

Index of Biotic Integrity Development

Aquatic biological integrity refers to the condition of the biological components of a water body. Because water bodies contain a variety of biological organisms (e.g., fish, amphibians, insects, algae) it is difficult to measure the condition of each. Therefore, specific categories of organisms are typically used as indicators of biological integrity.

Since 2002, the Program and other Bay Area urban runoff management programs having been collecting and analyzing aquatic invertebrates as indicators of biological integrity in local water bodies. As a next step, the Bay Area urban runoff programs, including SCVURPPP, are collaborating on the development of a Benthic Macroinvertebrate Index of Biotic Integrity (B-IBI) for creeks in the San Francisco Bay Area. A B-IBI serves as an easy-to-use scorecard for determining the condition of water quality and stream habitat (i.e., stream health) using biological communities. In January 2005, a B-IBI Work Plan was finalized. During FY 2007-2008, Program staff contributed substantial in-kind services towards the completion of following regional Work Plan tasks:

Acquire and Compile Existing Bay Area Bioassessment Data

Program staff provided in-kind services collecting and compiling existing bioassessment data from eight Bay Area counties. Data sources included the Water Board, municipal stormwater programs and volunteer monitoring programs. To date, data from approximately 400 sites have been compiled.

Standardize and Import into a Centralized Database

Data sets compiled were standardized into a format and imported into the California Ecological Data Application System (Cal EDAS), which is currently housed at SCVURPPP. All bioassessment data collected through spring 2005 are included in Cal EDAS.

Establish Preliminary Reference Conditions for Bay Area Creeks

The development of biological reference conditions for Bay Area creeks is an integral step in completing the B-IBI. Reference conditions provide a way for comparing biological data from a potentially impacted site to a "least disturbed" site; and to determine the degree of impact at a site. In FY 2007-2008, Program staff began working with UC Berkeley PhD candidates to conduct a GIS-based land use analysis to define "least disturbed sites" that will form the pool of reference sites used to establish the B-IBI.

Test, Select and Score Bioassessment Metrics

In FY 2007-2008, Program staff began conducting analyses to determine the pool of metrics that will be used in the B-IBI. This task will continue into FY 2008-2009.

In FY 2008-2009, Program staff will complete the remaining Work Plan tasks, including confirming the metrics using a validation data set, seeking technical review and publishing the Provisional Bay Area B-IBI. Program staff anticipates that the Provisional B-IBI for San Francisco Bay Area will be completed in FY 2008-2009.

References

--SCVURPPP 2007. *Monitoring and Assessment Summary Report: Santa Clara Basin Creeks (2002-2007)*. Prepared by Eisenberg, Olivieri and Associates (EOA, Inc.) for the Santa Clara Valley Urban Runoff Pollution Prevention Program. September 2007.
--SCVURPPP 2008. *Investigative Monitoring Project: Water and Sediment Quality and Toxicity in Stevens Creek, Santa Clara County, California*. Prepared by Eisenberg, Olivieri and Associates (EOA, Inc.) for the Santa Clara Valley Urban Runoff Pollution Prevention Program. September 2008.
--SCVURPPP 2008. *Monitoring and Assessment Summary Report: Coyote Creek and Lower Penitencia Creek*. Prepared by Eisenberg, Olivieri and Associates (EOA, Inc.) for the Santa Clara Valley Urban Runoff Pollution Prevention Program. September 2008.

SCVURPPP is an association of the thirteen cities and towns (Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale) in the Santa Clara Valley, together with Santa Clara County and the Santa Clara Valley Water District. Program participants share a common permit to discharge stormwater to South San Francisco Bay.



WATER QUALITY MONITORING AND WATERSHED ASSESSMENT

(3RD EDITION)

From its inception in 1987, the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) has been a regional, statewide and national leader in the collection and analysis of monitoring and assessment data used to evaluate the condition of water bodies and impacts of urban runoff. The Program's initial monitoring activities established baseline water quality conditions of runoff from various urban land uses. Subsequent annual monitoring plans have included waterbody assessments designed to enhance understanding of the sources and extent of urban runoff pollution, its effects and methods for its control.

The Program conducts, manages and/or actively collaborates on a range of monitoring and assessment-related activities at varying spatial scales. These include studies designed to assess water quality and beneficial uses in local water bodies (e.g., creeks) and the San Francisco Bay, and loading studies to evaluate the proportion of pollutants entering the Bay from local tributaries. Studies on local water bodies are typically conducted through the Program's Multi-Year Monitoring Program. Monitoring activities conducted in the San Francisco Bay and pollutant loading evaluations are conducted through regional partnerships such as the Regional Monitoring Program for Water Quality (RMP). The Program contributes financially and actively participates via the RMP Steering and Technical Review Committees.

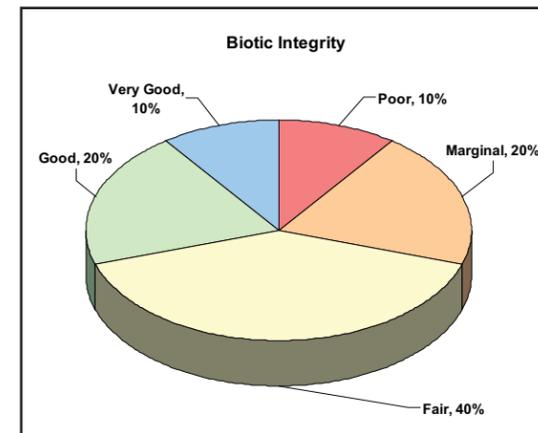


Figure 3. Conceptual summary (or rating) of biological integrity conditions at Bay Area bioassessment sites.

Local Water Body Monitoring and Assessment

Water and sediment quality data are collected in Santa Clara Valley creeks, analyzed and interpreted annually by the Program to answer the core management questions (Table 1). Fiscal Year (FY) 2007-08 was the sixth year of monitoring under the Program's Multi-Year Monitoring Plan. The following is a synopsis of results, conclusions and lessons learned from Program monitoring and assessment activities conducted in FY 2007-2008, and in previous years.

Core Management Questions

1. Are conditions in creeks/rivers protective or likely to be protective of beneficial uses?
2. What is the extent and magnitude of the current or potential creek problems?
3. What is the relative urban runoff contribution to the creek problem(s)?
4. What are the sources to urban runoff that contribute to creek problem(s)?
5. Are conditions in creeks getting better or worse?

Screening-Level Monitoring Results and Conclusions

Between July 2002 and June 2008, the Program collected and analyzed screening-level water quality monitoring data from 73 creek sites located within 11 of the 13 watersheds found in the Santa Clara Basin. Water samples were analyzed for conventional water quality parameters, chemical pollutants (metals and organic contaminants), aquatic toxicity and pathogen indicators. In addition, benthic macroinvertebrate and fish bioassessments were conducted to better understand the status of aquatic life in these watersheds.

Table 1. SCVURPPP Monitoring and Assessment Program Core Management Questions

Building on the lessons learned between 2002 and 2007, the Program began using the sediment quality triad (SQT) monitoring approach in FY 2007-2008. The SQT entails a “weight of evidence” approach using bedded sediment chemistry, sediment toxicity and bioassessment data (i.e., benthic macroinvertebrate community and physical habitat data) (Figure 1). During FY 2007-2008, the Program conducted sampling at 28 sites within Coyote Creek and Lower Penitencia Creek watersheds. In summary, the following conclusions were made based on sampling conducted between 2002 and 2008:

- Numeric Water Quality Objectives (WQOs) are generally met for all pollutants sampled, including mercury, copper and nickel (Table 2);
- Dissolved oxygen concentrations were > 7.0 mg/L in 93% of the 187 samples measured (Numeric WQO = 6.0 mg/L);
- 82% of the 200 pH measurements met Numeric Water Quality Objectives;
- 93% of the 188 samples analyzed for un-ionized ammonia met Numeric Water Quality Objectives;
- Organophosphate pesticides (including diazinon) are generally not detected in creek water since the phase-out of diazinon began in late 2004;
- Acute aquatic toxicity has dramatically decreased in creek water from the mid-1990’s to 2008;
- Biological and physical integrity generally decreases in creeks as you move from the uplands towards San Francisco Bay;
- With the exception of nickel (which is a naturally occurring metal at relatively high concentrations in Bay Area watersheds), metals measured in creek sediments were consistently below problematic concentrations; and
- Significant sediment toxicity was observed at 6 of 10 sites sampled and the co-occurrence of pyrethroid pesticides (i.e., bifenthrin and cypermethrin) suggests that pyrethroids may be the cause (at least partially) of the toxicity.

Pollutant	%
Arsenic	100%
Cadmium	100%
Chromium (III)	100%
Copper	96%
Lead	100%
Mercury	100%
Nickel	100%
Selenium	94%
Silver	100%
Zinc	100%

Table 2. Percentage of samples (n=82) collected by SCVURPPP between 2002 and 2007 that met metal Water Quality Objectives

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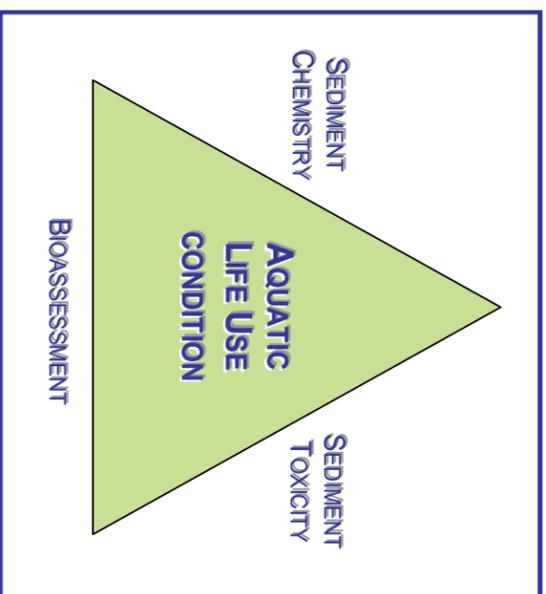


Figure 1. Sediment Quality Triad (SQT) used by SCVURPPP to assessment aquatic life use condition in Santa Clara Basin creeks.

Investigative Monitoring - Stevens Creek

In addition to SQT monitoring conducted in the Coyote Creek watershed, the Program conducted a follow-up investigative monitoring project in FY 2007-2008 to assess the intra-annual variability in pollutant concentrations in bedded sediment, and identify sources of sediment and/or water toxicity observed in Stevens Creek during previous sampling conducted by the San Francisco Bay Regional Water Quality Control Board’s (Water Board) Surface Water Ambient Monitoring Program. In particular, the investigative monitoring project was designed to answer the following monitoring questions:

- What are the extent, magnitude and causes of toxicity?
- What are the intra-annual range and variability of chemical concentrations in bedded sediments?

Based on the results of water samples and bedded sediment samples collected from three sites during four sampling events in FY 2007-2008, the following preliminary conclusions were made:

- Toxicity test organism survival was reduced in only two of twenty water samples collected between 2002 and 2008, suggesting that aquatic toxicity impacts are moderate to minimal (Figure 2).
- Sediment toxicity appears to be present in Stevens Creek, and in particular, a high degree of toxicity was present after storm events that generate runoff from primarily urban land uses (Figure 2).
- In general, all metals (with the exception of naturally occurring chromium and nickel) and pyrethroid pesticides appear to be below toxic concentrations, suggesting that these chemicals are not the primary causes of the observed toxicity.
- On average, the intra-annual variability of metal concentrations in Stevens Creek bedded sediments is minimal ($\pm 20\%$). Therefore, the Program feels confident that metal concentrations in a single bedded sediment sample collected after a significant rainfall event or following the wet weather season will be representative of the average annual concentration.

Based on the results of the investigative monitoring conducted in FY 2007-2008 within the Stevens Creek watershed, the Program plans to continue to investigate the extent, magnitude and causes of sediment toxicity in Stevens Creek in FY 2008-2009.

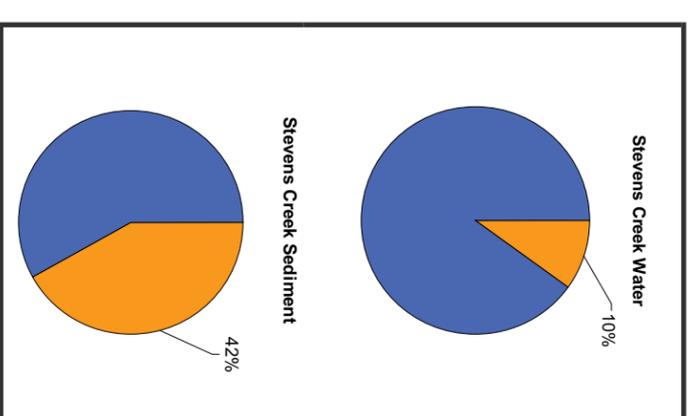


Figure 2. Percent of Stevens Creek water and sediment samples that reduced the survival of test organisms (2002-2008)

Unified Stream Assessments (Creek Surveys)

Unified Stream Assessment – Matadero Creek

To assess the overall condition and potential impacts to creeks in the Matadero Creek watershed, the Program conducted a screening-level continuous creek walk during the summer of 2007 using the Unified Stream Assessment (USA) protocol. This protocol uses visual observations to provide an overall picture of the condition and features of the creek channel and riparian corridor. Overall reach condition (e.g., bank stability, instream and riparian habitat, floodplain connectivity) was qualitatively assessed. In addition, individual impacts (e.g., creek crossings, utilities, outfalls, areas with erosion, channel modifications and trash) were recorded. To document the methods and results of the walks, the Program developed the report entitled *Unified Stream Assessment in Matadero Creek Watershed*.

Evaluating the Utility of the Unified Stream Assessment

During 2008, the Program collaborated with San Mateo Countywide Water Pollution Prevention Program to develop a guidance document on the potential uses of the USA protocol based on recent experience in the Bay Area. This document, entitled *Unified Stream Assessment: Potential Uses for Stormwater Programs - San Francisco Bay Area Examples* is intended for use by municipal stormwater programs and other interested agencies. In future years, Phase I municipal stormwater programs in the Bay Area will likely be required to conduct stream surveys using the USA or an equivalent method. Data generated through USA surveys can address multiple stormwater monitoring-related objectives.



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