SCVURPPP and SMSTOPPP Pilot
Implementation and Testing of the
RWQCB Rapid Trash Assessment
March 1, 2003

INTRODUCTION

Program staff implemented and tested the Regional Water Quality Control Board's (RWQCB) *Rapid Trash Assessment Worksheet* at nine stream locations in Santa Clara and San Mateo Counties. Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and San Mateo Countywide Pollution Prevention Program (SMSTOPPP) are collaborating to determine the utility of the approach for performing the following functions:

- Document baseline levels of trash in creeks
- Identify sources of trash and appropriate control measures to reduce trash
- Evaluate effectiveness of trash management practices
- Assess all creeks in the SCVURPPP and SMSTOPPP jurisdiction for trash
- Assess impairment of beneficial uses by trash

Results of the pilot assessment were presented by Program staff at the September 25th SCVURPPP Trash Ad Hoc Task Group (AHTG) and at the October 2, 2002 BASMAA Monitoring Committee meeting. Comments from the Trash AHTG were compiled and incorporated into the discussion section of this memorandum. The current draft of the trash assessment technical memorandum was approved by the AHTG at the November 4, 2002 Trash AHTG meeting.

Development and implementation of trash assessment protocols is one component of the SCVURPPP and SMSTOPPP Trash Work Plans. SCVURPPP and SMSTOPPP will consider the recommendations included in this memorandum and comments from Regional Board staff and members of the BASMAA Monitoring Committee for future implementation of trash assessments.

BACKGROUND

A November 2001 Regional Board staff report proposes changes to the 1998 303(d) list of impaired water bodies in the Bay area. The staff report states there "are excessive levels of trash in virtually all urbanized waterways of the San Francisco Bay Region." However, listing these waterways as impaired by trash is not proposed due to a lack of consistent assessment methodology.

Instead, the staff report proposes placing all Bay area urban creeks, lakes, and shorelines on a preliminary or "monitoring" list due to the threat of trash to impair water quality. It states that between now and the next 303(d) listing cycle, municipalities will be expected to assess trash impairments in their jurisdictions, as documented by storm water agencies in annual reports to the Regional Board. The report recommends that the approach mirror the standard TMDL approach of defining the problem, identifying the sources through monitoring or existing information, and developing a program of action to address the principle sources. Regional Board staff will review this specific information in the next listing cycle and determine whether specific water bodies warrant 303(d) listing for trash, and note the existence of relatively clean urban streams.

METHODS

The RWQCB Rapid Trash Assessment Version 6.0 was released to the public on September 25, 2002. The assessment was designed for several purposes, including ambient monitoring, evaluation of management actions, and evaluation of the effects of public access to trash condition of creeks. The RWQCB began implementing the trash assessment in summer of 2002 as part of their Surface Water Ambient Monitoring Program (SWAMP).

The assessment protocol includes identification and enumeration of all trash items that occur below high water line and along stream banks within a 100-foot section of stream. The second part of the RWQCB protocol includes determination of condition for six assessment parameters (scores 0-20, higher score = less trash) using the narrative parameter descriptions provided in the assessment worksheet. Program staff attended a training session on these protocols given by RWQCB staff. In addition to implementing the assessment approach, Program staff took digital photographs at each site to determine if photo documentation could accurately depict level of trash and potential impairment.

The pilot testing of the RWQCB's approach did not include implementing the assessment during different seasons to determine temporal variation of trash condition at individual sites. The pilot assessment was conducted in the fall to capture levels of trash in the creeks prior to winter rains, and before the national trash cleanup event that occurred on September 21st 2002.

Assessments were completed over a two-day period in September 2002 at five stream locations within San Pedro Creek (Figure 1), a coastal watershed in San Mateo County, and four stream locations in Coyote Creek watershed (Figure 2), which is located in the eastern portion of the Santa Clara Valley and drains into the South Bay. The assessment locations were selected based on several factors including known problem areas, land use type (residential, commercial, open space) and stream size. Creek segments in Upper Penitencia (total =3) and San Pedro Creek (total = 5) were selected at different points in each respective watershed to represent varying degrees of urbanization, i.e., sites at the lower, middle and upper sections of the urbanized portion were surveyed within each watershed. One site on Coyote Creek was sampled to identify the feasibility of this assessment approach in larger streams.

RESULTS

Individual parameters scores, total scores and the number of major trash item types for each assessment site are provided in Tables 1 and 2. Major findings include:

1) Known problem areas had the worst scores within each watershed. The flea market site, although not previously identified as a problem area, had low trash scores (more trash) with an apparent chronic trash problem and should be considered a problem area. The two highest scores (less trash) were at the upper sites of each watershed, toward the edge of the urban boundary.

2) Total scores (parameter scores combined) decreased and total trash items increased in the downstream direction. Most of the individual assessment parameter scores also decreased in the downstream direction, with the exception of the human health parameter, which was consistently rated as sub-optimal at all but two sites.

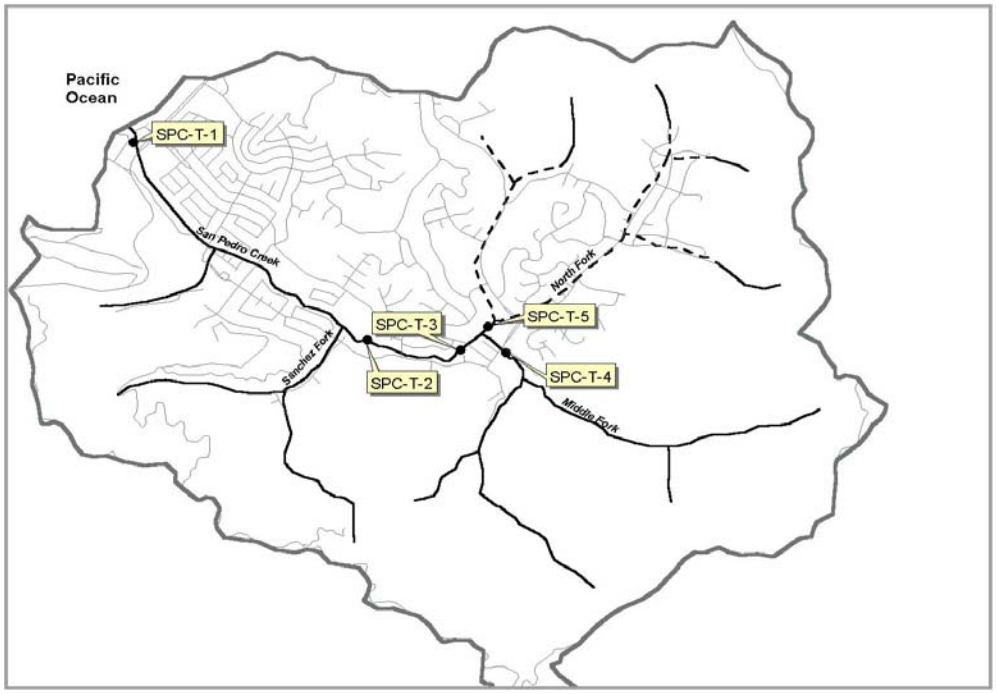

Figure 1. Location of pilot trash assessments conducted in San Pedro Creek.

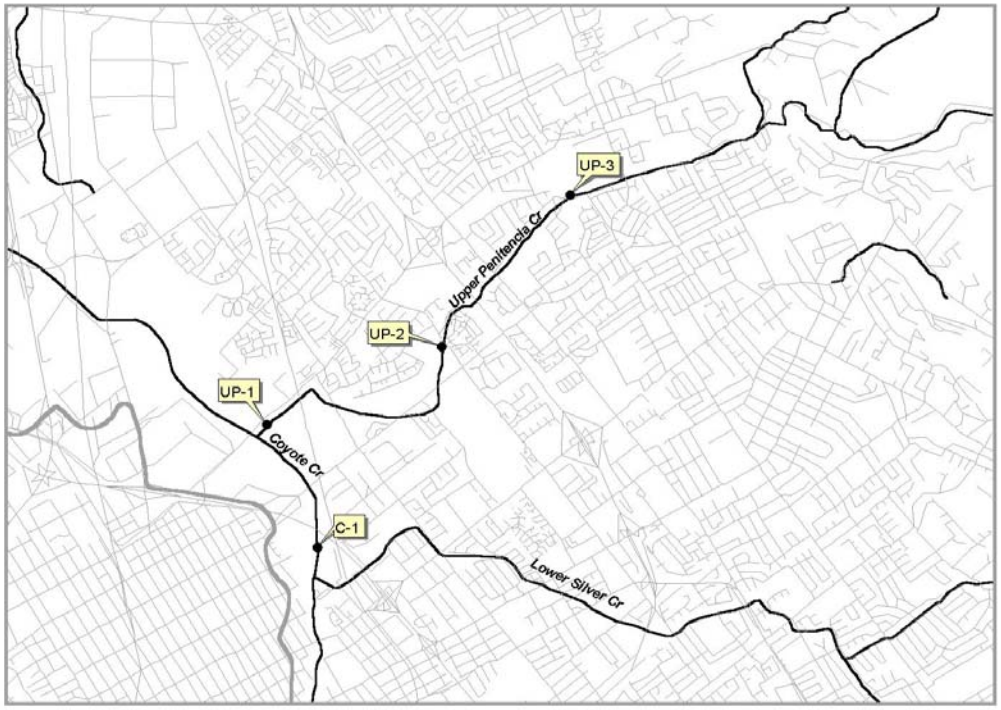

Figure 2. Location of pilot trash assessments conducted in Upper Penitencia and Coyote Creek.

3) The survey worked best in Upper Penitencia and San Pedro Creeks because all areas of the stream habitat were accessible and generally visible. The assessment at the site on Coyote Creek was less effective because the creek was too deep in some areas and the visibility too poor to accurately identify all trash items. There were generally no problems identifying trash along the stream banks, although there was difficulty in some instances of identifying the upper boundary (see # 5).

4) Digital photographs provided insufficient details to identify level of trash, estimate threats to water quality, or potential sources of trash. The relative number of trash items and types of trash are not clearly distinguishable. These results were consistent with earlier RWQCB evaluation. The photos may be useful for identifying benchmarks that define site boundaries and for documenting the general conditions of the site.

5) Using slightly different definitions for the stream bank boundary can have significant impact on the results. Incorporating trash items along the edge of upper right bank adjacent to a parking lot (at lowest site in San Pedro Creek) resulted in decreasing the total score from 74 to 30. Integrating trash for the upper section of streambank was questionable in this case because dense riparian vegetation appeared to prevent trash from entering the creek. There was minimal evidence of trash in the creek.

6) The lower site of San Pedro Creek and Upper Penitencia Creek (flea market) were cleaned up for trash shortly after the assessment. If the assessment had been repeated after the cleanup, the trash scores would have been much improved.

7) Eight of nine sites were rated poor for quantity of trash. In contrast, half of these eight sites were qualitatively rated sub-optimal (visual estimation of trash problem). As a result, conditions for qualitative and quantitative parameters were not very well correlated.

8) The most common trash items for all sites were plastic (primarily bags, bottles and wrappers), biodegradable (mostly paper), and metal (aluminum foil wrappers and cans). Trash items were more prevalent below the water line, with the exception of paper, cigarette butts and glass bottles, which were more common on the stream banks.

9) The trash items found that were considered potential threats to aquatic organism health were typically plastic (bags, bottles, wrappers) and other buoyant items (styrofoam and cigarette butts). The condition rating for aquatic health parameter was largely based on the relative number of these items found (e.g., low, medium prevalence, large amount), regardless if the plastic items were in the creek or on the bank. The scores typically decreased in the downstream direction.

10) There were few trash items found considered to be threats to human health. The most common were sharp objects, such as glass and jagged metal. There were animal feces and diapers found on the banks of two sites. The condition for this parameter was never optimal because there was always glass found on-site; five of the nine sites were rated sub-optimal due to presence of glass. There were no spatial trends observed for this parameter.

11) Dumping and littering appear to be a major problem for some sites we assessed. All four sites that were rated poor for this parameter had the lowest total scores and the highest number of trash items. Three of these sites were commercial and one was

Table 1. Rapid trash assessment results from watersheds in Santa Clara and San Mateo County. Individual trash assessment parameter scores range from 0-20, with low numbers representing poor conditions. Similarly, low total score represents poor conditions. The sites marked with (*) refer to previously known trash problem areas.

Location Description	Site Id	Land use	Date	Trash Assessment Parameter Scores						
				Qual.	Quant.	Aquatic Life	Human health	Dump/ Litter	Accum	Total Score
Santa Clara County (Upper Penitencia Creek)										
Fleamarket	UP-1	Commercial	9/12/02	6	0	5	16	5	7	**39**
Penitencia Park (lower)	UP-2	Residential/park	9/12/02	13	4	11	3	12	10	**53**
Penitencia Park (upper)	UP-3	Residential/park	9/12/02	15	5	15	15	14	13	**77**
Watson Park (Coyote)*	C-1	Undeveloped Park	9/12/02	8	2	4	12	1	6	**33**
San Mateo County (San Pedro Creek)										
Above Pacifica Beach*	SPC-T-1	Commercial	9/20/02	6	1	4	5	5	9	**30**
Behind Sanchez Art Center	SPC-T-2	Residential	9/20/02	12	3	6	15	15	4	**55**
Below Linda Mar Bridge	SPC-T-3	Residential	9/20/02	12	3	8	15	14	5	**57**
Above Oddstad Bridge	SPC-T-4	Residential/park	9/20/02	15	6	14	15	13	19	**82**
Behind Shopping Center (North Fork)*	SPC-T-5	Commercial	9/20/02	1	0	1	11	5	1	**19**

Table 2. Total number of items from each major category of trash tallied in trash assessments for nine locations in Santa Clara and San Mateo County. Stream location "A" and "B" represents above and below, respectively, high water line.

Site Id	Plastic		Biohazard		Const Debris		Misc.		Metal		Large Items		Toxic		Bio-degradable		Glass		Fabric		Total #
Location	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	
UP-1	77	85	0	0	3	0	2	13	10	4	0	0	0	0	35	36	0	0	1	4	**270**
UP-2	22	7	2	0	5	0	2	0	14	0	0	0	1	0	6	6	6	0	2	1	**74**
UP-3	17	13	0	0	0	1	2	0	1	4	0	0	0	0	7	12	2	1	1	0	**61**
C-1	35	17	0	0	4	0	1	0	10	2	20	0	0	0	18	26	3	3	2	2	**143**
SPC-T-1	32	46	0	1	2	0	1	61	4	6	0	0	0	0	4	64	0	1	0	1	**223**
SPC-T-2	66	29	0	0	11	0	4	0	14	3	1	0	0	0	3	6	1	1	14	3	**156**
SPC-T-3	80	10	0	0	8	0	14	1	11	0	0	0	0	0	4	0	2	0	1	1	**132**
SPC-T-4	5	9	0	0	4	1	1	0	9	2	0	1	0	0	0	2	2	9	1	1	**47**
SPC-T-5	205	31	0	0	11	17	14	3	29	11	4	1	0	0	19	4	0	11	2	4	**366**
Total	539	247	2	1	48	19	41	78	102	32	25	2	1	0	96	156	16	26	24	17	**1472**

undeveloped parkland, which had low scores due to dumping. A majority of the trash observed was from littering, not dumping.

12) Accumulation of trash generally increases in the downstream direction as expected, with the exception of the lower site on San Pedro Creek, which had very little accumulated trash. This may be due to yearly trash clean up events. Only two of nine sites had less than five accumulated trash items; the rest of the sites were marginal or poor.

DISCUSSION

The SCVURPPP Trash AHTG evaluated the results of the pilot assessment and the overall approach used in the RWQCB protocols. The AHTG addressed the following questions to evaluate the utility of the RWQCB's assessment protocols for assessing trash in urban streams:

- What role should the RWQCB's protocol play in assessing trash? (e.g., identify baseline levels of trash in urban creeks; document status and trends; identify trash sources; evaluate effectiveness of BMPs).
- How feasible is the approach to assess all urban creeks in SCVURPPP and SMSTOPPP jurisdictions?
- Can the results be used to assess potential impairment to beneficial uses?
- What refinements would enhance utility of the assessment approach?

Role of Trash Assessment for SCVURPPP

The Trash AHTG agreed that the RWQCB trash assessment could be used at specific reaches to establish baseline levels of trash during selected index periods. The dry season is optimal time period to use RWQCB protocols since low water levels provides maximum access to streambed and banks to measure trash condition. It is important to note the amount of trash documented in the assessment does not measure total amount of trash that enters and is transported in receiving waters, but rather more of a rapid estimate of trash condition for a snapshot in time in a limited number of locations. The trash assessments are useful to identify and prioritize trash problem areas. Future assessments could be conducted at these sites and index period using the same protocols to document status and trends or to help evaluate the effectiveness of targeted BMPs. In addition, the assessment results may assist in the identification of potential sources of trash and appropriate BMPs to implement. Overall, the protocols would be useful in prioritizing and implementing management activities and measuring the effectiveness of these actions.

One limitation identified by the AHTG is related to implementing the RWQCB protocols to characterize trash conditions for entire water bodies or subwatersheds. The level of trash within a single waterbody is assumed to be highly variable due to changes in land use, accessibility, size of the watershed, and channel characteristics (e.g., gradient, stream vegetation). Typically, many 100-foot sections would need to be assessed to measure the range of trash conditions found within an entire creek. Assessing some sections of creek and extrapolating the information to larger areas, however, could lead to misinterpretation of the results and potential listing for an entire waterbody based on data collected at a few reaches. Further discussion on the feasibility of using the RWQCB protocols to assess trash for all creeks within SCVURPPP or SMSTOPPP jurisdiction is provided below.

Another limitation of the RWQCB protocols is that it was not designed to assess lakes, shorelines or sloughs, which are types of waterbodies that are identified on the Regional Board's "monitoring" list due to the threat of trash to impair water quality.

The Trash AHTG agreed that the RWQCB protocols provide a standardized approach to assess trash, which could be used on a regional basis. Collaboration with other storm water programs and SWAMP using the same protocols would provide a larger data set for more detailed data analyses, which may include identifying relationships between trash condition and land use types. These relationships would assist managers in identifying potential trash problem areas and aid in selecting appropriate assessment locations. In addition, compilation of assessment data taken in urban streams would be useful for statistically identifying thresholds used in the condition categories for each of the assessment parameter (see recommendation section below). Program staff has started compiling trash assessment data gathered from Alameda County Cleanwater Program and Regional Board efforts.

Feasibility of Assessing all SCVURPPP and SMSTOPPP Creeks

The Trash AHTG believed it was not feasible or cost-effective to use the RWQCB protocols to assess all creeks within the SCVURPPP and SMSTOPPP jurisdiction. High variability of trash conditions would be expected within sections of urban creeks. In addition, an estimation of trash levels for a single creek would require numerous assessments. It is more cost effective to assess already known trash problem areas or in land uses that are associated with litter or illegal dumping and then monitor these sites over time to determine trends or evaluate the effectiveness of BMPs. The Trash AHTG agreed that a decision to spend resources on conducting trash assessments for all creeks in their jurisdiction needs to be weighed with efforts to resolve problems that have already been identified. For example, schools and commercial areas are land uses that are often associated with trash-impacted areas. The Trash AHTG will identify a process for prioritizing creek segments (potentially on land use) and implementing trash assessments as a task in the SCVURPPP Trash Work Plan. The proper entity (e.g., municipality/agency staff or volunteer citizen group) to conduct trash assessments will also be determined as a task in the Work Plan.

Utility of Assessment to Measure Potential Impairment

The trash AHTG identified several limitations of the protocol in linking trash assessment results with potential impairment to beneficial uses. First, there is no clear linkage between type of trash items or number of trash items in a reach to beneficial use impairment. There are no established criteria or threshold values of specific trash items that can be used to estimate the relative impairment to most beneficial uses. An exception may be using both quantitative and qualitative assessment parameters to evaluate the aesthetic quality of streams for recreational beneficial uses. Two parameters (aquatic and human health) identify specific trash items that may affect beneficial use attainment, but more than the presence of these items is needed to determine the level of impairment. For example, there is no method to determine how many small persistent trash items (e.g., styrofoam pellets) are necessary to impact aquatic biota. In addition, the link between human health and the presence of human diapers or animal feces within a 100-foot section of stream has not been clearly established. These trash items may not have direct contact with the water and in some cases, may not even contain human pathogens. Furthermore, the threat to human health ranking does not take into account the potential level of public exposure. Exposure to contaminated water or sharp objects (e.g., glass and metal) is dependent on the level of accessibility to a creek (e.g., fences limit access to creeks) and creek conditions (e.g., depth of water).

Recommendations for Modifying Protocols

The RWQCB protocols were designed to assess both rural and urban stream conditions. The threshold values used to identify conditions for some of the assessment parameters may be too conservative and not adequately represent the range of conditions typically found in urban streams. As a result, most urban creek segments are likely to fall into the poor or marginal categories. Ubiquitous low scores for all urban creeks would not provide adequate resolution to distinguish spatial or temporal variation in trash conditions.

The RWQCB protocols are intended to assist in management decisions, such as source identification. The utility for the protocols to identify trash sources could be enhanced if litter and illegal dumping were distinguished to better assist managers in the identification of appropriate BMPs to reduce the trash. In addition, new trash item categories should be added to enhance evaluation of BMP effectiveness, such as recycling programs. For example, tallying aluminum cans and plastic bottles that are labeled with California Redemption Value (CRV) symbol, along with non-CRV cans and bottles can help determine if recycling programs are effective at reducing trash in creeks.

Additional information should also be included in the assessment procedures. The assessment datasheet should include a place to indicate if an enforcement action or cleanup event is needed. Previous history of trash management activities (e.g., previous or planned cleanup events; known trash problem area) should be documented. Photo documentation should be used when at sites with large amounts of trash.

Based on the pilot evaluation, Table 3 lists some limitations of the RWQCB protocols for conducting trash assessments of urban creeks and provides recommended modifications. These modifications could be incorporated as an "urban management version" of the RWQCB protocols and not result in changes to the original protocols being used for the SWAMP program. The Trash AHTG will coordinate all recommended modification of the protocols with other stormwater programs, BASMAA Monitoring Committee and the RWQCB staff in order to develop a standardized approach for conducting trash assessments on a regional basis. The SCVURPPP and SMSTOPPP have identified tasks in their respective Work Plans to consider the recommendations to modify RWQCB assessment methodology for the purpose of developing a tool to evaluate trash problem areas. The assessment approach should also be evaluated in the future for continuous improvement as additional assessment results become available.

Table 3. Recommended Modifications to RWQCB Assessment Parameters

Trash Assessment Parameter	**Limitation**	**Recommendation**
Actual Number of Trash Items	Numerical thresholds used to rate categories too conservative and not representative for range of conditions in urban streams	Compile additional assessment results from urban streams and statistically compute ranges.
	Difficult to evaluate BMP effectiveness for existing trash item categories	Include additional categories useful for evaluating BMP effectiveness (e.g., distinction between recyclable and non-recyclable cans and bottles)
Threat to Aquatic Life	Subjective rating (little, medium, large) for number of persistent trash items may not provide consistent results.	Compile additional assessment results for specific trash items found in urban streams and statistically compute ranges.
	Equal weighing for trash above and below water line.	Place greater weight on trash below water line. Define water line mark as the bankfull channel.
Threat to Human Health	Human health threats are determined only by presence of specified trash items, not on potential for exposure.	Include additional rating for potential risk of exposure (e.g., public access: good/poor; wadable habitat: yes/no).
Illegal dumping and Littering	Doesn't provide a mechanism to distinguish two different trash sources.	Separate into two separate categories to enhance distinction of trash sources.
Illegal dumping and Littering	Litter categories do not address accumulation from adjacent land uses that result from wind.	Include narrative description to rate wind accumulated litter from adjacent land uses; expand its definition of "shoreline littering" to include "litter within creek and banks that appear to originate from adjacent land uses."
Accumulation of trash	Numerical thresholds used to rate categories not representative for range of conditions in urban streams.	Compile additional assessment results from urban streams and statistically compute ranges.