expect the originally identified trash problem areas to receive "marginal" or "poor" scores since these areas are considered the most problematic trash areas within their jurisdictions. Further, as discussed in the document entitled *SCVURPPP and SMSTOPPP Pilot Implementation and Testing of the RWQCB Rapid Trash Assessment* (dated March 1, 2003), two rating parameters ("actual number of trash items" and "threat to human health") can influence the overall score towards a "marginal" or "poor" rating. For example, numerical thresholds for trash items observed are too conservative and are not representative for a range of conditions in urban streams; and the presence of glass automatically reduces the score for the threat to human health regardless of human risk to exposure.

Future Trash Work Plan Tasks

The tasks identified in the FY 05-06 Trash Work Plan include: 1) continue conducting trash evaluations in a subset of identified trash problem areas; 2) identify and begin to implement or refine existing trash control measures, as appropriate, to address trash problem areas within high priority areas; and 3) begin to develop a long-term strategy for trash conditions in urban streams and waterways. The Trash AHTG is meeting on a quarterly basis to continue discussing the results of trash evaluations and potential implementation strategies.

Summary of Co-permittee Street Sweeping Results

A summary of street sweeping activities conducted by Co-permittees is provided within the table entitled *Summary of Co-permittee Street Sweeping Activities- FY 2004-2005* (see Appendix C-8). During FY 04-05, Co-permittees swept approximately 198,388 miles of paved streets and removed approximately 74,982 yd^3 or 28,118 tons of material[5]. Approximately 7,980 yd^3 of leaf litter was removed[6] by Co-permittees who have leaf removal programs other than routine street sweeping. In addition, approximately 184,060 tons of yard waste (which includes large amounts of leaves) was routinely collected by Co-permittees. As a result, yard waste pick-up programs are keeping large amounts of leaves out of Co-permittee storm drain systems.

[5] The City of San Jose collects and reports the amount of material removed in tons rather than cubic yards. During FY 04-05, the City removed 9,818 tons of material. To determine the total volume of material removed in cubic yards, it is necessary to convert tons to cubic yards. It is estimated that the average density of street sweeping material is 750 pounds per cubic yard (0.375 tons per cubic yard) assuming equal volume of materials are collected during dry and wet weather (Source: Woodward Clyde Consultants, August 1993, *Street Sweeping Status and Recommendation (Draft Report)*. Prepared for Santa Clara Valley Nonpoint Source Control Program). As a result, a value of 26,181 cubic yards is calculated when 9,818 tons is converted over to cubic yards. In addition, a value of 28,118 tons is calculated when 74,982 cubic yards is converted over to tons

[6] An additional 2,205 tons of leaf litter was collected by the City of Palo Alto. However, this figure is a combined figure that included the weight of the material collected from street sweeping plus the leaves collected by our autumn leaf pushing and pickup program. Since all of the material (both street sweeping debris and leaves gathered by leaf pusher trucks) is combined and hauled to the landfill in garbage compactor trucks, there is no way to provide a separate figure for leaf removal.

Evaluation of Effectiveness

One way to measure street sweeping effectiveness is to determine what solids and associated pollutants are collected within street sweeping debris. A typical unit of measure is the total volume of the pollutant removed by the sweeper relative to the curb length swept (e.g., yd^3/curb mile). This unit is typically referred as the removal rate. During FY 04-05, the average Co-permittee removal rate was 0.38 yd^3/curb mile (see Appendix C-8). The Co-permittee removal rate ranged from 0.20 yd^3/curb mile (City of Saratoga) to 0.59 yd^3/curb mile (City of Palo Alto). During FY 03-04, the average Co-permittee removal rate was 0.34 yd^3/curb mile. The effectiveness of street sweeping depends upon a number of factors including accumulation rates of pollutants, the relationship between rainfall and sweeping frequencies, particle size, pavement condition and automobile parking controls[7].

Many studies have shown that street sweeping removes significant quantities of dirt and debris from street surfaces[8]. However, results also demonstrate that the coefficient of variation of copper values and other metals (e.g., lead and zinc) in street sweeping debris is quite high[9]. To illustrate the effectiveness of street sweeping activities for pollutant removal, Program staff estimated the mean pollutant reduction for the following four metals: copper, nickel, lead and zinc. These estimates are provided within the tables entitled *Summary of Co-permittee Street Sweeping Activities and estimated Mean Pollutant Load Reduction for Copper and Nickel- FY 2004- 2005* and *Summary of Co-permittee Street Sweeping Activities and estimated Mean Pollutant Load Reduction for Lead and Zinc- FY 2004- 2005*. Both tables are provided within Appendix C-8. To determine the estimated pollutant load reduction (in pounds), the volume of material collected (in cubic yards) for each Co-permittee land use type (i.e., residential, commercial and industrial) was determined. This value was then multiplied by the mean concentration of trace metal content for street sweeping samples collected in the study entitled *Chemical and Physical Characteristics of Street Sweeping Sediments in Tampa, Florida, May 1999* and converted over to pounds of pollutant removed. These mean concentration values and the algorithm used to calculate the pounds of pollutant removed are provided within the tables. The estimated mean pollutant load reduction values for each land use type were summed. During FY 04-05, it is estimated that Co-permittees street sweeping activities resulted in the following pollutant load reductions for copper, nickel, lead and zinc:

Land Use Type	**Estimated Mean Pollutant Load Reduction (Pounds)**			
	Copper	Nickel	Lead	Zinc
Residential	837	1602	1560	2100
Commercial	417	826	1993	1412
Industrial	333	64	313	257
Total	**1588**	**2492**	**3865**	**3769**

[7] Source: Woodward Clyde Consultants, December 1994. *Street Sweeping Literature Review/Storm Inlet Modification*, Prepared for Alameda County Urban Runoff Clean Water Program.
[8] Source: Sartor, J. and G. Boyd, 1972. *Water Pollution Aspects of Street Surface Contaminants*. Prepared for United States Environmental Protection Agency, Washington, DC.
[9] Source: EOA, Inc, October 1996. *Estimation of Copper Collected Through Street Sweeping Efforts: Final Report*. Prepared for San Mateo Countywide Stormwater Pollution Prevention Program.

It is important to note that there is uncertainty with these estimates since certain assumptions were made regarding the exact volume of material collected from a particular land use type.

EVALUATION OF EFFECTIVENESS

Although typically subjective, the success (i.e., effectiveness) of a stormwater management program can be measured using many different assessment methods. Effectiveness assessment is defined as the process that managers use to evaluate whether their programs are resulting in desired outcomes, and whether these outcomes are being achieved efficiently and cost-effectively. The specific approach to be used in assessing effectiveness depends on a variety of factors including the type of program element or activity being evaluated and the stage of program development (i.e., planning, implementation, completion). Effectiveness assessments fall into two general categories:

- Implementation Assessment - Provides managers feedback on the effectiveness of their programs in achieving targeted objectives. This type of assessment is essential in determining whether priority sources of pollution are being effectively addressed. Implementation assessment may include any of three levels of analysis: the overall program, the elements that comprise the program (construction sources, municipal sources, etc.), or the specific activities that are conducted within these program elements. These may range in complexity from simple activities (e.g., verifying the completion of activities) to more sophisticated techniques (e.g., assessing the probable or actual locations of these activities and the significance of their spatial distribution).

- Water Quality Assessment - is the use of sampling data and related information to evaluate the condition of non-stormwater or stormwater discharges and the water bodies that receive these discharges. This can include a variety of chemical, biological, and physical parameters or outcomes. In instances where water quality assessment is used to draw conclusions about overall program effectiveness, results are usually very general and require extended periods of analysis.

Ideally, the two types of assessments should be linked together to create an integrated assessment, which is process of evaluating whether program implementation is resulting in the protection or improvement of water quality. In this process, relationships between program activities and water quality improvements are explored and refined. Due to the number and variety of BMPs and control programs being implemented at any given time, and because data is limited, establishing these relationships is difficult.

Efforts to date often include speculative or hypothetical exercises aimed at better understanding likely program outcomes and potential relationships to water quality. Quantitative “cause and effect” relationships will increasingly be sought in the future. This is a critical linkage because implementation assessment is, in many cases, simpler and less costly than water quality assessment. In addition, the time frame needed to see measurable results is shorter for implementation assessments. Over time, correlating water quality improvement to programmatic results will assist the Program in identifying the most expedient and cost-effective approaches to planning and assessing their programs. In the interim, the effectiveness of Program monitoring and assessment activities will continued to be assessed using an implementation assessment approach (i.e., were monitoring objectives met). As a result, the collection of data through environmental indicators continues to inform us about the condition of water bodies in the Santa Clara Valley and allows resources to be focused on the most pressing problems. The implementation of these indicators is a necessary step toward establishing a

sound regulatory basis for locally based watershed management described in Section 5.

Effectiveness of FY 04-05 Monitoring and Assessment Activities

In FY 04-05, the Program effectively met all obligations stated in its FY 04-05 Monitoring Program and Watershed Management Measures Work Plan. Monitoring and assessment activities were implemented through a variety of programs and projects which include the following: 1) baseline water quality monitoring described in the Program's Annual Monitoring Plan and Watershed Management Measures Work Plan; 2) regional collaborative efforts (e.g. RMP and CEP); and 3) active participation in TMDL development. In addition, the Program continued to address the following monitoring program objectives (as stated in the Program's NPDES Permit): (1) characterization of representative drainage areas and stormwater discharges; (2) assessment of existing or potential adverse impacts on beneficial uses caused by pollutants of concern in stormwater discharges; (3) identification of potential sources of pollutants of concern found in stormwater; and (4) evaluation of effectiveness of representative stormwater pollution prevention of control measures. The following paragraphs briefly describe the effectiveness of monitoring activities described in this Annual Report in addressing these objectives.

1) Characterization of Representative Drainage Areas and Stormwater Discharges

- Stevens and Permenente Creek Watershed Characterization Memorandum –This memorandum was intended to assist the Program in developing the appropriate sampling design for Stevens and Permenente Creek watersheds that will be implemented in FY 04-05. To develop this design, existing data and information resources were collected and reviewed; descriptions of the relevant watershed attributes were developed; and key issues relevant to these watersheds were identified. From a Program staff perspective; the memorandum was an effective "first cut" at: 1) describing watershed characteristics that may affect the quality of stormwater discharges in these creeks; 2) identifying known issues in the watershed; and 3) guiding the selection of indicators and sampling sites that will yield useful data.

- Trash Characterization and Management Activities – During FY 04-05, the Co-permittees conducted trash evaluations at a subset of trash problem areas to establish baseline levels of trash. Thirty sites were evaluated more than once to evaluate changes in trash conditions over time and to determine the effectiveness of existing trash management practices (i.e., rate of trash accumulation following clean up activities). A data analysis of sites evaluated more than once indicated that there was no consistent pattern in changes of trash condition over time. More specifically, there was no change in score for 45 percent of the sites. Subsequent evaluations indicated that higher scores occurred at 30 percent of the sites and lower scores occurred at 25 percent of the sites. There was also no apparent pattern in changes of scores for season or in the types of trash observed at the site over time. During the initial trash evaluations, Co-permittee staff, where feasible, identified potential management actions to address trash problem areas (e.g., educational outreach to businesses and schools). During FY 05-06, trash evaluations will be conducted at selected locations over time to determine the effectiveness of both existing and planned trash management actions.

2) Assessment of Existing or Potential Adverse Impacts on Beneficial Uses Caused by Pollutants of Concern in Stormwater Discharges

- Legacy Pesticides, Dioxins and PCBs Conceptual Model/Impairment Assessment Reports –The Bay was first listed as impaired by these pollutants of concern in 1998. Since 1998, a significant amount of data and information has been collected by the RMP and other stakeholders. Therefore, the CEP revisited the data originally used to justify an impairment listing and also assessed more recent data in an attempt to determine if the Bay is still impaired by legacy pesticides and PCBs. Although, the impairment assessment reports did not concretely state that impairments do or do not exist, the completion of the CMIA reports should be considered successful. Each report summarizes existing information into a single document, which allows all stakeholders to discuss possible management and regulatory actions from a level playing field.

- CEP Urban Creeks Monitoring – Urban creeks monitoring that were conducted by the CEP during FY 04-05 greatly assisted Bay Area urban runoff programs and the Water Board in assessing the adverse impacts on beneficial uses caused by pesticides. In addition, the monitoring results validated hypotheses that suggested diazinon concentrations and associated aquatic toxicity would decline with the phase out of diazinon.

- Receiving Water Monitoring – SCVURPPP water quality monitoring and assessments continue to yield baseline information on the condition of water bodies in the Santa Clara Valley. Potential impacts to beneficial uses were identified in the FY 04-05 Summary Assessment Report. Recommended next steps were also outlined to better define the potential issues or management actions that can be implemented.

- Stevens Creek Watershed Analysis – The Limiting Factors Analysis (LFA) conducted in the Stevens Creek watershed directly assessed the factors limiting steelhead trout (i.e., a cold water use). Key limiting factors that are directly attributable to natural conditions and anthropogenic activities were identified along with potential management actions.

3) Identification of Potential Sources of Pollutants of Concern Found in Stormwater

- Urban Runoff Copper Source Assessment – The Copper Source Report assisted stormwater management agencies by summarizing information on the sources of copper that is carried to San Francisco Estuary in urban runoff and copper that is released directly into the San Francisco Estuary from shoreline activities. The report also reviews available control measures for each copper source, providing control measure effectiveness information to the extent data are available.

4) Evaluation of Effectiveness of Stormwater Pollution Prevention of Control Measures

- Urban Runoff BMP Evaluation for Pollutants of Concern – In FY 04-05, SFEI was awarded a Proposition 13 grant to evaluate the effectiveness BMPs in reducing POCs in urban runoff. BASMAA member agencies (including SCVURPPP) have played an active role in developing the scope of work and technical advisory committee during this fiscal year. Results from the project will likely assist the Program in further evaluation of the effectiveness of control measures for POCs.

Table 4-1
Status of FY 2004-2005 Monitoring Activities, continued

Title	Category/ Monitoring Priority (MP)[2]/ Permit Provision	Origin	Capsule Scope	Product(s)[3]	Status Schedule
Quality Assurance Project Plan (QAPP)	MP#2	RWQCB Review of SCVURPPP Monitoring Program	Develop and implement a quality assurance and control plan for the SCVURPPP Multi-Year Receiving Waters Monitoring Program.	Draft QAPP[4a,b]	Draft - 9/15/05 Final - 10/15/05
Regional Monitoring Program (RMP) for Trace Substances in the San Francisco Estuary	MP #2, Permit Provision C.7.b	Permit	Provide funding and technical participation.	Attend meetings and review documents	Completed as needed
Clean Estuary Partnership (CEP)	MP #4		Provide funding and technical participation.	Attend meetings and review documents	Completed as needed
BASMAA Monitoring Committee	MP #4		Provide funding and technical participation.	Attend meetings	Completed as needed
Control Program for Mercury	Permit Provision C.3.e	Permit	Provide in kind funding and technical support (City of San Jose) for Mercury Atmospheric Deposition Monitoring. Participate in the development of the Guadalupe River Watershed TMDL for Mercury b attending meetings and reviewing technical results and reports. Provide funding and technical participation to	Attend meetings and review documents Attend meetings and review documents Final Draft 2003/2004	Completed as needed Completed as needed July 2005

Table 4-1
Status of FY 2004-2005 Monitoring Activities, continued

Title	Category/ Monitoring Priority (MP)[2]/ Permit Provision	Origin	Capsule Scope	Product(s)[3]	Status Schedule
			the RMP. Review technical results and reports.	Report	
			Conduct environmental monitoring via Multi-Year Monitoring Plan.	*FY 04-05 Watershed Monitoring and Assessment Summary Report*[4a,b]	Completed-9/15/05
Control Program for Pesticides	Permit Provision C.3.d	Permit	Provide in kind funding and technical support (City of Sunnyvale) for Urban Creeks Pesticide Monitoring.	Attend meetings and review documents	Completed as needed
			Provide funding and technical participation to the CEP. Review technical results and reports.	*Legacy Pesticides Conceptual Model Impairments Assessment (CMIA) for the San Francisco Bay*	Completed-11/11/04
			Conduct environmental monitoring via Multi-Year Monitoring Plan.	*FY 04-05 Watershed Monitoring and Assessment Summary Report*[4a,b]	Completed-9/15/05
Control Program for Copper and Nickel	Permit Provision C.9.a & b	Permit	Assist Bay Modeling and Monitoring (BMM) subgroup to conduct two semi-annual reviews of the Copper Action Plan and Nickel Action Plan	*Copper and Nickel Action Plan FY 03-04 Accomplishments and FY 04-05 Work Plan*	Completed-9/15/04
				Copper Sources and Management Strategies Clearinghouse (website)	Completed-12/3/04
				Copper in San Francisco Bay: Resources to Seduce Scientific Uncertainties (website)	Completed-12/15/04

Table 4-1
Status of FY 2004-2005 Monitoring Activities, continued

Title	Category/ Monitoring Priority (MP)[2]/ Permit Provision	Origin	Capsule Scope	Product(s)[3]	Status Schedule
				Copper and Nickel Action Plan FY 05-06 Work Plan and Reporting Tables (final)	Completed-2/25/05
			Conduct environmental monitoring via Multi-Year Monitoring Plan	*FY 04-05 Watershed Monitoring and Assessment Summary Report*[4a,b]	Completed-9/15/05
			Summarize Information on the Sources of Copper in Urban Runoff	*Copper Sources in Urban Runoff and Shoreline Activities*	Competed-November 2004
			Provide funding and technical participation to the Brake Pad Partners (BPP). Review technical results and reports.	Attend meetings and review documents	Completed as needed
Control Program for PCBs and Dioxin Compounds	Permit Provision C.9.e	Permit	Determine whether existing data are sufficient to quantify PCB concentrations in the near shore sediments of central and south San Francisco Bay that are not directly impacted by local PCBs sources	Draft Repot- *PCBs Concentrations of Nearshore Sediments and Assessment of Data Quality*	Draft report under scientific peer review
			Assist Water Board staff in developing an implementation plan for the PCBs TMDL	Draft Repot- *PCBs TMDL Implementation Plan*	Draft report under internal CEP review
			Provide a detailed analysis of the status of the impairment of the Bay by PCBs and associated uncertainties. It also presents a conceptual model that describes sources, estimated loads, and processes that affect the fate of PCBs in	*Conceptual Model/ Impairment Assessment Report on PCBs in San Francisco Bay*	Draft report under internal CEP review

Table 4-1
Status of FY 2004-2005 Monitoring Activities, continued

Title	Category/ Monitoring Priority (MP)[2]/ Permit Provision	Origin	Capsule Scope	Product(s)[3]	Status Schedule
			the Bay.		
			Provide prediction on the maximum concentration of PCBs in Bay sediments that result in safe levels of PCBs in Bay wildlife, in addition to predicting sediment concentrations associated with safe levels of PCBs in edible fish tissue for human consumption	*San Francisco Bay Food Wed Model*	Draft report under internal CEP review
			Developing a better tool for predicting future pollutant concentrations and testing potential management actions, 2) clarifying the uncertainty of existing model predictions, 3) identifying key areas where fieldwork can reduce uncertainties, and 4) conducting key fieldwork, including sediment coring in the Bay to improve estimates of the PCB inventory and historic loafs and tracer experiments to quantify flushing.	*Multibox Bay PCBs Fate and Transport Model and Multi-year Sediment Sampling Program*	Beta version multi-box model under internal CEP/RMP review
			Describes dioxins pollution prevention options developed by ABAG's Bay Area Dioxins Project in the context of potential implementation by municipalities.	*Summary of Selected Regional, State ad Federal Efforts Relevant to Addressing Dioxins*[4a,b]	Final report completed-9/15/05
			Provide a detailed analysis of the status of the impairment of the Bay by Dioxins and associated uncertainties. It also presents a conceptual model that describes sources, estimated loads, and professes that affect the gate f Dioxins in the Bay.	*Conceptual Model. Impairment Assessment for Dioxins in san Francisco Estuary*	Final report completed-1/20/05

Table 4-1
Status of FY 2004-2005 Monitoring Activities, continued

Title	Category/ Monitoring Priority (MP)[2]/ Permit Provision	Origin	Capsule Scope	Product(s)[3]	Status Schedule
Control Program for Sediment	Permit Provision C.9.f	Permit	Characterize channel and habitat conditions with respect to factors that limit the steelhead population in the San Francisquito Creek Watershed.	*Aquatic Habitat Assessment and Limiting Factors Analysis*	Draft report to be completed- Fall 2005
			Characterize the nature and degree of potential sediment-related effects on a selected indicator species (i.e. Steelhead Trout) in the Stevens Creek Watershed.	*Stevens Creek Limiting Factors Analysis (LFA) Report*	Final report submitted- 12/8/04
			Provide an inventory and document management practices relevant to erosion processes and sediment transport and deposition within the Stevens Creek Watershed, and to evaluate the effectiveness of these practices to the extent possible.	*Analysis of Sediment Management Practices in Stevens Creek Watershed*	Final report submitted- 12/8/04
			Characterize the nature and degree of potential sediment-related effects on a selected indicator species (i.e. Steelhead Trout) in the Upper Penitencia Creek Watershed.	*Upper Penitencia Creek Limiting Factors Analysis (LFA) Report*	Draft report to be completed- Fall 2005
				Analysis of Sediment Management Practices in Upper Penitencia Creek Watershed	Draft report to be completed- FY 05-06
Trash Characterization and Management Activities	MP #3c		Effectively address trash issues in the Santa Clara Basin Watershed	*Trash Problem Area Survey Results- FY 04-05* (include tables and figures)	Completed- 9/15/05