SCVURPPP FY 04-05
Watershed Monitoring and Assessment Summary Report

Submitted in fulfillment of NPDES Permit Provision C.10(b)

Screening-level Monitoring of Adobe Creek, Matadero/Barron Creek, Calabazas Creek, Sunnyvale East/West Channel and San Tomas Aquino Creek Watersheds

Prepared for
Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Prepared by
EOA, Inc.
1410 Jackson Street
Oakland, CA 94612

September 15, 2005

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Executive Summary

In FY 04-05, the SCVURPPP 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 SCVURPPP's Multi-Year Plan (SCVRUPPP 2004). This Watershed Monitoring and Assessment Summary Report (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.

Standard operating procedures used for field data collection and laboratory analyses are described in more detail in the SCVURPPP *Draft Quality Assurance Project Plan* (QAPP). Conventional water quality parameters of temperature, pH, conductivity, dissolved oxygen (D.O.) and water velocity were measured with portable field instruments. Measurements were made during all water quality and bioassessment sampling events.

Water quality samples were collected directly into sample bottles as close to midstream as possible. Water samples were analyzed for nutrients and anions, suspended sediment, metals (total and dissolved), and organophosphate pesticide concentrations. Water samples were tested for toxicity at six monitoring sites during both sampling events. Three species bioassays were performed using the water flea (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*), and a green alga (*Selenastrum capricornutum*). Water samples were collected at eight monitoring sites during both sampling events and analyzed for concentrations of total and fecal coliform and *enterococcus*. Initial field reconnaissance indicated these stations had potential public access with potential for contact water recreation.
The results of the water quality sampling were compared to the Water Quality Objectives identified in the San Francisco Bay Regional Water Quality Control Board 1995 Basin Plan (Basin Plan) (SFRWQCB 1995) and the California Toxics Rule (CTR) that identifies the numeric criteria for priority pollutants for the State of California (US EPA 2000).

Benthic macroinvertebrate (BMI) sampling was conducted following the California Stream Bioassessment Procedures (CSBP) protocols for high gradient streams (Harrington 2003). Physical habitat quality was assessed for each BMI sampling location using the U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocol (Barbour et al., 1999).

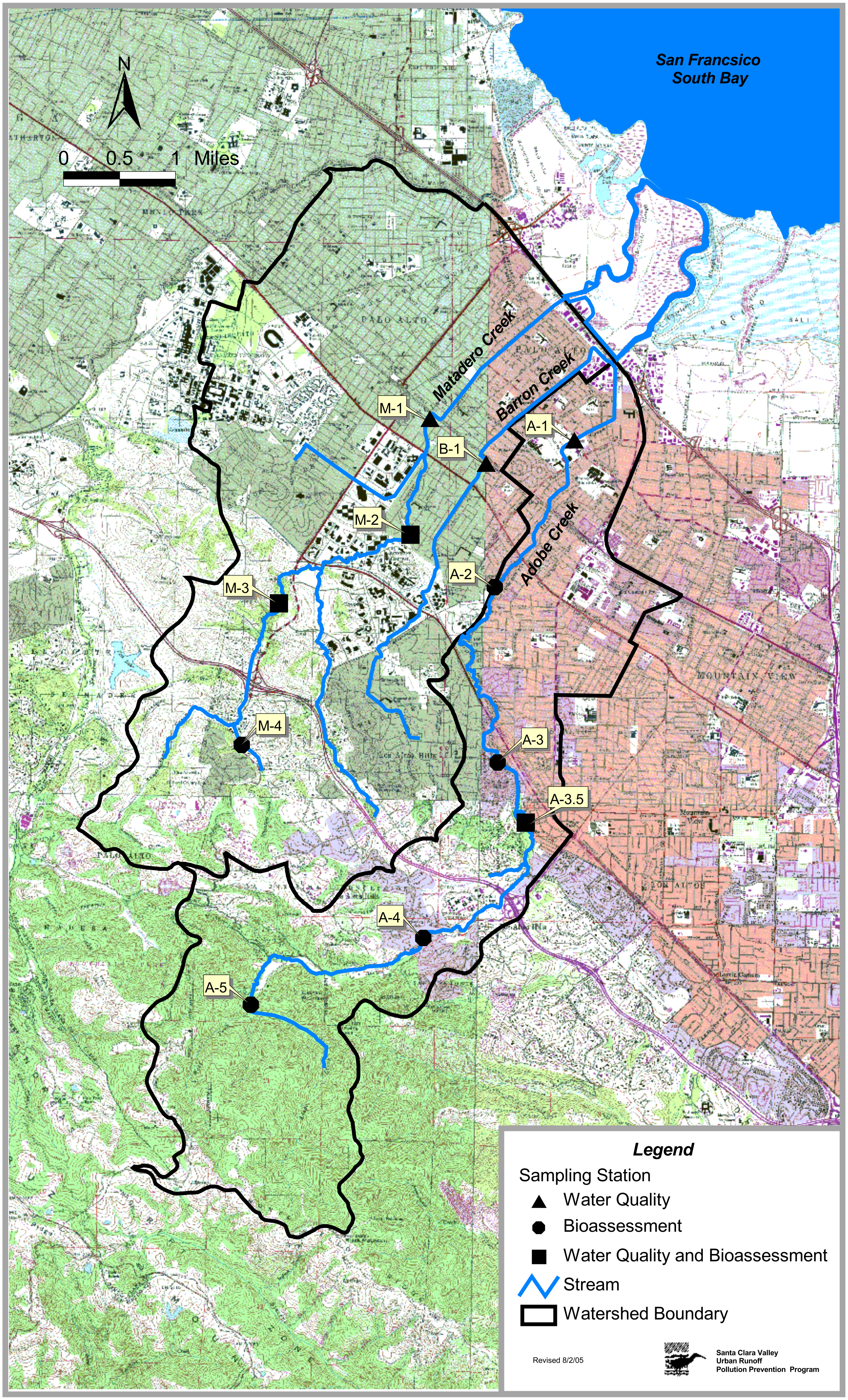

Figure ES-2. Sampling sites in the Adobe and Matadero/Barron Creek Watersheds.

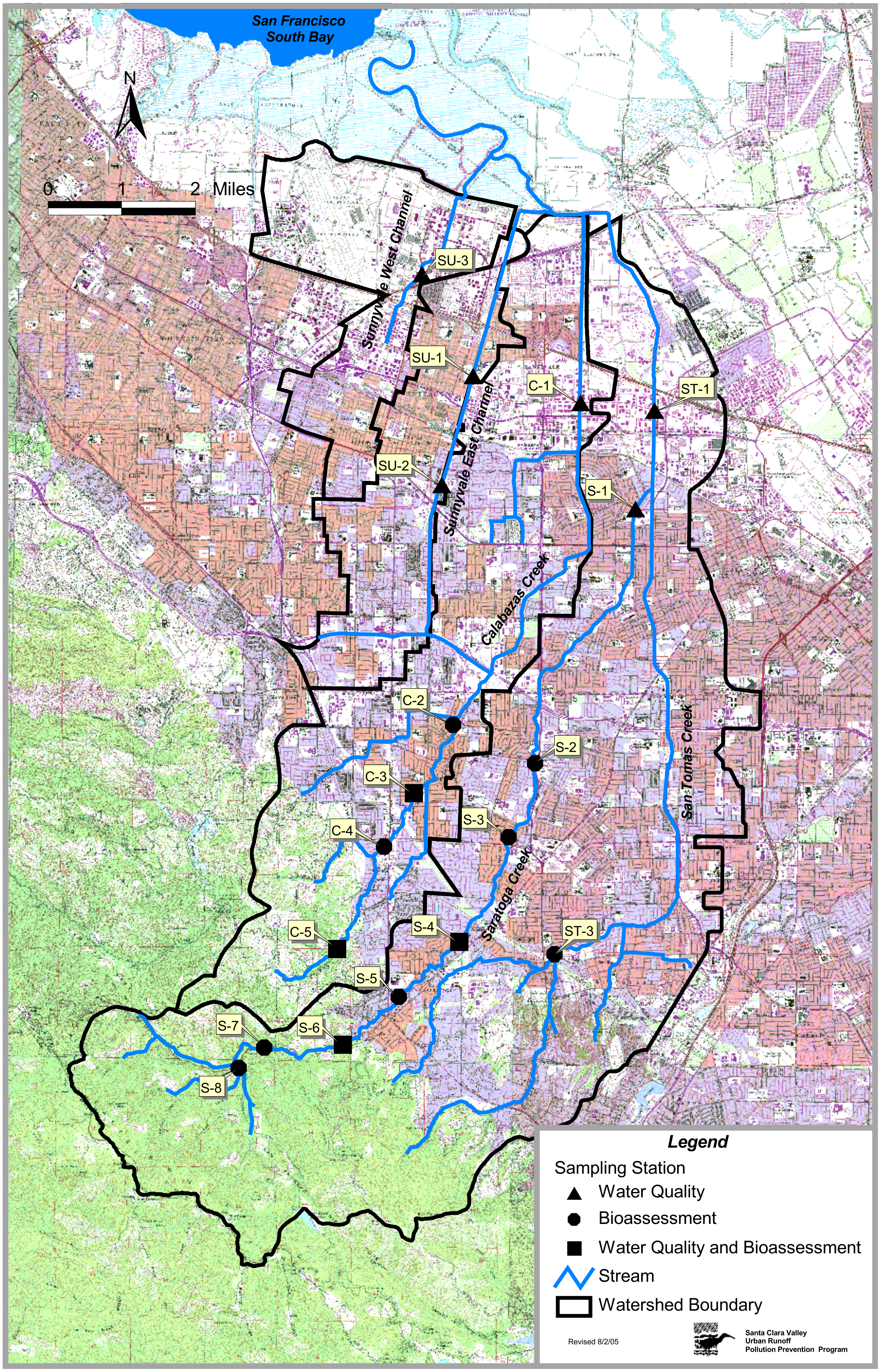

Figure ES-1. Sampling sites in the Calabazas Creek, San Tomas Creek and Sunnyvale East and West Channel Watersheds.

A 500 BMI subsample was generated for each sampling reach and the taxonomic composition of each subsample was identified using a standard level of taxonomic effort as specified in the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet), January 2003 revision.

A series of data analyses were performed using the BMI taxonomic list for each site, including generating five main types of biological metrics, calculating composite metric scores, identifying five most numerically abundant (dominant) taxa, and a composition analysis to determine natural groupings among the sites.

An electrofisher was used for sampling the fish community. A single pass with the electrofisher was made at each station and the captured fish held in a bucket of water for species identification, enumeration, measuring (fork length in mm), and for some of the sites, weighing (grams).

The Program piloted the Center for Watershed Protection Unified Stream Assessment (USA) method on Saratoga Creek to evaluate instream and riparian corridor conditions and associated stressors. A total of 2.4 miles of the Creek were surveyed from the Cox Road crossing upstream to the Highway 9 crossing.

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

[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 meterological, 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.

below Basin Plan water quality objectives for both REC-1 and REC-2 Uses. One sample analyzed for enterococcus[2] was above the U.S. EPA'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, enterococus data collected at site M-2 was above the U.S. EPA'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.

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

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

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, enterococus data collected at sites C-3 and C-5 were slightly above the U.S. EPA’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, enterococus data collected at a high majority of Saratoga Creek sites were below U.S. EPA’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.

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Section 1.0

Introduction

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1.1 Background

On February 21, 2001 the Santa Clara Valley Urban Runoff Pollution Prevention (SCVURPPP) was reissued a National Pollutant Discharge Elimination System (NPDES) permit (Permit) by the San Francisco Bay Regional Water Quality Control Board (Water Board) to discharge stormwater. Three provisions (C.7, C.9 and C.10) in the Permit contain environmental monitoring-related requirements. To meet these requirements the SCVURPPP submitted a Multi-Year Receiving Waters Monitoring Plan (Multi-Year Plan – Version 1.0) to the Water Board in 2002 that defined the SCVURPPP Watershed Monitoring and Assessment Program planned for implementation in Fiscal Years (FY) 2002-03 to 2009-10. The Monitoring and Assessment Program was designed to meet the following objectives listed in the Permit:

1. Characterization of representative drainage areas and storm water discharges, including land-use characteristics, pollutant concentrations, and mass loadings;
2. Assessment of existing or potential adverse impacts on beneficial uses caused by pollutants of concern in storm water discharges, including an evaluation of representative receiving waters;
3. Identification of potential sources of pollutants of concern found in storm water discharges; and
4. Evaluation of effectiveness of representative storm water pollution prevention or control measures.

1.1.1 Multi-Year Receiving Waters Monitoring Plan

The Multi-Year Plan (Version 1.0) outlined the SCVURPPP's approach to monitoring, presented monitoring priorities and described accomplishments to-date. Furthermore, the 2002 Multi-Year Plan described the SCVURPPP's linkage to, and support for the Santa Clara Basin Watershed Management Initiative (SCBWMI), a collaborative, stakeholder driven effort aimed at protecting and enhancing the watersheds in the Santa Clara Basin.

Following approval of the Multi-Year Plan, the SCVURPPP conducted screening level/baseline water quality monitoring in receiving water bodies in FY 02-03 and FY 03-04. In July 31, 2003, the SCVURPPP developed the *Assessment of Watershed Assessment Methods Technical Memorandum* (Technical Memo), which provides information necessary to improve SCVURPPP's monitoring and assessment program. Lessons learned from data collected during the first two years of implementing the Multi-Year Plan and recommendations presented in the Technical Memo provided the impetus to revise the Multi-Year Plan (Version 2.0).

Monitoring activities originally described in the Multi-Year Plan (Version 1.0) were generally aimed at developing and implementing programs/projects designed to assess programmatic and environmental effectiveness and practical, implementable indicators and protocols for assessing the beneficial uses of receiving water bodies, including local creeks and the San Francisco Bay estuary. The implementation of these indicators and protocols are a necessary step toward establishing a sound regulatory basis for locally based watershed management. The Multi-Year Plan (Version 2.0), submitted in March 1, 2004, continues to embrace this strategy and offers revisions that are intended to: 1) more fully integrate the monitoring activities identified in the Plan with the Program's need to conduct watershed assessments, and 2) allow for additional follow-up monitoring activities that will help better identify sources of pollutants or causes of impacts to Beneficial Uses (Uses). Additionally, the revised Multi-Year Plan attempts to provide the SCVURPPP a formalized process for conducting future monitoring and assessment activities.

1.1.2 Monitoring and Assessment Program Goals

Environmental monitoring and watershed assessments are key components in the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). Environmental monitoring provides information needed to: (1) assist the RWQCB to characterize receiving water quality in urban watersheds consistent with the priorities of the SCBWMI and the Program; (2) develop an understanding of baseline conditions in water bodies; (3) recognize the need for site-specific water quality investigations to address questions that might arise while conducting screening-level monitoring efforts; (4) allow for determining if control measures are having an intended effect; and, (5) conduct watershed assessments aimed at determining the condition of, and potential impacts to water bodies and Beneficial Uses (Uses). Prior to conducting environmental monitoring, data quality objectives and an understanding of how the data will be analyzed should be established. This understanding of the overall objectives of collecting the data typically allows for environmental monitoring that utilizes appropriate indicators and collects adequate quality and quantity of data needed to conduct an assessment of the watershed/subwatershed in question.

The following SCUVRPPP Monitoring and Assessment Program goals are intended to guide the programs monitoring and assessment activities.

1. Develop a better understanding of the chemical, biological, and physical characteristics of water bodies and watersheds relevant to the Program, which will help inform decisions about future management actions and help clarify and resolve storm water related issues within watersheds;
2. Assess baseline water quality conditions in representative watersheds within Program boundaries to evaluate storm water impacts and help solve creek drainage basin-specific water quality problems;
3. Assess whether specific pollutants of concern are found in storm water discharges and impact water quality in local water bodies and the San Francisco Bay;
4. Evaluate the effectiveness of existing storm water pollution prevention and control Best Management Practices (BMPs) and recommend improvements; and,
5. Evaluate overall Program effectiveness over time.

These goals and objectives are more fully described in the Multi-Year Plan (Version 2.0).

1.1.3 Monitoring and Assessment Approach

The SCVURPPP monitoring and assessment approach includes parameters that may be categorized into two tiers; screening-level monitoring and assessments (i.e. Tier I) and investigative monitoring (i.e., Tier II). Screening level monitoring and assessments include more general measurements made at various sampling locations, providing an initial characterization of the physical, chemical, and biological integrity of a particular watershed/waterbody. Screening level monitoring is conducted in each watershed identified in the Multi-Year Plan (Version 2.0) for two fiscal years on a rotating watershed basis. Investigative monitoring or studies include more detailed measurements typically taken in a more defined area (e.g., stream reach). Investigative monitoring is intended to address specific questions of impairment, such as: 1) what is the cause of the potential impairment, and 2) what is the potential source of the pollutant identified? Table 1 provides a few examples of screening-level indicators and investigative monitoring parameters.

A *Monitoring and Assessment Process Flow Chart* (Figure 1) illustrates the Program's "tiered" monitoring approach to environmental monitoring and the nexus between environmental monitoring and watershed assessment. This process is intended to provide the Program with a formalized structure for conducting monitoring and assessments under the Multi-Year Plan. This process utilizes the best available water quality and watershed-related information for each task, with the goal of collecting additional data needed to characterize, assess and protect/restore beneficial uses in receiving water bodies.

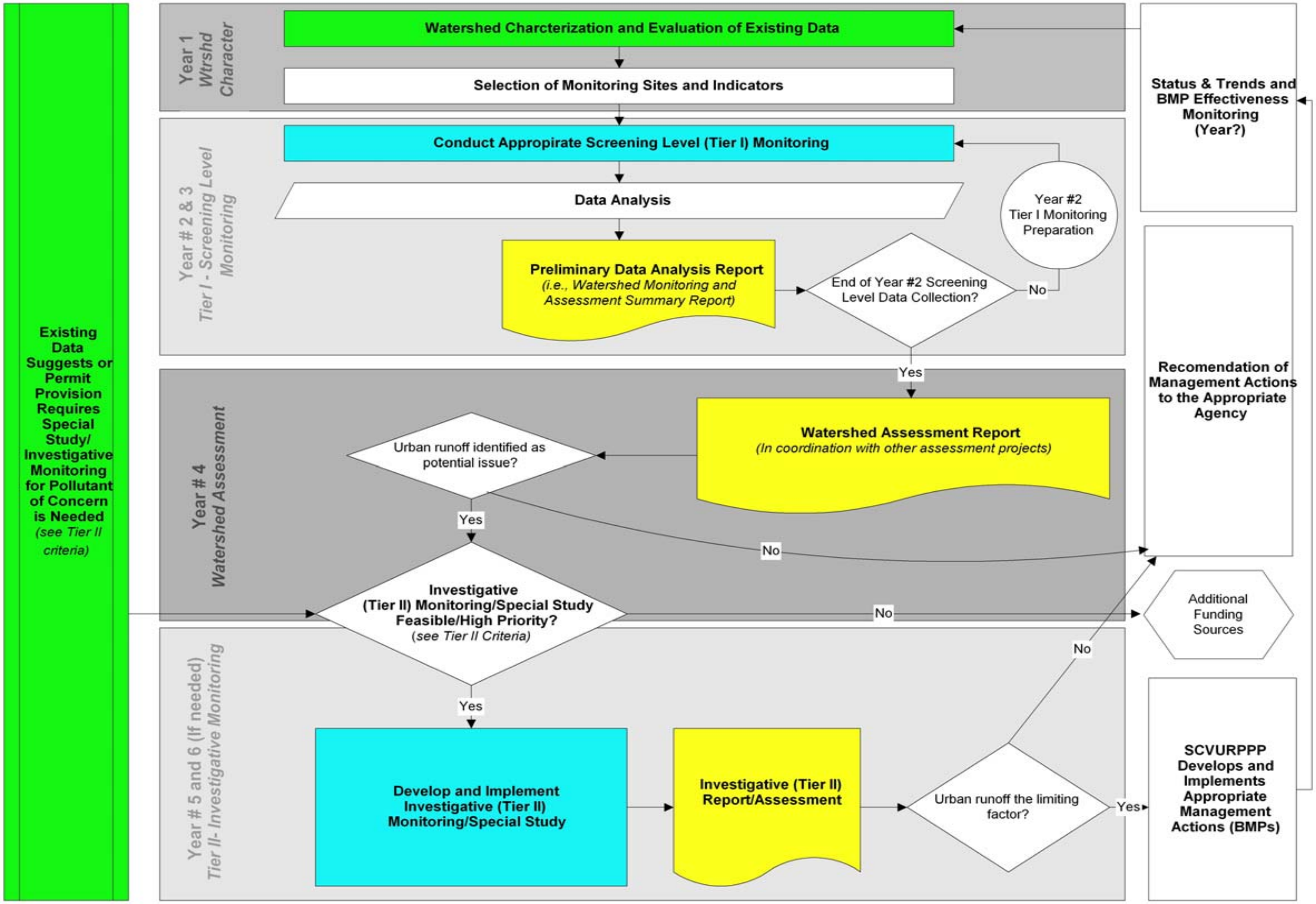
Ecological Indicators

An ecological indicator is a measure, an index of measures, or a model that characterizes an ecosystem or one of its critical components. An indicator may reflect biological, chemical and/or physical attributes of ecological condition, and may also be used to identify major ecosystem stress. The Program will collect two types of screening level indicators during the implementation of the Multi-Year Plan: (1) aquatic life use indicators (e.g., benthic macroinvertebrates and fish assemblages) and (2) water recreation use indicators (e.g., fecal and total coliforms, enterococcus and E. coli). Each type of indicator is further described below.

Table 1. Examples of screening-level indicators and investigative monitoring parameters, with associated beneficial uses.

Indicator/Parameter	Beneficial Uses
Screening-level Indicators	
General Water Quality	Aquatic Life Uses
Rapid Bioassessment	
Fisheries Assemblage Characterization	
Qualitative Physical Habitat Assessments	
Bacterial Indicators	Recreation Uses
Investigative Parameters	
Nutrients (NO3, NO2, NH4, PO4)	Aquatic Life Uses
Sediment (TSS, SSC, Geomorphic Analyses)	
Toxicity (3 species bioassays, TIEs)	
Metals (Cu, Ni, Cd, Hg, Cr, Pb, Se)	Aquatic Life and Recreation Uses
Pesticides (Organophosphates)	Aquatic Life Uses
Quantitative Physical Habitat Assessments	
Organics (PCBs, PAHs, Dioxins)	Aquatic Life and Recreation Uses

Figure 1. SCVURPPP Monitoring and Assessment Process Flow Chart**, illustrates the Program's "tiered" monitoring approach to .... environmental monitoring and the nexus between environmental monitoring and watershed assessment.**



Aquatic Life Use Indicators

As a first step in conducting environmental monitoring, the Program uses screening level indicators that will aid in determining ecological condition and status of aquatic life uses in Santa Clara basin water bodies. In particular, the Program has selected Benthic macroinvertebrates (BMIs) and fish community assemblages as screening level indicators of aquatic life uses. Extensive guidance on development and use of BMIs and fish as indicators is been supported at the national and state levels, and a number of agencies and volunteer groups have begun to sample BMIs in Bay Area creeks using the California Stream Bioassessment Procedure developed by the California Department of Fish and Game (Harrington 2003). Additionally, screening level assessments of physical habitat are conducted to aid in determining the physical/habitat condition or quality of a watershed and water body. Qualitative screening-level physical habitat assessments are conducted synoptically with BMI and fish data collection efforts. Qualitative physical habitat assessments also include, general water quality measurements and substrate composition estimates taken during biological sampling.

Recreation Use Indicators

Microbiological water analysis is typically carried out to safeguard the health of a community by testing for possible fecal pollution, the source of microorganisms causing waterborne disease. Indicators of recreational use are microbiological organisms that coexist with pathogens in the fecal environment and are easier and less expensive to test for than pathogens. For these reasons, indicator organisms are often the focus of water analyses rather than pathogens. The most commonly employed indicator organisms are total coliform, fecal coliform, enterococcus, and E. coli. The Program uses these organisms as screening level indicators of beneficial uses related to recreation (i.e., REC-1 and REC-2).

In addition, it is important to have data on access to sites, as well as the populations and frequencies of exposure expected at those locations. To ensure locations that have a high potential for recreational uses are sampled, Program staff identifies sampling sites within a given watershed during the watershed characterization stage of the watershed monitoring and assessment process. The selection of sampling site locations is based upon where the highest potential for exposure and access to the creek appears to exist (e.g., parks adjacent to creeks and local swimming sites).

1.2 Fiscal Year 2004 - 2005 Scope of Work

FY 04-05, the SCVURPPP 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 SCVURPPP's Multi-Year Plan (SCVRUPPP 2004). This Watershed Monitoring and Assessment Summary Report (Summary Report) discusses the results of FY 04-05 Watershed Monitoring and Assessment activities, and pursuant to Provision C.10(b) of the Program's NPDES Permit, illustrates the SCVURPPPs support for the SCBWMI by:

1) investigating beneficial uses and causes of impairment;
2) reviewing, compiling, and disseminating environmental data;
3) developing and implementing strategies for controlling adverse impacts of land use on beneficial uses; and,
4) facilitating, implementing, and supporting relevant SCBWMI subgroups.

Furthermore, this Report provides information on current or planned watershed management activities and suggests next steps needed for continuous improvement in addressing high priorities in each of the subject watersheds. The following sections describe SCVURPPP's watershed monitoring and assessment activities in FY 04-05conducted through the implementation of the Multi-Year Plan.

1.3 Report Organization

This FY 04-05 Summary Report is organized into six main sections. Section 1.0 provides an introduction and background for the SCVURPPP Receiving Waters Monitoring Program. Section 2.0 provides a characterization of the Santa Clara Basin Watersheds that were monitoring in FY 04-05 and a summary of known existing information resources for those watersheds. This section also identifies Beneficial Uses (Uses) that are designated by the Water Board for those watersheds, and describes the monitoring design and sampling locations implemented via the FY 04-05 Annual Plan.

The field and laboratory methods used for each monitoring indicator are described in Section 3.0. This section also summarizes data quality and data analysis methods and methods described in the Center for Watershed Protection's (CWP) Unified Stream Assessment.

Sections 4.0 through 8.0 provide a description and discussion of monitoring results watershed monitoring and assessment activities conducted in FY 04-05 in Adobe Creek, Matadero/Barron Creeks, Sunnyvale East/West Channels, Calabazas Creek and San Tomas Aquino/Saratoga Creek watersheds. Section 9.0 provides a discussion of the data quality assessment, including quality assurance and control results. Section 10.0 provides a description of conclusions based on FY 04-05 watershed monitoring results, and recommended future monitoring activities and management actions for each watershed. Section 11.0 lists all references cited in the Summary Report.

Section 2.0

Watershed Study Areas

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2.1 Watershed Characteristics

The watersheds monitored by SCVURPPP in FY 04-05 are shown in Figure 2. The following section provides a characterization for each of these watersheds.

2.1.1 Adobe Creek Watershed

Adobe Creek watershed drains approximately 10 square miles (SCBWMI 2001). The creek originates on the northeastern facing slopes of the Santa Cruz Mountains along the Montebello Ridge, at 2,600 feet in elevation. The main stem flows in a northern direction over steep forested terrain until it meets the middle, west and north forks at the upper end of a valley. The drainage area above the confluence of these forks is undeveloped open space land owned by the Mid-Peninsula Regional Open Space District and the Trust for Hidden Villa (SCBWMI 2001).

The Adobe Creek main stem continues approximately 2.5 miles in an eastern direction along a narrow valley. The upper end of this valley supports primarily agricultural land uses, including farming practices within the Hidden Villa Farm; the lower end of the valley contains areas of low-density residential development within the riparian corridor. The main stem then flows in a northern direction for about 3.0 miles in the foothill region with urbanization in the riparian corridor that includes Foothill Community College and moderate- and high-density residential development.

The Adobe Creek main stem continues flowing in a northeastern direction for approximately 4.0 miles within the alluvial plain of the Santa Clara Valley. The valley floor portion of Adobe Creek flows through residential areas of Los Altos Hills, Los Altos, Palo Alto, and Mountain View. There are several sections of the creek that have been re-aligned, including the construction of a trapezoidal concrete channel between El Camino Real and Highway 101. Adobe Creek is joined by Barron Creek just west of Highway 101 and continues to flow through estuarine area with tidal influence until it empties into the Palo Alto Flood Basin (SCBWMI 2001).

The Adobe Creek has intermittent streamflow during average and dry water years with no impoundments. The steep nature of the upper watershed typically results in high intensity streamflows that are short in duration for most major storms (SCBWMI 2001). Four species of native fishes have been collected from Adobe Creek (California roach, Sacramento sucker, threespine stickleback, and prickly sculpin); however, channelization, flood control, and physical barriers have drastically reduced the amount of available fish habitat (SCBWMI 2001).

2.1.2 Barron Creek Watershed

Barron Creek is primarily an urban watershed with a drainage area of about 3 square miles that is located between Adobe and Matadero Creek watersheds. The creek is approximately 5 miles in length originating in the foothill region in the Town of Los Alto Hills. The creek flows in a northeasterly direction through the alluvial plain of the Santa Clara Valley that contains residential, commercial, and industrial land uses within the City of Palo Alto. The creek empties into Adobe Creek just upstream of Highway 101.

Upstream of El Camino Real the creek is contained in a pipe for much of its length. Natural channel sections occur immediately adjacent to Arastradero Road and at the Barron Creek Debris Basin (SCVWD 2005a). Downstream of El Camino Real, Barron Creek is contained in a

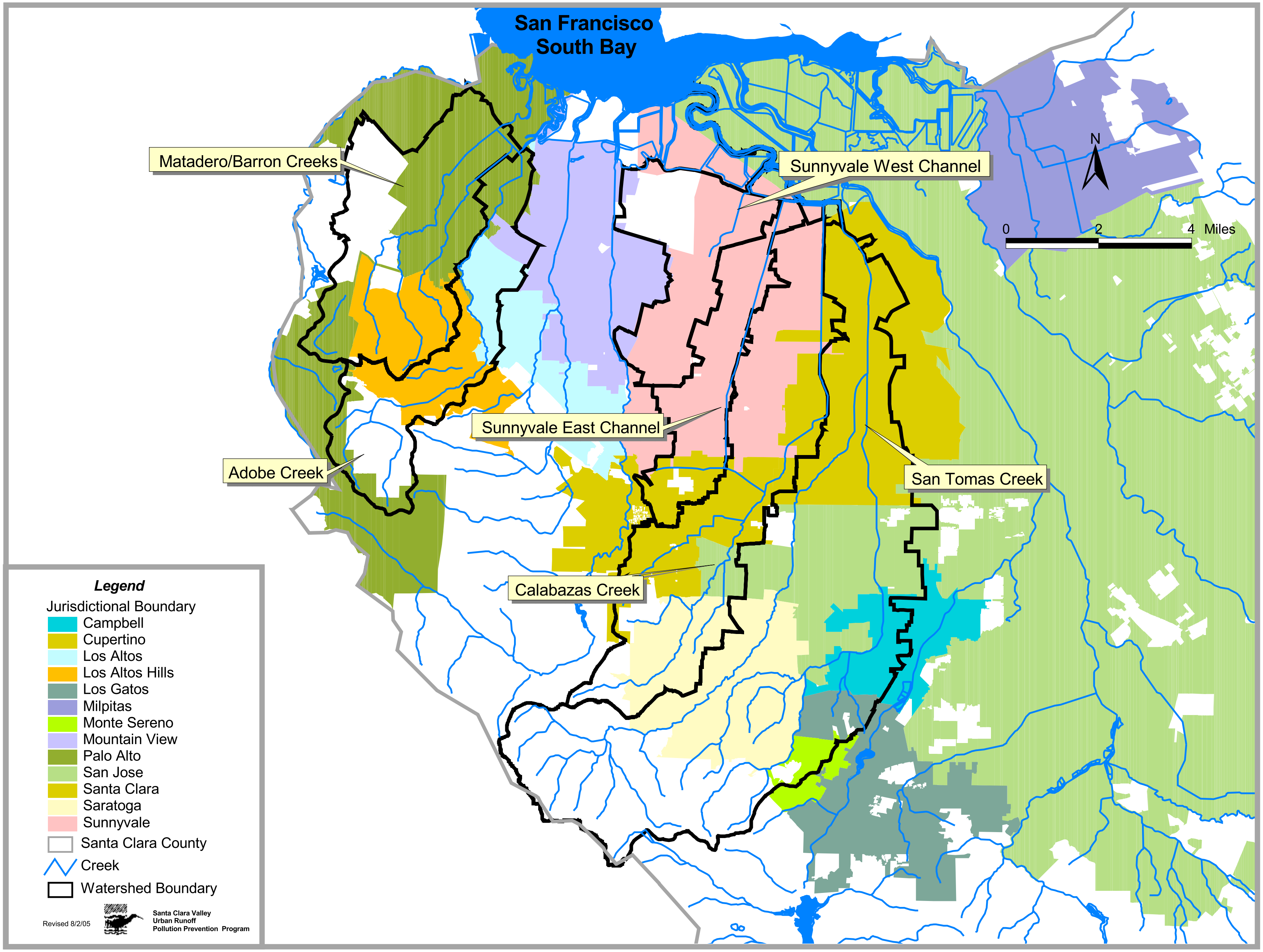

Figure 2. Santa Clara Basin watersheds monitored by SCVURPPP in FY 04-05.

concrete trapezoidal channel. Approximately 67 percent of the total length of creek bed has been hardened.

During wet storm events, high flows from Barron Creek can be diverted to Matadero Creek via the Barron Creek Bypass structure, which is also known as the Barron Creek Diversion Channel (SCVWD 2005a). This structure originates in the Barron Creek Debris Basin and carries water to the Matadero Creek Bypass Channel and Matadero Creek. Barron Creek is an ephemeral creek, with the lower section of the creek being kept wet by tidal inflows from the Palo Alto Flood Basin, water backing up Adobe Creek, and urban runoff. There are no existing reports that indicate the presence of native fish communities upstream of the tidally influenced area.

2.1.3 Matadero Creek Watershed

Matadero Creek has a total watershed area of about 14 square miles, of which approximately 11 square miles are mountainous land, and 3 square miles are gently sloping valley floor (SCBWMI 2001). Matadero Creek originates in the foothills of the Santa Cruz Mountains and flows in a northeasterly direction for approximately eight miles until it discharges into the Palo Alto Flood Basin, which outfalls into the Bay. Major tributaries to Matadero Creek include Arastradero and Deer Creeks.

The watershed includes a significant portion of central Palo Alto, including most of Stanford University, predominantly residential portions of Los Altos Hills and large areas within unincorporated Santa Clara County (SCVWD 2005a). The portions of the watershed that fall in the northern part of City of Palo Alto are predominantly residential, commercial and public/institutional. In the southern end of Palo Alto, the land use in this watershed is predominantly open space/rangeland/forest.

Matadero Creek has been extensively modified for flood protection. Approximately 50 percent of the total length of Matadero Creek has been hardened, most of which occurs along the reach from Highway 101 to Foothill Expressway. In addition, the creek periodically receives water during high flow events from the upper Barron Creek watershed via the Barron Diversion Channel (SCVWD 2005a). Water in Barron Creek is diverted to the Barron Creek Bypass, which extends from Barron Creek to the Matadero Bypass at Bol Park. The Matadero Bypass then carries the water to the Stanford Channel, primarily an underground stormdrain, which empties back into Matadero Creek at El Camino Real. The bypass channel is approximately 4,600 feet in length.

Existing data sources indicate that Matadero Creek supports a warmwater fish community upstream of Laguna Avenue (SCVWD 2005a). A warmwater mixed native/introduced community may be present between Highway 101 and Cowper Street but fish are scarce upstream to Laguna Avenue.

2.1.4 San Tomas Aquino Creek Watershed

The San Tomas Aquino Creek watershed drains approximately 45 square miles. The creek originates in the foothills of the Santa Cruz Mountains flowing in a northern direction through the cities of Campbell and Santa Clara and eventually emptying into the upper end of Guadalupe Slough (SCBWMI 2001). The major tributaries to San Tomas Aquino Creek include Saratoga, Wildcat, Smith and Vasona Creeks; Saratoga Creek has the largest area of these tributaries that enters the main stem about 1.5 miles above Highway 101 (see below for description). Over ninety percent of the San Tomas Aquino Creek watershed (not including the area within

Saratoga Creek subwatershed) is developed, with 72% of the total area containing high-density residential land use (SCBWMI 2001).

The stream channel has significantly been modified for most of San Tomas Aquino Creek; most of the entire channel between Smith Creek confluence in the upper reaches and Highway 101 is concrete lined. The creek flows underground through a box culvert just upstream of Highway 280. Hitch is the only native fish captured in San Tomas Aquino Creek; there are impassable barriers at the confluence of Saratoga Creek that prevents anadramous fish passage to both creeks (SCBWMI 2001).

The Saratoga Creek is the largest tributary to San Tomas Aquino Creek that drains approximately 17 square miles (SCBWMI 2001). The creek originates on the northeastern faces slopes of the Santa Cruz Mountains along Castle Rock Ridge at 3,100 feet in elevation. The mainstem flows in an eastern direction through forested mountain terrain for approximately 4.5 miles until it meets the town of Saratoga. The upper watershed area is predominantly evergreen forest with minimal development. The creek receives additional streamflow in this reach from the Booker and Bonjetti Creek subwatersheds.

The mainstem then flows in a northeastern direction for about 1.5 miles in the foothill region with urbanization in the riparian corridor that includes commercial businesses located in the Town of Saratoga and high-density residential development. The remaining 8.0 miles of the creek continue to flow in a northeastern direction through the alluvial plain of the Santa Clara Valley. The land uses along the riparian corridor are predominantly high-density residential areas of Saratoga, San Jose and Santa Clara. Most of the creek contains natural channel with some modifications (e.g., gabion walls) and a few sections of hardened channel.

Saratoga Creek is typically a perennial stream during average and dry water years and has no impoundments; however, water is exported in the upper reaches of the watershed by the San Jose Water Company for water supply. The SCVWD imports water into the channel near Highway 85 during the summer season for groundwater percolation. Three native fish species that have been collected from the creek include California roach, Sacramento sucker and rainbow trout (SCBWMI 2001). Saratoga Creek is a historic steelhead stream; however a barrier at the mouth prevents anadromous fish passage.

2.1.5 Calabazas Creek Watershed

Calabazas Creek drains approximately 20 square miles from northeast-facing slopes of the Santa Cruz Mountains (SCBWMI 2001). The creek is 13.3 miles long that begins at an elevation of approximately 2,000 feet and flows in a northeasterly direction until it empties into the Guadalupe Slough. Major tributaries to Calabazas Creek include Prospect, Rodeo, and Regnart Creeks. Additional sources of water to Calabazas Creek include the El Camino Storm Drain (main and East Branch) and the Junipero Serra Channel (SCBWMI 2001).

The Calabazas Creek watershed is highly urbanized, predominantly with high density residential land uses, with the exception of the southwestern corner which features a significant open space area that forms the headwaters of the creek (SCVWD 2005b). Heavy industrial land use areas exist between the Highway 101 and Central Expressway corridors with commercial development centered along El Camino Real, Wolfe Road, and Saratoga-Sunnyvale Road. Portions of the cities of Saratoga, Cupertino, Sunnyvale, San Jose, and Santa Clara are included in the watershed along with a small area of unincorporated Santa Clara County in the extreme southwestern portion.

Calabazas Creek experienced extensive residential development during the 1950s and 1960s. This development pattern resulted in highly developed riparian zones and channels that have been extensively modified for flood protection. Thirty-two percent of its length, approximately 4.2 miles, is classified as "hard bottom" (SCVWD 2005b). From Guadalupe Slough to Highway 101, Calabazas Creek is an enlarged earthen channel with levees. The reach between Highway 101 and Lawrence Expressway is a trapezoidal, concrete-lined channel and is classified continuously through the reach as "hard bottom." Upstream of Lawrence Expressway, the channel is mostly classified as "soft bottom" except several short concrete sections, which will act as fish passage barriers. Upstream of South Saratoga Sunnyvale Road, the channel has a natural bottom.

A potential mixed native/introduced community fisheries potential exists from Guadalupe Slough upstream to Central Expressway, followed by an approximately 5.5 mile reach to approximately Bollinger Road, in which fish are scarce (SCVWD 2005b). Recent surveys by Abel (2003) confirmed that fish were very scarce above Bollinger Road containing a few specimens of only three fish species, of which only sculpins were native and were probably introduced from imported water.

2.1.6 Sunnyvale East Channel Watershed

The Sunnyvale East Channel was constructed in 1967 to manage flooding that was becoming a problem due to subsidence of lands in the drainage area. The Sunnyvale East Channel watershed covers 7.1 square miles extending from central Cupertino northeastward through the City of Sunnyvale. One quarter of the Sunnyvale East Channel runs underground (SCVWD 2005b). The watershed draining to the Sunnyvale East Channel is located on the alluvial plain of the Santa Clara Valley.

The Sunnyvale East Channel is approximately 6 miles in length and extends from Interstate 280 in the south to Guadalupe Slough in the north. The channel is a man made feature with no natural antecedent and is connected to the Junipero Serra Channel in the south. The Sunnyvale East Channel is ephemeral in its upper reaches and tidally influenced from just upstream of Tasman Drive to Guadalupe Slough. Upstream of the Hetch-Hetchy Pipeline, the channel contains freshwater, while downstream of the pipeline the channel is brackish (SCVWD 2005b) .

The Sunnyvale East Channel watershed is almost entirely urbanized with predominately residential uses (59%) followed by commercial and industrial uses (23%). (SCVWD 2005b) There are no significant, contiguous open space areas in the watershed except for the Sunnyvale Baylands along the San Francisco Bay shoreline and smaller city-owned parks in Sunnyvale and Cupertino. There is no existing fish assemblage data for the watershed.

2.1.7 Sunnyvale West Channel Watershed

Sunnyvale West Channel was constructed for managing flood protection in 1964. The Sunnyvale West Channel watershed is a engineered drainage basin covering 7.5 square miles; the headwaters of which are located in the urbanized sections of Sunnyvale and Mountain View. The watershed draining to the Sunnyvale West Channel is located on the alluvial plain of the Santa Clara Valley.

The Sunnyvale West Channel is approximately 3 miles in length, extending from Guadalupe Slough to Maude Avenue (SCVWD 2005b). From the upper end of the channel at Maude

Avenue to Almanor Avenue, the Sunnyvale West Channel is a concrete pipe culvert. Downstream of Almanor Avenue to Mathilda Avenue, the channel is earth excavated channel. Sunnyvale West Channel empties into Moffett Channel and then to Guadalupe Slough.

The Sunnyvale West Channel watershed is significantly urbanized that include public/institutional uses (31%), industrial uses (25%) and residential uses (23%) (SCVWD 2005b). Only 10 percent of the watershed is non-urbanized. There are limited open space areas in the watershed that are comprised of the Sunnyvale Baylands along the San Francisco Bay shoreline and smaller city-owned parks in Sunnyvale. There is no existing fish assemblage data for the watershed.

2.2 Existing Data Sources

2.2.1 Existing Monitoring Data

Several data sources were compiled and assessed during the development of the FY04-05 Monitoring Plan. Initial information was accessed through the Program's *Meta-data Database*. All information collected is from previous studies and monitoring activities that have occurred in Adobe, Barron, Calabazas, Matadero, San Tomas Aquino Creek watersheds and Sunnyvale East and West Channels. Baseline data for these watersheds originated from the following projects:

West Valley Watershed Stewardship Plan (SCVWD 2005a and 2005b)

Fine-scale watershed assessment was conducted in the Calabazas Creek Watershed. As part of the assessment, geomorphic surveys were conducted at 14 stream locations in the upper reaches of Calabazas Creek, between Miller Avenue and Comer Drive. The surveys consisted of monumented stream cross-sections, pebble counts, geomorphic stream classification, measurements of the widths and depth at bankfull flow, characterization of bank material and estimated bank erosion.

A Unified Stream Assessment, developed by the Center for Watershed Protection, was conducted in the same reach of Calabazas Creek. The assessment included a rapid, continuous upstream walk using a qualitative rating system to score the condition on the riparian corridor, such as average bank stability, in-stream and riparian habitat, and flood plain connectivity. Eight categories of impacts observed during the assessment were documented and georeferenced; these include severe stream erosion, impacted stream buffers, utilities, trash and debris, stream crossings, channel modifications, storm water outfalls, and a catch-all category for miscellaneous features.

Geomorphic Channel Characteristics (SCBWMI 2005)

Cross sections, longitudinal profile and pebble counts were taken in summer and fall 2004 in Adobe Creek, between Hidden Villa Farm and Foothill Expressway. Stream flow gage and bedload and suspended load were monitored in Adobe Creek at Middlefield Road.

Technical Requirement and Geographical Areas for Hydromodification Management in Santa Clara Basin (SCVWD unpublished)

The SCVWD conducted a geomorphic assessment in upper San Tomas Aquino Creek to test and verify stream channel stability assessment methodology as part of the Hydromodification Management Plan. Channel cross-sections, and bed and bank material were measured at twelve stream locations in the upper reaches of the creek.

Matadero Creek Monitoring (SCBWMI 2005)

The SCVWD is monitoring the channel geometry in Matadero Creek, downstream of Highway 101, starting in 2002 through 2011 as part of sediment transport study in tidal reach of creek. Channel measurements include cross-sections and longitudinal profiles.

Mercury, PCB and Organochlorine Pesticide Monitoring (KLI 2002)

The SCVURPPP collected PCBs, mercury, and organochlorine pesticide data in 2001 in two locations within the Adobe Creek watershed as part of the Joint Stormwater Agency Program (JSAP), a San Francisco Bay region wide pollutant study.

Benthic Macroinvertebrate Study (Carter and Fend 2000)

The U.S. Geological Survey (USGS) sampled benthic macroinvertebrate (BMI) community assemblages at 6 stream sites along Saratoga Creek in the spring and fall of 1997. The USGS also generated biological metrics that describe the characteristics of the BMI assemblages.

Bay Area Stream Fishes Project (Leidy 1999)

Rob Leidy of U.S. EPA conducted stream surveys for 79 streams in the San Francisco Bay Area. Fish community assemblage information was collected at three stream locations in the Saratoga and Bonjetti Creek subwatersheds in April 1996 and three sites in the Matadero Creek watershed in February 1997.

2.2.2 Existing Watershed Assessments

Additional information and analysis on watershed health and restoration opportunities in the Adobe Creek watershed were obtained from the following studies:

Adobe Creek Watershed Planning Study (SCVWD 1996)

The SCVWD conducted a study investigating the existing and potential flooding, erosion, and sedimentation problems on Adobe Creek upstream El Camino Real to the Hidden Villa Trust Property on Moody Road. The study also presents an analysis of alternative solutions, recommended capital improvement project and summarizes the environmental impacts and mitigation required.

Adobe Creek Restoration Plan (Habitat Restoration Group 1989)

Existing vegetation, wildlife and fisheries resources in the Adobe Creek watershed were investigated from September 1988 through May 1989. Field reconnaissance was conducted to identify areas of potential habitat enhancement and restoration. These areas were mapped and then ranked as to type of habitat, its value to wildlife, and its potential for restoration.

Evaluation of fisheries potential in Calabazas (Abel 2003)

Fish and aquatic habitat reconnaissance was conducted in upper Calabazas Creek to identify existing and potential condition of fish habitat in reference to the proposed rehabilitation and widening of the Bollinger Street Bridge.

2.3 Designated Beneficial Uses and Numeric Water Quality Objectives/Criteria

2.3.1 Beneficial Uses

Table 2 lists the Beneficial Uses designated by the San Francisco Regional Water Quality Control Board (SFBRWQCB 1995) for water bodies that occur in watersheds monitored by the SCVURPPP in FY 04-05. The *Water Quality Control Plan for the San Francisco Bay Basin* (Basin Plan) designates no Beneficial Uses for Adobe, Barron and San Tomas Aquino Creeks or Sunnyvale East and West Channels.

Table 2. Beneficial uses designated in the *Water Quality Control Plan for the San Francisco Bay Basin* for Santa Clara Valley water bodies monitored by SCVURPPP in FY 04-05.

WATER BODY	AGR	COLD	FRSH	GWR	MIGR	NAV	REC-1	REC-2	SPWN	WARM	WILD
Matadero Creek		E			E		E	E	E	E	E
Saratoga Creek	E	E	E	E			E	E		E	E
Calabazas Creek	E	E		E		E	E	E		E	E

AGR - Agriculture
COLD = Cold Fresh Water Habitat
FRSH = Freshwater Replenishment
GWR - Groundwater Recharge
MIGR = Fish Migration
NAV – Navigation
REC-1 = Water Contact Recreation
REC-2 = Non-contact Recreation
SPWN = Fish Spawning
WARM = Warm Freshwater Habitat
WILD = Wildlife Habitat
E = Existing Use

2.3.2 Water Quality Objectives/Criteria

Water quality objectives (WQOs) listed in the Basin Plan (SFBRWQCB 1995) are either narrative or numerical. Narrative objectives present general descriptions of water quality that must be attained through pollution control measures and water shed management. Numerical WQOs describe pollutant concentrations and the physical/chemical conditions of the water itself. These objectives are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effects on organisms using the aquatic habitat and on people consuming those organisms or water (SFBRWQCB 1995).

Not all pollutants have established numerical WQOs presented in the Basin Plan. Additional water quality criteria have also been established by the U.S. EPA in the California Toxics Rule (CTR), which were subsequently adopted by the State of California (US EPA 2000). Numerical WQOs and criteria used to assess data collected by SCVURPPP in FY 04-05 are listed in Table 3.

Table 3. Numerical water quality objectives (WQOs), standards and criteria listed in either the San Francisco Bay Basin Plan (SFBRWQCB 1995) or the California Toxics Rule (CTR) (US EPA 2000).

Monitoring Parameter/Analyte	1995 Basin Plan Water Quality Objective	California Toxics Rule (CTR) Criterion Continuous Concentration (CCC)[3]
Physio-Chemical		
Dissolved Oxygen (mg/L)		
Warm water habitat	5.0	N/A
Cold water habitat	7.0	N/A
pH	> 6.5 or < 8.5	N/A
Metals (ug/L)		
Cadmium[4]	-	2.2[5]
Chromium (VI)[4,6]	-	11
Copper[4,6]	-	9.0[5]
Lead[4,6]	-	2.5[5]
Nickel[4,6]	-	52
Mercury	0.025	-
Selenium	-	5[7]
Silver[4,6]	-	3.4[8]
Zinc[4,6]	-	120[5]
Bacterial Indicators		
Water Contact Recreation		
Total Coliform (MPN/100mL)	no sample >10,000	-
Fecal Coliform (MPN/100mL)	90th percentile < 400	-
Enteroccoci (CFU/100mL)	151[9]	-
Non-Contact Water Recreation		
Fecal Coliform (MPN/100mL)	90th percentile < 4000	-

[3] Criteria continuous Concentration (CCC) equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects.

[4] Criteria for these metals are expressed as a function of the water-effect ratio (WER).

[5] Freshwater aquatic life criteria for metals are expressed as a function of total hardness (mg/L) in the water body. Values displayed in the table correspond to a total hardness of 100 mg/L.

[6] These criteria are expressed in terms of the dissolved fraction of the metal in the water column.

[7] Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta.

[8] Value is the Criteria Maximum Concentration (CMC), which equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1 hour) without deleterious effects.

[9] U.S. EPA bacteriological criteria for water contact recreation in “infrequently used areas”.

2.4 Monitoring Design and Sampling Locations

Table 4 shows the type of aquatic life and recreational use indicators and associated parameters measured by SCVURPPP in FY 04-05. The specific methods and analytes measured for each parameter are described in Section 3.0.

Table 4. Indicators and associated parameters measured in the FY 04-05 Monitoring Plan.

Indicator	Parameter Measured
Aquatic Life	
Physio-chemical	Water temperature, DO, pH, conductivity, stream velocity
Chemical	Total and dissolved metals
	Nutrients and anions
	Organophosphate pesticides
	Suspended sediment concentration
Aquatic Toxicity	3 species bioassays
Rapid Bioassessments	Benthic macroinvertebrates and fish community assemblage
Physical Habitat	Visual physical habitat assessment
Recreational Use	
Microorganisms	Total and fecal coliform, *Enterococcus*

Samples were collected by Kinnetic Laboratories, Inc. (KLI) during two events in FY 04-05, 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 stream sites in the Adobe and Barron Creek watersheds (A-1, A-3.5, B-1); three stream sites in the Matadero Creek watershed (M-1, M-2, M-3); three sites in the Sunnyvale East/West Channels (SU-1, SU-2, SU-3); three sites in the Calabazas Creek watershed (C-1, C-3, C-5); and four sites in the San Thomas Creek watershed, including Saratoga Creek (ST-1, S-1, S-4, S-6) (Figures 3 and 4). Site identifications, description of locations and parameter types that were measured for each site are listed in Table 5.

BMI and PHAB assessments were performed in four sites in Adobe Creek watershed (A-2, A-3, A-4, A-5); two sites in Matadero Creek watershed (M-2, M-4); and eight sites in the San Tomas Aquino Creek watershed (ST-3, S-2, S-3, S-4, S-5, S-6, S-7, S-8). Fish bioassessments were conducted during the dry season at one site in Adobe Creek watershed (A-3.5); two sites in the Matadero Creek watershed (M-2, M-3); and five sites in Saratoga Creek subwatershed (S-4, S-5, S-6, S-7, S-8). Site identifications, description of locations and parameter types that were measured for each site are also listed in Table 5.

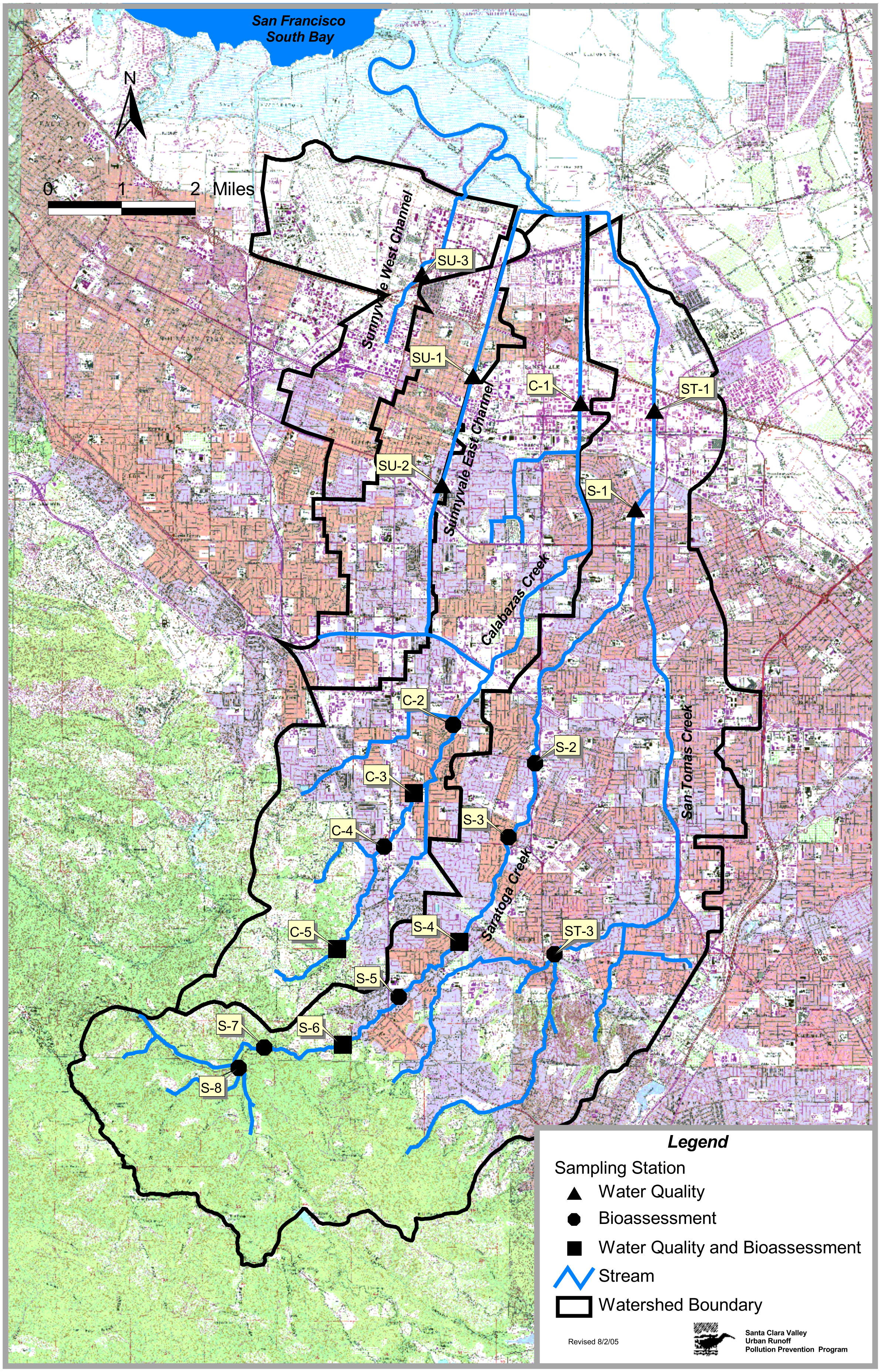

Figure 3. Sampling sites in the Calabazas Creek, San Tomas Creek and Sunnyvale East and West Channel Watersheds.

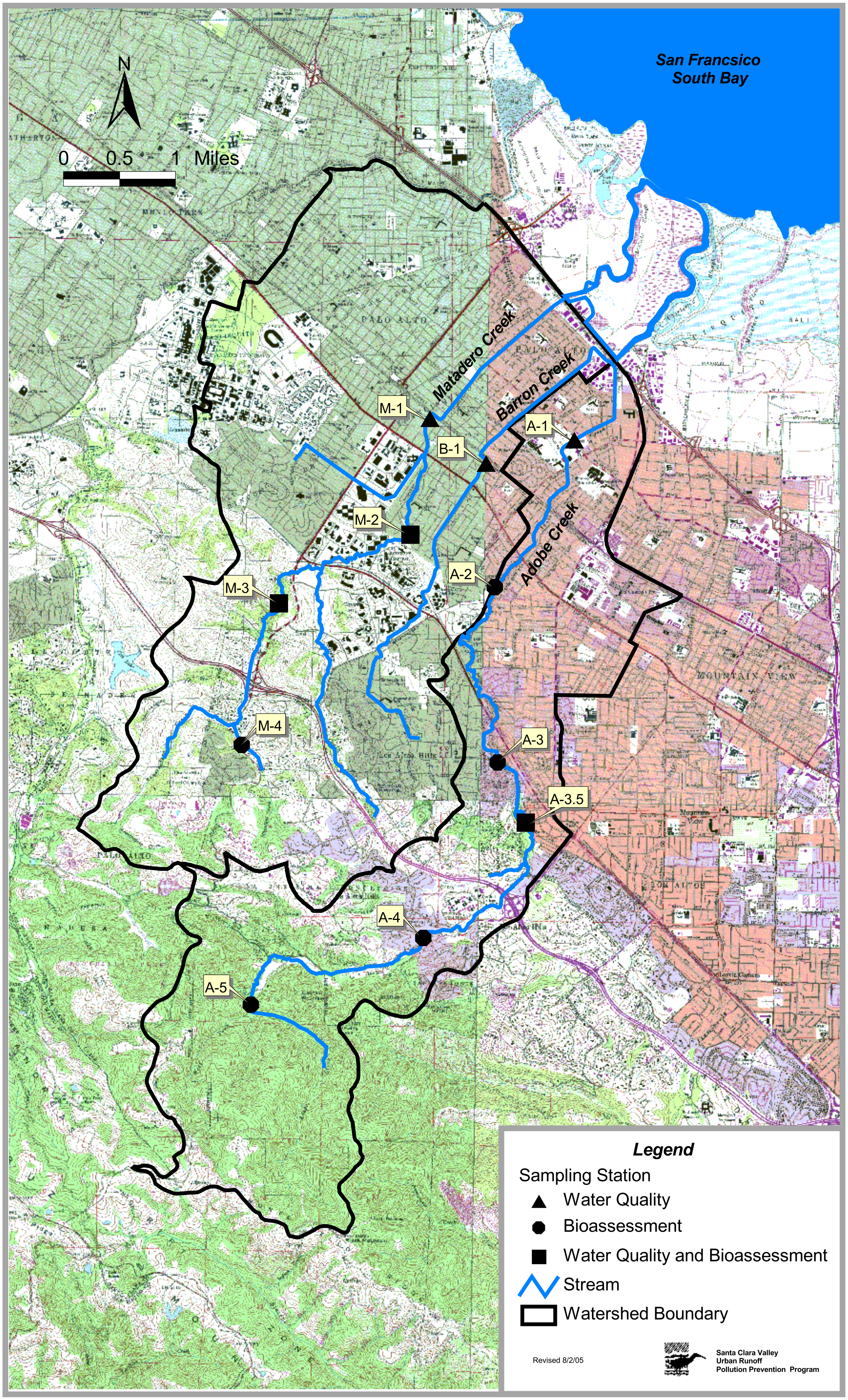

Figure 4. Sampling sites in the Adobe and Matadero/Barron Creek Watersheds.

Table 5. Monitoring indicators and sampling locations for FY 04-05 monitoring sites.

Station	Site Description	Field Measurement	Conventionals	Pesticides & Metals	Indicator Bacteria	Aquatic Toxicity	BMI	PHAB	Fish
Adobe Creek Watershed									
A-1	Adobe Creek - Middlefield Rd.	X	X	X		X			
A-2	Adobe Creek - Terman Dr.	X					X	X	
A-3	Adobe Creek - Edith Ave.	X					X	X	
A-3.5	Adobe Creek - Manresa Lane	X	X		X				X
A-4	Adobe Creek - Foothill College Rd.	X					X	X	
A-5	Adobe Creek - Hidden Villa Farm	X					X	X	
Barron/Matadero Creek Watershed									
B-1	Barron Creek - Park Blvd.	X	X	X					
M-1	Matadero Creek - Park Blvd.	X	X	X		X			
M-2	Matadero Creek - Laguna Ave.	X	X	X	X	X	X	X	X
M-3	Matadero Creek - Linda Lane	X	X		X				X
M-4	Matadero Creek - Arastradero Rd.	X					X	X	
Sunnyvale Channels									
SU-1	Sunnyvale East - Ahwanhee Ave.	X	X	X					
SU-2	Sunnyvale East - Daffodil Court	X	X	X					
SU-3	Sunnyvale West - Mathilda Ave.	X	X	X					
Calabazas Creek Watershed									
C-1	Calabazas Creek - Arques Ave.	X	X	X		X			
C-2	Calabazas Creek - La Mar Dr.	X					X	X	
C-3	Calabazas Creek - Blaney Ave.	X	X	X	X	X	X	X	
C-4	Calabazas Creek - DeAnza Rd.	X					X	X	
C-5	Calabazas Creek - Pierce Rd.	X	X		X		X	X	
San Tomas Aquino Creek Watershed									
S-1	Saratoga Creek - Cabrillo Ave.	X	X		X				
S-2	Saratoga Creek - Bollinger Rd.	X					X	X	
S-3	Saratoga Creek - Prospect Rd.	X					X	X	
S-4	Saratoga Creek - Crestbrook Dr.	X	X		X		X	X	X
S-5	Saratoga Creek - Alta Vista Ave	X					X	X	X
S-6	Saratoga Creek - Hwy 9 at Hakone	X	X		X		X	X	X
S-7	Saratoga Creek - Hwy 9 at Pierce	X					X	X	X
S-8	Bonjetti Creek - Hwy 9 at Sanborn	X					X	X	X
ST-1	San Tomas Aquino Creek - Scott Blvd.	X	X	X		X			
St-3	San Tomas Aquino Creek – Westmont Ave	X					X	X	

Field Measurements: Water Temperature, DO, pH, conductivity and stream velocity
Conventional: Nutrients and anions, Suspended Sediment Concentration
Pesticide/Metals: Organophosphate pesticides and total and dissolved metals (water)
Bacteria: Total and fecal coliform, enterococcus
Toxicity: 3 species bioassays (water flea, fathead minnow, and green alga)
BMI: Benthic macroinvertebrate bioassessment
PHAB: Visual physical habitat assessment
Fish: Fish community assemblage survey.

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Section 3.0

Methods

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3.1 Field and Laboratory Methods

Standard operating procedures used for field data collection and laboratory analyses are described in more detail in the SCVURPPP Draft *Quality Assurance Project Plan* (QAPP). The following sections summarize the field and laboratory methods used for monitoring aquatic life and recreational use indicators in the SCVURPPP FY 04-05 Monitoring Plan.

3.1.1 Aquatic Life Use Indicators

3.1.1.1 Physio-chemical Water Quality Indicators

Conventional water quality parameters of temperature, pH, conductivity, and dissolved oxygen (D.O.) were measured with portable field instruments. During water quality sampling events, temperature, pH, and, conductivity were measured by Kinnetic Laboratories Incorporated (KLI) with a YSI Model 63 handheld instrument, and D.O. was measured with a YSI Model 58 portable D.O. meter. In addition, water velocity was measured in feet/second with a Global Flow Probe, flow (velocity) meter, model number FP101. The dry season sampling events were performed on 28 September 2004 and on 5 October 2004. The wet season sampling events were performed on 24 January 2005 and on 31 January 2005.

During the benthic macroinvertebrate (BMI) and fish sampling events, conventional water quality parameters of temperature, pH, conductivity, and dissolved oxygen (D.O.) were measured by EOA, Inc. (BMI) or Scott Cressey and Associates (Fish) with portable field instruments. D.O. was measured using a YSI model 55 meter; conductivity and temperature were measured using YSI Model 30; pH was measured using Fisher Accumet 1003; and stream velocity was measured at each sample riffle using a Global Water FP101 flow meter. The water quality measurements during the fish sampling were made between October 6 and 8, 2004. The water quality measurements during the BMI bioassessments were made between April 11 and 22, 2005.

3.1.1.2 Chemical Water Quality Indicators

Water quality samples were collected KLI directly into sample bottles as close to midstream as possible. Following collections, the samples were directly stored and preserved with ice in an ice chest and maintained at a temperature of 4°C until delivered to the laboratory. Table 5 shows the type of analysis conducted on the water samples collected at each sampling station. Water samples were analyzed by ToxScan, Inc. for nutrients and anions, suspended sediment, metals (total and dissolved), and organophosphate pesticide concentrations. Analytical laboratory methods, reporting limits and holding times for chemical water quality parameters are shown in Table 6.

3.1.1.3 Aquatic Toxicity

Water samples were tested for toxicity during one dry season sampling events and one wet season sampling events at sampling station sites A-1, M-1, M-2, C-1, C-4, and ST-1. Three species bioassays were performed by ToxScan using the water flea (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*), and a green alga (*Selenastrum capricornutum*). Analytical laboratory methods, reporting limits and holding times for the samples used for toxicity testing are shown in Table 6.

Table 6. Chemical, Microbiological and Toxicity Testing Methods, Reporting Limits and Holding Times followed by SCVURPPP in FY 04-05 (N/A – Not Applicable).

Analyte	Analytical Method	Reporting Limit	Hold Time
NUTRIENTS AND ANIONS			
Orthophosphate-P (mg/L)	EPA 365.3	0.01	48 hours
Total Phosphorus (mg/L)	EPA 365.2	0.01	28 days
Total Dissolved Solids (mg/L)	EPA 160.1	1.0	7 days
Total Organic Carbon (mg/L)	EPA 415.1	1.0	28 days
Dissolved Organic Carbon (mg/L)	EPA 415.1	1.0	28 days
Total Ammonia as Nitrogen (mg/L)	EPA 350.1	0.10	28 days
Total Kjeldahl Nitrogen (mg/L)	EPA 351.3	0.10	28 days
Nitrite Nitrogen (mg/L)	EPA 300.0	0.10	48 hours
Nitrate Nitrogen (mg/L)	EPA 300.0	0.10	48 hours
Alkalinity as $CaCO_3$ (mg/L)	EPA 310.1	1.0	14 days
Total Hardness (mg/L)	EPA 130.2	25	6 months
Chloride (mg/L)	EPA 300.0	5.0	28 days
Sulfate (mg/L)	EPA 300.0	1.0	28 days
Chlorophyll (ug/L)	SM 10200H	1.0	14 days
SUSPENDED SEDIMENT CONCENTRATION (mg/L)	ASTM D3977-97C	1	7 days
TOTAL RECOVERABLE METALS (ug/L)			
Aluminum	EPA 200.8	25	6 months
Arsenic	EPA 206.3TR	0.50	6 months
Boron	EPA 200.8	5.0	6 months
Cadmium	EPA 200.8	0.20	6 months
Chromium	EPA 200.8	1.0	6 months
Copper	EPA 200.8	1.0	6 months
Lead	EPA 200.8	1.0	6 months
Manganese	EPA 200.8	1.0	6 months
Mercury	EPA 245.7	0.0050	28 days
Nickel	EPA 200.8	2.0	6 months
Selenium	EPA 270.3	1.0	6 months
Silver	EPA 200.8	0.20	6 months
Zinc	EPA 200.8	5.0	6 months
DISSOLVED METALS (ug/L)			
Aluminum	EPA 200.8	25	6 months
Arsenic	EPA 206.3D	0.50	6 months
Cadmium	EPA 200.8	0.20	6 months
Chromium	EPA 200.8	1.0	6 months
Copper	EPA 200.8	1.0	6 months
Lead	EPA 200.8	1.0	6 months
Manganese	EPA 200.8	1.0	6 months
Nickel	EPA 200.8	2.0	6 months
Selenium	EPA 270.3D	1.0	6 months
Silver	EPA 200.8	0.20	6 months
Zinc	EPA 200.8	5.0	6 months
BACTERIAL CONCENTRATIONS			
Total Coliform (MPN/100 ml)	SM9221B&E	2 MPN/100 ml	6 hours
Fecal Colifom (MPN/100 ml)	SM9221B&E	2 MPN/100 ml	6 hours
Enterococcus (CFU/100 ml)	EPA 1600	2 CFU/100 ml	6 hours
TOXICITY TESTING			
Ceriodaphnia dubia	EPA-821-R-02-013	NA	36 hours
Pimephales promelas	EPA-821-R-02-013	NA	36 hours
Selenastrum capricornutum	EPA-821-R-02-013	NA	36 hours
ORGANOPHOSPHATE PESTICIDES (ug/L)	EPA 8141A	0.0100-0.100	7 days – extraction 40 days - analyze

3.1.1.4 Rapid Bioassessments

Benthic Macroinvertebrate Field Sampling

Benthic macroinvertebrate (BMI) sampling was conducted by EOA, Inc. following the California Stream Bioassessment Procedures (CSBP) protocols for high gradient streams (Harrington 2003). Each study site consisted of a 100 meter reach of the channel with at least 3 riffle habitats, each greater than 1 meter wide and 1 meter long. If more than three riffles occurred within the reach, 3 riffles were randomly selected using a random number table. When a selected riffle was of sufficient length and width, a transect location for sampling was randomly chosen from the upper third of the riffle. This was accomplished by laying a tape measure along the length of the upper third of the riffle, assigning sequential numbers to each meter or 3-foot length on the tape measure, then using a random number table to select the transect to be sampled in each riffle.

Starting with the downstream riffle, the benthos within a 1 ft^2 area was disturbed upstream of a 1 ft (0.305 m) wide, 0.02 in. (0.5 mm) mesh D-frame kick net. Sampling of the benthos was performed by manually rubbing cobble and boulder substrates followed by ‘kicking’ the upper layers of substrate to dislodge any remaining invertebrates. Duration of sampling ranged from 60-180 seconds, depending on the amount of boulder and cobble-sized substrates that required rubbing by hand; more and larger substrates required more time to process. Samples were collected at three locations representing the habitats along each transect (usually the two margins and the mid-point). The samples were combined into a composite sample in the field (representing a 3 ft^2 area) and transferred into a 500-ml wide-mouth jar containing approximately 200 ml of 95% ethanol. This technique was repeated for each of the three riffles in each monitoring sampling station.

Using a permanent marker, each sample jar was labeled with a station code and transect number, date, and sampler’s name. Using a small piece of Rite-in-the Rain paper and a pencil, a second label was prepared and included inside each sample jar. Each sampled BMI station produced three benthic samples, which were composited at the laboratory prior to subsampling and identification of organisms. Not including the two sites that were sampled in duplicate, 54 benthic samples (18 samples after compositing) were collected from 18 stations in the four watersheds during the April 2005 sampling effort.

Benthic Macroinvertebrate Laboratory Processing and Analysis

At the Bioassessment Services, Inc. laboratory, each of the three samples collected at each site were composited, rinsed in a standard no. 35 sieve (0.02 in; 0.5 mm) and transferred to a tray with twenty, 4 $in.^2$ (26 cm^2) grids for subsampling. Benthic material in the subsampling tray was transferred from randomly selected grids (or half grids if BMI densities were high) to petri dishes where the BMIs were removed systematically with the aid of a stereomicroscope and placed in vials containing 70% ethanol and 2% glycerol. At least 500 BMIs were subsampled from a minimum of three grids. If there were more BMIs remaining in the last grid after 500 were archived, then the remaining BMIs were tallied and archived in a separate vial. This was done to assure a reasonably accurate estimate of BMI abundance based on the portion of benthos in the tray that was subsampled. These “extra” BMIs were not included in the taxonomic lists and metric calculations.

Subsampled BMIs were identified using taxonomic keys (Kathman and Brinkhurst 1998, Merritt and Cummins 1996, Stewart and Stark 1993, Thorp and Covich 2001, Wiggins 1996) and unpublished references. The subsampled BMIs identified from each sample were archived in labeled vials with a mixture of 70% ethanol and 2% glycerol. A standard level of taxonomic effort was used as specified in the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet) short list of taxonomic effort, January 2003 revision. Exceptions were made for some early instar/ young organisms and organisms in poor condition. Other exceptions included: 1) the identification of midges to subfamily/tribe; 2) the identification of Oligochaeta to family when feasible and 3) a tolerance value of 6 was applied to all oligochaete taxa (Adams 2004).

Fish Community Sampling

A Smith-Root model LR-24 electrofisher was used by Scott Cressey and Associates for sampling fish communities. Voltage output of 150 volts to 170 volts was typically used at most sites. The stream sections sampled ranged from 150 feet to 212 feet in length, while stream widths ranged from 2.5 feet to 16 feet. The sampling crew consisted of one biologist operating the electrofisher and one person netting. A single pass with the electrofisher was made at each station and the captured fish held in a bucket of water for species identification, enumeration, measuring (fork length in mm), and for some of the sites, weighing (grams). Due to malfunction of the electronic scale after the first day of sampling, fish weights were recorded for only the two sites on Matadero Creek. Whenever large numbers of fish of similar species and size class were captured at the Matadero Creek sites, a representative 10 individuals of a given size class were weighed.

Other data recorded at each sampling station were: maximum water depth; habitat types; dominant substrate; length of stream sampled; average width (mean of five width measurements); water temperature and time; dissolved oxygen; electrical conductivity; and pH. A measurement of stream flow was taken at each station using a Marsh-McBirney electromagnetic type meter.

3.1.1.5 Physical Habitat Assessment

Physical habitat quality was assessed by EOA, Inc. for each BMI monitoring reach using the U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocol (Barbour et al., 1999). These qualitative habitat assessments were recorded for each sampling station during field sampling. Note that the estimate of substrate size percent composition addressed only the riffle habitat sampled and not all other instream habitat types (e.g., pools). Therefore, qualitative and quantitative substrate composition measurements taken during this study should only be used to characterize riffle substrate at stations sampled, and should not be extrapolated to the entire stream system. The percent fines in riffles are expected to be less than the other instream habitats due to gradient and current velocities. An example of a Physical Habitat Quality Bioassessment Worksheet is provided in the SCVURPPP QAPP. Photographs of the BMI sampling sites were taken with a digital camera and field notes were taken to describe each photo point.

3.1.2 Recreational Use Indicators

3.1.2.1 Bacterial Indicators

Water samples were collected by KLI at sampling station stations A-3.5, M-2, M-3, C-3, C-5, S-1, S-4 and S-6 during both sampling events and analyzed by BioVir Laboratories, Inc. for concentrations of total and fecal coliform and *enterococcus*. Initial field reconnaissance indicated these stations had potential public access with potential for contact water recreation.

Laboratory methods, reporting limits and holding times for the samples analyzed for bacteria are shown in Table 4.

3.2 Data Quality Assessment Methods

Quality Assurance/Quality Control (QA/QC) activities associated with the field data collection and laboratory analyses are described in more detail in the SCVURPPP Draft Quality Assurance Project Plan (QAPP). The major goal for these QA/QC procedures is to have representative, comparable, accurate and precise data, to the extent possible under the given limitations.

3.2.1 Water Quality

QA/QC activities associated with water quality field sampling and laboratory analysis in the FY 04-05 Monitoring Plan included the following:

- Employing analytical chemists trained in the procedures to be followed;
- Adherence to documented procedures, USEPA methods (Table 6) and written SOPs;
- Calibration of analytical instruments;
- Use of quality control samples, internal standards, surrogates, and SRMs
- Complete documentation of sample tracking and analysis.

Data validation was performed in accordance with the National Functional Guidelines for Organic Data Review (EPA540/R-99/008) and Inorganic Data Review (EPA540/R-01/008). A summary the data quality assessment and inconsistencies of reported data with the analytical sampling results are discussed in Section 9.0.

3.2.2 Rapid Bioassessment

Duplicate samples were collected at 10% of the total number of sites (n=2) during this monitoring effort to evaluate precision of field sampling methods. In addition, two processed samples were submitted to DFG's Aquatic Bioassessment Laboratory for independent assessment of taxonomic accuracy, enumeration of organisms and conformance to standard taxonomic level. A summary of the QA/QC analysis of benthic samples is provided in Section 9.0.

3.3 Data Analysis Methods

3.3.1 Water Quality

The results of the water quality sampling were compared to the Water Quality Objectives identified in the San Francisco Bay Regional Water Quality Control Board 1995 Basin Plan (Basin Plan) (SFRWQCB 1995) or the California Toxics Rule (CTR) that identifies numeric criteria for priority pollutants for the State of California (US EPA 2000).

3.3.2 Rapid Bioassessment

3.3.2.1 Macroinvertebrate Metrics

BMI taxa and the numbers of BMIs comprising each taxonomic group were entered into a Microsoft Access® database. A taxonomic list and a table of the five most numerically abundant (dominant) taxa for each site were generated using Microsoft Excel®.

Commonly reported biological metrics (numerical attributes of biotic assemblages) were generated using Excel® and are described in Appendix A. Tolerance values and functional feeding group designations were obtained from the CAMLnet short list of taxonomic effort, January 2003 revision; tolerance values assigned to the families of Oligochaeta were obtained from Adams (2004). Functional feeding group percent values from samples collected in 2005 were compared with samples collected in 2004.

The various metrics can be categorized into five main types:

- Richness Measures (total number of distinct taxa);
- Composition Measures (distribution of individuals among taxonomic groups and includes measures of diversity);
- Tolerance/Intolerance Measures (reflects the relative sensitivity of the assemblage to disturbance);
- Functional Feeding Groups (shows the balance of feeding strategies in the aquatic assemblage);
- Abundance (estimates total number of organisms in sample based on a nine sq. ft. sampling area).

Composite Metric Score

Finding a consistent pattern in all metrics is overwhelming due to the plethora of data, and metrics can contribute to conflicting results. Consequently, to better assess the biological integrity of a given site, nine metrics were integrated into a single ranking score for relative comparison to a large regional data set. A regional data set is necessary to develop an Index of Biological Integrity (IBI); however, at this time, an IBI for the San Francisco Bay Area has not been developed. Therefore, single BMI composite metric scores are calculated for each site within a watershed to provide a relative ranking of the various sampling stations. This process serves as a placeholder for the eventual development of a regional IBI (P. Ode, DFG, personal communication).

The composite metric score approach to evaluating BMI metric data is to normalize and sum the means for nine metrics, and then compare the resulting score between the various sampling sites. The metrics used for the scores were Taxonomic Richness, EPT Richness, Coleoptera Richness, Shannon Diversity, Tolerance Value, Percent Intolerant Organisms, Percent Tolerant Organisms, Percent Dominant Taxon and Predator Richness. The composite metric score was an integrative index of these nine metrics. Most of the metrics used for the ranking score were found to be reliable responders to disturbance by Karr and Chu (1999). Shannon Diversity, although not identified by Karr and Chu, was incorporated into the suite of metrics because it integrates richness and evenness (Shannon and Weaver 1963; Magurran 1988). In addition, Coleoptera Richness was also used in the composite metric score because of its recent use in the development of regional IBIs.

Sites that score high in this integrative index have better than average scores for most or all of the metrics, while sites that score low have poorer scores for most or all of the component metrics. Average ranking sites either have average scores for the component metrics or have a combination of high and low scores.

The formula for computing the composite metric scores is as follows:

$$\textbf{Composite Metric Score} = \sum \pm(x_i - x_i)/sem_i$$

where:

x_i = sample value for the i-th metric;
x_i = overall mean for the i-th metric;
sem_i = standard error of the mean for the i-th metric; ±: a plus sign denotes a metric that decreases with response to impairment (e.g. Taxonomic Richness) while a minus sign denotes a metric that increases with response to impairment (e.g. Tolerance Value).

In addition to plotting composite metric scores by site, composite metric scores and EPT Taxa were plotted against substrate quality. Substrate quality scores were determined by adding substrate complexity and substrate embeddedness scores that were assessed qualitatively during benthic sampling. The substrate quality categories are: 0 – 5 (poor); >5 to 10 (marginal); >10 to 15 (suboptimal) and >15 to 20 (optimal).

3.3.2.2 Macroinvertebrate Composition Analyses

Cluster analysis is a multivariate procedure for detecting natural groupings in data. PC-ORD® (version 4) software (McCune and Mefford 1999) was used for performing cluster analysis on taxa lists. The cluster distance measure used was Sorenson (Bray Curtis) and the Group Average method was used for group linking; both are frequently used in ecological studies (Magurran 1988). Dendrograms are scaled by the percentage of information remaining, which is based on information loss as agglomeration (linking of groups) proceeds during the analysis until all links are made and no information remains. For example, sites that group at 95% information remaining means that they grouped early in the agglomeration process and are closely related while a link that occurs at 20% information remaining means that the link was made toward the end of the agglomeration process. The output of the cluster analysis is a tree-like dendrogram, which shows relative site similarity based on BMI composition.

3.4 CWP Urban Streams Assessment

The Center for Watershed Protection (CWP) has developed an integrated framework to restore small urban watersheds. Their framework includes a series of eleven manuals that focus on techniques to identify and address conditions in urban watersheds in a format that can easily be accessed by watershed groups, municipal staff, environmental consultants, and other users. The Unified Stream Assessment (USA) riparian corridor assessment is described in manual 10 (CWP 2004).

The USA is implemented as a continuous stream walk that rapidly collects basic information needed to develop a manageable list of potential restoration projects in a stream corridor. These projects include stream restoration, riparian management, discharge prevention and storm water retrofit. The USA consists of an overall reach assessment that collects information about overall corridor conditions such as average bank stability, in-stream and riparian habitat, and flood plain connectivity and condition. In addition, the reach form is used to track and locate associated impacts including severe stream erosion, impacted stream buffers, utilities, trash and debris, stream crossings, channel modifications, storm water outfalls, and a catch-all category for miscellaneous features. Information collected for these eight categories of impacts are recorded on separate forms that are spatially referenced through the reach survey forms.

The reach assessment helps identify the highest quality, most impacted, and most restorable stream reaches within a subwatershed. With its focus on utilizing stressor and response indicators to identify appropriate management actions, the USA method will complement and potentially guide the location and timing of SCVURPPP's suite of biological and water quality response and exposure indicators.

In April, 2005, SCVURPPP piloted the USA method on Saratoga Creek to evaluate instream and riparian corridor conditions and associated stressors. A total of 2.4 miles of the Creek were surveyed from the Cox Road crossing upstream to the Highway 9 crossing.

Section 4.0

Adobe Creek Watershed

Results and Discussion

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4.1 Results

The following sections provide a brief summary of the FY 04-05 monitoring results for the Adobe Creek watershed.

4.1.1 Physio-chemical Parameters

Physio-chemical measurements were made *in situ* during a total of eight sampling events at six sites in FY 04-05. All measurements were taken during non-storm events in daylight hours.

Water temperatures at Adobe Creek sampling sites ranged between 9.9 and 20.1^0 C (Table 7). The dissolved oxygen concentrations at all sites were greater than 9.2 mg/L, with the exception of site A-3.5 in October, where a 4.1 mg/L measurement was recorded. Conductivity ranged between 366 and 850 uS/cm and pH concentrations were between 8.0 and 8.7. The average water velocity at all sites measured was 1.1 ft/sec during sampling events.

4.1.2 Chemical Parameters

Water quality samples were collected at two sites on Adobe Creek (A-1 and A-3.5) during two sampling events. Samples were analyzed for nutrients and anions, suspended sediment concentrations, total recoverable metals dissolved metals and organophosphate pesticides. All measurements were taken during non-storm events in daylight hours.

Total phosphorous and orthophosphate concentrations in Adobe Creek ranged from 0.09 – 1.7 and 0.038 - 0.17 mg/L, respectively (Table 7). Ammonia (as N) and nitrite concentrations were below reporting limits (0.10 mg/L), and nitrate concentrations ranged from 0.72 – 3.4 mg/L.

Suspended sediment concentrations ranged between 2.8 and 5.8 mg/L, of which a significant portion (> 75%) was reported as fines (Table 7).

Only water samples from A-1 were analyzed for total recoverable and dissolved metals and organophosphate pesticides (Table 7). No organophosphate pesticides were detected during either sampling event.

4.1.3 Aquatic Toxicity

Three species bioassays were conducted on samples collected from site A-1 on Adobe Creek during two sampling events. The only significant result in samples from Adobe Creek was a slight inhibition of green alga growth during the dry season sampling event. A full tabulation of toxicity results can be found in Table 8.

4.1.4 Indicator Bacteria

Water column samples were collected during two sampling events from one site on Adobe Creek where potential water contact recreation occurs. Samples were analyzed for total coliforms, fecal coliforms and enterococcus. During the first sampling event, total, fecal and enterococcus concentrations were 1600 MPN/100 mL, 300 MPN/100 mL and 860 CFU/100 mL, respectively. Concentrations enumerated from samples collected during the second sampling event were less than or equal to concentrations from the first sampling event for all three organisms. Results are presented in Table 7.

Table 7. Water quality results for Adobe Creek watershed sites sampled in FY 04-05 by SCVURPPP.

	Station[1]								
	A-1		A-2	A-3	A-3.5			A-4	A-5
Date	28-Sep-04	24-Jan-05	13-Apr-05	11-Apr-05	28-Sep-04	6-Oct-04	24-Jan-05	11-Apr-05	11-Apr-05
PHYSIO-CHEMICAL PARAMETERS									
Temperature (°C)	17.8	10.1	9.9	13.7	15.6	20.1	11.5	12.8	10.1
pH	8.29	8.22	8.33	8.28	8.71	8.5	8.56	8.06	8.33
Conductivity (µS/cm)	677	641	454.5	498	702	850	526	460	366.9
Dissolved Oxygen (mg/L)	12.43	12.63	10.8	10.04	9.23	4.1	9.70	10.26	10.82
Velocity (ft/sec)	0.9	1.16	2.0	NR	0.1	NR	1.15	NR	NR
NUTRIENT AND ANIONS									
Orthophosphate-P (mg/L)	0.038	0.17	-	-	0.062	-	0.051	-	-
Total Phosphorus (mg/L)	0.15	0.3	-	-	1.7	-	0.09	-	-
Total Dissolved Solids (mg/L)	660	570	-	-	530	-	450	-	-
Total Organic Carbon (mg/L)	4.9	1.9	-	-	1.7	-	1.9	-	-
Dissolved Organic Carbon (mg/L)	4.6	1.8	-	-	1.9	-	1.8	-	-
Total Ammonia as Nitrogen (mg/L)	0.10U	0.10U	-	-	0.10U	-	0.10U	-	-
Total Kjeldahl Nitrogen (mg/L)	0.7	0.4	-	-	0.34	-	0.26	-	-
Nitrite Nitrogen (mg/L)	0.10U	0.10U	-	-	0.10U	-	0.10U	-	-
Nitrate Nitrogen (mg/L)	3.4	2.9	-	-	0.72	-	1.8	-	-
Alkalinity as $CaCO_3$ (mg/L)	370	360	-	-	380	-	300	-	-
Total Hardness (mg/L)	460	410	-	-	380	-	340	-	-
Chloride (mg/L)	66	48	-	-	58	-	30	-	-
Sulfate (mg/L)	81	64	-	-	59	-	50	-	-
Chlorophyll (ug/L)	10	1.6	-	-	2.2	-	2	-	-
SUSPENDED SEDIMENT CONCENTRATION									
Total Particulate Solids (mg/L)	5.8	5.8	-	-	4.7	-	2.84	-	-
Total Coarse (mg/L)	1.4	0.75	-	-	<1.0	-	<0.5	-	-
Total Fine (mg/L)	4.4	5.09	-	-	4.6	-	2.59	-	-
TOTAL RECOVERABLE METALS (ug/L)									
Aluminum	25U	25U	-	-	-	-	-	-	-
Arsenic	1	2.2	-	-	-	-	-	-	-
Boron	83	49	-	-	120	-	48	-	-
Cadmium	0.20U	0.20U	-	-	-	-	-	-	-
Chromium	2.7	1.6J	-	-	-	-	-	-	-
Copper	6.7	1.9	-	-	-	-	-	-	-
Lead	1.0U	1.0U	-	-	-	-	-	-	-
Manganese	7	1.1	-	-	-	-	-	-	-
Mercury	0.002	0.0050U	-	-	-	-	-	-	-
Nickel	4.2	2.3	-	-	-	-	-	-	-
Selenium	1.0U	1.0U	-	-	-	-	-	-	-
Silver	0.20U	0.20U	-	-	-	-	-	-	-
Zinc	11	6.6	-	-	-	-	-	-	-

Table 7. (continued).

	Station[1]								
	A-1		A-2	A-3	A-3.5			A-4	A-5
Date	28-Sep-04	24-Jan-05	13-Apr-05	11-Apr-05	28-Sep-04	6-Oct-04	24-Jan-05	11-Apr-05	11-Apr-05
DISSOLVED METALS (ug/L)									
Aluminum	25U	25U	-	-	-	-	-	-	-
Arsenic	1.2	1.9	-	-	-	-	-	-	-
Cadmium	0.2U	0.20U	-	-	-	-	-	-	-
Chromium	3.2	4.4J	-	-	-	-	-	-	-
Copper	4	1.8	-	-	-	-	-	-	-
Lead	1.0U	1.0U	-	-	-	-	-	-	-
Manganese	1.0U	1.0U	-	-	-	-	-	-	-
Nickel	3.5	2.3	-	-	-	-	-	-	-
Selenium	1.0U	1.0U	-	-	-	-	-	-	-
Silver	0.2U	0.20U	-	-	-	-	-	-	-
Zinc	5.0U	5.0U	-	-	-	-	-	-	-
ORGANOPHOSPHATE PESTICIDES (ug/L)									
Azinphos menthyl	0.16U	0.052U	-	-	-	-	-	-	-
Bolstar	0.057U	0.016U	-	-	-	-	-	-	-
Coumaphos	0.080U	0.071U	-	-	-	-	-	-	-
Demeton O&S	0.23U	0.010U	-	-	-	-	-	-	-
Diazinon	0.036U	0.017U	-	-	-	-	-	-	-
Dichlorvos	0.032U	0.021U	-	-	-	-	-	-	-
Disulfoton	0.039U	0.015U	-	-	-	-	-	-	-
Chlorpyrifos (Dursban)	0.035U	0.018U	-	-	-	-	-	-	-
Ethoprop	0.041U	0.026U	-	-	-	-	-	-	-
Fensulfothion	0.10U	0.10U	-	-	-	-	-	-	-
Fenthion	0.014U	0.015U	-	-	-	-	-	-	-
Merphos	0.022U	0.030U	-	-	-	-	-	-	-
Mevinphos	0.075U	0.098U	-	-	-	-	-	-	-
Parathion methyl	0.041U	0.020U	-	-	-	-	-	-	-
Phorate	0.050U	0.016U	-	-	-	-	-	-	-
Ronnel	0.020U	0.011U	-	-	-	-	-	-	-
Stirophos	0.022U	0.030U	-	-	-	-	-	-	-
Tokuthion (Prothiofos)	0.037U	0.016U	-	-	-	-	-	-	-
Trichloronate	0.032U	0.026U	-	-	-	-	-	-	-
Ethion	0.012U	0.021U	-	-	-	-	-	-	-
Malathion	0.032U	0.026U	-	-	-	-	-	-	-
Parathion-ethyl	0.013U	0.017U	-	-	-	-	-	-	-
BACTERIAL INDICATORS									
Total Coliform (MPN/100 mL)	-	-	-	-	1600	-	500	-	-
Fecal Coliform (MPN/100 mL)	-	-	-	-	300	-	300	-	-
Enterococus (CFU/100 mL)	-	-	-	-	860	-	94	-	-

1= Refer to Table 1 for station locations.
J= The result is an estimated quantity.
J-= The result is an estimated quantity but result may be biased low.
R= The data are unusable (the analyte may or may not be present).
U= Not measured above reported sample reporting limit (Diazinon not measured above reported sample detection limit).
UJ= Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NR = Not receorded
NA = Creek Dry, no samples taken.
– = Not sampled for selected analyte.

Table 8. Summary of bioassay results from the Adobe Creek watershed.

Site	Date	Survival			Growth/Reproduction				
		NOEC	LOEC	LC_{50}	NOEC	LOEC	IC_{50}	IC_{25}	IC_{10}
Ceriodaphnia dubia									
A-1	21-Sept-2004	100	>100	>100	100	>100	>100	92.5	20.9
	24 -Jan - 2005	100	>100	>100	100	>100	>100	>100	69.4
Pimephales promelas									
A-1	21-Sept-2004	100	>100	>100	100	>100	>100	>100	>100
	24 -Jan - 2005	100	>100	>100	100	>100	97.2	56.1	6.4
Selenastrum capricornutum									
A-1	21-Sept-2004	NA	NA	NA	50	100	>100	>100	73
	24 -Jan - 2005	NA	NA	NA	100	>100	>100	>100	>100

4.1.5 Bioassessments

4.1.5.1 Benthic Macroinvertebrates

A total of 1,992 benthic macroinvertebrates (BMIs) were processed from the four reaches (i.e., sites) sampled in Adobe Creek. BMIs identified were comprised of 49 distinct taxa. The evaluation of these data was conducted by reviewing metric values, composite metric scores, dominant taxa, and BMI composition similarity. The following paragraphs briefly describe the results of BMI bioassessments conducted in FY 04-05 (i.e., Spring 2005). A portion of the results of bioassessments conducted in FY 03-04 (i.e., Spring 2004) are also provided for comparison.

Metrics

Complete results for the ten selected metrics generated from the BMI data set are provided in Appendix B. Summary results for the five major types of metrics are presented below for Adobe Creek.

Richness - Site richness metrics increased with increasing site elevation. The highest values for Taxa (32) and EPT (14) Richness occurred at site A-5. In contrast, the lowest values for Taxa Richness (9) occurred at site A-2 and EPT Richness (2) occurred at the lower two sampling sites (A-2 and A-3) in Adobe Creek.

Composition - Metrics associated with composition also varied with site elevation. In Adobe Creek, EPT Index values ranged from 28% to 52% and sensitive EPT values ranged from 0.2% to 21%, with the highest value occurring at site A-5 and the lowest value occurring at site A-2 and A-3.

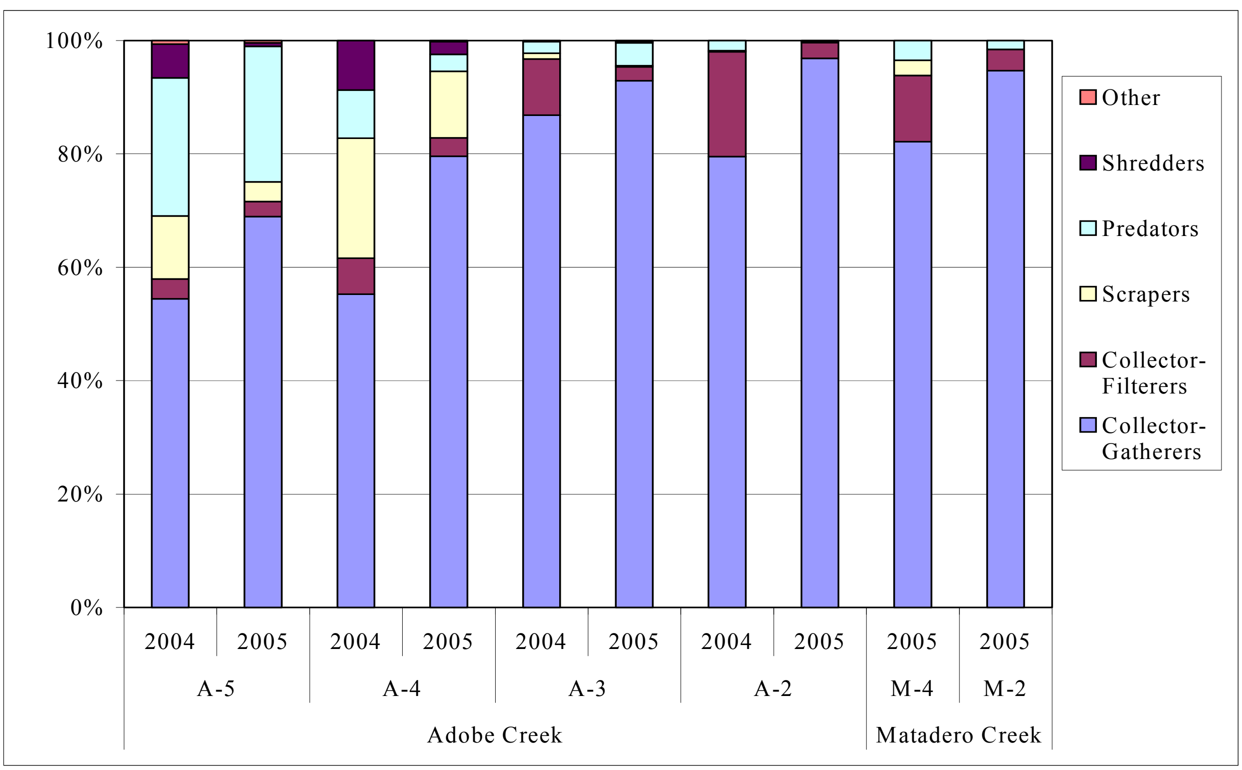
Shannon Diversity Index values are affected by taxonomic richness and the distribution of individuals among the taxa. The Shannon Diversity values may range from 0 to 3.3 (natural log), with the higher diversity values being indicative of greater stream health. Shannon Diversity values were highest (2.4) at A-5 and lowest (1.7) at A-2 and A-3.

Another measure of composition characteristics is Percent Dominant Taxon. Unlike the previous metrics, a higher Percent Dominant Taxon value often indicates a more disturbed environment. Percent Dominant Taxon values ranged from 25% to 48% with the lowest percentage occurring at A-5.

Tolerance Measures- In the Adobe Creek watershed, weighted Mean Tolerance values ranged from 4.2 to 5.4 (on a scale from 0 to 10, 10 having the greatest tolerance. Percent Intolerant Organism values ranged from 0.2% to 22%, with the highest value occurring at site A-5 and the lowest value occurring at site A-2. Percent Tolerant Organism values were below 2.0% for all sites.

Functional Feeding Groups – The percentage of organisms in different functional feeding groups were generally consistent among Adobe Creek sites, with the exception of A-5 (Figure 5). Collector-Gatherers dominated all sites, making up between 69% and 97% of all BMIs identified. Site A-4 exhibited a greater percentage of Scrapers (12%) than any other site. Site A-5 had the highest percentage (24%) and richness (10) of Predators compared to other sites in the Adobe Creek watershed.

Figure 5. Percentages of benthic macroinvertebrates distributed among six functional feeding groups from Adobe Creek (years 2004 and 2005) and Matadero Creek (year 2005).

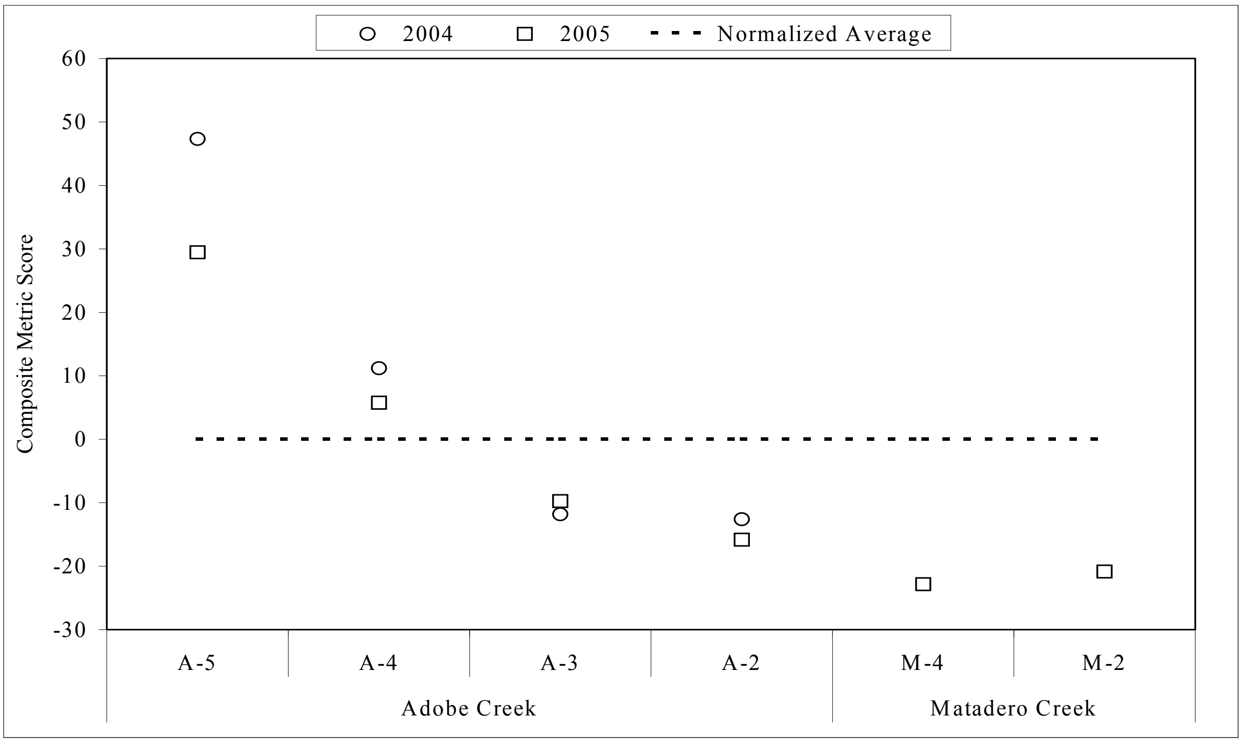


Abundance - Abundance metric values generally increased at lower elevations (Appendix B). The mean BMI abundance per ft^2 estimated from Adobe Creek samples was 179 and ranged from 144 at site A-4 to 227 at site A-2.

Composite Metric Scores

A plot of composite metric scores is shown in Figure 6 for the Adobe Creek sites sampled in years 2004 and 2005. A clear gradient of decreasing composite metric scores with decreasing elevation was evident for Adobe Creek sites for both years, but scores were generally higher in year 2004. BMI assemblages from sites that scored consistently above average had consistently higher richness (total and EPT) and diversity and lower tolerance when compared to BMI assemblages from sites that scored below average.

Figure 6. Composite metric scores for Adobe Creek (years 2004 and 2005) and Matadero Creek (year 2005).



Dominant Taxa Composition

High numerical abundances of midges (Orthocladiinae and Tanytarsini), baetid mayflies (*Baetis*) and segmented worms (Naididae) contributed to the low composite metric scores for sites A-2 and A-3 (Table 9). The riffle beetle, *Optioservus*, and chloroperlid stonefly, *Sweltsa*, were dominant at sites A-4 and A-5, respectively. Numerically dominant non-baetid EPT taxa were absent from all sites except site A-5 where *Sweltsa* comprised 13% of the BMIs sampled. Segmented worms (Naididae and/or Enchytraeidae) were numerically dominant in all samples except site A-5.

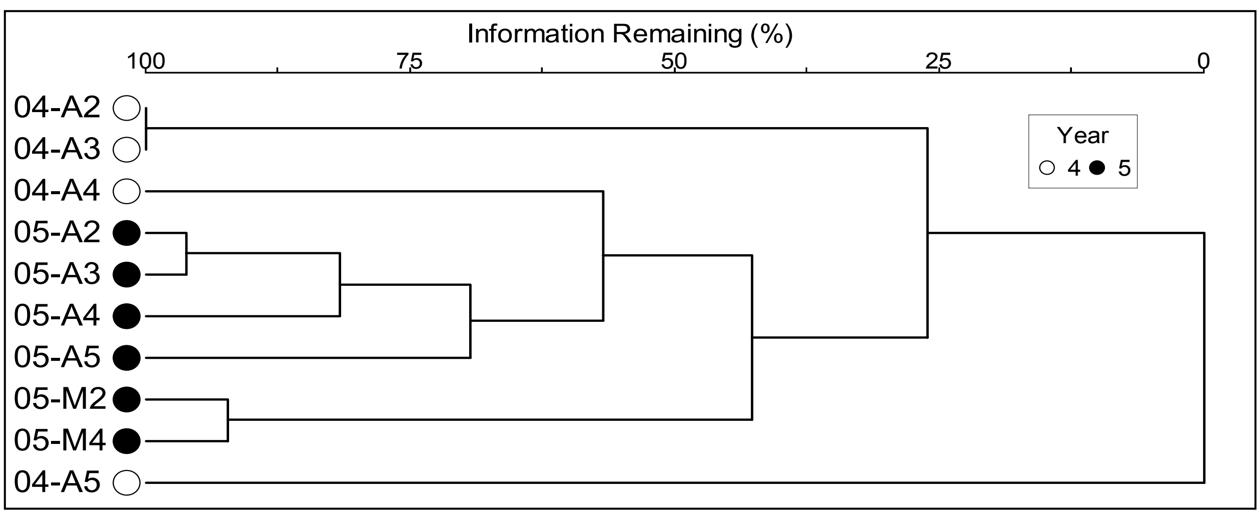
Table 9. Numerically dominant macroinvertebrate taxa and their percent relative abundance for Adobe Creek sites (2005).

Site	Dominant Taxa				
	1	**2**	**3**	**4**	**5**
A-2	Orthocladiinae 33%	*Baetis* 28%	Naididae 12%	Enchytraeidae 12%	Tanytarsini 8%
A-3	*Baetis* 40%	Orthocladiinae 24%	Tanytarsini 12%	Naididae 9%	Enchytraeidae 5%
A-4	*Baetis* 48%	Orthocladiinae 12%	*Optioservus* 11%	Tanytarsini 7%	Naididae 6%
A-5	*Baetis* 25%	Orthocladiinae 19%	*Sweltsa* 13%	Tanytarsini 13%	Planariidae 6%

Taxonomic Similarity

Figure 7 shows relative site similarity for Adobe Creek sites as a function of BMI taxonomic composition and year of sampling (year 2004 shown for additional perspective). Site dissimilarity increases as links are made from left to right. A cluster of sites was formed for Adobe Creek sites sampled in year 2005 (identified by grouping 5). This grouping indicates relative dissimilarity of Adobe Creek taxonomic composition when compared by year of sampling with the exception of site A-4 in year 2004, which grouped more closely to year 2005 Adobe Creek sites than it did to year 2004 sites. When the dendrogram is examined by year of sampling, the sites formed similar relationships: site A-5 was the most dissimilar among the year 2005 Adobe sites and was the most dissimilar among the year 2004 Adobe sites and sites A-2 and A-3 were the most closely associated for both years.

Figure 7. Dendrogram showing degree of site similarity based on the composition of benthic macroinvertebrates sampled from Adobe Creek (2004 and 2005) and Matadero Creek (2005).



4.1.5.2 Fish

Fish sampling results are summarized in Appendix C, where both fish numbers and percent species composition are provided. One stream reach (A-3.5) was sampled on Adobe Creek. Non-native fish species were found to be low in number at this site. With its isolated pools shaded by mature redwoods, the Adobe Creek site had a fish community consisting of stickleback (41%), sucker (33%), and roach (26%). The vast majority of the Sacramento suckers at this site were young-of-the-year fish, as were the roach and stickleback.

4.1.6 Physical Habitat Assessments

A summary of physical habitat results for the four reaches where BMI bioassessments were conducted are provided in Appendix D. Habitat assessment results for each of the parameters and riffle habitat measurements are also presented in Appendix E.

The Adobe Creek sites were moderately to densely canopied with intact to moderately impacted riparian zones. Site habitat quality scores can range from 0-200 (200 having the greatest quality habitat). Habitat quality scores in Adobe creek ranged from 90 at site A-2 to 164 at site A-5. Scores of 50 or less would imply poor habitat, scores greater than 50 to 100 would imply marginal habitat, scores greater than 100 to 150 would imply suboptimal habitat, and scores greater than 150 would imply optimal habitat (Barbour et al. 1999).

Substrate quality scores, ranging from 0 (poor quality) to 20 (high quality), integrate embeddedness and substrate complexity for estimating epifaunal colonization potential. Substrate quality scores for Adobe Creek sites ranged from 6.0 at A-4 to 13 at A-5. Substrate composition of the sites was cobble/gravel dominant with moderate embeddedness. Site A-4 exhibited a larger proportion of fine (<2mm) substrate (22%) than any other site. Stream gradients for the sites ranged from 0.84 to 3.1 percent.

4.2 Discussion

4.2.1 Aquatic Life Use Indicators

There are no designated Beneficial Uses in the Basin Plan for water bodies in the Adobe Creek watershed. The results of the fish sampling during FY 04-05 indicate a native warm water fish community is supported at site A-3.5. The fish community consisted of relatively high abundances of California roach, Sacramento sucker and threespine stickleback that occurred in pools within an intermittent section of Adobe Creek (Appendix C). Field reconnaissance during the summer of 2004 indicated that significant sections of Adobe Creek between Terman Park (A-2) and the headwater reaches at Hidden Villa (A-5) exhibited intermittent flow with limited number of pools that could provide fish with refuge during the dry season. The section between Redwood Preserve and the seminary was the only location that fish were observed and subsequently sampled in the fall.

California roach, Sacramento sucker and threespine stickleback were also documented at selected sites above and below A-3.5 during a previous study (Habitat Restoration Group 1989). The study determined that low streamflow, lack of deep pools and fish passage barriers were identified as the key limiting factors for native warm water fish community in Adobe Creek. The best potential habitat for native fishes was identified in the upper reaches above Murieta Lane; however fish were not observed in this reach presumably as a result of fish barriers preventing decolonization from downstream fish populations following drought years.

Steelhead have not been documented in Adobe Creek, although they are thought to have been present historically (Habitat Restoration Group 1989). Existing fish passage barriers, including a long section of trapezoidal concrete channel downstream of El Camino Real, is likely to prevent access for steelhead to the upper reaches. In addition, low flow conditions during the dry season in Adobe Creek is likely to create poor growing conditions for juvenile rearing steelhead/trout (i.e., limited connectivity between pools can result in inadequate food resources to support juvenile steelhead/trout in habitats with relatively high water temperatures).

Physical and chemical water quality sampling results during FY 04-05 indicate ambient water quality generally met the Water Quality Objectives (WQO) identified in the Basin Plan (SFBRWQCB 1995). Dissolved oxygen (D.O.) concentrations at most sites were above the WQO for warm water habitat (5.0 mg/L), with one exception. D.O. measured at site A-3.5 during fish sampling event was 4.1 mg/L. Dissolved oxygen recorded at the Adobe Creek sites during water quality sampling and bioassessment study, however, ranged from 9.23 to 12.63 mg/L. The D.O. measurement taken during the fish survey occurred in a stagnant pool slightly downstream of the water quality site, which was taken one week earlier, at a station with more stream flow (0.1 ft/s velocity). The pH values for all sites were within the WQO (6.5 to 8.5), again with on exception at site A-3.5 (8.71) during the dry season event.

The dissolved metal concentrations from Adobe Creek samples, adjusted for hardness, were significantly lower than the Freshwater Critierion Chronic Concentrations (CCC) presented in the California Toxics Rule (CTR) (Appendix F). Adobe Creek water samples exhibited no detectable concentrations of organophosphate pesticides or toxicity during the two sampling events. Water quality results from FY 04-05 were very similar to FY 03-04 results, with slightly lower nutrient concentrations in samples collected during FY 04-05.

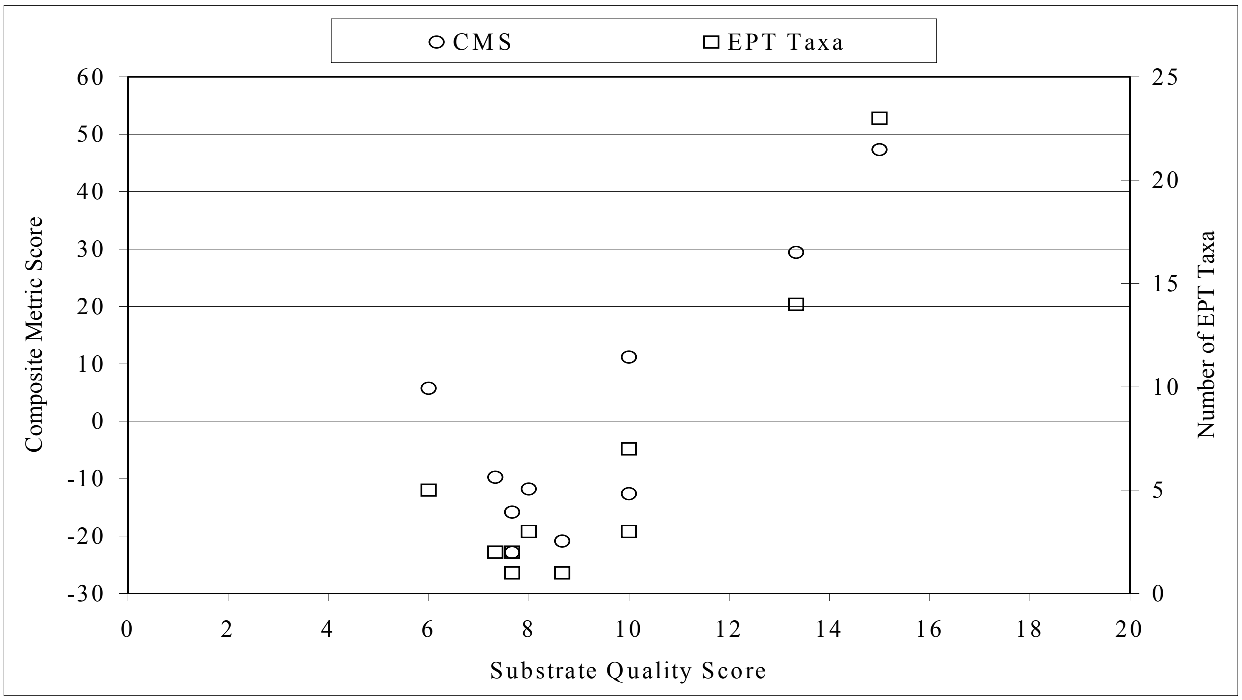
The results of the two years of BMI bioassessments and physical habitat assessments at the four sampling locations indicate that biological integrity and aquatic habitat conditions are generally poor downstream of the Foothill Community College. Sites A-4 through A-2 exhibited low scores of richness, composition and tolerance metrics, as well as low composite metric scores, compared to site A-5. This may in part be explained by natural variation caused by differences in elevation and position in the watershed. The physical habitat assessment, however, shows substrate quality (composition and embeddedness) and overall habitat condition for the three urbanized sites were much lower than site A-5. It is not likely that intermittent flow conditions were a significant factor causing low biological integrity in FY 04-05 since site A-5, which was also intermittent during the dry season, exhibited good biological integrity and aquatic habitat condition.

The poor physical habitat conditions observed in the urban reaches of Adobe Creek may be significantly influenced by channel instability in reaches downstream of Foothill Expressway. The SCVWD is currently investigating the hydrologic geomorphic conditions of Adobe Creek to evaluate existing sediment supply and transport processes. The geomorphic analysis may provide useful information to determine how existing geomorphic conditions may be impacting aquatic biota and habitat condition and identify potential management actions to enhance or restore habitat.

Physical and biological stream ecosystem functional capacities are likely to be very low in Adobe Creek downstream of El Camino Real due to the trapezoidal concrete channel that was constructed in 1959. This section of Adobe Creek is a low gradient stream that functions as a depositional zone. SCVWD has periodically conducted sediment removal projects between 1980 and 1998 to maintain channel capacity for flood control (SCVWD 1996).

Allan (1995) summarized numerous studies documenting the effects of substrate composition on the quality of BMI assemblages. Adobe Creek (years 2004 and 2005) and Matadero Creek (year 2005) substrate quality scores were mostly low to moderate (6 to 10) with indistinct composite metric scores and EPT responses (Figure 8). Two sites, however, with higher substrate quality scores (14 and 16) had correspondingly high composite metric scores and EPT Taxa.

Figure 8. Composite metric scores (CMS) and EPT Taxa vs. substrate quality scores for Adobe Creek sites (years 2004 and 2005), Santa Clara County.



4.2.2 Recreational Use Indicators

Bacterial indicators are nonpathogenic indicator organisms that are commonly used to indicate the potential presence of (human and nonhuman) fecal contamination. The correlation between bacterial indicator organisms and pathogens of public health concern is subject to debate. A majority of bacterial indicator concentrations collected by SCVURPPP were relatively elevated at most sites during most sampling events. However, it is important to note that when evaluating bacterial indicator data, one must take into consideration potential for human exposure to the water bodies of interest. Given water quality and exposure data, it may be possible to estimate the risk associated with human health. Microbial risk assessments typically involve characterizing both water quality and exposure, with regards to the specific pathogens of concern. However, with limited bacterial indicator data available, as is the case in Adobe Creek, one must determine if risk is high through less rigorous and more subjective methods.

REC-1 and REC-2 Uses have not been established for water bodies in the Adobe Creek watershed. Only water samples taken at site A-3.5 were analyzed since it was determined during field reconnaissance to be an area in close proximity to the City of Los Altos Redwood Preserve. Most of the creek areas at the preserve however were typically dry and did not contain pools considered suitable for swimming activities. Therefore, the potential for swimming activities at sites where samples were taken is highly unlikely, thus limiting the risk to exposure.

Results from this study indicate the fecal and total coliform data collected by SCVURPPP at site A-3.5 during both the summer and winter sampling events were below the Basin Plan's Water Quality Objectives (WQO)[10] for both REC-1 and REC-2 Uses. Similarly, One sample (860 MPN/100ml) taken during the summer event and analyzed for enteroccocus[11] was higher than the suggested bacteriological criteria for water contact recreation at "infrequently used areas".

[10] It is important to note that the WQO are based on a minimum of five consecutive samples equally spaced over a 30-day period.
[11] Enterococcus is an indicator organism typically used in marine waters.

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Section 5.0

Matadero/Barron Creek Watersheds

Results and Discussion

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5.1 Results

The following sections provide a brief summary of results for the Matadero/Barron Creek watersheds.

5.1.1 Physio-chemical Parameters

Physio-chemical measurements were made *in situ* during a total of twelve sampling events at five sites in FY 04-05. All measurements were taken during non-storm events in daylight hours.

Water temperatures at Matadero/Barron Creek sampling sites ranged between 7.8 and 20.5^0 C (Table 10). The dissolved oxygen concentrations at all sites were greater than 6.2 mg/L, with the exception of site M-3 in October, where a 5.2 mg/L measurement was recorded. Conductivity ranged between 196 and 2793 uS/cm, with a vast majority of measurements > 1000 uS/. The pH concentrations were between 7.89 and 8.62.

The average water velocity at all sites measured was 0.62 ft/sec during sampling events. Flow measurements were also unsuccessful at M-3 (Matadero Creek at Linda Lane). During the dry season event, water levels were so low there was no measurable water movement. An unusually high conductivity value (2793 µs/cm) was measured for this event but no source could be ascertained. This site is surrounded by fenced private property with livestock (goats) visible in the immediate area. During the wet season event, flow, though visible, was too slow to be measured and was estimated to be <0.1 ft/sec.

5.1.2 Chemical Parameters

Water quality samples were collected at three sites on Matadero Creek (M-1, M-2 and M-3) and one site on Barron Creek (B-1) during two sampling events. Samples were analyzed for nutrients and anions, suspended sediment concentrations, total recoverable metals dissolved metals and organophosphate pesticides. All measurements were taken during non-storm events in daylight hours.

Total phosphorous and orthophosphate concentrations in Matadero and Barron Creeks ranged from 0.25 – 1.6 and 0.15 - 1.1 mg/L, respectively (Table 10). Ammonia (as N) and nitrite concentrations were below reporting limits (0.10 mg/L), and nitrate concentrations ranged from 0.28 – 1.6 mg/L. Suspended sediment concentrations ranged between 2.1 and 63.9 mg/L.

Only water samples from M-1, M-2 and B-1 were analyzed for total recoverable and dissolved metals and organophosphate pesticides (Table 10). No organophosphate pesticides were detected during either sampling event.

5.1.3 Aquatic Toxicity

Three species bioassays were conducted on samples collected from site M-1 and M-2 on Matadero Creek during two sampling events. Water samples collected from either site did not significantly inhibit the survival or reproduction/growth of test organisms. A full tabulation toxicity testing results can be found in Table 11.

5.1.4 Indicator Bacteria

Water column samples were collected during two sampling events from two sites on Matadero Creek where potential water contact recreation occurs (M-1 and M-2). Samples were analyzed for total coliforms, fecal coliforms and enterococcus. During the first sampling event, total, fecal and enterococcus concentrations were >1600 MPN/100 mL, >1600 MPN/100 mL and 1800 CFU/100 mL, respectively for site M-2; and, 900 MPN/100 mL, 240 MPN/100 mL and 200 CFU/100 mL, respectively for site M-3. Concentrations enumerated from samples collected during the second sampling event were less than or equal to concentrations from the first sampling event for all three organisms. Results are presented in Table 10.

Table 10. Water quality results for Matadero/Barron Creek watersheds sites sampled in FY 04- 05 by SCVURPPP.

	Station[1]											
	M-1		M-2				M-3			M-4	B-1	
Date	28-Sep-04	24-Jan-05	28-Sep-04	6-Oct-04	24-Jan-05	13-Apr-05	28-Sep-04	24-Jan-05	6-Oct-04	13-Apr-05	28-Sep-04	24-Jan-05
PHYSIO-CHEMICAL PARAMETERS												
Temperature (°C)	20.5	13.6	16.3	16.8	9.5	12.0	15.4	9.8	17.3	12.8	18.2	7.8
pH	8.59	8.55	8.41	8.3	8.62	8.18	8.17	8.47	8	7.89	7.93	8.46
Conductivity (µS/cm)	943	1096	908	1250	1239	1235	2793	1250	>1990	855	196.2	342
Dissolved Oxygen (mg/L)	8.08	12.33	8.4	7.5	11.21	9.69	6.27	11.98	5.2	9.74	7.51	12.80
Velocity (ft/sec)	0.8	0.9	0.43	NR	0.71	1.5	NR	<0.1	NR	0.9	0.1	0.1
NUTRIENT AND ANIONS												
Orthophosphate-P (mg/L)	0.22	0.22	0.2	-	0.24	-	0.38	0.21	-	-	1.1	0.15
Total Phosphorus (mg/L)	0.45	0.28	0.36	-	0.28	-	0.64	0.25	-	-	1.6	0.25
Total Dissolved Solids (mg/L)	440	1200	690	-	1300	-	3000	1300	-	-	200	340
Total Organic Carbon (mg/L)	11	5.1	6.2	-	5.6	-	15	6.2	-	-	18	14
Dissolved Organic Carbon (mg/L)	11	5	5.8	-	5.4	-	11	6	-	-	19	13
Total Ammonia as Nitrogen (mg/L)	0.10U	0.10U	0.10U	-	0.10U	-	0.10U	0.10U	-	-	0.29	0.10U
Total Kjeldahl Nitrogen (mg/L)	0.85	0.54	0.7	-	0.54	-	0.76	0.54	-	-	1.9	1.3
Nitrite Nitrogen (mg/L)	0.10U	0.10U	0.10U	-	0.10U	-	0.10U	0.10U	-	-	0.10U	0.10U
Nitrate Nitrogen (mg/L)	0.72	0.86	1.6	-	1.1	-	0.28	0.65	-	-	0.34	0.49
Alkalinity as $CaCO_3$ (mg/L)	220	370	290	-	410	-	520	420	-	-	62	140
Total Hardness (mg/L)	220	750	330	-	780	-	1600	880	-	-	67	190
Chloride (mg/L)	21	140	120	-	140	-	190	110	-	-	62	41
Sulfate (mg/L)	52	440	110	-	430	-	1400	520	-	-	12	55
Chlorophyll (ug/L)	3.5	1.6	3.7	-	1.9	-	3.5	1.5	-	-	75	10
SUSPENDED SEDIMENT CONCENTRATION												
Total Particulate Solids (mg/L)	7.5	4.1	8.8	-	10.8	-	4.5	2.1	-	-	63.9	17
Total Coarse (mg/L)	<1.0	0.35	1.4	-	6.39	-	<1.0	<0.5	-	-	50.6	1.4
Total Fine (mg/L)	7.5	3.73	7.4	-	4.38	-	4.5	2.15	-	-	13	15.6
TOTAL RECOVERABLE METALS (ug/L)									-	-		
Aluminum	270	25U	290	-	25U	-	-	-	-	-	280	1700
Arsenic	1.5	4	2.2	-	3.6	-	-	-	-	-	2	5.3
Boron	130	120	200	-	120	-	790	120	-	-	52	55
Cadmium	0.20U	0.20U	0.20U	-	0.20U	-	-	-	-	-	0.20U	0.28
Chromium	2.3	1.0UJ	2.6	-	1.0UJ	-	-	-	-	-	2.3	8.5
Copper	12	2.1	5	-	2.1	-	-	-	-	-	20	47
Lead	1.2	1.0U	1.0U	-	1.0U	-	-	-	-	-	2.6	19
Manganese	37	12	35	-	18	-	-	-	-	-	33	64
Mercury	0.0069	0.0050U	0.0032	-	0.0050U	-	-	-	-	-	0.0181	0.011
Nickel	5.3	5.3	6.1	-	5.9	-	-	-	-	-	5.5	11
Selenium	1.0U	1.0U	1.0U	-	1.0U	-	-	-	-	-	1.0U	1.0U
Silver	0.20U	0.20U	0.2	-	0.20U	-	-	-	-	-	0.20U	0.20U
Zinc	21	6.6	17	-	5.5	-	-	-	-	-	42	77

Table 10. (Continued)

	Station[1]											
	M-1		M-2				M-3			M-4	B-1	
Date	28-Sep-04	24-Jan-05	28-Sep-04	6-Oct-04	24-Jan-05	13-Apr-05	28-Sep-04	24-Jan-05	6-Oct-04	13-Apr-05	28-Sep-04	24-Jan-05
DISSOLVED METALS (ug/L)									-	-		
Aluminum	25U	25U	25U	-	25U	-	-		-	-	25U	25U
Arsenic	1.3	4	2.1	-	3.6	-	-	-	-	-	2	3.2
Cadmium	0.2U	0.20U	0.2U	-	0.20U	-	-	-	-	-	0.2U	0.20U
Chromium	1.5	2.4J	2	-	2.4J	-	-	-	-	-	1.5	1.8
Copper	6.9	1.8	2.9	-	1.8	-	-	-	-	-	10	12
Lead	1.0U	1.0U	1.0U	-	1.0U	-	-	-	-	-	1.0U	1.0U
Manganese	10	9.1	8	-	16	-	-	-	-	-	14	2.5
Nickel	4	4.9	4	-	5.5	-	-	-	-	-	3.9	5.5
Selenium	1.0U	1.0U	1.0U	-	1.0U	-	-	-	-	-	1.0U	1.0U
Silver	0.2U	0.20U	0.2U	-	0.20U	-	-	-	-	-	0.2U	0.20U
Zinc	5.8	5.0U	7.8	-	5.0U	-	-	-	-	-	20	5
ORGANOPHOSPHATE PESTICIDES (ug/L)									-	-		
Azinphos menthyl	0.16U	0.052U	0.16U	-	0.052U	-	-	-	-	-	0.16U	0.052U
Bolstar	0.057U	0.016U	0.057U	-	0.016U	-	-	-	-	-	0.057U	0.016U
Coumaphos	0.080U	0.071U	0.080U	-	0.071U	-	-	-	-	-	0.080U	0.071U
Demeton O&S	0.23U	0.010U	0.23U	-	0.010U	-	-	-	-	-	0.23U	0.010U
Diazinon	0.036U	0.017U	0.036U	-	0.017U	-	-	-	-	-	0.036U	0.017U
Dichlorvos	0.032U	0.021U	0.032U	-	0.021U	-	-	-	-	-	0.032U	0.021U
Disulfoton	0.039U	0.015U	0.039U	-	0.015U	-	-	-	-	-	0.039U	0.015U
Chlorpyrifos (Dursban)	0.035U	0.018U	0.035U	-	0.018U	-	-	-	-	-	0.035U	0.018U
Ethoprop	0.041U	0.026U	0.041U	-	0.026U	-	-	-	-	-	0.041U	0.026U
Fensulfothion	0.10U	0.10U	0.10U	-	0.10U	-	-	-	-	-	0.10U	0.10U
Fenthion	0.014U	0.015U	0.014U	-	0.015U	-	-	-	-	-	0.014U	0.015U
Merphos	0.022U	0.030U	0.022U	-	0.030U	-	-	-	-	-	0.022U	0.030U
Mevinphos	0.075U	0.098U	0.075U	-	0.098U	-	-	-	-	-	0.075U	0.098U
Parathion methyl	0.041U	0.020U	0.041U	-	0.020U	-	-	-	-	-	0.041U	0.020U
Phorate	0.050U	0.016U	0.050U	-	0.016U	-	-	-	-	-	0.050U	0.016U
Ronnel	0.020U	0.011U	0.020U	-	0.011U	-	-	-	-	-	0.020U	0.011U
Stirophos	0.022U	0.030U	0.022U	-	0.030U	-	-	-	-	-	0.022U	0.030U
Tokuthion (Prothiofos)	0.037U	0.016U	0.037U	-	0.016U	-	-	-	-	-	0.037U	0.016U
Trichloronate	0.032U	0.026U	0.032U	-	0.026U	-	-	-	-	-	0.032U	0.026U
Ethion	0.012U	0.021U	0.012U	-	0.021U	-	-	-	-	-	0.012U	0.021U
Malathion	0.032U	0.026U	0.032U	-	0.026U	-	-	-	-	-	0.032U	0.026U
Parathion-ethyl	0.013U	0.017U	0.013U	-	0.017U	-	-	-	-	-	0.013U	0.017U
BACTERIAL INDICATORS												
Total Coliform (MPN/100 mL)	-	-	≥1600	-	1600	-	900	280	-	-	-	-
Fecal Coliform (MPN/100 mL)	-	-	≥1600	-	300	-	240	130	-	-	-	-
Enterococus (CFU/100 mL)	-	-	1800	-	1200	-	200	82	-	-	-	-

J= The result is an estimated quantity.
J-= The result is an estimated quantity but result may be biased low.
R= The data are unusable (the analyte may or may not be present).
U= Not measured above reported sample reporting limit (Diazinon not measured above reported sample detection limit).
UJ= Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
NA = Creek Dry, no samples taken.
– = Not sampled for selected analyte.

Table 11. Summary of bioassay results from the Matadero Creek watershed.

Site	Date	Survival			Growth/Reproduction				
		NOEC	LOEC	LC_{50}	NOEC	LOEC	IC_{50}	IC_{25}	IC_{10}
Ceriodaphnia dubia									
M-1	28-Sept-2005	100	>100	>100	100	>100	>100	>100	>100
	24-Jan-2005	100	>100	>100	100	>100	>100	>100	35.3
M-2	28-Sept-2005	100	>100	>100	100	>100	>100	>100	>100
	24-Jan-2005	100	>100	>100	100	>100	>100	>100	65.4
Pimephales promelas									
M-1	28-Sept-2005	100	>100	>100	100	>100	>100	>100	>100
	24-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
M-2	28-Sept-2005	100	>100	>100	100	>100	>100	>100	>100
	24-Jan-2005	100	>100	>100	100	>100	>100	>100	69.8
Selenastrum capricornutum									
M-1	28-Sept-2005	NA	NA	NA	100	>100	>100	>100	>100
	24-Jan-2005	NA	NA	NA	100	>100	>100	>100	74.7
M-2	28-Sept-2005	NA	NA	NA	100	>100	>100	>100	>100
	24-Jan-2005	NA	NA	NA	100	>100	>100	>100	>100

Values are Percent Sample
NOEC = Highest Test Concentration Not Producing a Statistically Significant Reduction in Survival or Fertilization.
LOEC = Lowest Test Concentration Producing a Statistically Significant Reduction in Survival or Fertilization.
LC_{50} = Median (50%) Lethal Concentration.
IC_{50} = Concentration Inhibitory to Reproduction by 50% (Median).
IC_{25} = Concentration Inhibitory to Reproduction by 25%.
IC_{10} = Concentration Inhibitory to Reproduction by 10%.
NA = Not Applicable.

5.1.5 Bioassessments

5.1.5.1 Benthic Macroinvertebrates

A total of 997 benthic macroinvertebrates (BMIs) were processed from the two reaches (i.e., sites) sampled in Matadero Creek. BMIs identified were comprised of 18 distinct taxa. The evaluation of these data was conducted by reviewing metric values, composite metric scores, dominant taxa, and BMI composition similarity. The following paragraphs briefly describe the results of BMI bioassessments conducted in FY 04-05 (i.e., Spring 2005). A portion of the results of bioassessments conducted in FY 03-04 (i.e., Spring 2004) are also provided for comparison.

Metrics

Complete results for the ten selected metrics generated from the BMI data set are provided in Appendix B. Summary results for the five major types of metrics are presented below for Matadero Creek.

Richness - Site richness metrics were similar for both sites sampled. The highest values for Taxa Richness (17) occurred at site M-4. EPT Taxa Richness was relatively low (1) for both sites.

Composition - Metrics associated with composition were also similar between sites. In Matadero Creek, EPT Index values ranged from 18% to 21% and no Sensitive EPTs were identified at either site.

Shannon Diversity Index values are affected by taxonomic richness and the distribution of individuals among the taxa. The Shannon Diversity values may range from 0 to 3.3 (natural log), with the higher diversity values being indicative of greater stream health. Shannon Diversity values were highest (1.8) at M-4.

Another measure of composition characteristics is Percent Dominant Taxon. Unlike the previous metrics, a higher Percent Dominant Taxon value often indicates a more disturbed environment. Percent Dominant Taxon values ranged from 42% to 60% with the lowest percentage occurring at site M-2.

Tolerance Measures- In the Matadero Creek watershed, weighted Mean Tolerance values were similar for both sites (5.7 and 5.8). No Percent Intolerant Organisms were identified. Percent Tolerant Organism values were below 5.5% for both sites.

Functional Feeding Groups – The percentage of organisms in different functional feeding groups were generally consistent between both sites, with the exception of Percent Collector-Filterers (see Section 4.1.5.1, Figure 5). Collector-Gatherers dominated both sites, making up between 82% and 95% of all BMIs identified.

Abundance - Abundance metric values generally increased at lower elevations (Appendix B). The BMI abundance per ft^2 estimated from Matadero Creek samples ranged from 389 at site M-4 to 800 at site M-2.

Composite Metric Scores

A plot of composite metric scores is shown in Figure 6 for the Matadero Creek sites sampled in years 2005. Compared to Adobe Creek sites, composite metric scores were much lower for Matadero Creek sites (See Section 4.1.5.1, Figure 6).

Dominant Taxa Composition

High numerical abundances of midges (Orthocladiinae and Tanytarsini), baetid mayflies (*Baetis*) and segmented worms (Naididae) contributed to the low composite metric scores for Matadero Creek sites (Table 12). The riffle beetle, *Optioservus*, and chloroperlid stonefly, *Sweltsa*, were dominant at sites A-4 and A-5, respectively. Numerically dominant non-baetid EPT taxa were absent from all sites except site A-5 where *Sweltsa* comprised 13% of the BMIs sampled. Segmented worms (Naididae and/or Enchytraeidae) were numerically dominant in all samples except site A-5.

Table 12. Numerically dominant macroinvertebrate taxa and their percent relative abundance for Matadero Creek sites (2005).

Site	Dominant Taxa				
	1	**2**	**3**	**4**	**5**
M-2	Naididae 60%	*Baetis* 21%	Orthocladiinae 13%	*Simulium* 3%	Tanytarsini 1%
M-4	Naididae 42%	*Baetis* 18%	Orthocladiinae 14%	*Simulium* 9%	Tanytarsini 6%

Taxonomic Similarity

Section 4.1.5.1 Figure 7 shows relative site similarity for Matadero Creek sites (and Adobe Creek sites) as a function of BMI taxonomic composition. Site dissimilarity increases as links are made from left to right. Results indicate BMI communities from Matadero Creek sites are very similar, as compared to Adobe Creek sites.

5.1.5.2 Fish

Fish sampling results are summarized in Appendix C, where both fish numbers and percent species composition are provided. Of all sites sampled in the Santa Clara Basin in FY 04-05, Matadero exhibited the highest abundance of non-native fish, including one bluegill, one green sunfish, and one goldfish. All other fish identified were native species.

The fish community of Matadero Creek at Bol Park (M-2) was dominated by the native minnow, California roach (71%), followed by Sacramento sucker (20%) and threespine stickleback (8%). The sampling of the second station on Matadero Creek (M-3) was truncated because of the ineffectiveness of the electrofisher in the excessively high conductivity. The water at the M-3 site had an electrical conductivity in excess of 1,990 uS/cm. The electrofisher repeatedly shut down due to its effective upper limit of approximately 1,700 uS/cm. Based on the fish captured and on visual observation, it appears likely that California roach comprise the majority of the fish at this location.

5.1.6 Physical Habitat Assessments

A summary of physical habitat results for the two reaches where BMI bioassessments were conducted are provided in Appendix D. Habitat assessment results for each of the parameters and riffle habitat measurements are also presented in Appendix E.

The Matadero Creek sites were moderately to densely canopied with intact to moderately impacted riparian zones. Site habitat quality scores can range from 0-200 (200 having the greatest quality habitat). Habitat quality scores in Matadero creek ranged from 136 at site M-2 to 153 at site M-4. Scores of 50 or less would imply poor habitat, scores greater than 50 to 100 would imply marginal habitat, scores greater than 100 to 150 would imply suboptimal habitat, and scores greater than 150 would imply optimal habitat (Barbour et al. 1999).

Substrate quality scores, ranging from 0 (poor quality) to 20 (high quality), integrate embeddedness and substrate complexity for estimating epifaunal colonization potential. Substrate quality scores for Matadero Creek sites ranged from 7.7 at M-4 to 8.7 at M-2. Substrate composition of site M-2 was cobble/gravel dominant with moderate embeddedness. Site M-4 exhibited a substantially larger proportion of fine (<2mm) substrate (43%) than M-2. Stream gradients for the sites ranged from 0.8 to 2.0 percent.

5.2 Discussion

5.2.1 Aquatic Life Use Indicators

The Basin Plan identifies several designated Beneficial Uses in Matadero Creek associated with aquatic life uses, including COLD, WARM, MIGR and SPWN. The results of the fish sampling during FY 04-05 indicate that a native warm water fish community is supported at sites M-2 and M-3. The fish community consisted of relatively moderate to high abundances of California roach, Sacramento sucker and threespine stickleback with small numbers of non-native fish. Visual observations made during the bioassessment study also indicated a large number of fish, mostly California Roach, at site M-4 and downstream of M-2 within the Stanford Research Area. During field reconnaissance in the summer season 2004, Matadero Creek appeared to be intermittent creek with isolated pools in reaches upstream of Stanford property boundary and perennial creek downstream of Foothill Expressway. A native fish community was also observed in the upper reaches of Matadero Creek during a previous fish study (Leidy 1999).

No cold water fish species (e.g., steelhead/rainbow trout) were identified during SCVURPPP fish sampling in FY 04-05 or in previous studies (Leidy 1999). Existing fish passage barriers, including a long section of trapezoidal concrete channel downstream of El Camino Real, is likely to prevent access for steelhead to the upper reaches. In addition, low flow conditions during the dry season in Matadero Creek is likely to create poor growing conditions for juvenile rearing steelhead/trout (i.e., limited connectivity between pools can result in inadequate food resources to support juvenile steelhead/trout in habitats with relatively high water temperatures). Currently, there is insufficient habitat information in Matadero Creek to determine existing condition of habitat suitable for steelhead passage, spawning and rearing.

There are no designated Beneficial Uses for Barron Creek. Barron Creek watershed is a very small urban drainage to the east of Matadero Creek with limited to no suitable habitat for a warm water fish community. During the field reconnaissance in summer 2004, most of the creek was dry with the exception of the lower section of concrete channel that had a trickle flow and no low flow channel. Based on these observations, it was determined that Barron Creek did not have suitable enough habitat to warrant a fish survey. In addition, BMI bioassessments were not conducted in the watershed due to the high percent of modified channel and lack of riffle habitat.

Physical and chemical water quality sampling results in Matadero and Barron Creeks during FY 04-05 indicate ambient water quality generally met the Water Quality Objectives (WQO) identified in the Basin Plan (SFBRWQCB 1995). The dissolved oxygen (D.O.) measured at site M-3 during dry season water quality and fish sampling events were 6.27 and 5.2 mg/L, respectively, which is above the WQO for warm water (5.0 mg/L) but below the WQO for cold water habitat (7.0 mg/L). Conductivity measurements for the Matadero Creek sites were relatively high, ranging from 908 – 2793 uS/cm during the dry season and 1096 – 1250 uS/cm during the wet season. The highest measurement was taken at site M-3, which had water levels that were so low that flow velocity could not be measured. Water samples taken during the dry season event at site M-3 had the highest total dissolved solid concentrations (3000 mg/L), total hardness (1600 mg/L) and sulfate (1400 mg/L) concentrations compared to all other sites. Since site M-3 has limited urban influence, it is not clear if the high conductivity was natural or influenced by runoff from agricultural or grazing land uses.

With the exception of copper, the dissolved metal concentrations from the Matadero and Barron Creek samples, adjusted for hardness, were significantly lower than the Freshwater Critierion Chronic Concentrations (CCC) presented in the California Toxics Rule (CTR) (Appendix F). Copper concentrations in water samples taken during the dry season at site B-1, adjusting for hardness, were 10.0 ug/L compared to 6.6 ug/L (adjusted for hardness) identified in the CTR. Neither Matadero nor Barron Creek water samples exhibited any detectable concentrations of organophosphate pesticides or toxicity at any of the sites during the two sampling events.

The results of the first year of BMI bioassessments and physical habitat assessments at the two sampling locations in Matadero Creek indicate that biological integrity is poor. Sites M-2 and M-4 exhibited very low scores of richness, composition and tolerance metrics, as well as low composite metric scores. Approximately 50% of the BMIs collected at these sites were segmented worms.

The physical habitat assessment shows poor substrate quality (composition and embeddedness) for the two sites. Both Matadero sites were very different than sites sampled during FY 04-05 in other watersheds, in that riffles were typically small changes in gradient that were typically clay bedrock that was frequently covered in algae or mats of willow roots. Substrate was infrequent at each riffle and when present, small in size (i.e., fines or gravel).

The overall physical habitat quality, however, was better than the substrate quality alone would indicate. Physical habitat total scores at M-2 and M-4 were 136 and 153, respectively, which is considered suboptimal (Barbour et al. 1999). The results of the habitat assessment are supported by the observations of an abundant population of native fishes. Although it is unknown what the reference condition would be for upper Matadero Creek, it is likely that the substrate condition observed at these two sites reflects the stream type (i.e., low gradient with limited riffle habitat) rather than habitat degradation. Using a multi-habitat approach for low gradient streams to sample BMI community may be more suitable for conducting future bioassessments in upper Matadero Creek.

5.2.2 Recreational Indicators

Bacterial indicators are nonpathogenic indicator organisms that are commonly used to indicate the potential presence of (human and nonhuman) fecal contamination. The correlation between bacterial indicator organisms and pathogens of public health concern is subject to debate. A majority of bacterial indicator concentrations collected by SCVURPPP were relatively elevated at most sites during most sampling events. However, it is important to note that when evaluating bacterial indicator data, one must take into consideration potential for human exposure to the water bodies of interest. Given water quality and exposure data, it may be possible to estimate the risk associated with human health. Microbial risk assessments typically involve characterizing both water quality and exposure, with regards to the specific pathogens of concern. However, with limited bacterial indicator data available, as is the case in Matadero Creek, one must determine if risk is high through less rigorous and more subjective methods.

Both contact (REC-1) and non-contact (REC-1) Uses for recreation have been designated for Matadero Creek. During field reconnaissance, site M-2 appeared to be used for water contact recreation. This site has good public access (Bol Park) and contains pools which may be suitable for swimming activities. There are several grade control structures that create water depths that are suitable for wading. During sampling events, families were observed using areas along the creek banks. In addition, a rope swing was observed at the site. Conversely, public access to site M-3 is likely limited, given that a large portion of the reach is fenced, densely vegetated and located on private property.

Results from this study indicate fecal coliform concentrations at site M-2 during the summer event were higher than the Basin Plan's Water Quality Objective (WQO) for water contact recreation. Fecal coliform concentrations in the water sample taken during the dry season event (>1600 MPN/100ml) was higher than the WQO listed for the 90th percentile (< 400 MPN/100ml). However, it is important to note that the WQO are based on a minimum of five consecutive samples equally spaced over a 30-day period. Similarly, enteroccocus concentrations in samples taken at site M-2 during both summer and wet events (1800 and 1200 MPN/100ml) were higher than the US EPA suggested bacteriological criteria for freshwater "infrequently used areas". All indicator bacteria concentrations enumerated from samples collected at site M-3 were below WOQs and US EPA suggested criteria.

Section 6.0

Sunnyvale East/ West Channel Watersheds

Results and Discussion

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6.1 Results

The following sections provide a brief summary of results for the Sunnyvale East and West Channel watersheds. Please note that water samples were only analyzed for physio-chemical and chemical parameters in these watersheds.

6.1.1 Physio-chemical Parameters

Physio-chemical measurements were made *in situ* during a total of six sampling events at three sites in FY 04-05. All measurements were taken during non-storm events in daylight hours.

Water temperatures in the Sunnyvale Channels ranged between 8.9 and 23.0^0 C (Table 13). The dissolved oxygen concentrations at all sites were greater than 7.7 mg/L, with most >10.0 mg/L. Conductivity ranged between 476 and 1008 uS/cm. The pH concentrations were between 7.38 and 9.00.

The average water velocity at all sites measured was 1.24 ft/sec during sampling events. Flow (velocity) measurements were unsuccessful at SU-2 (Sunnyvale East Channel at Daffodil Ct.) for both the dry season and the wet season event. The water sampled at this location was a stagnant to slow moving pool. Flow at this site generally appeared to be subsurface with the water percolating up into the observed pool and then flowing underground again. The channel bed was observed to be dry in both upstream and downstream of the pool.

6.1.2 Chemical Parameters

Water quality samples were collected at one site on Sunnyvale West Channel (SU-3) and two sites on Sunnyvale East Channel (SU-1 and SU-2) during two sampling events. Samples were analyzed for nutrients and anions, suspended sediment concentrations, total recoverable metals dissolved metals and organophosphate pesticides. All measurements were taken during non-storm events in daylight hours.

Total phosphorous and orthophosphate concentrations in Sunnyvale Channels ranged from 0.056 – 1.6 mg/L and 0.018 - 1.5 mg/L, respectively. Ammonia (as N) and nitrite concentrations were below reporting limits (0.10 mg/L), with the exception of Ammonia (as N) at site SU-2 during the wet season sampling event where a concentration of 0.56 mg/L was made. Nitrate concentrations ranged from 0.12 – 6.2 mg/L. Suspended sediment concentrations ranged between 1.2 and 73.5 mg/L.

Results for total recoverable and dissolved metals and organophosphate pesticides can be found in Table 13. No organophosphate pesticides were detected at any site during either sampling event.

6.2 Discussion

6.2.1 Aquatic Life Use Indicators

There are no designated Beneficial Uses for Sunnyvale East or West Channels in the Basin Plan. Both channels were artificially created in the early 1960's by the SCVWD in response to increasing frequency of flooding in the City of Sunnyvale. During the field reconnaissance in summer 2004, most of the channel consisted of long stagnant pools and/or glides with limited riffle habitat (mostly artificial substrate). Based on these observations it was determined that

Table 13. Water quality results for Sunnyvale East and West Channel watershed sites sampled in FY 04-05 by SCVURPPP.

	Sation[1]					
	SU-1		SU-2		SU-3	
Date	28-Sep-04	24-Jan-05	28-Sep-04	24-Jan-05	28-Sep-04	24-Jan-05
PHYSIO-CHEMICAL PARAMETERS						
Temperature (°C)	23.00	17.60	16.00	8.90	20.50	15.40
pH	8.35	8.51	7.38	8.83	9.00	8.80
Conductivity (µS/cm)	1008.00	914.00	476.00	391.00	933.00	878.00
Dissolved Oxygen (mg/L)	10.80	14.05	7.70	14.08	10.84	11.51
Velocity (ft/sec)	1.17	1.21	NM	NM	0.65	1.93
NUTRIENT AND ANIONS						
Orthophosphate-P (mg/L)	0.028	0.018	1.5	0.87	0.14	0.037
Total Phosphorus (mg/L)	0.16	0.064	1.6	0.99	0.34	0.056
Total Dissolved Solids (mg/L)	690	710	540	340	680	730
Total Organic Carbon (mg/L)	2	1.0U	29	9.2	3.9	1
Dissolved Organic Carbon (mg/L)	2	1.0U	29	7.6	4.1	1.0U
Total Ammonia as Nitrogen (mg/L)	0.10U	0.10U	0.10U	0.56	0.10U	0.10U
Total Kjeldahl Nitrogen (mg/L)	0.5	0.25	2.6	1.8	0.55	0.46
Nitrite Nitrogen (mg/L)	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U
Nitrate Nitrogen (mg/L)	5.9	6.2	0.12	2.8	2.8	3.9
Alkalinity as $CaCO_3$ (mg/L)	330	340	180	76	350	370
Total Hardness (mg/L)	470	470	200	120	460	490
Chloride (mg/L)	74	71	86	78	63	54
Sulfate (mg/L)	120	130	61	57	130	150
Chlorophyll (ug/L)	1.0U	1.4	41	1.6	1.8	2.7
SUSPENDED SEDIMENT CONCENTRATION						
Total Particulate Solids (mg/L)	4.7	1.2	73.5	5.1	6.1	2
Total Coarse (mg/L)	<1.0	<0.5	64.2	0.66	<1.0	<0.5
Total Fine (mg/L)	4.7	0.95	9.3	4.46	6.1	1.8
TOTAL RECOVERABLE METALS (ug/L)						
Aluminum	25U	25U	25U	25U	25U	25U
Arsenic	0.85	1.2	0.78	1.6	0.85	1.2
Boron	230	120	190	72	220	110
Cadmium	0.20U	0.20U	0.20U	0.20U	0.2	0.20U
Chromium	1.2J	1.0UJ	1.2	1.0U	1.0UJ	1.0UJ
Copper	1.4	2.4	5.1	3.3	6.2	1.1
Lead	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Manganese	4.7	5.2	29	16	16	12
Mercury	0.0016	0.0050U	0.0042	0.0068	0.0012	0.0050U
Nickel	4.2	2.4	6.7	2.0U	4.4	2.6
Selenium	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Silver	0.20U	0.20U	0.20U	0.20U	0.20U	0.20U
Zinc	7	5.7	33	21	29	7.6

Table 13. (Continued)

	Sation[1]					
	SU-1		SU-2		SU-3	
Date	28-Sep-04	24-Jan-05	28-Sep-04	24-Jan-05	28-Sep-04	24-Jan-05
DISSOLVED METALS (ug/L)						
Aluminum	25U	25U	25U	25U	25U	25U
Arsenic	0.62	0.82	0.88	1.2	0.88	1.2
Cadmium	0.2U	0.20U	0.2U	0.20U	0.2U	0.20U
Chromium	2.5J	2.5J	1.8	1.0U	2.3J	2.2J
Copper	1.0U	1.0U	3.6	2.9	3.8	1.0U
Lead	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Manganese	2.7	4.3	25	8.6	7.9	7.4
Nickel	3.7	2.5	6.7	2.0U	3.8	2.6
Selenium	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Silver	0.2U	0.20U	0.2U	0.20U	0.2U	0.20U
Zinc	5.0U	5.0U	20	13	5.0U	5.0U
ORGANOPHOSPHATE PESTICIDES (ug/L)						
Azinphos menthyl	0.16U	0.052U	0.16U	0.052U	0.16U	0.052U
Bolstar	0.057U	0.016U	0.057U	0.016U	0.057U	0.016U
Coumaphos	0.080U	0.071U	0.080U	0.071U	0.080U	0.071U
Demeton O&S	0.23U	0.010U	0.23U	0.010U	0.23U	0.010U
Diazinon	0.036U	0.017U	0.036U	0.017U	0.036U	0.017U
Dichlorvos	0.032U	0.021U	0.032U	0.021U	0.032U	0.021U
Disulfoton	0.039U	0.015U	0.039U	0.015U	0.039U	0.015U
Chlorpyrifos (Dursban)	0.035U	0.018U	0.035U	0.018U	0.035U	0.018U
Ethoprop	0.041U	0.026U	0.041U	0.026U	0.041U	0.026U
Fensulfothion	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U
Fenthion	0.014U	0.015U	0.014U	0.015U	0.014U	0.015U
Merphos	0.022U	0.030U	0.022U	0.030U	0.022U	0.030U
Mevinphos	0.075U	0.098U	0.075U	0.098U	0.075U	0.098U
Parathion methyl	0.041U	0.020U	0.041U	0.020U	0.041U	0.020U
Phorate	0.050U	0.016U	0.050U	0.016U	0.050U	0.016U
Ronnel	0.020U	0.011U	0.020U	0.011U	0.020U	0.011U
Stirophos	0.022U	0.030U	0.022U	0.030U	0.022U	0.030U
Tokuthion (Prothiofos)	0.037U	0.016U	0.037U	0.016U	0.037U	0.016U
Trichloronate	0.032U	0.026U	0.032U	0.026U	0.032U	0.026U
Ethion	0.012U	0.021U	0.012U	0.021U	0.012U	0.021U
Malathion	0.032U	0.026U	0.032U	0.026U	0.032U	0.026U
Parathion-ethyl	0.013U	0.017U	0.013U	0.017U	0.013U	0.017U

1= Refer to Table 1 for station locations.
J= The result is an estimated quantity.
J-= The result is an estimated quantity but result may be biased low.
R= The data are unusable (the analyte may or may not be present).
U= Not measured above reported sample reporting limit (Diazinon not measured above reported sample detection limit).
UJ= Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NR = Not receorded
NA = Creek Dry, no samples taken.
− = Not sampled for selected analyte.

neither channel appeared to have suitable enough habitat to warrant a fish or BMI bioassessment.

Physical and chemical water quality sampling results in Sunnyvale East and West Channels during FY 04-05 indicate ambient water quality generally met the Water Quality Objectives (WQO) identified in the Basin Plan. The D.O. measurements ranged from 7.7 to 10.8 mg/L during the dry season and ranged from 11.51 to 14.08 mg/L during the wet season. Conductivity measurements at site SU-1 and SU-3 were generally high, ranging from 933 – 1008 uS/cm during the dry season and 878 – 914 uS/cm during the wet season. Suspended sediment concentrations were high at site SU-2 (73.5 mg/L Total Particulate Solids) during the dry season, but much lower (5.1 mg/L) during the wet season.

The dissolved metal concentrations from the Sunnyvale East and West Channel samples, adjusted for hardness, were lower than the Freshwater Critierion Chronic Concentrations (CCC) presented in the California Toxics Rule (CTR) (Appendix F). None of the water samples exhibited any detectable concentrations of organophosphate pesticides at any of the sites during the two sampling events.

6.2.2 Recreational Indicators

During field reconnaissance it was determined that a lack of public access (i.e., no public parks and or fences along the creek banks) and deep water would result in a low risk of exposure during contact water recreation. As a result, water samples were not analyzed for bacterial indicators.

Section 7.0

Calabazas Creek Watershed

Results and Discussion

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7.1 Results

The following sections provide a brief summary of results of water quality monitoring data collected from the Calabazas Creek watershed in FY 04-05.

7.1.1 Physio-chemical Parameters

Physio-chemical measurements were made *in situ* during a total of eleven sampling events at five sites in the Calabazas Creek watershed. All measurements were taken during non-storm events in daylight hours.

Water temperatures in Calabazas Creek sampling sites ranged between 7.0 and 24.3^0 C (Table 14). The dissolved oxygen concentrations (D.O.) at all sites were greater than 8.35 mg/L, with a majority above 10.0 mg/L. Dissolved oxygen measurements at C-1 (Calabazas Creek at Arques Ave) were greater than the meter could measure (upper limit of the dissolved oxygen meter is >20 mg/L). This site had a high amount of algae growth in a very shallow stream (~0.25 inches deep) and oxygen was visibly degassing and forming bubbles around the algae.

Conductivity ranged between 388 and 1137 uS/cm, with a vast majority of measurements < 500 uS/cm. The pH concentrations were between 7.75 and 9.17. The average water velocity at all sites measured was 2.12 ft/sec during sampling events.

7.1.2 Chemical Parameters

Water quality samples were collected at three sites on Calabazas Creek (C-1, C-3 and C-5) during two sampling events. Samples were analyzed for nutrients and anions, suspended sediment concentrations, total recoverable metals dissolved metals and organophosphate pesticides. All measurements were taken during non-storm events in daylight hours.

Total phosphorous and orthophosphate concentrations in Calabazas Creek ranged from 0.08 – 0.39 mg/L and 0.032 – 0.079 mg/L, respectively (Table 12). Ammonia (as N) and nitrite concentrations were below reporting limits (0.10 mg/L), and nitrate concentrations ranged from 0.14 – 2.6 mg/L. Suspended sediment concentrations ranged between 1.1 and 7.7 mg/L.

Only water samples from C-1 and C-3 were analyzed for total recoverable and dissolved metals and organophosphate pesticides (see Table 14). No organophosphate pesticides were detected during either sampling event.

7.1.3 Aquatic Toxicity

Three species bioassays were conducted on samples collected from site C-1 and C-3 on Calabazas Creek during two sampling events. Water samples collected from site C-1 during the wet season sampling event inhibited the survival and reproduction of *Ceriodaphia dubia* , and inhibited the growth of *Selanastrum capricortum*. No toxic effects on *Pimephales promelas* were observed during either sampling event. A full tabulation toxicity testing results can be found in Table 15.

Table 14. Water quality results for Calabazas Creek watershed sites sampled in FY 04-05 by SCVURPPP.

	Station[1]									
	C-1		**C-2**	**C-3**			**C-4**	**C-5**		
Date	5-Oct-04	31-Jan-05	19-Apr-05	5-Oct-04	31-Jan-05	19-Apr-05	19-Apr-05	5-Oct-04	31-Jan-05	21-Apr-05
PHYSIO-CHEMICAL PARAMETERS										
Temperature (°C)	24.3	16.1	10.3	16.7	7.0	14.6	15.0	14.5	7.3	13.9
pH	9.17	8.82	8.1	8.24	8.19	8.38	8.19	8.05	7.92	7.75
Conductivity (µS/cm)	892	772	403.8	388	485	465	467	1137	470	667
Dissolved Oxygen (mg/L)	>20*	11.50	11.14	9.05	11.44	10.27	10.02	8.36	11.38	9.35
Velocity (ft/sec)	1.1	1.8	3.2	1.21	1.3	3.6	4.2	0.29	1.27	3.2
NUTRIENT AND ANIONS										
Orthophosphate-P (mg/L)	0.032	0.052	-	0.061	0.079	-	-	0.044	0.045	-
Total Phosphorus (mg/L)	0.23	0.39	-	0.08	0.14	-	-	0.078	0.12	-
Total Dissolved Solids (mg/L)	560	500	-	260	450	-	-	860	440	-
Total Organic Carbon (mg/L)	3	2.5	-	4.8	4.2	-	-	4.8	4	-
Dissolved Organic Carbon (mg/L)	3.6	2.4	-	4.1	4	-	-	3.8	3.9	-
Total Ammonia as Nitrogen (mg/L)	0.10U	0.10U	-	0.10U	0.10U	-	-	0.10U	0.10U	-
Total Kjeldahl Nitrogen (mg/L)	0.54	0.55	-	0.4	0.52	-	-	0.38	0.4	-
Nitrite Nitrogen (mg/L)	0.10U	0.10U	-	0.10U	0.10U	-	-	0.10U	0.10U	-
Nitrate Nitrogen (mg/L)	2.1	2.6	-	0.14	0.47	-	-	0.35	0.45	-
Alkalinity as $CaCO_3$ (mg/L)	310	270	-	100	260	-	-	500	270	-
Total Hardness (mg/L)	390	330	-	120	290	-	-	590	280	-
Chloride (mg/L)	67	47	-	59	45	-	-	130	37	-
Sulfate (mg/L)	87	73	-	34	58	-	-	110	59	-
Chlorophyll (ug/L)	6.8	2.2	-	4.1	1.2	-	-	1.8	2	-
SUSPENDED SEDIMENT CONCENTRATION			-			-	-			-
Total Particulate Solids (mg/L)	2.8	1.1	-	3.4	2	-	-	2	7.7	-
Total Coarse (mg/L)	1.3	0.3	-	1.4	0.3	-	-	0.6	3.7	-
Total Fine (mg/L)	1.5	0.83	-	2	1.65	-	-	1.4	4.04	-
TOTAL RECOVERABLE METALS (ug/L)			-			-	-			-
Aluminum	25U	25U	-	47	47	-	-	-	-	-
Arsenic	0.92	2.1	-	1.9	2.5	-	-	-	-	-
Boron	290	220	-	120	340	-	-	180	410	-
Cadmium	0.20U	0.20U	-	0.20U	0.20U	-	-	-	-	-
Chromium	1.0U	1.1J	-	1.0U	1.1J	-	-	-	-	-
Copper	3	1.8	-	2.2	2.1	-	-	-	-	-
Lead	1.0U	1.0U	-	1.0U	1.0U	-	-	-	-	-
Manganese	3.7	6.6	-	6.8	3.2	-	-	-	-	-
Mercury	0.0085	0.0050U	-	0.0057	0.0050U	-	-	-	-	-
Nickel	2.4	2.5	-	2.0U	3.3	-	-	-	-	-
Selenium	1.0U	1.0U	-	1.0U	1.0U	-	-	-	-	-
Silver	0.20U	0.20U	-	0.73J	0.20U	-	-	-	-	-
Zinc	5.0U	9.4	-	5.0U	6.1	-	-	-	-	-

Table 14. (Continued)

	Station[1]									
	C-1		C-2	C-3			C-4	C-5		
Date	5-Oct-04	31-Jan-05	19-Apr-05	5-Oct-04	31-Jan-05	19-Apr-05	19-Apr-05	5-Oct-04	31-Jan-05	21-Apr-05
DISSOLVED METALS (ug/L)			-			-	-			-
Aluminum	25U	25U	-	25U	25U	-	-	-	-	-
Arsenic	0.7	2.2	-	2	2.6	-	-	-	-	-
Cadmium	0.20U	0.20U	-	0.20U	0.20U	-	-	-	-	-
Chromium	1.5	4.3J	-	1.0U	3.3J	-	-	-	-	-
Copper	2.5	1.6	-	1.7	1.8	-	-	-	-	-
Lead	1.0U	1.0U	-	1.0U	1.0U	-	-	-	-	-
Manganese	1.2J-	5.1	-	1.0UJ	1.5	-	-	-	-	-
Nickel	2.3	2.3	-	2.0U	2.1	-	-	-	-	-
Selenium	1.0U	1.0U	-	1.0U	1.0U	-	-	-	-	-
Silver	0.20U	0.20U	-	0.20U	0.20U	-	-	-	-	-
Zinc	5.0U	5.0U	-	5.0U	5.0U	-	-	-	-	-
ORGANOPHOSPHATE PESTICIDES (ug/L)			-			-	-			-
Azinphos menthyl	0.16U	0.052U	-	0.16U	0.052U	-	-	-	-	-
Bolstar	0.057U	0.016U	-	0.057U	0.016U	-	-	-	-	-
Coumaphos	0.080U	0.071U	-	0.080U	0.071U	-	-	-	-	-
Demeton O&S	0.23U	0.010U	-	0.23U	0.010U	-	-	-	-	-
Diazinon	0.036U	0.017U	-	0.036U	0.017U	-	-	-	-	-
Dichlorvos	0.032U	0.021U	-	0.032U	0.021U	-	-	-	-	-
Disulfoton	0.039U	0.015U	-	0.039U	0.015U	-	-	-	-	-
Chlorpyrifos (Dursban)	0.035U	0.018U	-	0.035U	0.018U	-	-	-	-	-
Ethoprop	0.041U	0.026U	-	0.041U	0.026U	-	-	-	-	-
Fensulfothion	0.10U	0.10U	-	0.10U	0.10U	-	-	-	-	-
Fenthion	0.014U	0.015U	-	0.014U	0.015U	-	-	-	-	-
Merphos	0.022U	0.030U	-	0.022U	0.030U	-	-	-	-	-
Mevinphos	0.075U	0.098U	-	0.075U	0.098U	-	-	-	-	-
Parathion methyl	0.041U	0.020U	-	0.041U	0.020U	-	-	-	-	-
Phorate	0.050U	0.016U	-	0.050U	0.016U	-	-	-	-	-
Ronnel	0.020U	0.011U	-	0.020U	0.011U	-	-	-	-	-
Stirophos	0.022U	0.030U	-	0.022U	0.030U	-	-	-	-	-
Tokuthion (Prothiofos)	0.037U	0.016U	-	0.037U	0.016U	-	-	-	-	-
Trichloronate	0.032U	0.026U	-	0.032U	0.026U	-	-	-	-	-
Ethion	0.012U	0.021U	-	0.012U	0.021U	-	-	-	-	-
Malathion	0.032U	0.026U	-	0.032U	0.026U	-	-	-	-	-
Parathion-ethyl	0.013U	0.017U	-	0.013U	0.017U	-	-	-	-	-
BACTERIAL INDICATORS										
Total Coliform (MPN/100 mL)	-	-	-	≥1600	1600	-	-	≥1600	920	-
Fecal Coliform (MPN/100 mL)	-	-	-	900	170	-	-	900	920	-
Enterococus (CFU/100 mL)	-	-	-	340	600	-	-	560	500	-

* = >20 mg/L is the upper limit of the Dissolved Oxygen Meter.
1= Refer to Table 1 for station locations.
J= The result is an estimated quantity.
J-= The result is an estimated quantity but result may be biased low.
R= The data are unusable (the analyte may or may not be present).
U= Not measured above reported sample reporting limit (Diazinon not measured above reported sample detection limit).
UJ= Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Table 15. Summary of bioassay results from the Calabazas Creek watershed.

Site	Date	Survival			Growth/Reproduction				
		NOEC	LOEC	LC_{50}	NOEC	LOEC	IC_{50}	IC_{25}	IC_{10}
Ceriodaphnia dubia									
C-1	5-Oct-2005	100	>100	>100	100	>100	>100	>100	>100
	31-Jan-2005	50	100	81.2	50	100	76.3	61.9	53.2
C-3	5-Oct-2005	100	>100	>100	100	>100	>100	>100	>100
	31-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
Pimephales promelas									
C-1	5-Oct-2005	100	>100	>100	100	>100	>100	>100	>100
	31-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
C-3	5-Oct-2005	100	>100	>100	100	>100	>100	>100	>100
	31-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
Selenastrum capricornutum									
C-1	5-Oct-2005	NA	NA	NA	100	>100	>100	>100	>100
	31-Jan-2005	NA	NA	NA	50	100	80.7	65.4	56.2
C-3	5-Oct-2005	NA	NA	NA	100	>100	>100	>100	>100
	31-Jan-2005	NA	NA	NA	100	>100	>100	>100	>100

Values are Percent Sample
NOEC = Highest Test Concentration Not Producing a Statistically Significant Reduction in Survival or Fertilization.
LOEC = Lowest Test Concentration Producing a Statistically Significant Reduction in Survival or Fertilization.
LC_{50} = Median (50%) Lethal Concentration.
IC_{50} = Concentration Inhibitory to Reproduction by 50% (Median).
IC_{25} = Concentration Inhibitory to Reproduction by 25%.
IC_{10} = Concentration Inhibitory to Reproduction by 10%.
NA = Not Applicable.

7.1.4 Indicator Bacteria

Water column samples were collected during two sampling events from two sites on Calabazas Creek (C-3 and C-5) where water contact recreation may potentially occur. Samples were analyzed for total coliforms, fecal coliforms and enterococcus. During the first sampling event, total, fecal and enterococcus concentrations were >1600 MPN/100 mL, 900 MPN/100 mL and 340 CFU/100 mL, respectively for site C-3; and, >1600 MPN/100 mL, 900 MPN/100 mL and

560 CFU/100 mL, respectively for site C-5. Concentrations enumerated from samples collected during the second sampling event were less than or equal to concentrations from the first event for all three organisms. Results are presented in Table 14.

7.1.5 Bioassessments

7.1.5.1 Benthic Macroinvertebrates

A total of 2,432 benthic macroinvertebrates (BMIs) were processed from the four reaches (i.e., sites) sampled in Calabazas Creek. BMIs identified were comprised of 35 distinct taxa. The evaluation of these data was conducted by reviewing metric values, composite metric scores, dominant taxa, and BMI composition similarity. The following paragraphs briefly describe the results of BMI bioassessments conducted in FY 04-05 (i.e., Spring 2005).

<u>Metrics</u>

Complete results for the ten selected metrics generated from the BMI data set are provided in Appendix B. Summary results for the five major types of metrics are presented below for Calabazas Creek.

Richness – In contrast to other watershed sampled in FY 04-05, site richness metric did not increase with increasing site elevation in the Calabazas Creek watershed. The highest values for Taxa (21) and EPT (7) Richness occurred at site C-2 and C-5, respectively. The lowest values for Taxa Richness (13) occurred at site C-3 and EPT Richness (1) occurred at the lower two sampling sites (C-2 and C-3) in Calabazas Creek.

Composition - EPT Index values ranged from 26% to 81% and sensitive EPT values ranged from 0 % to 4.7%, with the highest values occurring at site C-5 and the lowest value occurring at site C-2.

Shannon Diversity Index values are affected by taxonomic richness and the distribution of individuals among the taxa. The Shannon Diversity values may range from 0 to 3.3 (natural log), with the higher diversity values being indicative of greater stream health. Interestingly, Shannon Diversity values were highest (2.0) at C-2, the lowest site in the watershed, and lowest (0.9) at C-4. The Calabazas Creek sites with low Shannon Diversity values generally had high Percent Dominant Taxon values (range: 26 to 76) due to high abundance of *Baetis* mayflies.

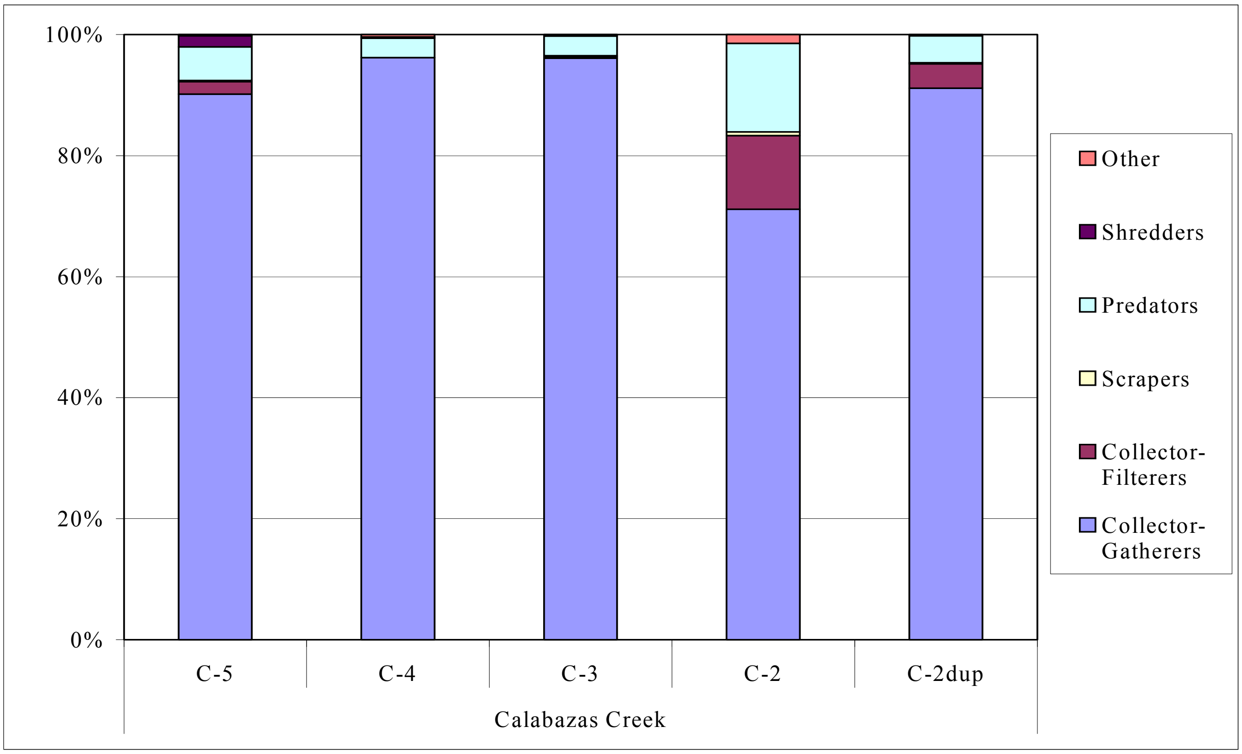
Another measure of composition characteristics is Percent Dominant Taxon. Unlike the previous metrics, a higher Percent Dominant Taxon value often indicates a more disturbed environment. Percent Dominant Taxon values ranged from 26% to 76% with the lowest percentage occurring at C-2.

Tolerance Measures- In the Calabazas Creek watershed, weighted Mean Tolerance values ranged from 4.9 to 5.5 (on a scale from 0 to 10, 10 having the greatest tolerance). Percent Intolerant Organism values ranged from 0% to 4.7%, with the highest value occurring at site C-5 and the lowest value occurring at sites C-2 and C-3. Percent Tolerant Organism values were below 4.1% for all sites.

Functional Feeding Groups – The percentage of organisms in different functional feeding groups were generally consistent among Calabazas Creek sites, as collector-gatherers comprised over 90% of the FFGs at the sites except for site C-2 (Figure 9). Site C-2 had a relatively large percentage of predators (12%) compared to other sites. Generally, FFGs other than collector-gatherers were poorly represented at the sites.

Abundance - The mean BMI abundance per ft^2 estimated from Adobe Creek samples was 164 and ranged from 52 at site C-3 to 256 at site C-4.

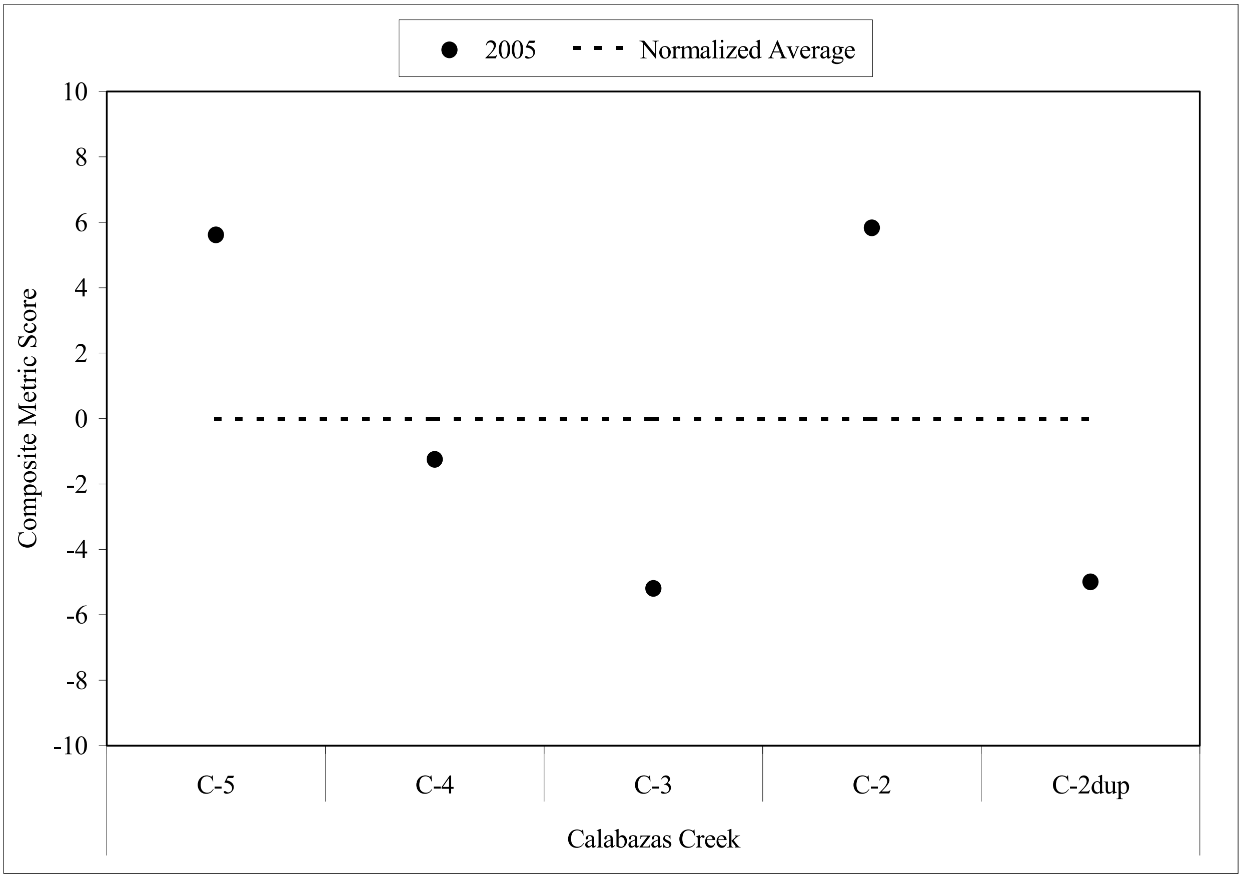
Figure 9. Percentages of benthic macroinvertebrates distributed among six functional feeding groups from Calabzas Creek sites (dup = duplicate sample).



Composite Metric Scores

A plot of composite metric scores is shown in Figure 10 for the Calabazas Creek sites. The plot shows relative dissimilarity among the sites but the range of composite metric scores was relatively low compared to other watersheds sampled in FY 04-05. The low range of composite metric scores indicates a similar range of metric values for the sites. Note that the duplicate composite sample collected at site C-2 grouped more closely to site C-3. Site C-2's duplicate sample contained nearly 70% *Baetis* mayflies, which more closely approximated the percentage of *Baetis* mayflies sampled from sites C-3, C-4 and C-5 (range: 58% to 75%); site C-2 contained 26% *Baetis* mayflies.

Figure 10. Composite metric scores for Calabazas Creek sites (Year 2005).



Dominant Taxa Composition

High numerical abundances of midges (Orthocladiinae and Tanytarsini), baetid mayflies (*Baetis*) and segmented worms (Naididae) contributed to the low composite metric scores for sites A-2 and A-3 (Table 16). The riffle beetle, *Optioservus*, and chloroperlid stonefly, *Sweltsa*, were dominant at sites A-4 and A-5, respectively. Numerically dominant non-baetid EPT taxa were absent from all sites except site A-5 where *Sweltsa* comprised 13% of the BMIs sampled. Segmented worms (Naididae and/or Enchytraeidae) were numerically dominant in all samples except site A-5.

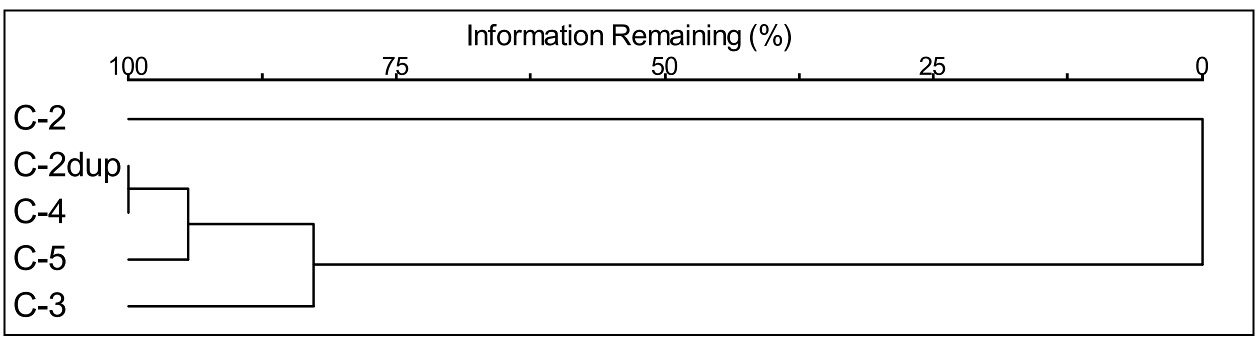
Table 16. Numerically dominant macroinvertebrate taxa and their percent relative abundance for Calabazas Creek sites (2005).

Site	Dominant Taxa				
	1	2	3	4	5
C-2	*Baetis* 26%	Orthocladiinae 22%	Naididae 20%	*Simulium* 12%	Planariidae 6%
C-2dup	*Baetis* 68%	Orthocladiinae 17%	Naididae 4%	*Simulium* 4%	*Torrenticola* 1%
C-3	*Baetis* 63%	Orthocladiinae 23%	Naididae 8%	*Bezzia/ Palpomyia* 2%	Tanytarsini 1%
C-4	*Baetis* 75%	Orthocladiinae 17%	Naididae 3%	*Bezzia/ Palpomyia* 2%	Tanytarsini 1%
C-5	*Baetis* 76%	Orthocladiinae 11%	*Bezzia/ Palpomyia* 2%	*Simulium* 2%	*Suwallia* 2%

Taxonomic Similarity

Figure 11 shows relative site similarity for Calabazas Creek sites as a function of BMI taxonomic composition. Site dissimilarity increases as links are made from left to right. The cluster dendrogram (Figure 10) supports the distribution of dominant taxa shown in Table 14 where *Baetis* mayflies comprised 60% to 76% of individuals at all sites except site C-2 where *Baetis* mayflies comprised 26% of the BMIs. Dominant taxa were similar for the sites but differences in the number of individuals within the taxonomic groups at site C-2 contributed to its separation from the other sites, and its duplicate sample.

Figure 11. Dendrogram showing degree of site similarity based on the composition of benthic macroinvertebrates sampled from Calabazas Creek, 2005.



4.1.6 Physical Habitat Assessments

A summary of physical habitat results for the four reaches where BMI bioassessments were conducted are provided in Appendix D. Habitat assessment results for each of the parameters and riffle habitat measurements are also presented in Appendix E.

The Calabazas Creek sites were moderately to densely canopied with intact to moderately impacted riparian zones. Site habitat quality scores can range from 0-200 (200 having the greatest quality habitat). Habitat quality scores in Calabazas creek ranged from 67 at site C-3 to 120 at site C-5. Scores of 50 or less would imply poor habitat, scores greater than 50 to 100 would imply marginal habitat, scores greater than 100 to 150 would imply suboptimal habitat, and scores greater than 150 would imply optimal habitat (Barbour et al. 1999).

Substrate quality scores, ranging from 0 (poor quality) to 20 (high quality), integrate embeddedness and substrate complexity for estimating epifaunal colonization potential. Substrate quality scores for Calabazas Creek sites ranged from 5.3 at C-3 to 8.7 at C-4. Substrate composition of the sites was gravel dominant with moderate embeddedness. Site C-3 exhibited a larger proportion of fine (<2mm) substrate (18%) than any other site. Stream gradients for the sites ranged from 0.7 to 2.0 percent.

7.2 Discussion

7.2.1 Aquatic Life Use Indicators

The Basin Plan designates both COLD, WARM and WILD Beneficial Uses in Calabazas Creek. The field reconnaissance in summer 2004, indicated that significant sections of Calabazas Creek between Creekside Park (C-2) and the headwater reaches above Pierce Road (C-5) exhibited intermittent flow with limited number of pools that could provide fish with refuge during the dry season. During the field reconnaissance and BMI bioassessments, no fish were observed in the creek. Only three fish species were documented during previous electrofishing fish surveys in Calabazas Creek (Abel 2003), with one native species that was presumed to have been colonized from imported water. Based on these observations in the field and existing information, it was determined that Calabazas Creek did not have suitable enough habitat to warrant a fish survey.

Abel (2003) concluded that lack of refuge from high wet flows and lack of suitable habitat likely results in fish species being extirpated frequently in Calabazas Creek. The presence of multiple types of barriers (i.e., high and/or low flow conditions, dryback zones, physical barriers) inhibits recolonization to the reaches above Miller Avenue. Recolonization may be more feasible in the lower reaches that do not regularly dry back and which have access to other systems. The channel between Highway 101 and Miller Avenue is predominantly hardscaped, however, and is not highly suitable for recolonization to upstream reaches. As a result, current conditions in Calabazas Creek appear to not support COLD or WARM Uses.

Physical and chemical water quality sampling results during FY 04-05 indicate ambient water quality generally met the Water Quality Objectives (WQO) identified in the Basin Plan (SFBRWQCB 1995). The dissolved oxygen (D.O.) recorded during the summer season for Calabazas Creek ranged from 8.36 to > 20 mg/L during the water quality study, and 9.4 to 11.0 mg/L during the BMI bioassessment sampling, both of which are higher than the WQO for warm water (5.0 mg/L) and cold water (7.0 mg/L) habitat. All pH measurements were within the WQO (6.5 to 8.5), with the exception of site C-1. The pH measured at site C-1 during the dry and wet season was 9.17 and 8.82, both of which were slightly higher than the Basin Plan WQO of 8.5.

The dissolved metal concentrations from the Calabazas Creek water samples, adjusted for hardness, were lower than the Freshwater Critierion Chronic Concentrations (CCC) presented in the California Toxics Rule (CTR) (Appendix F). The Calabazas Creek water samples did not exhibited any detectable concentrations of organophosphate pesticides, although slight toxicity was observed at site C-1 during the wet season sampling event.

The results of the first year of BMI bioassessments and physical habitat assessments at the four sampling locations in Calabazas Creek indicate that biological integrity is poor. All of the sites exhibited very low scores of richness, composition and tolerance metrics, as well as low composite metric scores. Segmented worms (Naididae and/or Enchytraeidae) were numerically dominant at all sites except C-5.

The physical habitat assessment shows poor substrate quality (composition and embeddedness) for the four sites sampled. All of the sites exhibited predominately small substrate that was moderately embedded. In addition, substrate in the riffles had low consolidation, indicating high bed mobility. Physical habitat scores in the lower three sites ranged from 67 – 109, which is considered marginal condition. The low scores were highly influence by lack of habitat complexity and significant bank erosion areas. At this time it is difficult to determine to what degree the low biological integrity was the result of poor habitat versus intermittent flow conditions.

7.2.2 Recreational Use Indicators

Bacterial indicators are nonpathogenic indicator organisms that are commonly used to indicate the potential presence of (human and nonhuman) fecal contamination. The correlation between bacterial indicator organisms and pathogens of public health concern is subject to debate. A majority of bacterial indicator concentrations collected by SCVURPPP were relatively elevated at most sites during most sampling events. However, it is important to note that when evaluating bacterial indicator data, one must take into consideration potential for human exposure to the water bodies of interest. Given water quality and exposure data, it may be possible to estimate the risk associated with human health. Microbial risk assessments typically involve characterizing both water quality and exposure, with regards to the specific pathogens of concern. However, with limited bacterial indicator data available, as is the case in Calabazas Creek, one must determine if risk is high through less rigorous and more subjective methods.

Both contact (REC-1) and non-contact (REC-2) beneficial uses for recreation are designated for Calabazas Creek in the Basin Plan. Indicator bacteria were collected at two sites (C-3 and C-5) in Calabazas Creek in FY 04-05. Site C-4 is located in Calabazas Park, which has good public access to the creek, however, no deep pools were observed suitable for swimming activities. Site C-6 was nearly dry during summer season and also had no deep pools considered suitable for swimming activities.

Although it appears that REC-1 Uses were not present at either sampling site during FY 04-05, screening level data collected was compared to both REC-1 REC-2 WQOs listed in the Basin Plan. The limited indicator bacteria data for fecal coliforms were slightly above the WQO[12] for water contact recreation, but below the WQO for non-contact recreation at both sites. In addition, enterococcus data collected both sites were slightly above the US EPA's suggested bacteriological criteria for "infrequently used areas".

[12] It is important to note that the WQO are based on a minimum of five consecutive samples equally spaced over a 30-day period.

Section 8.0

San Tomas Aquino Creek Watershed

Results and Discussion

8.1 Results

The following sections provide a brief summary of results of water quality monitoring data collected from the water bodies in the San Tomas Aquino Creek watershed in FY 04-05 (i.e., San Tomas and Saratoga Creeks).

8.1.1 Physio-chemical Parameters

Physio-chemical measurements were made *in situ* during a total of 21 sampling events at 10 sites in the San Tomas Aquino Creek watershed (8 on Saratoga Creek and 2 on San Tomas Aquino Creek). All measurements were taken during non-storm events in daylight hours.

Water temperatures in San Tomas Aquino Creek sampling sites ranged between 7.8 and 18.5^0 C (Table 17). The dissolved oxygen concentrations (D.O.) at all sites were greater than 7.5 mg/L, with a majority above 10.0 mg/L. Conductivity ranged between 262 and 1149 uS/cm, with a vast majority of measurements < 500 uS/cm. The pH concentrations were between 7.05 and 8.4. The average water velocity at all sites measured was 2.49 ft/sec during sampling events.

8.1.2 Chemical Parameters

Water quality samples were collected at three sites on Saratoga Creek (S-1, S-4 and S-6) and one site on San Tomas Aquino Creek (ST-1) during two sampling events. Samples were analyzed for nutrients and anions, suspended sediment concentrations, total recoverable metals dissolved metals and organophosphate pesticides. All measurements were taken during non-storm events in daylight hours.

Total phosphorous and orthophosphate concentrations in Saratoga and San Tomas Aquino Creeks ranged from 0.035 – 0.15 mg/L and 0.01 – 0.066 mg/L, respectively (Table 15). Ammonia (as N) and nitrite concentrations were below reporting limits (0.10 mg/L), and nitrate concentrations ranged from 0.15 – 1.3 mg/L. Suspended sediment concentrations ranged between <1.0 and 7.6 mg/L.

Only water samples from site ST-1 were analyzed for total recoverable and dissolved metals and organophosphate pesticides (see Table 17). No organophosphate pesticides were detected during either sampling event.

8.1.3 Aquatic Toxicity

Three species bioassays were conducted on samples collected from site ST-1 on San Tomas Aquino Creek during two sampling events. Water samples collected from site ST-1 during the dry season sampling event inhibited the growth of *Selanastrum capricortum*. No toxic effects to either *Ceriodaphnia dubia* or *Pimephlaes promelas* were observed during either sampling event. A full tabulation of toxicity testing results can be found in Table 18.

Table 17. Water quality results for San Tomas Aquino Creek watershed sites sampled in FY 04-05 by SCVURPPP.

	Station[1]																				
	S-1		S-2	S-3	S-4				S-5		S-6				S-7		S-8		ST-1		ST-3
Date	5-Oct-04	31-Jan-05	21-Apr-05	14-Apr-05	5-Oct-04	7-Oct-04	31-Jan-05	14-Apr-05	7-Oct-04	21-Apr-05	5-Oct-04	7-Oct-04	31-Jan-05	22-Apr-05	7-Oct-04	22-Apr-05	8-Oct-04	22-Apr-05	5-Oct-04	31-Jan-05	21-Apr-05
PHYSIO-CHEMICAL PARAMETERS																					
Temperature (°C)	18.2	9.3	10.4	8.5	15.4	16.5	8.5	10.5	17.0	11.2	14	15.7	7.8	10.1	14.3	10.6	13.1	11.1	18.5	13.9	12.8
pH	7.9	7.93	8.2	7.72	8.12	8.4	8.13	7.44	8.2	7.56	7.78	8.4	7.83	7.3	8.4	7.58	8.4	7.05	8.23	8.41	8.14
Conductivity (µS/cm)	1149	400	326.4	293.4	481	640	285	310.5	580	318	409	560	263	304	470	284.1	470	262	956	604	445.8
Dissolved Oxygen (mg/L)	8.46	10.20	10.62	11.09	9.35	7.8	11.47	10.39	7.5	10.47	9.80	8.1	11.45	10.61	9.2	10.51	9.4	9.95	12.10	10.36	10.55
Velocity (ft/sec)	0.18	1.4	2.7	3.1	0.2	NR	2.25	5.1	4.1	NR	0.34	NR	2.05	3.6	NR	4.7	NR	3.4	0.3	1.05	2.9
NUTRIENT AND ANIONS																					
Orthophosphate-P (mg/L)	0.01U	0.059	-	-	0.04	-	0.054	-	-	-	0.066	-	0.058	-	-	-	-	-	0.034	0.052	-
Total Phosphorus (mg/L)	0.035	0.15	-	-	0.062	-	0.14	-	-	-	0.094	-	0.13	-	-	-	-	-	0.067	0.17	-
Total Dissolved Solids (mg/L)	830	380	-	-	350	-	280	-	-	-	300	-	270	-	-	-	-	-	720	490	-
Total Organic Carbon (mg/L)	2.9	1.9	-	-	1.6	-	1.7	-	-	-	1.6	-	1.7	-	-	-	-	-	2.7	1.8	-
Dissolved Organic Carbon (mg/L)	2.6	1.8	-	-	1.5	-	1.6	-	-	-	1.3	-	1.7	-	-	-	-	-	3.3	1.8	-
Total Ammonia as Nitrogen (mg/L)	0.10U	0.10U	-	-	0.10U	-	0.10U	-	-	-	0.10U	-	0.10U	-	-	-	-	-	0.10U	0.10U	-
Total Kjeldahl Nitrogen (mg/L)	0.34	0.3	-	-	0.26	-	0.3	-	-	-	0.17	-	0.2	-	-	-	-	-	0.42	0.4	-
Nitrite Nitrogen (mg/L)	0.10U	0.10U	-	-	0.10U	-	0.10U	-	-	-	0.10U	-	0.10U	-	-	-	-	-	0.10U	0.10U	-
Nitrate Nitrogen (mg/L)	1.1	0.7	-	-	0.46	-	0.25	-	-	-	0.23	-	0.15	-	-	-	-	-	1.3	1.3	-
Alkalinity as $CaCO_3$ (mg/L)	490	200	-	-	200	-	160	-	-	-	190	-	150	-	-	-	-	-	440	280	-
Total Hardness (mg/L)	640	250	-	-	240	-	180	-	-	-	210	-	170	-	-	-	-	-	550	340	-
Chloride (mg/L)	85	25	-	-	45	-	14	-	-	-	30	-	10	-	-	-	-	-	69	37	-
Sulfate (mg/L)	130	62	-	-	46	-	46	-	-	-	42	-	45	-	-	-	-	-	120	77	-
Chlorophyll (ug/L)	1.2	1.0U	-	-	1.0U	-	1.6	-	-	-	1	-	1.0U	-	-	-	-	-	4.7	2.2	-
SUSPENDED SEDIMENT CONCENTRATION			-	-		-		-	-	-		-		-	-	-	-	-			-
Total Particulate Solids (mg/L)	<2.0	2.6	-	-	<1.0	-	2.9	-	-	-	7.6	-	2.9	-	-	-	-	-	2.7	2.8	-
Total Coarse (mg/L)	<1.0	0.5	-	-	<1.0	-	0.5	-	-	-	3.7	-	0.5	-	-	-	-	-	<1.0	1.3	-
Total Fine (mg/L)	<1.0	2.1	-	-	<1.0	-	2.44	-	-	-	4	-	2.42	-	-	-	-	-	2.3	1.48	-
TOTAL RECOVERABLE METALS (ug/L)			-	-		-		-	-	-		-		-	-	-	-	-			-
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25U	33	-
Arsenic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.4	-
Boron	470	170	-	-	490	-	170	-	-	-	760	-	160	-	-	-	-	-	380	200	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20U	0.20U	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0U	1.0U	-
Copper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	1.4	-
Lead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0U	1.0U	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57	19	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0055	0.0050U	-
Nickel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.3	-
Selenium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0U	1.0U	-
Silver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20U	0.20U	-
Zinc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0U	7.9	-

Table 17. (Continued)

	Station[1]																				
	S-1		S-2	S-3	S-4				S-5		S-6				S-7		S-8		ST-1		ST-3
DISSOLVED METALS (ug/L)			-	-		-		-	-	-		-		-	-	-	-	-			-
Aluminum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25U	25U	-
Arsenic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.92	1.5	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20U	0.20U	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	2	-
Copper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	1	-
Lead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0U	1.0U	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52J-	17	-
Nickel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4	1.9	-
Selenium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	1.0U	-
Silver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20U	0.20U	-
Zinc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0U	5.0U	-
ORGANOPHOSPHATE PESTICIDES (ug/L)			-	-		-		-	-	-		-		-	-	-	-	-			-
Azinphos menthyl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16U	0.052U	-
Bolstar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.057U	0.016U	-
Coumaphos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.080U	0.071U	-
Demeton O&S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.23U	0.010U	-
Diazinon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.036U	0.017U	-
Dichlorvos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.032U	0.021U	-
Disulfoton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.039U	0.015U	-
Chlorpyrifos (Dursban)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.035U	0.018U	-
Ethoprop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.041U	0.026U	-
Fensulfothion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10U	0.10U	-
Fenthion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.014U	0.015U	-
Merphos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.022U	0.030U	-
Mevinphos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.075U	0.098U	-
Parathion methyl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.041U	0.020U	-
Phorate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.050U	0.016U	-
Ronnel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020U	0.011U	-
Stirophos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.022U	0.030U	-
Tokuthion (Prothiofos)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.037U	0.016U	-
Trichloronate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.032U	0.026U	-
Ethion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.012U	0.021U	-
Malathion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.032U	0.026U	-
Parathion-ethyl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013U	0.017U	-
BACTERIAL INDICATORS																					
Total Coliform (MPN/100 mL)	900	920	-	-	900	-	170	-	-	-	300	-	240	-	-	-	-	-	-	-	-
Fecal Coliform (MPN/100 mL)	500	540	-	-	500	-	49	-	-	-	80	-	23	-	-	-	-	-	-	-	-
Enterococus (CFU/100 mL)	220	130	-	-	110	-	24	-	-	-	180	-	22	-	-	-	-	-	-	-	-

1= Refer to Table 1 for station locations.
J= The result is an estimated quantity.
J-= The result is an estimated quantity but result may be biased low.
R= The data are unusable (the analyte may or may not be present).
U= Not measured above reported sample reporting limit (Diazinon not measured above reported sample detection limit).
UJ= Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NR = Not receorded
NA = Creek Dry, no samples taken.
– = Not sampled for selected analyte.

8.1.4 Indicator Bacteria

Water column samples were collected during two sampling events from three sites on Saratoga Creek (S-1, S-4 and S-6) where water contact recreation may potentially occur.

Samples were analyzed for total coliforms, fecal coliforms and enterococcus. During the first sampling event, total, fecal and enterococcus concentrations were 900 MPN/100 mL, 500 MPN/100 mL and 220 CFU/100 mL, respectively for site S-1; 900 MPN/100 mL, 500 MPN/100 mL and 110 CFU/100 mL, respectively for site C-4; and, 300 MPN/100 mL, 80 MPN/100 mL and 180 CFU/100 mL, respectively for site S-6. Concentrations enumerated from samples collected during the second sampling event were less than or equal to concentrations from the first event for all three organisms. Results are presented in Table 17.

Table 18. Summary of bioassay results from the San Tomas Aquino Creek watershed.

Site	Date	Survival			Growth/Reproduction				
		NOEC	LOEC	LC_{50}	NOEC	LOEC	IC_{50}	IC_{25}	IC_{10}
Ceriodaphnia dubia									
ST-1	5-Oct-2005	100	>100	>100	100	>100	>100	>100	78.8
	31-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
Pimephales promelas									
ST-1	5-Oct-2005	50	100	>100	100	>100	>100	>100	>100
	31-Jan-2005	100	>100	>100	100	>100	>100	>100	>100
Selenastrum capricornutum									
ST-1	5-Oct-2005	NA	NA	NA	50	100	87.3	67.9	57.5
	31-Jan-2005	NA	NA	NA	100	>100	>100	>100	>100

Values are Percent Sample
NOEC = Highest Test Concentration Not Producing a Statistically Significant Reduction in Survival or Fertilization.
LOEC = Lowest Test Concentration Producing a Statistically Significant Reduction in Survival or Fertilization.
LC_{50} = Median (50%) Lethal Concentration.
IC_{50} = Concentration Inhibitory to Reproduction by 50% (Median).
IC_{25} = Concentration Inhibitory to Reproduction by 25%.
IC_{10} = Concentration Inhibitory to Reproduction by 10%.
NA = Not Applicable.

8.1.5 Bioassessments

8.1.5.1 Benthic Macroinvertebrates

A total of 3,974 benthic macroinvertebrates (BMIs) were processed from the seven reaches (i.e., sites) sampled in Saratoga Creek and one in San Tomas Aquino Creek. BMIs identified in Saratoga and San Tomas Aquino Creeks were comprised of 81 and 16 distinct taxa, respectively. The evaluation of these data was conducted by reviewing metric values, composite metric scores, dominant taxa, and BMI composition similarity. The following paragraphs briefly describe the results of BMI bioassessments conducted in FY 04-05 (i.e., Spring 2005). Results from bioassessments conducted in FY 03-04 are also presented for comparison.

Metrics

Complete results for the ten selected metrics generated from the BMI data set are provided in Appendix B. Summary results for the five major types of metrics are presented below for Saratoga and San Tomas Aquino Creeks.

Richness – Site richness metric increased with increasing site elevation in the San Tomas Aquino Creek watershed. The highest values for Taxa (45) and EPT (20) Richness occurred at sites S-7 and S-8, respectively. The lowest values for Taxa Richness (17) and EPT Richness (3) occurred at site ST-3 on San Tomas Aquino Creek.

Composition - Metrics associated with composition also correlated with site elevation. In Saratoga Creek, EPT Index values ranged from 6% to 73% and sensitive EPT values ranged from 5% to 40%, with the highest value occurring at site S-8 and the lowest value occurring at site S-2.

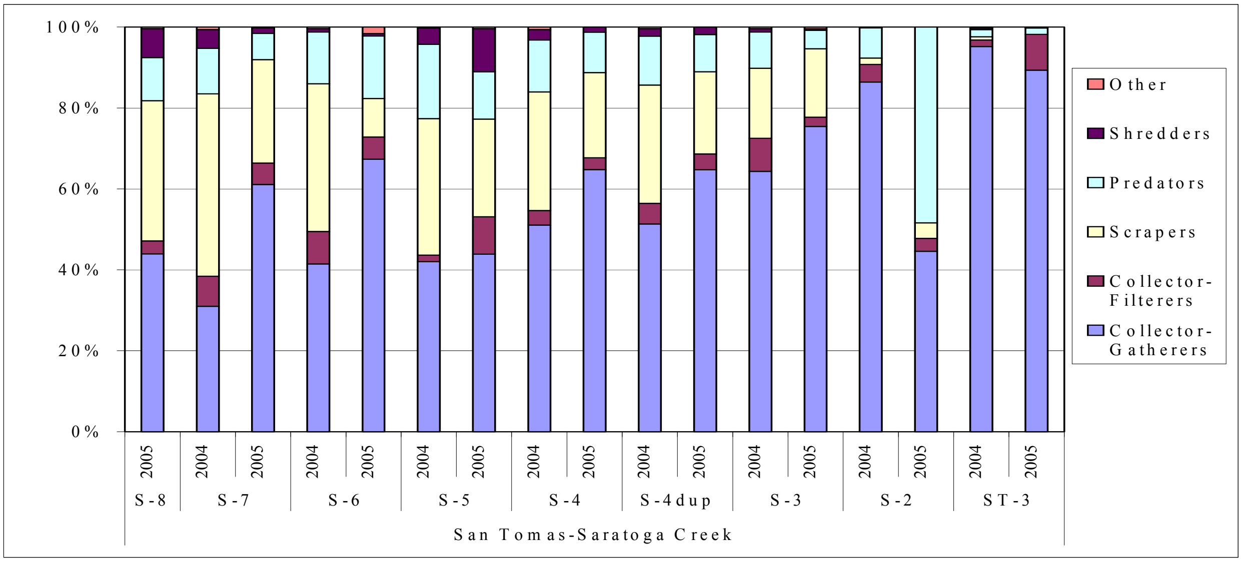
Shannon Diversity Index values are affected by taxonomic richness and the distribution of individuals among the taxa. The Shannon Diversity values may range from 0 to 3.3 (natural log), with the higher diversity values being indicative of greater stream health. Shannon Diversity values were highest (2.4-2.7) at sites S-4 through S-8, and lowest at site ST-3 (1.6).

Another measure of composition characteristics is Percent Dominant Taxon. Unlike the previous metrics, a higher Percent Dominant Taxon value often indicates a more disturbed environment. Percent Dominant Taxon values ranged from 19% to 37% with the lowest percentage occurring at S-4.

Tolerance Measures- In San Tomas Aquino Creek watershed, Intolerant Organism values ranged from 0.8% to 40%, with the highest value occurring at site S-8 and the lowest value occurring at site ST-3. Percent Tolerant Organism values were below 4.1% for all sites, except S-5 (7.8%).

Functional Feeding Groups - There was a wide range of FFGs among the San Tomas Aquino-Saratoga Creek sites for years 2004 and 2005 (Figure 12). Both years showed a decreasingly balanced distribution of FFGs with decreasing site elevation. However, FFGs were more evenly distributed at most sites in year 2004 when compare to year 2005.

Figure 12. Percentages of benthic macroinvertebrates distributed among six functional feeding groups from San Tomas Aquino-Saratoga Creek sites in years 2004 and 2005.

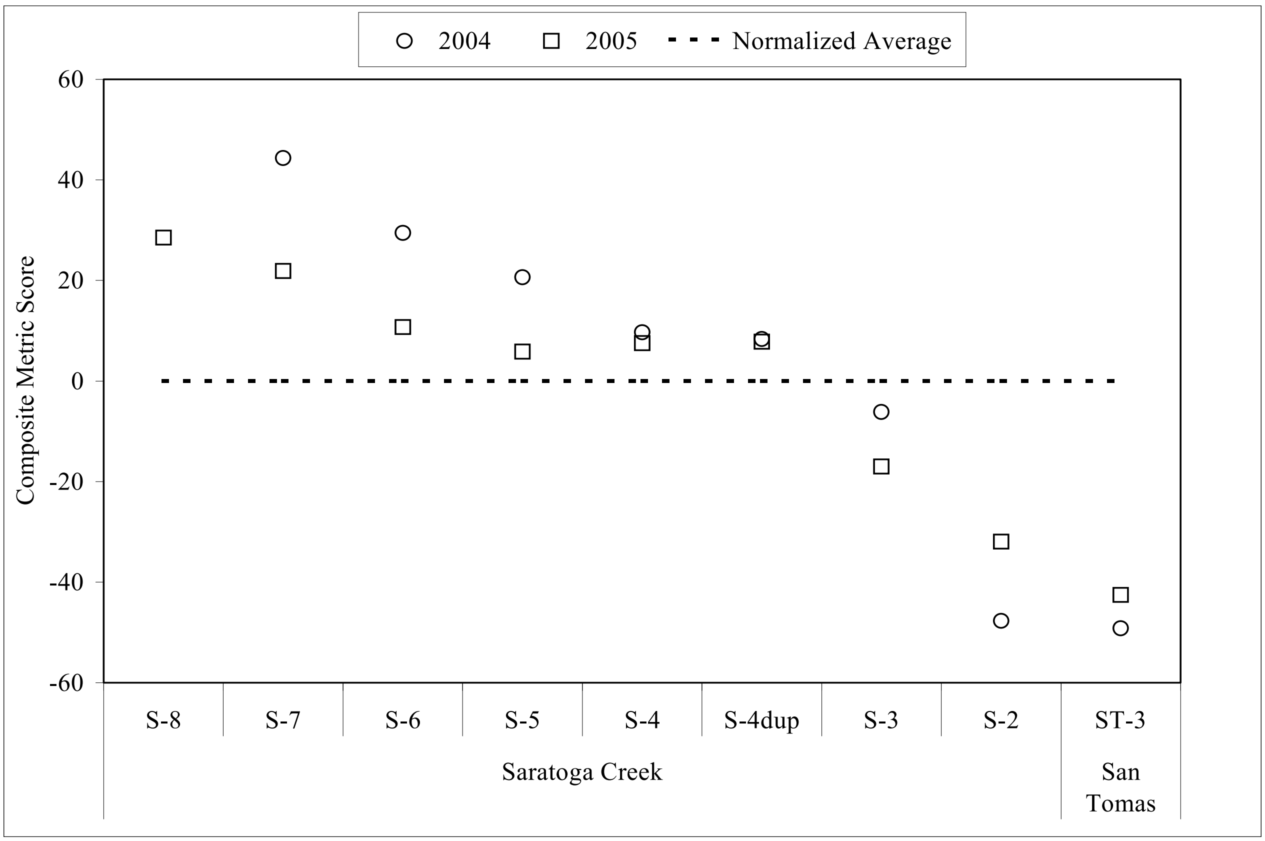


Abundance - Abundance metric values did not correlate with elevation. Median BMI abundance per ft^2 for the San Tomas Aquino -Saratoga Creek samples was 263 and ranged from 72 at site S-3 to 778 at site S-6.

Composite Metric Scores

A plot of composite metric scores is shown in Figure 13 for the San Tomas Aquino-Saratoga Creek sites, which includes data from year 2004 for an additional perspective. There was a clear gradient of decreasing composite metric scores with decreasing elevation (and/or other factors). There was a trend of lower composite metric scores for middle to upper elevation sites in year 2005 when compared to scores in year 2004. BMI assemblages from sites that scored consistently above average had consistently higher richness (total and EPT) and diversity and lower tolerance when compared to BMI assemblages from sites that scored below average

Figure 13. Composite metric scores for the San Tomas Aquino Creek site (ST-3) and Saratoga Creek sites.



Note: The site denoted S-4 dup was collected and processed as a duplicate for site S-4. Site S-8 was sampled in year 2005 only.

Dominant Taxa Composition

The only consistently dominant taxon across all sites was the midge subfamily Orthocladiinae (Table 19). *Drunella* mayflies were dominant at all sites except site ST-3 and *Baetis* mayflies were numerically dominant at six sites where they comprised 15% to 33% of the BMIs. Sites S-2 and S-5 had low abundances of *Baetis* mayflies and site S-2 was unique in having 42% of the BMIs represented by the mite *Torrenticola*. The mayfly scraper *Epeorus* was dominant at the two uppermost sites. One caddisfly taxon (*Lepidostoma*) and one stonefly taxon (*Suwallia*) were dominant but restricted to sites S-5 and S-6. Segmented worms (Naididae) were dominant at the three lowermost sites.

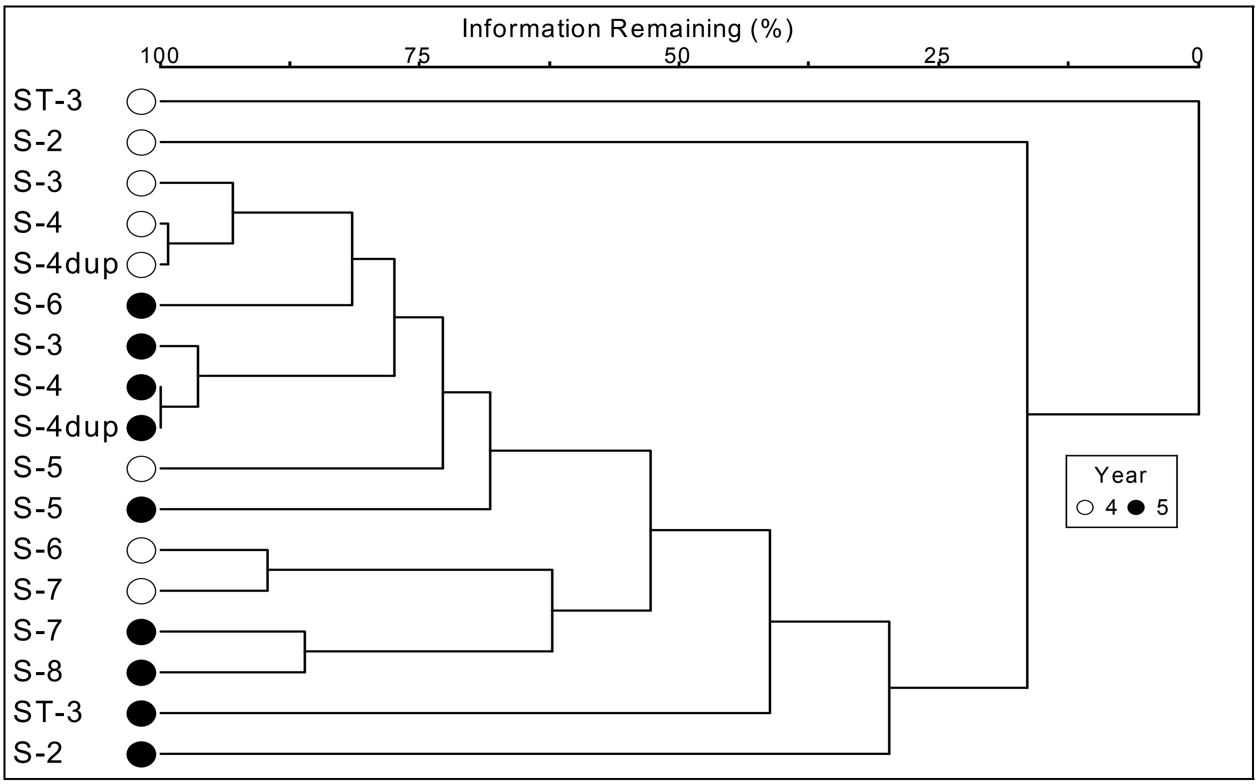
Table 19. Numerically dominant macroinvertebrate taxa and their percent relative abundance for San Tomas Aquino-Saratoga Creek sites (2005).

Site	Dominant Taxa				
	1	**2**	**3**	**4**	**5**
ST-3	Orthocladiinae 37%	*Baetis* 32%	Naididae 12%	*Simulium* 9%	Tanytarsini 7%
S-2	*Torrenticola* 42%	Orthocladiinae 27%	Chironomini 6%	Naididae 5%	*Drunella* 5%
S-3	Orthocladiinae 21%	*Baetis* 20%	Naididae 14%	*Drunella* 11%	*Ordobrevia nubifera* 10%
S-4	Orthocladiinae 18%	*Baetis* 16%	*Drunella* 17%	*Optioservus* 9%	*Ordobrevia nubifera* 8%
S-4dup	Orthocladiinae 18%	*Baetis* 15%	*Drunella* 13%	*Optioservus* 9%	*Ordobrevia nubifera* 7%
S-5	Orthocladiinae 19%	*Drunella* 18%	*Lepidostoma* 10%	*Optioservus* 9%	Hydrobiidae 7%
S-6	Orthocladiinae 31%	*Baetis* 23%	*Drunella* 7%	*Suwallia* 7%	*Torrenticola* 5%
S-7	*Baetis* 33%	*Epeorus* 16%	*Drunella* 11%	Orthocladiinae 6%	*Simulium* 3%
S-8	*Baetis* 28%	*Epeorus* 23%	*Drunella* 6%	*Cryptolabis* 5%	Orthocladiinae 3%

Taxonomic Similarity

Relative similarity of sites based on BMI composition is shown as a cluster dendrogram in Figure 14 including data from year 2004. Site dissimilarity increases as links are made from left to right. BMI composition for the two samples collected at site S-4 had the highest relative similarity for both years while site ST-3 in year 2004 was the most dissimilar when compared to the taxonomic composition of the other sites. Site S-2 was also dissimilar from the other sites for both years. The first six clusters (most closely associated site pairs/groups) formed at sites sampled the same year but the grouping of sites by year was generally inconsistent for subsequent groups.

Figure 14. Dendrogram showing degree of site similarity based on the composition of benthic macroinvertebrates sampled from San Tomas Aquino-Saratoga Creek (2004 and 2005).



8.1.5.2 Fish

Fish sampling results for all sites sampled in FY 04-05 are summarized in Appendix C. The fish community of the lowermost station on Saratoga Creek (S-4) was dominated by California roach (80%), followed by rainbow trout (11%) and suckers (9%). While this site had fewer rainbow trout than upstream sites on Saratoga Creek, it contained the largest rainbow trout with two fish approximately 9 inches in fork length (235-246 mm). Saratoga Creek stations S-5 and S-6 were dominated by rainbow trout (74% and 60%, respectively) and the only other fish species present was Sacramento sucker. Stations S-7 and S-8 contained 100 percent rainbow trout, with the majority of the fish being young-of-the-year. Although the following numbers should not be used as population estimates, the relative abundance of rainbow trout for the five stations in the Saratoga Creek drainage are expressed in Table 20 as the number of trout per mile for site comparison purposes.

Table 20. Estimated number of Rainbow Trout per stream mile in Saratoga Creek, based on field sampling in October 2004.

Station	Estimated trout per mile
S-4	269
S-5	704
S-6	1,701
S-7	1,276
S-8	1,320

8.1.6 Physical Habitat Assessments

A summary of physical habitat results for the eight reaches where BMI bioassessments were conducted are provided in Appendix D. Habitat assessment results for each of the parameters and riffle habitat measurements are also presented in Appendix E.

Habitat conditions of the San Tomas Aquino-Saratoga Creek sites were highly variable. Canopy cover ranged from 10% at site S-2 to 85% at site S-3. Substrate composition became increasingly coarse with increasing elevation: the four lower elevation sites were gravel/cobble dominant while the four higher elevation sites were mostly cobble/boulder dominant. Substrate Quality scores ranged from 8.0 at site ST-3 to 14 at site S-7. Stream gradients for the sites ranged from 0.58% to 6.0%, generally increasing with increasing elevation. Site habitat quality scores ranged from 71 at site ST-3 to 171 at site S-7. According to Barbour et al. (1999), the sites ranged in quality from marginal (site ST-3) to optimal (sites S-5, S-6, S-7 and S-8) and followed a trend of improvement with increasing elevation.

8.1.7 Unified Stream Assessment Pilot Study

The Unified Stream Assessment (USA) was piloted in a 2.4 mile section of Saratoga Creek which overlapped with SCVURPPP monitoring sites S-4 and S-5 (Figure 18). Five channel reaches were identified during the assessment that corresponded to observed changes in the channel and riparian corridor condition. The composite reach assessment scores, which are normalized for comparison purposes, are shown in Table 21.

Table 21. Composite scores for the USA reach level assessment (spring 2005).

Assessment Score (max = 1.0)	**Reach[1]**				
	1	**2**	**3**	**4**	**5**
Overall Stream Condition	0.8	0.7	0.4	0.8	0.9
Buffer and Floodplain Condition	0.7	0.4	0.2	0.5	0.8
Total Reach Score	**0.7**	**0.6**	**0.3**	**0.7**	**0.8**

[1] Reach boundaries were defined as follows:
Reach 1: Cox Avenue to Hwy 85 Bridge Crossing
Reach 2: Hwy 85 to Via Monte
Reach 3: Via Monte to Crestbrook
Reach 4: Crestbrook to Merriman
Reach 5: Merriman to DeAnza Blvd

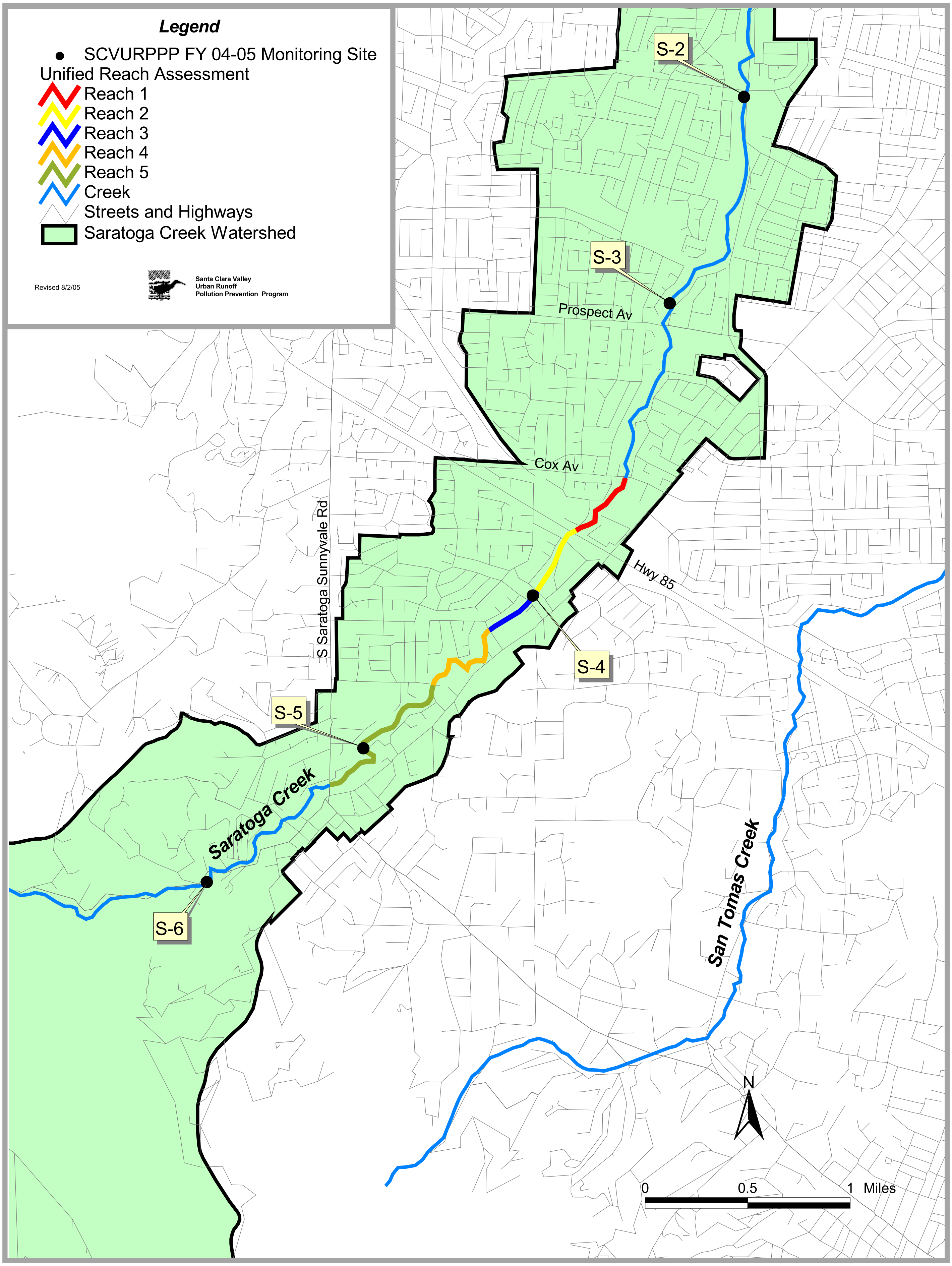


Figure 15. Five reaches on Saratoga Creek that were assessed using the Unified Stream Assessment (USA) in May 2005.

The composite scores are based on the summation of scores assigned in the field to individual parameters. Instream habitat, streambank vegetative protection, streambank erosion, and flood plain connectivity parameters were summed to represent the Overall Stream Condition. Vegetated riparian buffer width, floodplain vegetation, and floodplain restoration potential parameters were summed to represent the Overall Buffer and Floodplain Condition.

Reach 3 received low scores for most of the parameters associated with the overall habitat and buffer/floodplain condition. Reach 3 was a highly incised reach with a narrow riparian corridor due to residential development along the stream banks. The in-stream habitat was marginal due to low complexity of substrate and channel forms, eroding banks with limited vegetative cover and very limited access to floodplain. Monitoring site S-5 occurred in the upper end of this reach, which contained several long riffles and a series of plunge pools that were created by several grade control structures.

The overall habitat condition parameters for the remaining reaches were generally scored in the suboptimal and optimal range due to high habitat complexity, substantial vegetative cover (notably large sycamore trees stabilizing banks, limited areas of bank erosion and areas with floodplain access. Some of the overall buffer/floodplain condition parameters were scored marginal to suboptimal due to urban encroachment in riparian zone, as well as good floodplain vegetative cover.

During the USA reach assessment, information on the type and location of stream impacts were recorded. The types of impacts included severe stream erosion, impacted stream buffers, utilities, stream crossings, channel modifications, storm water outfalls. Table 22 shows the type and number of impacts documented for each reach.

Table 22. Number and type of impacts documented for each reach during the USA.

Reach	Reach Score	Channel Modification	Bank Erosion	Stormdrain Outfalls	Stream Crossings	Utility Crossings	Impacted Buffer
1	**0.7**	1	1	1	1	0	X
2	**0.6**	1	1	2	3	1	X
3	**0.3**	3	1	1	3	0	X
4	**0.7**	4	1	2	2	0	X
5	**0.8**	6	2	10	2	2	X

Bank erosion impacts and utility crossings were infrequent for all five reaches. Channel modification and stormdrain outfall impacts increased in the upstream direction. Stream crossings were relatively consistent for all reaches. The entire reach length was determined to have impacted buffer, however, the degree of impact was variable. Similarly, severity of impact appeared to be more important than the frequency (i.e., the total length of impact may have more influence on habitat and riparian condition).

8.2 Discussion

8.2.1 Aquatic Life Use Indicators

The Basin Plan designates both COLD, WARM and WILD Beneficial Uses in Saratoga Creek. The results of the fish sampling conducted during FY 04-05 indicate that a cold water fish community is supported in the creek, from site S-4 upstream to site S-8. Rainbow trout, Sacramento sucker, and California roach were documented during the fish survey, with rainbow trout being the most abundant at all sites except for S-4. Rainbow trout densities generally increased with increasing elevation, with the exception of S-6, which had the greatest density of trout. Majority of the trout observed at all five sites were young-of-the-year. Previous fish surveys also documented rainbow trout and suckers (Leidy 1999). It is believed that steelhead trout are unable to access Saratoga Creek due to an existing anadramous fish barrier at its confluence to San Tomas Aquino Creek.

Although native hitch have been reported (SCBWMI 2001), there are currently no Uses designated for San Tomas Aquino Creek. Additionally, there is limited available habitat to fully support a warm water native fish community. San Tomas Aquino Creek is a concrete-lined channel for 8.5 miles between McCoy Avenue and the Bay. The only section of the creek that is identified as perennial and unhardened occurs within a one mile reach between McCoy Avenue and the confluence of Wildcat Creek. Although, no existing fish surveys were available to verify the fish composition within this reach; native minnows (i.e., hitch or California roach) were observed at site ST-3 during the BMI bioassessment. San Tomas Aquino Creek is highly unlikely to support COLD Use due to the low flow conditions and high water temperatures during summer season, as well as the lack of suitable habitat conditions for salmonids.

General water quality measurements collected by SCVURPPP in FY 04-05 indicate that water temperatures were suitable in the upper reaches of Saratoga Creek for critical life stages of rainbow trout. Water temperature measurements taken from site S-4 upstream to site S-8 were < 17 °C during the summer sampling event and < 13 °C during the sampling spring event, which are considered suitable conditions for egg incubation and juvenile rearing, respectively (FAHCE 2000). Water temperatures taken in the lower site (S-1) during the dry season were greater than 17 °C indicating that habitat may be unsuitable for juvenile trout rearing. It is important to note that water temperatures collected as part of FY 04-05 water quality study were grab samples and do not take into account the diurnal variation of water temperature, which naturally occurs in most stream systems. These results were consistent with temperatures recorded during FY 03-04 monitoring.

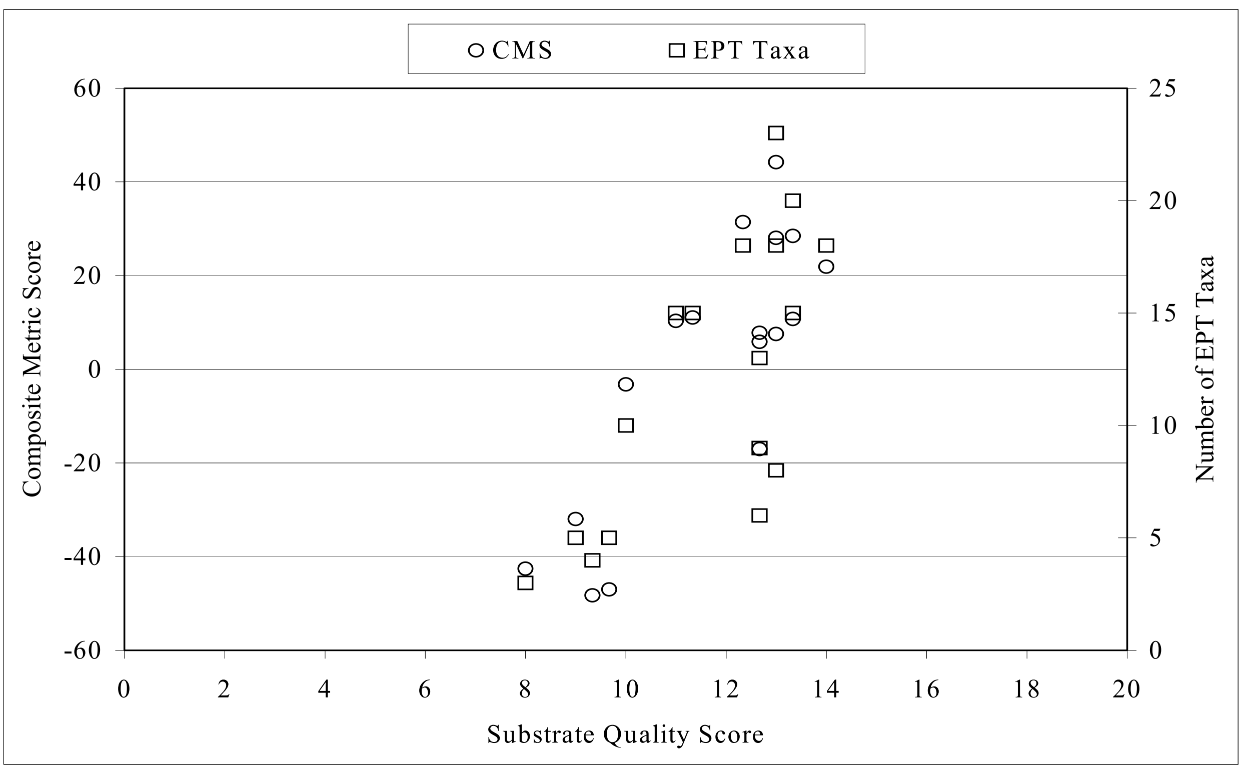
Physical and chemical water quality sampling results during FY 04-05 indicate ambient water quality generally met the Water Quality Objectives (WQO) identified in the Basin Plan. The dissolved oxygen (D.O.) concentrations recorded during the summer season for San Tomas Aquino and Saratoga Creeks ranged from 8.46 to 12.10 mg/L during the water quality study, and 7.5 to 9.4 mg/L during the fish sampling. Both sets of values are higher than the WQO for protection of warm water (5.0 mg/L) and cold water (7.0 mg/L) habitat.

The dissolved metal concentrations from the San Tomas Aquino and Saratoga Creek water samples, adjusted for hardness, were lower than the Freshwater Critierion Chronic Concentrations (CCC) presented in the California Toxics Rule (CTR) (Appendix F). Neither San Tomas Aquino nor Saratoga Creek water samples exhibited any detectable concentrations of organophosphate pesticides or toxicity at sites sampled during the wet and dry season sampling events.

The results of the two years of BMI bioassessments and physical habitat assessments at the eight sampling locations in San Tomas Aquino Creek watershed indicate that biological integrity and aquatic habitat conditions are generally optimal upstream of Prospect Avenue. Site S-4 upstream to site S-8 exhibited high scores of richness, composition and tolerance metrics, as well as relatively high composite metric scores, compared with sites on lower Saratoga and other sites sampled in the Adobe, Matadero, and Calabazas Creek watersheds. The BMI community sampled in FY 04-05 was overall similar to the FY 03-04 results; however, there was a trend of lower composite metric scores for middle to upper elevation sites in year 2005 when compared to scores in year 2004.

The overall physical habitat quality for a majority of sites in Saratoga Creek was good, ranging from 113 to 170 (optimal). Physical habitat scores in the lower three sites were considered suboptimal habitat condition. Substrate quality (composition and embeddedness) in the riffles that BMIs were sampled in San Tomas Aquino-Saratoga Creek generally increased with increasing elevation. Changes in substrate quality were largely due to increasing size of substrate as embeddedness values were consistently around 50% for all the sites. The substrate quality scores for both 2004 and 2005 samples fell within a moderate range (8 to 14) that exhibited a pattern of increasing composite metric scores and EPT taxa response with increasing substrate quality (Figure 16). Although embeddedness values appear to be relatively high, both BMI and fish community assemblages appear to be in good condition.

Figure 16. Composite metric scores and EPT Taxa vs. substrate quality scores for San Tomas Aquino-Saratoga Creek sites (years 2004 and 2005), Santa Clara County.



The results of the Unified Reach Assessment (USA) provide more detailed information on the habitat and riparian condition, along with the additional identification of potential stressors, which can be used to better interpret results from the fish and BMI bioassessment conducted at sites S-4 and S-5. Both the fish and BMI communities appear to be in relatively good condition. Since many of the recorded impacts were localized (e.g., channel incision and bank erosion) the bioassessment sampling locations within the reach may not have been suitable for identifying a potential response to these impacts. Alternatively, other impacts that are not localized may have more influence on the biological communities, in which case, the bioassessment communities may be showing a similar response among the upper four sites.

As part of the watershed assessment activities in FY 05-05, the SCVURPPP is planning to implement the USA for additional areas of Saratoga Creek that will overlap with all of the bioassessment sampling locations. Additional analysis of the reach assessment will be conducted in effort to better interpret the biological and water quality response indicator data collected during screening level monitoring.

Additional impacts that may have impacts to the beneficial uses in Saratoga Creek include upstream sediment supply and transport processes and alteration to stream flow. Relatively high levels of embeddedness show that fine sediment is being deposited in the system. The observation of deep pool habitat and healthy trout populations, however, may indicate that sediment is getting transported out of the system and not limiting trout reproduction. Other impacts that may have important affects on the biological communities include water export and imports. The creek is diverted about 1.0 mile upstream of site S-6 for water supply during the summer months. Water is exported into the creek just upstream of the Interstate 280 crossing (approximately 3 miles below the water diversion) during the summer season to promote groundwater recharge.

Historical channel modifications to Saratoga Creek downstream of Bollinger Road have likely resulted in low physical and biological stream ecosystem functional capacities. This section of the creek has historically been channelized and armored (i.e., gabion and concrete-lined) and is deeply incised. Due to the low stream gradient for this section of creek, several areas of the channel function as depositional zones. The SCVWD has periodically conducted sediment removal projects between 1982 and 1998 to maintain channel capacity for flood control in sections of the creek below Interstate 280 and above the confluence with San Tomas Aquino Creek.

Physical and biological stream ecosystem functional capacities are likely to be very low within the concrete-lined section of San Tomas Aquino Creek. Due to the low stream gradient for this section of creek, several areas of the channel functions as a depositional zone. The SCVWD has periodically conducted sediment removal projects between 1977 and 1997 to maintain channel capacity for flood control.

Physical and biological stream ecosystem functional capacities may also be relatively low in the reach above the concrete-lined channel section. A geomorphic study was conducted within an approximate five mile reach of San Tomas Aquino Creek from the concrete-lined section to about one mile upstream of State Highway 9 (SCVWD 2004). In total, 7 of the 12 cross-sections taken in this reach were ranked as either “medium” or “high” erosion. Important factors influencing low bank stability at these cross-sections include small width-to-depth ratios, lack of bank vegetation, and active debris flows and landslides in the headwater areas (SCVWD 2004). The geomorphic study also noted lack of streamflow in 8 of the 12 cross-sections during summer and fall months.

8.2.2 Recreational Use Indicators

Bacterial indicators are nonpathogenic indicator organisms that are commonly used to indicate the potential presence of (human and nonhuman) fecal contamination. The correlation between bacterial indicator organisms and pathogens of public health concern is subject to debate. A majority of bacterial indicator concentrations collected by SCVURPPP were relatively elevated at most sites during most sampling events. However, it is important to note that when evaluating bacterial indicator data, one must take into consideration potential for human exposure to the water bodies of interest. Given water quality and exposure data, it may be possible to estimate the risk associated with human health. Microbial risk assessments typically involve characterizing both water quality and exposure, with regards to the specific pathogens of concern. However, with limited bacterial indicator data available, as is the case in Adobe Creek, one must determine if risk is high through less rigorous and more subjective methods.

Both contact (REC-1) and non-contact (REC-2) beneficial uses for recreation are designated for Saratoga Creek. Three sites (S-1, S-4 and S-6) where REC-1 uses were thought to possibly exist were sampled for indicator bacteria. Of these locations, site S-1 is most accessible to the public (Bowers Park); however, the creek contains no deep pools that would be suitable for swimming activities. Site S-4 has relatively deep pools created by grade control structures that are adjacent to footpath along the creek that is close to a private school. However, the creek along this reach is highly incised however and surrounded by short fence along the top of the bank. Site S-6 has minimal urban influence with difficult access to creek.

Results from this study indicate that the limited bacteria indicator data collected at three sites for fecal and total coliforms were all below the Basin Plan WQOs[13] for contact and non-contact recreation, with the exception of fecal coliform concentrations at site S-1 that were slightly higher than the WQO for water contact recreation. In addition, enteroccocus concentrations in samples taken at sites S-1 and S-6 during the summer event were slightly higher than US EPA's suggested bacteriological criteria for "infrequently used areas".

No beneficial uses for recreation are designated for San Tomas Creek. During field reconnaissance, it was confirmed that a lack of public access (i.e., no public parks and or fences along the creek banks) and deep water would result in a low risk to exposure during contact water recreation. As a result, water samples were not analyzed for bacterial indicators.

[13] It is important to note that the WQO are based on a minimum of five consecutive samples equally spaced over a 30-day period.

Section 9.0

Data Quality Assessment

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9.1 Water Quality

This section addresses Quality Assurance and Quality Control (QA/QC) activities associated with both field sampling and laboratory analyses for the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) FY 04-water quality monitoring data. The field QA/QC samples were used to evaluate potential contamination and sampling error introduced prior to submittal to the analytical laboratory. Laboratory QA/QC activities provide information needed to assess potential laboratory contamination, analytical precision and accuracy, and representativeness.

Data quality was assessed through two steps: 1) data verification; and 2) data validation. Data verification generally included checks to verify compliance with Quality Assurance/Quality Control practices, information contained in the laboratory reports was correct and free of typographical errors or other obvious inconsistencies, and that information presented in the laboratory data reports was complete. Data validation was performed in accordance with the National Functional Guidelines for Organic Data Review (EPA540/R-99/008) and Inorganic Data Review (EPA540/R-01/008). Where appropriate, data qualifiers were associated with the data using the following standard notations from the EPA guidance documents:

- U = The material was analyzed for, but was not detected above the level of the associated value.
- J = The associated value is an estimated quantity.
- J- = The associated value is an estimated quantity, but the result may be biased low.
- R = The data are unusable (The analyte may or may not be present).

9.1.1 Precision

Precision objectives apply to duplicate, replicate and split samples taken as part of a QC session or as part of periodic in-field QC checks. Precision describes how well repeated measurements agree.

Appendix G, Table G-1 presents Relative Percent Differences (RPDs) for Laboratory Duplicates in association with each water quality sampling event. RPDs in association with laboratory duplicates, with the exception of chlorophyll and silver during the first sampling event; and various total recoverable metals in second sampling event were within QC limits for all compounds analyzed. The calculated RPD for chlorophyll slightly exceeded (26%) the QC limit of 20%. No qualification was necessary since both the original and the duplicate sample were less than five times the reporting limit and the absolute difference between the sample and duplicate is less than the reporting limit. The calculated RPD for total silver exceeded (117%) the QC limit. Both the original and the duplicate sample were less than five times the reporting limit but the absolute difference between the sample and duplicate is greater than the reporting limit. With the exception of this source sample (0.73 ug/L) and sample M-2 (Table 8 – 28 September 2004), which had a measured value of 0.20 ug/L, all other total silver analyses were not measured above the reporting limit of 0.20 ug/L. The duplicate result for total silver was measured just below the reporting limit at 0.19 ug/L. Therefore, this source sample C-3 (Table 12 – 05 October 2004) is qualified in as (J) an estimated quantity.

During the second sampling event Laboratory Duplicate QC limits for RPDs (Appendix G, Table G-1) were exceeded by chromium (27%), copper (48%), lead (26%), manganese (27%), silver

(65% and 56%), and zinc (55%). No qualification of any total recoverable metals results was necessary, since in all cases both the original source results and associated duplicate results were less than their respective reporting limits.

Field duplicate evaluation criteria were exceeded during the first sampling event (dry season event – 28 September 2004 and 05 October 2004) for total phosphorus (Appendix G, Table G-9). The variability in measured values of total phosphorus may be an effect of variable values in the sampled stream flow but may also be an indication of laboratory precision.

Field duplicate evaluation criteria were exceeded during the second sampling event (wet season event – 24 January 2005 and 31 January 2005) for total solids SSC, total fine SSC, and fecal coliform and *enterococcus* (Appendix G, Table G-10). Variability in measured values of SSC reflects both the high variability typically encountered when sampling this constituent from stream flow and when attempting to accurately measure low concentration samples. Variability in measured values of fecal coliform and *enterococcus* reflect the high variability typically encountered when sampling these constituents from stream flow.

9.1.2 Accuracy

Accuracy describes how close a measurement is to its true value. Method blanks, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicates (MSD) and surrogate spike percent recoveries are all used to assess the accuracy of results.

The method blank for total recoverable arsenic, performed in association with samples collected on 21 January 2005, displayed a value (0.225 ug/L) less than the reporting limit (0.50 ug/L). No action is required if respective sample results are greater than or equal to the reporting limit. The associated sampling results ranged from 1.2 to 5.3 ug/L. Therefore, no qualification of analytical results was necessary with regards to method blank results.

Appendix G, Table G-2 presents Laboratory Control Sample (LCS) percent recoveries for nutrients and anions, and organophosphorus pesticides in association with each water sampling event. LCS recoveries were with QC limits for all compounds analyzed, with the exception of mevinphos (28 September 2004), and demeton O&S and disulfoton (31 January 2005). In all three cases the upper acceptance limit was exceeded. No qualification was performed since all targeted analytes were non-detected.

Appendix G, Table G-3 presents LCS and LCSD (Laboratory Control Sample Duplicate) percent recoveries and RPDs for metals in association with each water sampling event. LCS and LCSD percent recoveries and RPDs were within QC limits for all compounds analyzed.

Appendix G, Table G-4 presents a summary of MS/MSD percent recoveries and RPDs in association with the dry weather sampling event. With the exception of dissolved manganese and mevinphos, both percent recoveries and RPDs were within QC limits for all compounds analyzed. The MS/MSD for dissolved manganese performed on samples collected 05 October 2004 had low recoveries for both the MS (60%) and the MSD (57%) that exceeded QC limits (70-130%). Results for dissolved manganese for samples C-1 and ST-1 on 05 October 2004 are qualified (J-) as an estimated quantity, but the result may be biased low (see Table 5). Results for C-3 on the same date are qualified (UJ) where the analyte was not detected but the reporting limit is approximate and maybe in accurate imprecise (see Table 5). The MSD recovery for mevinphos (229%) exceeded the upper QC limit (205%). No qualification was performed since all target analyte was non-detect.

Appendix G, Table G-5 presents a summary of MS/MSD percent recoveries and RPDs in association with the wet weather sampling event. With the exception of total recoverable boron, and various organophosphorous pesticides both percent recoveries and RPDs were within QC limits for all compounds analyzed. The MS percent recovery was not reported because the recovery was less than the original source value. The MSD recovery (148%) exceeded the upper QC limit (130%). No qualification of total recoverable boron associated with this batch was performed since all related LCS/LCSD and SRM recoveries were well within QC limits. Upper acceptance criteria limits were exceeded for MS and or MSD recoveries for demeton O&S, fensulfothion, merphos, and trichloronate. The RPD QC limit (25%) was slightly exceeded for demeton O&S (26%) and phorate (30%). No qualification was performed since all targeted analytes were non-detected.

Appendix G, Table G-6 presents a summary of SRM percent recoveries for metals in association with each sampling event. SRM percent were within QC limits for all compounds analyzed.

Appendix G, Table G-7 and G-8 present a summary of surrogate spike percent recoveries of triphenylphosphate for organophosphorus pesticides in association with each sampling event. Surrogate spike recoveries were within QC limits for all samples analyzed.

9.1.3 Data Inconsistencies

A general review of the analytical sampling results has identified certain inconsistencies in the reported data. These inconsistencies are discussed in the following sections by their corresponding field sampling events. In some cases, references are made to tables included in Appendix G for more complete information

9.1.3.1 Dry Season Sampling Event

Dissolved Organic Carbon (DOC) values were slightly larger in five samples (A-3.5, B-1, SU-3, C-1, and ST-1) than the measured values for Total Organic Carbon (TOC). In all cases the differences were at or less than the reporting limit (1.0 mg/L) apart, well within acceptable method variability, and likely an indication that DOC forms the bulk of the measured TOC. Dissolved arsenic values were slightly larger in four samples (A-1, SU-2, SU-3, and C-3) than the measured values for total recoverable arsenic. In all cases the differences were less than the reporting limit (0.5 ug/L) apart, well within acceptable method variability, and likely an indication that dissolved arsenic forms the bulk of the measured total recoverable arsenic.

Dissolved chromium values were greater than the corresponding total recoverable value on a number of samples (A-1, SU-1, SU-2, SU-3, C-1, and ST-1). The samples were rerun with the same results. The samples were then completely re-digested and rerun with the same results. No blank hits were seen in the samples so it was unclear to the analytical laboratory as to what caused the noted discrepancies. These discrepancies could possibly be explained by iron interference. Trapping of chromium by iron under neutral/acidic conditions make it difficult to recover in the analysis. This was reported by MWH (Montgomery Watson Harza) Laboratories at the EVWD (East Valley Water District)/AWWA (American Water Works Association) Research Foundation 2004 Water Quality Conference in Ontario, California. Concentrations of iron in unfiltered samples are generally found to be much higher than in the filtered samples used for analysis of dissolved metals. As a result, it is expected that there would be greater levels of interference in the samples analyzed for total recoverable chromium if particulates in the sample contained high concentrations of iron. Samples filtered for the analysis of dissolved chromium would likely have low levels of iron and therefore less iron interference. Since iron was not a target analyte, we do not have total recoverable and dissolved iron information to support our belief that higher levels of iron in the unfiltered samples may be responsible for cases where the dissolved fraction of chromium exceeds the total recoverable concentration of chromium. In four of these samples (A-1, SU-2, C-1, and ST-1) the differences were less than the reporting limit (1.0 ug/L) apart, well within acceptable method variability, and likely an indication that dissolved chromium forms the bulk of the measured total recoverable chromium. The total chromium sample for SU-1, and the dissolved chromium samples for SU-1 and SU-3 should be qualified (J) an estimated quantity. In addition, total chromium for SU-3 should be qualified (UJ) where the analyte was not detected and the reported quantitation limit is approximate and may be inaccurate or imprecise.

Total recoverable selenium was not measured above the reporting limit (1.0 ug/L) in the sample for ST-1, while the dissolved fraction was measured at1.2 ug/L. This difference is well within acceptable method variability and at this level, the concentrations in the total and dissolved sample should be considered equivalent.

9.1.3.2 Wet Season Sampling Event

Dissolved arsenic values were slightly larger in three samples (C-1, C-3, and ST-1) than the measured values for total recoverable arsenic. In all cases the differences were less than the reporting limit (0.5 ug/L) apart, well within acceptable method variability, and likely and indication that dissolved arsenic forms the bulk of the measured total recoverable arsenic.

Dissolved chromium values were greater than the corresponding total recoverable value on a number of samples (A-1, M-1, M-2, SU-1, SU-3, C-1, C-3, and ST-1). The samples were rerun with the same results. The samples were then completely re-digested and rerun with the same results. No blank hits were seen in the samples so it was unclear to the analytical laboratory as to what caused the noted discrepancies. With the exception of the samples from ST-1, these differences were greater than the reporting limit (1.0 ug/L) apart. Results from the samples at ST-1 were well within acceptable method variability, and likely an indication that dissolved chromium forms the bulk of the measured total recoverable chromium. The total chromium for samples A-1, C-1, and C-3; and the dissolved chromium samples for A-1, M-1, M-2, SU-1, SU-3, C-1, and C-3 should be qualified (J) an estimated quantity. In addition, total chromium for samples M-1, M-2, SU-1, and SU-3 should be qualified (UJ) where the analyte was not detected and the reported quantitation limit is approximate and may be inaccurate or imprecise.

Dissolved nickel was measured slightly higher in sample SU-1 than the measured value for total recoverable nickel. The difference was less than the reporting limit (2.0 ug/L) apart, well within acceptable method variability, and likely and indication that dissolved nickel forms the bulk of the measured total recoverable nickel.

9.2 Rapid Bioassessments

9.2.1 Precision

To assess the precision of field protocols, duplicate BMI samples were collected from two sites; one in Saratoga Creek (S-4) and one in Calabazas Creek (C-2). Duplicate samples were compared to samples collected at the same location and variability was assessed to determine is field methods met draft data quality objectives that will be included in the SCVURPPP Draft Quality Assurance Project Plan (QAPP).

Quality assurance analysis indicated that the Saratoga Creek site S-4 duplicates for both years (2004 and 2005) were similar to the original samples with respect to taxonomic composition, distribution of FFGs and metric values as demonstrated by composite metric scores. The Saratoga Creek S-4 duplicate sample was a composite sample taken at different transects from the same riffles as the S-4 sample due to limited number of riffles available within the reach. The C-2 duplicate was more similar to upstream sites (C-3 through C-5) with *Baetis* mayflies and orthoclad midges predominating. The lower percentage of *Baetis* mayflies and higher metric scores at site C-2 was relatively dissimilarity with the site's duplicate sample. The Calabazas Creek site C-2 duplicate was a composite sample from three different riffles than site C-4 since there were six riffle habitats that occurred within the reach. As a result, the riffle habitats may not have been homogeneous within the reach. In addition, it is important to note that there is little variability in composite metric scores for Calabazas Creek sites demonstrated by the low range of values (- 5 to 6) compared to the range of composite metric scores for Saratoga-San Tomas Aquino sites (-50 to 44) and Adobe-Matadero sites (-20 to 48).

9.2.2 Accuracy

Laboratory accuracy, the California Department of Fish and Game Aquatic Bioassessment Laboratory conducted an independent review of the voucher collection for three BMI samples collected in FY 04-05. The CDFG assessment determined that the overall taxonomy was very good and performed in accordance with the California Stream Bioassessment Procedure (CSBP) Level I standards with a few minor exceptions. The resulting changes in taxonomy had no effect on the analytical results. Appendix H contains the QA/QC results for BMI laboratory analyses.

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Section 10.0

Conclusions and Recommendations

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Section 10.0 Conclusions and Recommendations

10.1 Adobe Creek Watershed

Although no Beneficial Uses (Uses) for warm or cold water habitat have been designated, 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). 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 show 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.

Recreational Uses have also not been designated for Adobe Creek. Limited bacterial indicator data collected were below Basin Plan WQOs for both contact and non-contact recreation. The site where bacterial indicators were collected (A-3.5) appeared to have moderate potential for both public access and risk to exposure. Public access and risk to exposure upstream and downstream of this site appear to be low.

The SCVURPPP purposes the following potential follow-up studies and/or management actions for Adobe Creek:

- Using results from the SCVWD hydrology and geomorphology study, evaluate the potential for habitat enhancement and channel restoration projects to improve conditions for warm water fish community.
- Assess physio-chemical water quality parameters (e.g., dissolved oxygen) during the summer at site A-3.5 to better determine if a WARM Use exist in this creek reach.
- Continue to conduct bioassessments at site A-5 to evaluate variation of BMI assemblage over time.

10.2 Matadero/Barron Creek Watersheds

The Basin Plan designates several Uses in Matadero Creek associated with aquatic life uses, including COLD, WARM, MIGR and SPWN. The results of the 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).

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, enterococus data collected at site M-2 was above the U.S. EPA'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.

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 Barron Creek. 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.

The SCVURPPP purposes the following potential follow-up studies and/or management actions for Matadero and Barron Creeks:

- Conduct additional analyses of water samples (e.g., dissolved metals) in the upper reaches of Matadero Creek to determine sources of elevated total hardness, TDS and conductivity.
- Conduct BMI bioassessments in FY 05-06 using the low gradient protocol described in the CSBP at sites M-2 and M-4.
- In FY 05-06, conduct additional investigations relative to characterizing exposure at site M-2 and collect E. coli concentrations to better determine waterborne pathogen-related risks at this site.

10.3 Sunnyvale East/West Channel Watersheds

The results from one year of screening level indicator monitoring were not conclusive for assessing support of aquatic life uses in Sunnyvale East and West Channel Watersheds. 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.

The SCVURPPP recommends following potential follow-up studies and/or recommend management actions for Sunnyvale East and West Channels:

- Continue screening level monitoring at selected channel sites in FY 05-06 as described in the SCVURPPP Multi-Year Plan (Version 2.0).

10.4 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, enterococus data collected at sites C-3 and C-5 were slightly above the U.S. EPA'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.

The SCVURPPP purposes the following potential follow-up studies and/or management actions for Calabazas Creeks:

- Continue screening level monitoring at selected stream sites in FY 05-06 as described in the SCVURPPP Multi-Year Plan (Version 2.0) using both water quality and bioassessment parameters.
- Continue screening level monitoring of bacterial indicators at site C-3 in FY 05-06 as described in the SCVURPPP Multi-Year Plan (Version 2.0).

10.5 San Tomas Aquino Creek Watershed

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, enterococus data collected at a high majority of Saratoga Creek sites were below U.S. EPA'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.

The SCVURPPP purposes the following potential follow-up studies and/or management actions for San Tomas Aquino and Saratoga Creeks:

- Conduct the Unified Stream Assessment in additional areas of Saratoga Creek to obtain more detailed information on riparian corridor condition and potential impacts. These areas should include areas upstream and downstream of the section that was assessed in May 2005 to overlap existing sampling stations between S-2 and S-8.
- Conduct additional fish population and aquatic habitat surveys at representative reaches for the entire Saratoga Creek watershed, including tributaries. The objective of the survey will be to determine overall condition of the trout population in Saratoga Creek and to what extent is fine sediment impacting the trout population.
- Identify potential for channel enhancement and/or restoration opportunities.
- Develop and implement a recreational use survey to determine what areas in Saratoga Creek are used for contact water recreation and if additional indicator data should be collected to assess REC-1 Use.

Section 11.0

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Appendices

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Appendix A

Metrics Used to Describe Characteristics of Benthic Macroinvertebrate Assemblages.

BMI Metric	Description	Response to Impairment
Richness Measures		
1. Taxonomic Richness	Total number of individual taxa.	decrease
2. EPT Taxa	Number of taxa in the orders Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly)	decrease
3. Ephemeroptera Taxa	Number of mayfly taxa	decrease
4. Plecoptera Taxa	Number of stonefly taxa	decrease
5. Trichoptera Taxa	Number of caddisfly taxa	decrease
6. Coleoptera Taxa	Number of beetle taxa	decrease
Composition Measures		
7. EPT Index	Percent composition of mayfly, stonefly and caddisfly larvae	decrease
8. Sensitive EPT Index	Percent composition of mayfly, stonefly and caddisfly larvae with Tolerance Values less than 4.	decrease
9. Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness (Shannon and Weaver 1963).	decrease
10. Percent Dominant Taxon	The highest percentage of organisms represented by one taxon.	increase
Tolerance/Intolerance Measures		
11. Tolerance Value (TV)	TVs between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values).	increase
12. Percent Intolerant Organisms	Percentage of organisms that are highly intolerant to water and/ or habitat quality impairment as indicated by TVs of 0, 1 or 2.	decrease
13. Percent Tolerant Organisms	Percentage of organisms that are highly tolerant to water and/ or habitat quality impairment as indicated by TVs of 8, 9 or 10.	increase
Functional Feeding Groups (FFG)		
14. % Collector-gatherers (cg)	Percent of macroinvertebrates that collect or gather material	increase
15. % Collector-filterers (cf)	Percent of macroinvertebrates that filter suspended material from the water column	increase
16. % Scrapers (sc)	Percent of macroinvertebrates that graze upon periphyton	variable
17. % Predators (p)	Percent of macroinvertebrates that prey on living organisms	decrease
18. Predator Richness	Number of predator taxa	decrease
19. % Shredders (sh)	Percent of macroinvertebrates that shred leaf litter	decrease
20. % Others (ot)	Percent of macroinvertebrates that occupy an FFG not described above	variable
Other		
21. Abundance	Estimate of the number of BMIs in a sample based on the proportion of BMIs subsampled.	variable

Biological metric values for benthic macroinvertebrates sampled from Adobe Creek, Matadero Creek, Calabazas Creek and San Tomas Aquino-Saratoga Creek monitoring sites, April 2005

Metrics	Adobe Creek				Matadero Creek		Calabazas Creek				
	A-2	A-3	A-4	A-5	M-2	M-4	C-2	C-2dup	C-3	C-4	C-5
Richness:											
Taxonomic*	9	14	29	32	13	17	21	16	13	15	16
EPT*	2	2	5	14	1	1	1	1	1	4	7
Ephemeroptera	1	1	2	6	1	1	1	1	1	2	3
Plecoptera	0	0	0	4	0	0	0	0	0	1	3
Trichoptera	1	1	3	4	0	0	0	0	0	1	1
Coleoptera*	0	1	3	2	1	0	2	1	2	1	1
Composition:											
EPT Index (%)	28	40	52	48	21	18	26	68	63	76	81
Sensitive EPT Index (%)	0.2	0.2	3.0	21	0.0	0.0	0.0	0.0	0.0	0.4	4.7
Shannon Diversity*	1.7	1.7	1.9	2.4	1.2	1.8	2.0	1.2	1.1	0.9	1.0
Dominant Taxon (%)*	33	40	48	25	60	42	26	68	63	75	76
Tolerance:											
Tolerance Value*	5.4	5.2	5.0	4.2	5.7	5.8	5.5	5.2	5.1	5.0	4.9
Intolerant Organisms (%)*	0.2	0.4	3.2	22	0.0	0.0	0.0	0.0	0.0	0.4	4.7
Tolerant Organisms (%)*	0.0	0.0	1.6	0.2	1.0	5.5	4.1	2.0	0.4	0.2	0.2
Funct. Feeding Groups:											
Collector-Gatherers (%)	97	93	80	69	95	82	71	91	96	96	90
Collector-Filterers (%)	2.8	2.4	3.2	2.6	3.7	12	12	4.0	0.2	0.0	2.0
Scrapers (%)	0.0	0.2	12	3.4	0.0	2.7	0.6	0.2	0.2	0.0	0.2
Predators (%)	0.0	4.0	3.0	24	1.6	3.5	15	4.4	3.3	3.2	5.5
Predator Richness*	0	3	9	10	5	5	7	7	4	7	5
Shredders (%)	0.2	0.2	2.2	0.6	0.0	0.0	0.0	0.0	0.0	0.2	1.8
Other (%)	0.2	0.2	0.2	0.4	0.0	0.0	1.4	0.2	0.2	0.4	0.2
Estimated Abundance:											
Composite Sample (9 ft2)	2,040	1,700	1300	1,400	7,200	3,500	1,300	1,500	470	2,300	1,830
#/ft2	227	189	144	156	800	389	144	167	52	256	203
#/m2	2,440	2,033	1,555	1,675	8,612	4,187	1,555	1,794	562	2,751	2,189

* Metrics used for composite metric score

Appendix B

Metrics	San Tomas Aquino Creek ST-3	Saratoga Creek S-2	S-3	S-4	S-4dup	S-5	S-6	S-7	S-8
Richness:									
Taxonomic*	17	24	30	31	34	36	41	45	43
EPT*	3	5	6	8	13	9	15	18	20
Ephemeroptera	2	4	4	5	6	4	8	8	9
Plecoptera	0	0	0	1	2	1	3	4	5
Trichoptera	1	1	2	2	5	4	4	6	6
Coleoptera*	1	4	4	6	5	6	6	6	6
Composition:									
EPT Index (%)	32	6	35	45	45	42	47	69	73
Sensitive EPT Index (%)	0.8	5.0	13	25	25	35	22	31	40
Shannon Diversity*	1.6	1.8	2.3	2.6	2.7	2.6	2.4	2.6	2.6
Dominant Taxon (%)*	37	43	22	19	19	20	32	33	28
Tolerance:									
Tolerance Value*	5.3	5.0	4.5	3.7	3.8	3.5	4.1	3.3	2.9
Intolerant Organisms (%)*	0.8	5.0	13	25	24	36	23	35	40
Tolerant Organisms (%)*	0.8	4.6	4.1	2.5	2.5	7.8	3.0	3.1	0.8
Funct. Feeding Groups:									
Collector-Gatherers (%)	89	45	75	65	65	44	67	61	44
Collector-Filterers (%)	8.9	3.2	2.3	2.9	3.9	9.3	5.5	5.3	3.2
Scrapers (%)	0.0	3.8	17	21	20	24	9.5	26	35
Predators (%)	1.6	48	4.5	10	9.2	12	15	6.5	11
Predator Richness*	7	8	7	10	9	10	11	11	10
Shredders (%)	0.2	0.0	0.4	1.3	1.8	11	0.6	1.4	7.1
Other (%)	0.0	0.0	0.4	0.0	0.0	0.4	1.6	0.2	0.4
Estimated Abundance:									
Composite Sample (9 ft2)	5,400	1,300	650	920	1,200	2,000	7,000	1,300	3,400
#/ft2	600	144	72	102	133	222	778	144	378
#/m2	6,459	1,555	778	1,100	1,435	2,392	8,373	1,555	4,067

* Metrics used for composite metric score

Appendix C

Numbers and percent composition of fish species in Matadero, Adobe and Saratoga Creek sampling reaches in October 6-8, 2004.

Sampling Site	Location/Description	Fish Totals by Site	Number and Percent (%) of Fish Captured						
			California Roach	Threespine Stickleback	Sacramento Sucker	Rainbow Trout	Bluegill[1]	Green Sunfish[1]	Goldfish[1]
M-2	Matadero Cr. at Bol Park	192	136 (71%)	15 (8%)	39 (20%)		1 (0.5%)		1 (0.5%)
M-3[2]	Matadero Cr. at Old Page Mill Rd.	25	17 (68%)	7 (28%)				1 (4%)	
A-3.5	Adobe Cr. at Seminary	157	40 (26%)	65 (41%)	52 (33%)				
S-4	Saratoga Cr. at Crestwood St.	101	81 (80%)		9 (9%)	11 (11%)			
S-5	Saratoga Cr. via Walnut/Alta Vista	27			7 (26%)	20 (74%)			
S-6	Saratoga Cr. at Hakone Gardens	97			39 (40%)	58 (60%)			
S-7	Saratoga Cr. at Congress Springs	43				43 (100%)			
S-8	Booker Cr. above Saratoga Springs	53				53 (100%)			

Note: The fish numbers shown above are based on a single pass and are not population estimates.

[1] Non-native species

[2] Electrical conductivity of the water at this site was greater than 1,990 uS/sm and was too conductive for the electrofisher. Only a small percentage of the fish present were captured because of this problem.

Mean site physical habitat and water quality values documented at macroinvertebrate sampling stations at Adobe, Matadero, Calabazas Creeks and Saratoga/San Tomas Aquino Creeks, April 2005.

Site scale habitat parameters assessed during macroinvertebrate surveys, April 2005.

	Adobe Creek				Matadero Cr.		Calabazas Creek					Saratoga Creek						
Habitat Parameter	**A-2**	**A-3**	**A-4**	**A-5**	**M-2**	**M-4**	**C-2**	**C-3**	**C-4**	**C-5**	**ST-3***	**S-2**	**S-3**	**S-4**	**S-5**	**S-6**	**S-7**	**S-8**
Epifaunal Substrate/ Available Cover	6	7	5	16	12	15	4	2	6	8	7	9	14	12	17	18	19	18
Embeddedness	7	9	6	12	13	10	10	7	10	8	8	8	11	11	10	10	10	10
Velocity/Depth Regime	8	12	10	10	17	19	12	11	12	16	12	12	18	13	15	18	18	17
Sediment Deposition	7	6	8	18	7	15	3	3	5	5	6	8	12	14	13	10	9	12
Channel Flow Status	19	19	19	19	19	18	14	12	13	16	13	14	18	19	18	18	17	18
Channel Alteration	7	13	10	19	7	15	14	9	7	16	6	13	13	12	18	17	20	20
Frequency of Riffles	12	10	11	19	17	13	15	13	15	16	11	16	18	12	19	19	20	19
Bank Stability	15	15	15	16	18	18	15	4	9	10	3	17	12	16	16	16	18	20
Vegetative Protection	5	9	9	17	17	18	15	4	5	15	3	14	14	15	18	18	20	20
Riparian Veg Zone Width	4	6	5	18	9	12	7	2	9	10	2	2	6	6	17	14	20	16
Total Score	90	106	98	164	136	153	109	67	91	120	71	113	136	130	161	158	171	170

* San Tomas Aquino Creek

Mean site physical habitat values documented at macroinvertebrate sampling stations in Adobe, Calabazas, Matadero and San Tomas Aquino-Saratoga Creek watersheds, April 2005.

Habitat Parameters	BMI Sampling Stations in Adobe, Matadero and Calabazas Creek Watersheds										
	A-2	A-3	A-4	A-5	M-2	M-4	C-2	C-2 dup	C-3	C-4	C-5
Riffle Characteristics											
Mean Length (ft)	17	17	15	24	10	8.3	11	15	8.0	15.3	12.7
Mean Width (ft)	12	11	7.7	12	11	4.3	5.8	8.2	10	8.3	5.7
Mean Depth (ft)	0.4	0.4	0.6	0.5	0.3	0.4	0.2	0.2	0.2	0.2	0.3
Mean Velocity (ft/sec)	2.0	NR	NR	NR	1.5	0.9	3.2	2.5	3.6	4.2	3.2
Subjective Assessment											
% Canopy	83	32	55	83	68	53	88	45	80	65	45
Substrate Complexity (1-10)	4.0	3.0	3.0	7.3	3.3	2.7	3.0	2.7	2.0	3.3	3.3
Embeddedness (1-10)	3.7	4.3	3.0	6.0	5.3	5.0	4.7	5.3	3.3	5.3	4.7
Substrate Quality Score*	7.7	7.3	6.0	13	8.7	7.7	7.7	8.0	5.3	8.7	8.0
% Fines (<2 mm)	6.7	10	22	6.7	6.7	43	10	7	18	6.7	10
% Gravel (2-50 mm)	48	63	53	37	52	52	73	67	72	60	57
% Cobble (50-256 mm)	33	27	25	45	40	5.0	17	27	10	32	30
% Boulder (>256 mm)	6.7	0.0	0.0	10	1.7	0.0	0.0	0.0	0.0	1.7	3.3
% Bedrock (soild)	5.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Substrate Consolidation	med	low	low	high	low	low	low	low	low	low	low
Reach Characteristics											
Total Length (ft)	258	346	152	183	130	133	470	470	232	198	165
% Gradient	1.1	0.84	1.5	3.1	0.8	2.0	0.70	0.70	0.90	1.4	2.0
Habitat Quality Score	90	106	98	164	136	153	109	109	67	91	120
Water Quality Conditions											
Time of Sampling	9:30	14:30	12:45	9:45	11:40	14:30	8:30	8:30	12:00	14:00	14:00
Water Temperature (°C)	9.9	13.7	12.8	10.1	12.0	12.8	10.3	10.3	14.6	15.0	13.9
Specific Conductance (uS/cm)	455	498	460	367	1235	855	404	404	465	467	667
pH	8.3	8.3	8.1	8.3	8.2	7.9	8.12	8.12	8.4	8.2	7.8
Dissolved Oxygen (mg/l)	10.8	10.0	10.3	10.8	9.7	9.7	11.1	11.1	10.3	10.0	9.4

* Substrate Quality Score=Substrate Complexity + Embeddedness

Habitat Parameters	BMI Sampling Stations in San Tomas-Saratorga Creek Watersheds							
	ST-3	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Riffle Characteristics								
Mean Length (ft)	15	20	33	20	14	22	18	17
Mean Width (ft)	11	14	20	17	14	16	19	15
Mean Depth (ft)	0.4	0.3	0.6	0.6	0.7	0.8	0.7	0.8
Mean Velocity (ft/sec)	2.9	2.7	3.1	5.1	4.1	3.6	4.7	3.4
Subjective Assessment								
% Canopy	63	10	85	57	73	73	80	78
Substrate Complexity (1-10)	3.7	4.7	7.3	7.7	7.7	8.7	9.0	9.0
Embeddedness (1-10)	4.3	4.3	5.3	5.0	5.0	4.7	5.0	4.3
Substrate Quality Score*	8.0	9.0	13	13	13	13	14	13
% Fines (<2 mm)	10	8.3	10	5.0	6.7	12	8.3	6.7
% Gravel (2-50 mm)	40	40	30	30	25	20	22	13
% Cobble (50-256 mm)	50	48	45	40	38	25	25	30
% Boulder (>256 mm)	0.0	3.3	15	25	30	43	43	42
% Bedrock (soild)	0.0	0.0	0.0	0.0	0.0	0.0	1.7	8.3
Substrate Consolidation	low	med	med	high	high	high	high	high
Reach Characteristics								
Total Length (ft)	183	242	246	390	170	240	180	127
% Gradient	0.92	0.58	0.80	0.80	1.8	2.8	3.7	6.0
Habitat Quality Score	71	113	136	130	161	158	171	170
Water Quality Conditions								
Time of Sampling	10:00	8:30	9:20	13:00	12:00	9:00	11:00	13:00
Water Temperature (°C)	12.8	10.4	8.5	10.5	11.2	10.1	10.6	11.1
Specific Conductance (uS/cm)	446	326	293	311	318	304	284	262
pH	8.1	8.2	7.7	7.4	7.6	7.3	7.6	7.1
Dissolved Oxygen (mg/l)	10.6	10.6	11.1	10.4	10.5	10.6	10.5	10.0

* Substrate Quality Score=Substrate Complexity + Embeddedness

Appendix F

A comparison of total recoverable metals in water samples collected during FY 04-05 and Freshwater Criterion Continuous Concentrations (CMC) presented in the California Toxics Rule (CTR) which are adjusted for hardness.

Water Quality Results for Dry Season Sampling Event (28 September or 5 October 2004)
Dissolved Metals

Station	Hardness	Cadmium		Copper		Lead		Nickel		Silver		Zinc	
	(mg/L)	Sample	CCC	Sample	CCC	Sample	CCC	Sample	CCC	Sample	CMC	Sample	CCC
A-1	460	0.2U	8.2	4.0	34.4	1.0U	22.2	3.5	189.7	0.2U	56.0	5.0U	436.6
B-1	67	0.2U	1.8	**10.0**	6.6	1.0U	1.9	3.9	37.2	0.2U	2.0	20.0	85.3
M-1	220	0.2U	4.6	6.9	18.3	1.0U	8.7	4.0	101.6	0.2U	15.8	5.8	233.7
M-2	330	0.2U	6.3	2.9	25.9	1.0U	14.5	4.0	143.2	0.2U	31.6	7.8	329.5
SU-1	470	0.2U	8.3	1.0U	35.0	1.0U	22.8	3.7	193.2	0.2U	58.1	5.0U	444.6
SU-2	200	0.2U	4.2	3.6	16.9	1.0U	7.7	6.7	93.8	0.2U	13.4	20.0	215.6
SU-3	460	0.2U	8.2	3.8	34.4	1.0U	22.2	3.8	189.7	0.2U	56.0	5.0U	436.6
C-1	390	0.2U	7.2	2.5	29.8	1.0U	18.0	2.3	165.0	0.2U	42.2	5.0U	379.6
C-4	120	0.2U	2.8	1.7	10.9	1.0U	4.0	2.0U	60.9	0.2U	5.6	5.0U	139.8
ST-1	550	0.2U	9.4	1.4	40.0	1.0U	27.9	2.4	220.7	0.2U	76.2	5.0U	508.0

Water Quality Results for Wet Season Sampling Event (24 or 31 January 2005)
Dissolved Metals

Station	Hardness	Cadmium		Copper		Lead		Nickel		Silver		Zinc	
	(mg/L)	Sample	CCC	Sample	CCC	Sample	CCC	Sample	CCC	Sample	CMC	Sample	CCC
A-1	410	0.2U	7.5	1.8	31	1.0U	19	2.3	172	0.2U	46	5.0U	396
B-1	190	0.2U	4.1	12.0	16	1.0U	7	5.5	90	0.2U	12	5	206
M-1	750	0.2U	12.0	1.8	52	1.0U	41	4.9	287	0.2U	130	5.0U	661
M-2	780	0.2U	12.4	1.8	54	1.0U	43	5.5	297	0.2U	139	5.0U	683
SU-1	470	0.2U	8.3	1.0U	35	1.0U	23	2.5	193	0.2U	58	5.0U	445
SU-2	120	0.2U	2.8	2.9	11	1.0U	4	2.0U	61	0.2U	6	13	140
SU-3	490	0.2U	8.6	1.0U	36	1.0U	24	2.6	200	0.2U	62	5.0U	461
C-1	330	0.2U	6.3	1.6	26	1.0U	15	2.3	143	0.2U	32	5.0U	329
C-4	290	0.2U	5.7	1.8	23	1.0U	12	2.1	128	0.2U	25	5.0U	295
ST-1	340	0.2U	6.4	1.0	27	1.0U	15	1.9	147	0.2U	33	5.0U	338

J = The associated value is an estimated quantity.
U = Not measured above reported sample limit.
Bolded values = exceedances in CTR water quality standards

Field and laboratory Quality Assurance and Control (QA/QC) results for chemical and bacteriological water quality monitoring parameters sampled and analyzed in FY 2004-05 by SCVURPPP.

Table G-1. Summary of Relative Percent Differences for Laboratory Duplicates in Association with each Water Sampling Event.

	DRY WEATHER SAMPLING EVENT		WET WEATHER SAMPLING EVENT	
WATER	9/28/2004	10/5/2004	1/24/2005	1/31/2005
Nutrients and Anions				
Ortho Phosphorus	1	3	0	2
Total Phosphorus	10	0	10	8
Total Dissolved Solids	2	1	3	9
Total Organic Carbon	3	4	5	1
Dissolved Organic Carbon	9	1	NA[1]	3
Total Ammonia as Nitrogen	NA[1]	NA[1]	NA[1]	NA[1]
Total Kjeldahl Nitrogen	10	6	16	16
Nitrite Nitrogen	NA[1]	NA[1]	0	0
Nitrate Nitrogen	1	0	NA[1]	NA[1]
Alkalinity, as $CaCO_3$	1	1	1	0
Total Hardness	0	1	0	0
Chloride	0	0	1	0
Sulfate	0	0	1	0
Chlorophyll	**26**	14	0	0
Total Recoverable Metals				
Aluminum	2	3.55	NA[1]	1
Boron	3	1.65	NA[1]	0
Cadmium	6	NA[1]	NA[1]	NA[1]
Chromium	20	13.5	**27**	6
Copper	3	0.454	**48**	3
Lead	1	11.9	**26**	9
Manganese	1	0.886	**27**	1
Nickel	3	3.69	6	14
Silver	6	**117**	**65**	**56**
Zinc	1	4.34	**55**	2
Dissolved Metals				
Aluminum	NA[1]	NA[1]	NA[1]	NA[1]
Cadmium	NA[1]	NA[1]	NA[1]	NA[1]
Chromium	4	5.80	NA[1]	4
Copper	8	1.44	NA[1]	3
Lead	NA[1]	12.2	NA[1]	5
Manganese	8	2.14	NA[1]	1
Nickel	8	8.24	NA[1]	1
Silver	NA[1]	NA[1]	NA[1]	NA[1]
Zinc	2	0.294	8	2

Bolded Values indicate analyses that were outside the Data Quality Objectives
1 = Value not applicable since one or more results were non-detect (not measured above the sample reporting limit)
2 = Second laboratory duplicate analyzed

Table G-2. Summary of Laboratory Control Sample Percent Recoveries for Nutrients and Anions, and Organophosphorous Pesticides in Association with each Water Sampling Event.

	DRY WEATHER SAMPLING EVENT		WET WEATHER SAMPLING EVENT		
	9/28/2004	10/5/2004	1/24/2005	1/31/2005	
WATER	LCS	LCS	LCS	LCS	QC Limits
Nutrients and Anions					
Ortho Phosphorus	104	96	105	87	80-120
Total Phosphorus	95	99	95	95	80-120
Total Organic Carbon	106	100	105	107	80-120
Dissolved Organic Carbon	110	113	98	109	80-120
Total Ammonia as Nitrogen	101	98	95	95	80-120
Total Kjeldahl Nitrogen	111	102	98	98	80-120
Nitrite Nitrogen	101	98	100	102	80-120
Nitrate Nitrogen	95	94	99	99	80-120
Alkalinity, as $CaCO_3$	100	99	102	100	80-120
Chloride	97	95	94	92	80-120
Sulfate	95	94	99	100	80-120
Organophosphorous Pesticides					
Azinphos menthyl	113	100	108	108	36-189
Bolstar	66	65	76	85	43-119
Coumaphos	96	65	87	95	60-124
Demeton O&S	36	61	73	**91**	12-85
Diazinon	94	83	84	91	64-122
Dichlorvos	57	65	70	93	46-141
Disulfoton	44	59	68	**92**	29-90
Chlorpyrifos (Dursban)	96	82	84	90	61-125
Ethoprop	96	86	84	90	65-125
Fensulfothion	122	78	134	142	54-161
Fenthion	85	78	70	115	50-118
Merphos	94	74	82	113	54-114
Mevinphos	**230**	193	159	177	43-205
Parathion methyl	101	92	94	93	53-137
Phorate	72	73	71	82	45-101
Ronnel	90	69	71	91	53-114
Stirophos	120	82	93	131	28-158
Tokuthion (Prothiofos)	84	79	81	87	56-123
Trichloronate	84	68	76	109	43-113
Ethion	90	69	79	94	59-118
Malathion	98	75	85	119	47-125
Parathion-ethyl	94	75	84	98	62-123

Bolded Values indicate analyses that were outside the Data Quality Objectives
LCS = Laboratory Control Sample
\- = Not Analyzed

Table G-3. Summary of Laboratory Control Sample/Laboratory Control Sample Duplicate Percent Recoveries and Relative Percent Differences for Metals in Association with each Water Sampling Event.

	DRY WEATHER SAMPLING EVENT							
	9/28/2004			10/5/2004			QC Limits	
WATER	LCS	LCSD	RPD	LCS	LCSD	RPD	% Recovery	RPD Limits
Dissolved Metals								
Aluminum	101	98	3	106	102	4	70-130	20
Cadmium	108	106	2	107	108	1	70-130	20
Chromium	107	105	2	106	107	1	70-130	20
Copper	108	108	0	104	104	0	70-130	20
Lead	99	98	1	100	100	0	70-130	20
Manganese	108	106	2	118	118	0	70-130	20
Nickel	106	104	2	104	104	0	70-130	20
Silver	105	104	1	106	106	0	70-130	20
Zinc	126	126	0	102	101	1	70-130	20
Total Recoverable Metals								
Aluminum	101	98	3	98	97	1	70-130	20
Boron	103	97	6	102	102	0	70-130	20
Cadmium	108	106	2	108	108	0	70-130	20
Chromium	107	105	2	92	93	2	70-130	20
Copper	108	108	0	110	109	1	70-130	20
Lead	99	98	1	91	92	0	70-130	20
Manganese	108	106	2	118	118	0	70-130	20
Nickel	106	104	2	102	102	0	70-130	20
Silver	105	104	1	99	99	0	70-130	20
Zinc	126	126	0	99	99	0	70-130	20

Bolded Values indicate analyses that were outside the Data Quality Objectives
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
RPD = Relative Percent Difference

Table G-3. Continued

	WET WEATHER SAMPLING EVENT							
	1/24/2005			1/31/2005			QC Limits	
WATER	LCS	LCSD	RPD	LCS	LCSD	RPD	% Recovery	RPD Limits
Dissolved Metals								
Aluminum	97	100	3	94	94	0	70-130	20
Cadmium	105	103	2	103	104	1	70-130	20
Chromium	94	94	0	100	100	0	70-130	20
Copper	94	96	2	93	94	0	70-130	20
Lead	89	86	2	101	101	0	70-130	20
Manganese	99	101	2	105	106	1	70-130	20
Nickel	92	95	4	92	92	0	70-130	20
Silver	98	97	1	103	104	1	70-130	20
Zinc	89	89	0	95	95	0	70-130	20
Total Recoverable Metals								
Aluminum	94	94	0	92	94	1	70-130	20
Boron	102	102	0	95	98	3	70-130	20
Cadmium	102	101	1	104	104	0	70-130	20
Chromium	101	102	1	98	99	1	70-130	20
Copper	101	101	0	96	97	1	70-130	20
Lead	100	100	0	102	101	1	70-130	20
Manganese	92	92	0	102	103	1	70-130	20
Nickel	100	100	0	94	95	1	70-130	20
Silver	104	103	1	107	106	1	70-130	20
Zinc	99	99	0	97	97	0	70-130	20

Bolded Values indicate analyses that were outside the Data Quality Objectives
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
RPD = Relative Percent Difference

Table G-4. Summary of Matrix Spike/Matrix Spike Duplicate Percent Recoveries and Relative Percent Differences in Association with the Dry Weather Sampling Event.

	DRY WEATHER SAMPLING EVENT							
	9/28/2004			10/5/2004			QC Limits	
WATER	MS	MSD	RPD	MS	MSD	RPD	% Recovery	RPD Limits
Analyte								
Ortho Phosphorus	104	105	0	110	111	1	80-120	20
Total Phosphorus	97	91	5	89	89	0	80-120	20
Total Organic Carbon	102	117	10	89	97	6	80-120	20
Dissolved Organic Carbon	101	97	3	101	106	4	80-120	20
Total Ammonia as Nitrogen	101	103	3	99	99	1	80-120	20
Total Kjeldahl Nitrogen	106	103	3	97	97	0	80-120	20
Nitrite Nitrogen	100	100	1	96	93	3	80-120	20
Nitrate Nitrogen	100	100	0	104	108	2	80-120	20
Chloride	97	98	0	89	92	2	80-120	20
Sulfate	98	99	1	88	91	1	80-120	20
Total Recoverable Metals								
Aluminum	87	87	0	94	94	0	70-130	20
Arsenic	-	-	-	-	-	-	70-130	20
Boron	88 (111)	88 (104)	0 (4)	98 (111)	106 (104)	2 (4)	70-130	20
Cadmium	103	104	1	108	108	0	70-130	20
Chromium	92	91	0	92	92	0	70-130	20
Copper	97	97	0	106	105	0	70-130	20
Lead	97	97	0	95	95	0	70-130	20
Manganese	88	89	1	117	116	1	70-130	20
Mercury	111	109	2	108	105	3	80-120	20
Nickel	92	91	0	102	102	0	70-130	20
Selenium	-	-	-	-	-	-	70-130	20
Silver	94	94	0	92	91	1	70-130	20
Zinc	92	91	1	100	99	1	70-130	20
Dissolved Metals								
Aluminum	88	90	2	89	87	2	70-130	20
Arsenic	88	89	1	88	89	1	70-130	20
Cadmium	109	107	1	109	108	1	70-130	20
Chromium	107	108	1	107	103	3	70-130	20
Copper	105	105	0	104	102	1	70-130	20
Lead	101	102	1	103	102	1	70-130	20
Manganese	105	107	2	**60**	**57**	2	70-130	20
Nickel	102	104	1	101	100	0	70-130	20
Selenium	97	97	1	103	107	4	70-130	20
Silver	99	100	1	94	93	1	70-130	20
Zinc	105	106	1	105	105	0	70-130	20

Bolded Values indicate analyses that were outside the Data Quality Objectives
MS = Matrix Spike NA = Not Applicable RPD = Relative Percent Difference MSD = Matrix Spike Duplicate - = Not Analyzed

Table G-4. Continued

WATER	DRY WEATHER SAMPLING EVENT 9/28/2004 MS	MSD	RPD	10/5/2004 MS	MSD	RPD	QC Limits % Recovery	RPD Limits
Organophosphorous Pesticides								
Azinphos menthyl	121	133	10	112	124	11	36-189	25
Bolstar	81	90	10	84	90	7	43-119	25
Coumaphos	-	-	-	81	83	2	60-124	25
Demeton O&S	-	-	-	70	84	18	12-85	25
Diazinon	80	93	15	86	95	11	64-122	25
Dichlorvos	-	-	-	84	90	7	46-141	25
Disulfoton	-	-	-	76	83	8	29-90	25
Chlorpyrifos (Dursban)	87	95	9	91	101	11	61-125	25
Ethoprop	84	98	15	89	93	4	65-125	25
Fensulfothion	-	-	-	103	105	2	54-161	25
Fenthion	-	-	-	98	98	0	50-118	25
Merphos	-	-	-	89	90	2	54-114	25
Mevinphos	188	**229**	19	197	191	3	43-205	25
Parathion methyl	92	103	11	105	116	10	53-137	25
Phorate	71	87	20	82	85	4	45-101	25
Ronnel	-	-	-	90	93	3	53-114	25
Stirophos	-	-	-	104	108	3	28-158	25
Tokuthion (Prothiofos)	89	91	2	89	93	5	56-123	25
Trichloronate	-	-	-	87	92	6	43-113	25
Ethion	-	-	-	87	88	1	59-118	25
Malathion	-	-	-	94	95	1	47-125	25
Parathion-ethyl	-	-	-	101	99	2	62-123	25

Bolded Values indicate analyses that were outside the Data Quality Objectives
MS = Matrix Spike NA = Not Applicable RPD = Relative Percent Difference MSD = Matrix Spike Duplicate - = Not Analyzed

Table G-5. Summary of Matrix Spike/Matrix Spike Duplicate Percent Recoveries and Relative Percent Differences in Association with the Wet Weather Sampling Event.

	WET WEATHER SAMPLING EVENT						QC Limits	
	1/24/2005			1/31/2005				
WATER	MS	MSD	RPD	MS	MSD	RPD	% Recovery	RPD Limits
Analyte								
Ortho Phosphorus	110	108	1	112	113	1	80-120	20
Total Phosphorus	109	106	2	110	112	1	80-120	20
Total Organic Carbon	102	99	3	109	105	3	80-120	20
Dissolved Organic Carbon	112	107	4	94	94	0	80-120	20
Total Ammonia as Nitrogen	106	100	5	106	100	5	80-120	20
Total Kjeldahl Nitrogen	101	100	1	101	100	1	80-120	20
Nitrite Nitrogen	116	114	2	113	115	2	80-120	20
Nitrate Nitrogen	102	96	2	101	107	4	80-120	20
Chloride	92	92	0	83	87	2	80-120	20
Sulfate	102	102	0	87	92	1	80-120	20
Total Recoverable Metals								
Aluminum	88	88	0	87	94	6	70-130	20
Arsenic	83	84	2	82	78	5	70-130	20
Boron	90	89	1	**NR**	**148**	14	70-130	20
Cadmium	102	103	1	100	100	0	70-130	20
Chromium	93	94	1	95	97	2	70-130	20
Copper	99	99	0	89	89	0	70-130	20
Lead	100	99	1	104	104	0	70-130	20
Manganese	86	86	0	99	102	3	70-130	20
Mercury	79	81	2	79	81	2	70-120	20
Nickel	95	95	0	87	86	1	70-130	20
Selenium	114	109	4	71	71	1	70-130	20
Silver	103	103	1	99	97	1	70-130	20
Zinc	100	101	1	88	90	3	70-130	20
Dissolved Metals								
Aluminum	86	85	2	86	88	2	70-130	20
Arsenic	83	84	2	82	78	5	70-130	20
Cadmium	113	113	0	102	103	2	70-130	20
Chromium	97	95	2	85	86	1	70-130	20
Copper	105	105	0	78	79	1	70-130	20
Lead	106	107	0	110	111	0	70-130	20
Manganese	111	109	2	76	80	3	70-130	20
Nickel	107	107	0	74	75	1	70-130	20
Selenium	117	120	3	71	71	1	70-130	20
Silver	98	98	0	88	90	2	70-130	20
Zinc	123	125	2	86	87	2	70-130	20

Bolded Values indicate analyses that were outside the Data Quality Objectives
MS = Matrix Spike NA = Not Applicable RPD = Relative Percent Difference MSD = Matrix Spike Duplicate - = Not Analyzed

Table G-5. Continued

	WET WEATHER SAMPLING EVENT						QC Limits	
	1/24/2005			1/31/2005				
WATER	MS	MSD	RPD	MS	MSD	RPD	% Recovery	RPD Limits
Organophosphorous Pesticides								
Azinphosmethyl	103	126	20	118	110	8	36-189	25
Bolstar	68	78	14	92	89	3	43-119	25
Coumaphos	102	103	1	101	103	2	60-124	25
Demeton O&S	75	**97**	**26**	76	82	7	12-85	25
Diazinon	71	87	20	92	91	1	64-122	25
Dichlorvos	70	89	24	95	100	5	46-141	25
Disulfoton	68	86	24	65	68	5	29-90	25
Chlorpyrifos (Dursban)	74	86	16	94	99	4	61-125	25
Ethoprop	72	86	18	96	95	1	65-125	25
Fensulfothion	**163**	**178**	9	159	155	3	54-161	25
Fenthion	79	88	11	110	114	4	50-118	25
Merphos	89	96	8	**117**	114	3	54-114	25
Mevinphos	136	169	22	180	176	2	43-205	25
Parathion methyl	83	97	16	101	97	4	53-137	25
Phorate	56	76	**30**	84	74	13	44-117	25
Ronnel	76	88	14	95	96	1	53-114	25
Stirophos	109	119	9	137	132	3	28-158	25
Tokuthion (Prothiofos)	69	84	20	90	89	2	56-123	25
Trichloronate	78	90	14	112	**114**	2	43-113	25
Ethion	87	91	4	99	99	1	59-118	25
Malathion	95	100	5	123	121	2	47-125	25
Parathion-ethyl	95	100	5	99	104	5	62-123	25

Bolded Values indicate analyses that were outside the Data Quality Objectives

MS = Matrix Spike NA = Not Applicable RPD = Relative Percent Difference MSD = Matrix Spike Duplicate - = Not Analyzed

Table G-6. Summary of SRM Percent Recoveries for Metals in Association with each Sampling Event.

	DRY WEATHER SAMPLING EVENT		WET WEATHER SAMPLING EVENT	
WATER	9/28/2004	10/5/2004	1/24/2005	1/31/2005
Total Recoverable Metals				
Aluminum	97 (95[1]) (80[2]) (90[3])	95 (91[1])	106 (101[1])	99 (96[1]) (90[2])
Arsenic	93	93	76 (78[1])	76 (78[1])
Boron	100 (99[1]) (93[2]) (94[3])	98 (93[1])	120 (115[1])	99 (103[1]) (87[2])
Cadmium	111 (106[1]) (111[2]) (107[3])	112 (105[1])	102 (100[1])	106 (103[1]) (104[2])
Chromium	104 (99[1]) (97[2]) (93[3])	91 (88[1])	107 (94[1])	100 (98[1]) (101[2])
Copper	102 (96[1]) (100[2]) (99[3])	106 (102[1])	101 (101[1])	96 (93[1]) (95[2])
Lead	105 (101[1]) (98[2]) (95[3])	100 (95[1])	104 (102[1])	105 (102[1]) (104[2])
Manganese	105 (95[1]) (98[2]) (94[3])	113 (89[1])	115 (99[1])	105 (94[1]) (109[2])
Mercury	-	109	104	104
Nickel	100 (99[1]) (97[2]) (97[3])	97 (99[1])	103 (102[1])	95 (96[1]) (96[2])
Selenium	95	105	-	70 (66[1])
Silver	108 (103[1]) (102[2]) (98[3])	93 (89[1])	105 (98[1])	107 (104[1]) (105[2])
Zinc	107 (103[1]) (101[2]) (101[3])	107 (102[1])	105 (105[1])	102 (104[1]) (103[2])
Dissolved Metals				
Aluminum	97 (95[1]) (80[2]) (90[3])	106 (101[1])	88 (99[1])	96 (90[1]) (89[2])
Cadmium	111 (106[1]) (111[2]) (107[3])	109 (105[1])	105 (102[1])	103 (104[1]) (103[2])
Chromium	104 (99[1]) (97[2]) (93[3])	111 (104[1])	93 (92[1])	98 (101[1]) (99[2])
Copper	102 (96[1]) (100[2]) (99[3])	102(97[1])	92 (99[1])	93 (95[1]) (94[2])
Lead	105 (101[1]) (98[2]) (95[3])	107 (102[1])	90 (95[1])	102 (104[1]) (102[2])
Manganese	105 (95[1]) (98[2]) (94[3])	113 (89[1])	100 (93[1])	94 (109[1]) (99[2])
Nickel	100 (99[1]) (97[2]) (97[3])	104 (101[1])	91 (92[1])	96 (96.0[1]) (99[2])
Silver	108 (103[1]) (102[2]) (98[3])	107 (99[1])	98 (96[1])	104 (105[1]) (103[2])
Zinc	105 (97[1]) (100[2]) (91[3])	105 (99[1])	92 (98[1])	97 (101[1]) (95[2])

Bolded Values indicate analyses that were outside the Data Quality Objectives

1 = Duplicate SRM analyzed 2 = Triplicate SRM analyzed 3= Quadruplicate SRM analyzed - = Not analyzed

Table G-7. Summary of Surrogate Spike Percent Recoveries of Triphenylphosphate for Organophosphorous Pesticides in Association with each Water Sampling Event.

	DRY WEATHER SAMPLING EVENT		WET WEATHER SAMPLING EVENT		
WATER	9/28/2004	10/5/2004	1/24/2005	1/31/2005	QC Limits
Sample ID					
Method Blank	97	90	73	90	57-125
Laboratory Control Sample	102	76	79	93	57-125
Matrix Spike	94	88	93	95	57-125
Matrix Spike Duplicate	98	86	95	95	57-125
Field Duplicate (Duplicated Station)	116 (M-2)	-	-	97 (C-4)	57-125
A-1 (Adobe Creek at Middlefield Road)	99	-	93	-	57-125
B-1 (Barron Creek at Park Blvd.)	84	-	84	-	57-125
M-1 (Matadero Creek at Park Blvd.)	94	-	92	-	57-125
M-2 (Matadero Creek at Laguna Ave.)	103	-	92	-	57-125
SU-1 (Sunnyvale East Channel at Ahwanhee.)	108	-	93	-	57-125
SU-2 (Sunnyvale East Channel at Daffodil Ct..)	92	-	85	-	57-125
SU-3 (Sunnyvale West Channel at Mathilda Ave.)	109	-	99	-	57-125
C-1 (Calabazas Creek at Arques Ave.)	-	81	-	101	57-125
C-4 (Calabazas Creek at Blaney Ave.)	-	86	-	100	57-125
ST-1 (San Thomas Aquino Creek at Scott Blvd.)	-	84	-	106	57-125

Bolded Values indicate analyses that were outside the Data Quality Objectives

- = Not analyzed

NA = Not applicable

Table G-8. Summary of Surrogate Spike Percent Recoveries of Tributylphosphate for Organophosphorous Pesticides in Association with each Water Sampling Event.

	DRY WEATHER SAMPLING EVENT		WET WEATHER SAMPLING EVENT		
WATER	9/28/2004	10/5/2004	1/24/2005	1/31/2005	QC Limits
Sample ID					
Method Blank	107	96	84	99	65-145
Laboratory Control Sample	108	80	87	102	65-145
Matrix Spike	94	95	94	106	65-145
Matrix Spike Duplicate	106	95	97	105	65-145
Field Duplicate (Duplicated Station)	118 (M-2)	-	-	111 (C-4)	65-145
A-1 (Adobe Creek at Middlefield Road)	106	-	100	-	65-145
B-1 (Barron Creek at Park Blvd.)	106	-	90	-	65-145
M-1 (Matadero Creek at Park Blvd.)	103	-	96	-	65-145
M-2 (Matadero Creek at Laguna Ave.)	112	-	98	-	65-145
SU-1 (Sunnyvale East Channel at Ahwanhee.)	112	-	101	-	65-145
SU-2 (Sunnyvale East Channel at Daffodil Ct..)	107	-	91	-	65-145
SU-3 (Sunnyvale West Channel at Mathilda Ave.)	112	-	109	-	65-145
C-1 (Calabazas Creek at Arques Ave.)	-	92	-	116	65-145
C-4 (Calabazas Creek at Blaney Ave.)	-	98	-	110	65-145
ST-1 (San Thomas Aquino Creek at Scott Blvd.)	-	92	-	113	65-145

Table G-9. Summary of Field Replicate Sample (submitted blind to analytical laboratory) Results in Association with Sampling Event 1 (28 September 2004 and 5 October 2004).

Sample Location	Analyte or Analytical Suite of Analyses	Reporting Limits Value	Reporting Limits Units	Original Sample Concentration	Duplicate Sample Concentration (SC-G-1-001)	RPD
SC04-M-2-001	**Analyte**					
	Ortho Phosphorus	0.01	mg/L	0.20	0.21	5
	Total Phosphorus	0.05	mg/L	0.36	0.71	**65**
	Total Dissolved Solids	1.0	mg/L	690	690	0
	Total Organic Carbon	1.0	mg/L	6.2	6.2	0
	Dissolved Organic Carbon	1.0	mg/L	5.8	6.1	5
	Total Ammonia as Nitrogen	0.10	mg/L	0.10U	0.10U	NA[1]
	Total Kjeldahl Nitrogen	0.10	mg/L	0.70	0.73	4
	Nitrite Nitrogen	0.10	mg/L	0.10U	0.10U	NA[1]
	Nitrate Nitrogen	0.10	mg/L	1.6	1.6	0
	Alkalinity as $CaCO_3$	1.0	mg/L	290	290	0
	Total Hardness	1.0	mg/L	330	330	0
	Chloride	5.0	mg/L	120	120	0
	Sulfate	1.0	mg/L	110	110	0
	Chlorophyll	1.0	µg/L	3.7	3.3	11
	Suspended Sediment Concentration					
	Total Solids	0.01	mg/L	8.8	7.0	23
	Total Coarse	0.01	mg/L	1.4	<1.0	NA[1]
	Total Fine	0.01	mg/L	7.4	6.9	7
	Total Recoverable Metals					
	Aluminum	25	µg/L	290	300	3
	Arsenic	0.500	µg/L	2.2	2.2	0
	Boron	1.0	µg/L	200	200	0
	Cadmium	0.20	µg/L	0.20U	0.20U	NA[1]
	Chromium	1.0	µg/L	2.6	2.3	12
	Copper	1.0	µg/L	5.0	5.0	0
	Lead	1.0	µg/L	1.0U	1.1	NA[1]
	Manganese	1.0	µg/L	35	43	21
	Mercury	0.00500	µg/L	3.2	2.6	21
	Nickel	2.0	µg/L	6.1	6.3	3
	Selenium	1.00	µg/L	1.0U	1.0U	NA[1]
	Silver	0.20	µg/L	0.20	0.20U	NA[1]
	Zinc	5.0	µg/L	17	20	16

Bolded Values indicate analyses that were outside the Data Quality Objectives

[1] = Value not applicable since one or more results were non-detect (not measured above the sample reporting limit)

Table G-9. (Continued)

Sample Location	Analyte or Analytical Suite of Analyses	Reporting Limits Value	Reporting Limits Units	Original Sample Concentration	Duplicate Sample Concentration (SC-G-1-001)	RPD
SC04-M-2-001	**Dissolved Metals**					
	Aluminum	25	µg/L	25U	25U	NA[1]
	Arsenic	0.500	µg/L	2.1	2.1	0
	Cadmium	0.20	µg/L	0.20U	0.20U	NA[1]
	Chromium	1.0	µg/L	2.0	2.5	22
	Copper	1.0	µg/L	2.9	2.6	11
	Lead	1.0	µg/L	1.0U	1.0	NA[1]
	Manganese	1.0	µg/L	8.0	7.1	12
	Nickel	2.0	µg/L	4.0	3.6	11
	Selenium	1.00	µg/L	1.0U	1.0U	NA[1]
	Silver	0.20	µg/L	0.20U	0.20U	NA[1]
	Zinc	5.0	µg/L	7.8	6.6	17
	Organophosphorus Pesticides	0.01-0.10	µg/L			
	Bacterial Concentrations					
	Total Coliform	2	MPN/100 ml	≥ 1600	≥ 1600	0
	Fecal Colifom	2	MPN/100 ml	≥ 1600	≥ 1600	0
	Enterococcus	2	CFU/100 ml	1800	1800	0

Bolded Values indicate analyses that were outside the Data Quality Objectives

[1] = Value not applicable since one or more results were non-detect (not measured above the sample reporting limit)

Table G-10. Summary of Field Replicate Sample (submitted blind to analytical laboratory) Results in Association with Sampling Event 2 (24 January 2005 and 31 January 2005).

Sample Location	Analyte or Analytical Suite of Analyses	Reporting Limits Value	Reporting Limits Units	Original Sample Concentration	Duplicate Sample Concentration (SC-G-1-002)	RPD
SC04-C-4-002	**Analyte**					
	Ortho Phosphorus	0.01	mg/L	0.079	0.08	1
	Total Phosphorus	0.05	mg/L	0.14	0.15	7
	Total Dissolved Solids	1.0	mg/L	450	450	0
	Total Organic Carbon	1.0	mg/L	4.2	4.1	2
	Dissolved Organic Carbon	1.0	mg/L	4.0	4.1	2
	Total Ammonia as Nitrogen	0.100	mg/L	0.10U	0.10U	NA[1]
	Total Kjeldahl Nitrogen	0.10	mg/L	0.52	0.32	48
	Nitrite Nitrogen	0.10	mg/L	0.10U	0.10U	NA[1]
	Nitrate Nitrogen	0.10	mg/L	0.47	0.46	2
	Alkalinity as $CaCO_3$	5.0	mg/L	260	260	0
	Total Hardness	1.0	mg/L	290	290	0
	Chloride	0.20	mg/L	45	45	0
	Sulfate	0.80	mg/L	58	58	0
	Chlorophyll	1.0	µg/L	1.2	1.4	15
	Suspended Sediment Concentration					
	Total Solids	0.01	mg/L	2.0	1.1	**58**
	Total Coarse	0.01	mg/L	0.3	0.2	40
	Total Fine	0.01	mg/L	1.65	0.94	**55**
	Total Recoverable Metals					
	Aluminum	25	µg/L	47	49	4
	Arsenic	0.500	µg/L	2.5	2.6	4
	Boron	5.0	µg/L	340	340	0
	Cadmium	0.20	µg/L	0.20U	0.20U	NA[1]
	Chromium	1.0	µg/L	1.1J	1.1	0
	Copper	1.0	µg/L	2.1	2.1	0
	Lead	1.0	µg/L	1.0U	1.0U	NA[1]
	Manganese	1.0	µg/L	3.2	3.5	9
	Mercury	0.00500	µg/L	5.0U	5.0U	NA[1]
	Nickel	2.0	µg/L	3.3	2.4	32
	Selenium	1.00	µg/L	1.0U	1.0U	NA[1]
	Silver	0.20	µg/L	0.20U	0.20U	NA[1]
	Zinc	5.0	µg/L	6.1	6.1	0

Bolded Values indicate analyses that were outside the Data Quality Objectives
[1] = Value not applicable since one or more results were non-detect (not measured above the sample reporting limit)

Table G-10. (Continued)

Sample Location	Analyte or Analytical Suite of Analyses	Reporting Limits Value	Reporting Limits Units	Original Sample Concentration	Duplicate Sample Concentration (SC-G-1-002)	RPD
SC04-C-4-002	**Dissolved Metals**					
	Aluminum	25	µg/L	25U	25U	NA[1]
	Arsenic	0.500	µg/L	2.6	2.4	8
	Cadmium	0.20	µg/L	0.20U	0.20U	NA[1]
	Chromium	1.0	µg/L	3.3J	4.5	31
	Copper	1.0	µg/L	1.8	1.8	0
	Lead	1.0	µg/L	1.0U	1.0U	NA[1]
	Manganese	1.0	µg/L	1.5	1.6	6
	Nickel	2.0	µg/L	2.1	2.2	5
	Selenium	1.00	µg/L	1.0U	1.0U	NA[1]
	Silver	0.20	µg/L	0.20U	0.20U	NA[1]
	Zinc	5.0	µg/L	5.0U	5.0U	NA[1]
	Organophosphorus Pesticides	0.01-0.10	µg/L			
	Bacterial Concentrations					
	Total Coliform	2	MPN/100 ml	1600	1600	0
	Fecal Colifom	2	MPN/100 ml	170	540	**104**
	Enterococcus	2	CFU/100 ml	600	130	**129**

Bolded Values indicate analyses that were outside the Data Quality Objectives

[1] = Value not applicable since one or more results were non-detect (not measured above the sample reporting limit)

STATE OF CALIFORNIA - THE RESOURCES AGENCY Arnold Schwarzenegger, *Governor*

DEPARTMENT OF FISH AND GAME
AQUATIC BIOASSESSMENT LABORATORY-CHICO
CALIFORNIA STATE UNIVERSITY, CHICO
CHICO, CA 95929-0555
530-898-4792

July 19, 2005

Tom King
Bioassessment Services
24988 Blue Ravine Road, Suite 108
Folsom, CA 95630

Dear Tom,

Attached are the results of my QC analysis of 2 samples submitted from the Santa Clara Spring 2005 project. The results are presented in five summary tables.

Overall taxonomy was very good and performed in accordance with the California Stream Bioassessment Procedure (CSBP) Level I standards with the following exceptions.

A vial containing specimens originally identified as *Drunella* contained both *Drunella* and *Serratella*. The *Serratella* were earlier instars but could be separated from the *Drunella* by their cylindrical forefemora, the lack of tubercles on the leading edge of the femora and their reduced maxillary palps (Allen and Edmunds, 1962; 1963).

The specimen originally identified as Ephydridae is instead, in my opinion, a sciomyzid. The head had been dissected from the body and had a small scleritized structure near where the ventral scleritized arch would be if the larva were a sciomyzid (Courtney et al., 1996). It appears as if this structure was damaged during the dissection. I would qualify my identification since I have some experience with adult Sciomyzidae, but little with the larvae.

Neoplasta larvae were consistently misidentified as *Chelifera/Metachela*. The figures in MacDonald and Harkrider (1999) show *Neoplasta* as having more robust prolegs (i.e. thick in comparison to the abdominal segment length) and the pairs of terminal abdominal setae arising from well-separated processes. Larvae of *Chelifera/Metachela* have thinner prolegs and the setal processes are usually contiguous, although we have seen some specimens where these processes were very slightly separated.

I welcome any questions or comments you may have concerning this report.

Sincerely,

Brady Richards
Austin Brady Richards
Aquatic Bioassessment Laboratory–Chico
California State University, Chico
Chico, CA 95929-0555

arichards@csuchico.edu
(530) 898-4792

Literature Cited

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MacDonald, J. F. and J. R. Harkrider (1999). "Differentiation of larvae of *Metachela* Coquillett and *Neoplasta* Coquillett (Diptera: Empididae: Hemerodromiinae) based on larval rearing, external morphology, and ribosomal DNA fragment size." Journal of the North American Benthological Society **18**(3): 414-419.

Comparative Taxonomic Listing of all Submitted Samples

Samples submitted by Bioassessment Services for Project: Santa Clara Spring 2005

Report prepared by Brady Richards, CDFG ABL-Chico, 7/19/2005

Taxonomis	Sample no.	Vial	Original	Original Count	Stag	ABL Coun	ABL ID
	BAS-2193						
		1	Ostracoda	5		5	Ostracoda
		2	Simulium	13		13	Simulium
		3	Orthocladiinae	58		58	Orthocladiinae
		4	Torrenticola	1		1	Torrenticola
		5	Neohermes	1		1	Neohermes
		6	Optioservus	4	A	4	Optioservus
		7	Caloparyphus/Euparyphus	1		1	Caloparyphus/Euparyphus
		8	Prostoma	1		1	Prostoma
		9	Antocha	5		5	Antocha
		10	Hemerodromia	3		3	Hemerodromia
		11	Brachycera	1		1	Brachycera
		12	Glossosoma	1		1	Glossosoma
		13	Enchytraeidae	10		10	Enchytraeidae
		14	Naididae	29		26	Naididae
		15	Optioservus	54		54	Optioservus
		16	Chelifera/Metachela	1		1	Neoplasta
		17	Diphetor hageni	1		1	Diphetor hageni
		18	Ceratopogonidae	1	L	1	Ceratopogonidae
		19	Baetis	239		238	Baetis
		20	Narpus	4		4	Narpus
		21	Bezzia/Palpomyia	1		1	Bezzia/Palpomyia
		22	Tanypodinae	1		1	Tanypodinae
		23	Pisidium	2		2	Pisidium
		24	Prosimulium	1		1	Prosimulium
		25	Argia	5		5	Argia
		26	Chironomini	3		3	Chironomini
		27	Tanytarsini	35		34	Tanytarsini
		28	Glutops	1		1	Glutops
		29	Agapetus	3		3	Agapetus
		30	Lepidostoma	11		11	Lepidostoma

Page 1 of 3

Appendix H (Continued)

Taxonomis	Sample no.	Vial	Original	Original Count	Stag	ABL Coun	ABL ID
	BAS-2207						
		1	Maruina lanceolata	2		2	Maruina lanceolata
		2	Chironomini	1		1	Chironomini
		3	Amiocentrus aspilus	1		1	Amiocentrus aspilus
		4	Lepidostoma	1		1	Lepidostoma
		5	Argia	1		1	Argia
		6	Bezzia/Palpomyia	2		2	Bezzia/Palpomyia
		7	Cinygmula	2		2	Cinygmula
		8	Soliperla	1		1	Soliperla
		9	Orthocladiinae	159		159	Orthocladiinae
		10	Blephariceridae	2		2	Blephariceridae
		11	Clinocera/Trichocl inocera	1		1	Clinocera/Trichoclinocera
		12	Tanytarsini	1		1	Tanytarsini
		13	Ameletus	1		1	Ameletus
		14	Ephemerella	7		7	Ephemerella
		15	Epeorus	16		16	Epeorus
		16	Caloparyphus/Eup aryphus	3		3	Caloparyphus/Euparyphus
		17	Eubrianax edwardsii	3		3	Eubrianax edwardsii
		18	Simulium	18		18	Simulium
		19	Ordobrevia nubifera	1	A	1	Ordobrevia nubifera
		20	Hygrobates	1		1	Hygrobates
		21	Optioservus	11		11	Optioservus
		22	Sperchon	2		2	Sperchon
		23	Hydrobiidae	8		8	Hydrobiidae
		24	Chelifera/Metache la	1		1	Neoplasta
		25	Planariidae	4		4	Planariidae
		26	Ceratopogonidae	1		1	Ceratopogonidae
		27	Drunella	35		28	Drunella
		27	Drunella	35		8	Serratella

Taxonomis	Sample no.	Vial	Original	Original Count	Stag	ABL Coun	ABL ID
	BAS-2207						
		28	Torrenticola	22		22	Torrenticola
		29	Naididae	1		1	Naididae
		30	Lebertia	4		4	Lebertia
		31	Diamesinae	3		3	Diamesinae
		32	Paraleptophlebia	1		1	Paraleptophlebia
		33	Micrasema	8		8	Micrasema
		34	Ordobrevia nubifera	3		3	Ordobrevia nubifera
		35	Cryptolabis	1		1	Cryptolabis
		36	Optioservus	2	A	2	Optioservus
		37	Diphetor hageni	1		1	Diphetor hageni
		38	Baetis	114		114	Baetis
		39	Narpus	1		1	Narpus
		40	Hydropsyche	9		9	Hydropsyche
		41	Calineuria californica	2		2	Calineuria californica
		42	Suwallia	35		35	Suwallia