Santa Clara Valley
Urban Runoff
Pollution Prevention Program

MEMORANDUM

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TO: **Trash Ad Hoc Task Group**

FROM: **Paul Randall and John Fusco (Program Staff)**

DATE: **February 28, 2006 (Draft)**
March 13, 2006 (Final)

SUBJECT: **Development of Urban Rapid Trash Assessment Protocol**

INTRODUCTION

During FY 04-05, Co-permittee staff and volunteers from watershed stakeholder groups conducted trash evaluations at thirty-five wadeable creek sites that were previously identified as trash problem areas. The evaluations were conducted using the San Francisco Bay Regional Water Quality Control Board's (Water Board) Rapid Trash Assessment (RTA) Protocol (Version 7.0). The primary objectives for conducting trash evaluations were to establish a baseline condition of trash at known trash problem areas; identify potential sources of trash and potential management actions, where feasible; and to monitor the condition of trash over time to evaluate effectiveness of management actions. Co-permittees are planning to conduct a second year of trash evaluations at selected sites during FY 05-06.

To improve the effectiveness of the Water Board RTA Protocol (Version 7.0), the Program's Trash Ad Hoc Task Group (Trash AHTG) agreed that refinements were necessary to better address trash problem areas located in urban creeks. The Water Board RTA Protocol (Version 7.0) was developed to assess a range of trash conditions in urban and rural creeks. As a result, the protocol was not designed to evaluate conditions of trash-impacted sites in urban streams, especially downstream reaches of a watershed. To evaluate trash problem areas in urban creeks, the Trash AHTG requested that a separate "Urban RTA" be developed to identify, prioritize and evaluate trash management activities over time. The Urban RTA is intended to be used by Co-permittee staff to evaluate and monitor trash problem areas in urban creeks within the Santa Clara Basin. However, this protocol may also be used by other agencies and/or stormwater Programs within the San Francisco Bay area. The purpose of this memorandum is to document the approach and results of the analysis used to develop the Urban RTA.

BACKGROUND

Limitations of Water Board RTA at Trash Impacted Sites

The Water Board developed a memorandum entitled *Evaluation of the Rapid Trash Assessment Methodology* (dated October 20, 2003) that stated that the Water Board RTA Protocol (Version 7.0) is "less sensitive at the low end of the scoring range, corresponding to conditions commonly observed in the lower watersheds of urbanized areas." Furthermore, "it is difficult (for the RTA) to distinguish conditions at trash hotspots." Since these trash problem areas are of most interest to cleanup programs sponsored by local organizations and agencies, "a separate hotspot evaluation methodology may need to be developed." In addition, this urban method "may be necessary to demonstrate progress at the most impacted sites."

Previous Modifications to the Water Board RTA

Prior to the development of the Urban RTA, Program staff actively contributed to modifying and improving the Water Board's RTA (Version 6.0). In September 2002, EOA, Inc. pilot implemented and tested Water Board RTA Version 6.0 at nine stream locations in Santa Clara and San Mateo Counties. In March 2003, Program staff developed a technical memorandum providing an assessment of the protocol. Some of the key findings from pilot implementation and testing include the following:

- The threshold values used to identify conditions for some of the assessment parameters may be too conservative and may 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;

- There is no clear linkage between the type and number of trash items in a reach to impairment of aquatic life use. As a result, the number of specific types of trash items is not a good basis for an assessment of relative impairment;

- 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);

- A distinction between litter and illegal dumping is needed to better assist managers in the identification of appropriate BMPs to reduce the trash;

- The recommended modifications to the RTA protocols could be incorporated as an "urban management version" of the protocols.

In March 2003, Water Board staff developed Version 7.0 of the RTA to incorporate some of the Program recommendations described above. In summary, these changes included:

- Slight increase to the scoring ranges for parameters dependent on trash item enumerations;
- Numeric guidelines were added to provide a more objective scoring system;
- The "illegal dumping and littering" parameter was broken into two separate sub-parameters with distinct scoring systems.

In Water Board RTA (Version 8.0) dated November 12, 2004, the Water Board modified the time spent counting and collecting trash at each site. The Water Board RTA was originally designed to be rapid (i.e., conducted within a 20 to 30 minute time period). As a result, not all trash items within a 100-foot section of stream would necessarily be counted during an assessment (Terri Fashing, former Water Board staff, personal communication, 2005). The number of trash items used to define some of the RTA condition categories were developed under the assumption that assessments would be completed within 20 to 30 minutes. During FY 03-04, Water Board staff started to emphasize the enumeration and pickup of *all* trash items at each site. This change typically increased assessment time to 1 to 2 hours and resulted in higher numbers of trash getting counted. The increase in assessment time and trash numbers did not result in any change to the ranges of trash items used to rank some of the RTA trash parameters.

The Urban RTA was developed to incorporate the recommendations from the Program's memorandum entitled *SCVURPPP and SMSTOPPP Pilot Implementation and Testing of the RWQCB Rapid Trash Assessment* (dated March 1, 2003), adjust the number of trash items associated with RTA condition categories and enhance the overall assessment of trash impacted sites.

APPROACH

Program staff compiled RTA data collected by Water Board staff between 2001 and 2004. The data, which was collected as part of the Surface Water Ambient Monitoring Program (SWAMP), consists of results from 85 monitoring events (at 27 stream locations) over a range of seasonal time periods. In addition to SWAMP data, Program staff compiled Co-permittee RTA data collected during one monitoring event at 35 sites. The combined data set included RTA scores and number and type of trash items for 120 trash assessments conducted at 69 stream locations in 23 watersheds within the San Francisco Bay area. Both urban (n = 17) and non-urban (n = 103) assessment results were represented in the combined data set. The majority of Program RTA sites were conducted at trash problem areas (there were two exceptions on Stevens Creek). SWAMP conducted assessments at sites with a variety of trash conditions.

New scoring ranges for three of the six RTA trash assessment parameters were developed for several categories of trash items. The trash categories and corresponding assessment parameter (in parentheses) include: 1) total number of trash pieces (Actual Number of Trash Items); 2) total number of combined plastic and miscellaneous trash items (Threat to Aquatic Health); 3) total number of biohazard trash items (Threat to Human Health); and 4) total number of combined glass and metal objects (Threat to Human Health). The distribution of values was plotted and a frequency histogram was calculated for each trash category to determine scoring

ranges and associated ranking scores for three condition categories (i.e., “suboptimal urban”, “marginal urban” and “poor”).

The scoring range for ranking the trash assessment parameters as “least disturbed” (formerly the “optional” condition category) were determined using data collected at non-urban sites. Non-urban site results were used because the number of items collected at these sites was usually very low when compared to urban site results. The “least disturbed” category represents sites with very little trash. Non-urban sites represented creek locations that were typically the highest elevation sites containing park and open space land uses in the upstream drainage area. Trash conditions at non-urban sites were assumed to be reasonable targets for trash management in urban stream locations. “Least disturbed” scoring ranges for each of the trash item categories were determined by calculating and summing the mean and standard deviation.

Qualitative revisions to two of the trash assessment parameters were made, including name changes, to address the some of the key findings presented in Program’s memorandum entitled *SCVURPPP and SMSTOPPP Pilot Implementation and Testing of the RWQCB Rapid Trash Assessment* (dated March 1, 2003). These include the following: 1) linkage between trash condition and threat to aquatic life use not well established or documented; and 2) assessment of threat to human health from selected hazardous and toxic trash items should include an assessment of potential public access and/or evidence of use. Additional revisions were made to selected trash parameters to emphasize more subjective scoring system by eliminating the use of trash enumeration.

RESULTS AND DISCUSSION

The revisions made to each of the six RTA trash assessment parameters are described below and summarized within Table 1. The Urban RTA protocol is provided in Attachment A. A protocol summary for use in the field is provided in Attachment B.

Assessment Parameter #1: “Level of Trash”

To base scoring upon a visual “first impression” of the site, the scoring ranges for the total number of trash items was removed from the “Level of Trash” parameter. The quantitative component of this parameter was removed to eliminate redundancy since Parameter #2 already assesses the total number of trash items collected at the site. This revision would provide an assessment parameter in the Urban RTA that focuses on the aesthetic quality of the site. To reduce any influence from enumeration of trash items, scoring for this parameter should be done prior to tallying and collecting trash.

Assessment Parameter #2: “Actual Number of Trash Items Found”

The “Actual Number of Trash Items Found” (Number of Items) parameter is scored based on the total number of trash items counted at the site. The total number of trash pieces counted during each of the 120 trash assessment events ranged from 3 - 1133 pieces (mean of 307). When using the Water Board RTA Protocol (Version 7.0), 75 percent of the sites were assigned a condition of “poor” (Figure 1). The percentage of sites ranked “poor” for this parameter was higher (83%) for urban sites. Thus, all sites that contained between 101 and 1133 trash items are considered “poor” when scored with the Water Board RTA (Version 7).

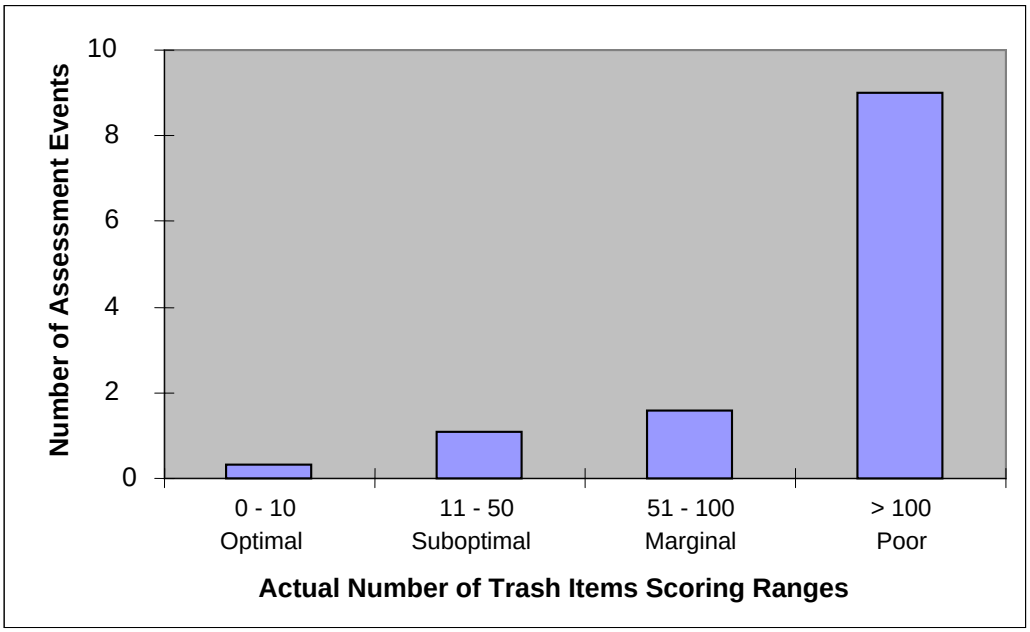

Figure 1. Frequency histogram of the total number of trash items and corresponding rank scores using the Water Board RTA Protocol.

To reflect the distribution of total trash items documented in the combined SWAMP and Program RTA data set, the scoring ranges were changed for the "Number of Items" parameter in the Urban RTA. The condition categories were renamed in the Urban RTA to (ranging from better to worse) "least disturbed", "suboptimal urban", "marginal urban" and "poor". The scoring ranges for each of these categories were defined by calculating quartiles for the combined RTA data. The higher bound for the "least disturbed" category was determined using results from the non-urban sites (n=17). The upper limit defining "least disturbed" was calculated by adding the mean and standard deviation for the total number of trash items collected at the non-urban sites. Total trash items from non-urban sites ranged from 3 – 290 pieces. All data points more than three standard deviations away from the mean were removed as outliers (Stevens Creek at Moss Rock). The mean (56) and standard deviation (52) was calculated and summed for a total of 108 trash pieces. A range of 100 pieces or less was selected to define the upper bound for the "least disturbed" scoring range for the "Number of Items" parameter. Figure 2 shows a frequency histogram of the total number of trash items collected from all RTA assessment sites and new corresponding rank score for parameter #2 using the Urban RTA. As shown in Figure 2, there is a wider distribution in the number of trash items for each ranking score (when compared to Figure 1). This increases the ability to evaluate trash problem areas in urban sites over time.

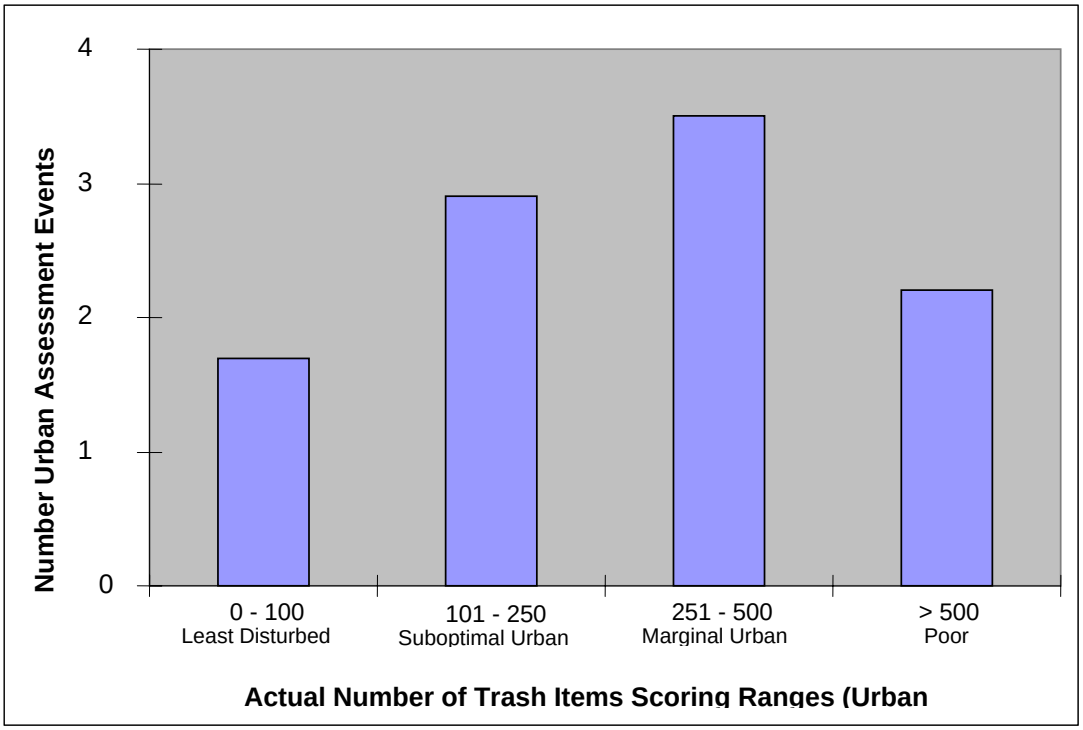

Figure 2. Frequency histogram of the total number of trash items collected at urban sites and corresponding rank scores using Program Urban RTA Protocol.

Assessment Parameter #3: "Transportable, Persistent, Buoyant Litter"

One key finding from the Program's memorandum entitled *SCVURPPP and SMSTOPPP Pilot Implementation and Testing of the RWQCB Rapid Trash Assessment* (dated March 1, 2003) was that the linkage between trash condition and threat to aquatic life use in creeks is not well established or documented. To eliminate the suggestion of impairment to aquatic life use with the type or number of trash items, the Water Board RTA Protocol trash assessment parameter entitled "Threat to Aquatic Life" was renamed to "Transportable, Persistent, Buoyant Trash" within the Urban RTA. The revised trash assessment parameter is intended to better assist Program staff in assessing the condition of problematic trash items (i.e., plastic and miscellaneous trash items). As a result, site scores for this parameter can help guide management actions in the future. To accurately describe the new parameter, all reference to biodegradable, metal, glass and toxic trash was removed.

Similar to the approach used in Parameter #2, new scoring ranges of total transportable, persistent, buoyant trash items were derived using the combined RTA data set. The scoring ranges for each of the condition categories of the "Transportable, Persistent, Buoyant Trash" parameter were defined by calculating quartiles for RTA data collected at urban sites. The higher bound for the "least disturbed" category was determined using results from the non-urban sites. The mean and standard deviation of combined plastic and miscellaneous (includes cigarette butts) trash items collected at the non-urban creek sites was calculated and summed for a total of 37 pieces. All outliers more than three standard deviations greater than the mean were removed from the analysis. A more conservative range of 25 or less pieces was used to define the range for the "least disturbed" category. Figure 3 shows the new scoring ranges and the number of assessment events that fit into each condition category based on the total number of plastic and miscellaneous trash items.

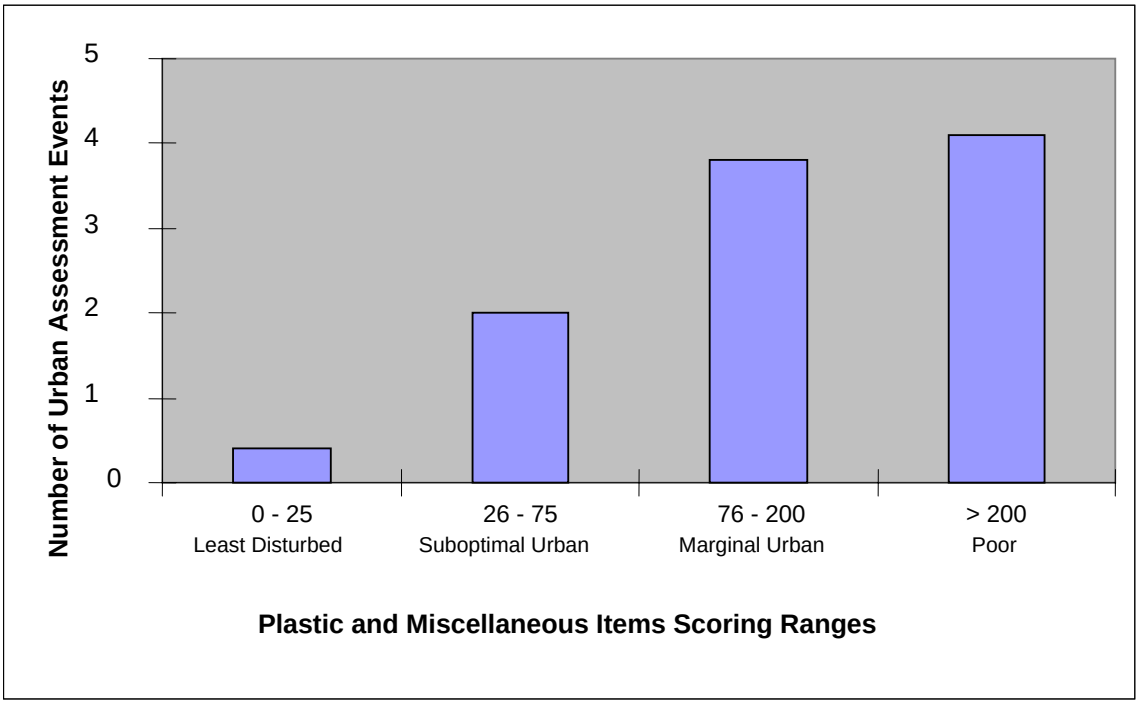

Figure 3. Existing RTA assessment event data is applied to the new scoring system for the "Transportable, Persistent, Buoyant Litter" assessment parameter.

Assessment Parameter #4: "Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use"

The Program's memorandum entitled *SCVURPPP and SMSTOPPP Pilot Implementation and Testing of the RWQCB Rapid Trash Assessment* (dated March 1, 2003) found that assessment of threat to human health from selected hazardous and toxic trash items should also include an assessment of potential public access and/or evidence of use. To eliminate the linkage between human health risk with the type or number of trash items identified, the original trash assessment parameter entitled "Threat to Human Health" was renamed "Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use" within the Urban RTA. Furthermore, this parameter was divided into two sub-parameters: "Biohazard, Toxic and Sharp Objects" and "Site Accessibility" to allow an independent assessment of the potential risk of public exposure from these types of trash items. 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). As a result, a site's accessibility or use now affects the final score for the new "Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use" parameter.

The method used to derive new scoring ranges for the total number of metal and glass trash items within the Urban RTA was slightly different than described above. For example, the sum of the mean and standard deviation for sharp items resulted in a number that was too high to define the upper limit of the "least disturbed" condition category. Instead, an iterative process of creating frequency histograms using different condition category ranges resulted in a set of scoring ranges for total glass and sharp object pieces that best fit the existing data set. A frequency histogram of the total number of glass and metal objects and corresponding rank score for the Urban RTA is provided within Figure 4. Similar analysis of the biohazard and toxic

data suggested that the established scoring ranges used in the Water Board RTA Protocol were consistent with the distribution of these trash items found in the existing data. As a result, the established scoring ranges used in the Water Board RTA Protocol were not changed.

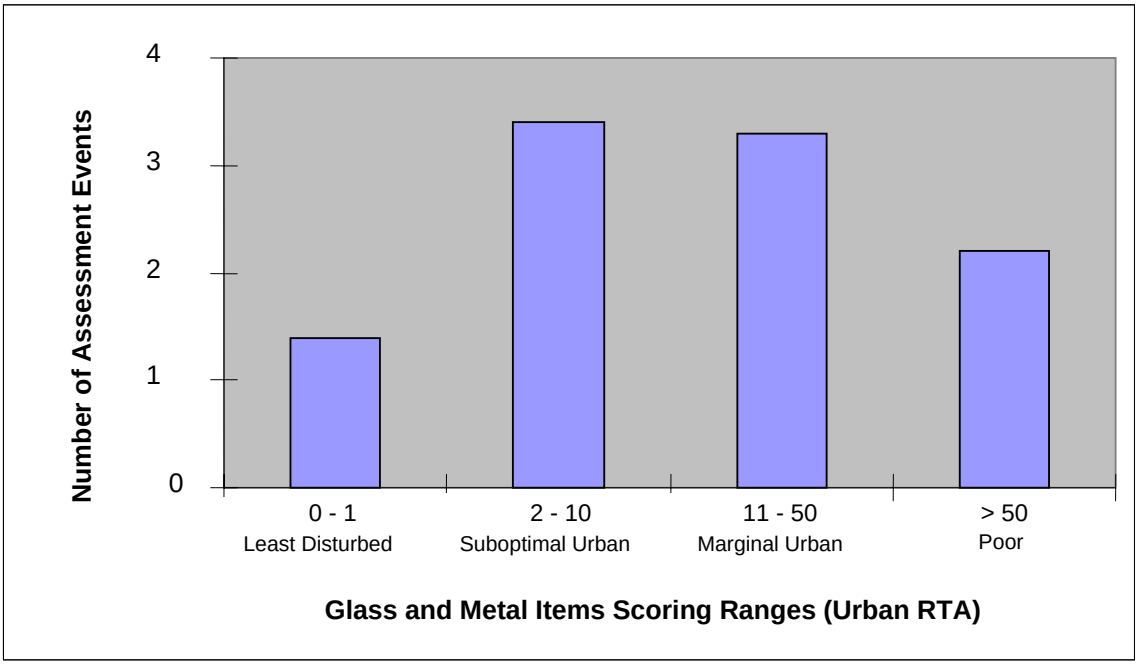

Figure 4. Existing RTA assessment event data is applied to the new scoring ranges for total metal and glass trash items (sharp objects)

Assessment Parameters #5 and #6: "Illegal Dumping and Littering" and "Accumulation of Trash"

To emphasize a more subjective scoring system, additional revisions were made to selected trash parameters by eliminating the use of trash enumeration. In the Water Board RTA Protocol, the number of item ranges used to score each condition category under the "Illegal Dumping and Littering" and the "Accumulation of Trash" parameters are presented to help guide score assignment in the field. However, the Water Board RTA Protocol does not require the enumeration of items that were dumped, littered or accumulated. Therefore, no data exists to analyze how well the existing ranges are suited to each condition category. The process of determining the number of collected items that originated from adjacent land use littering versus upstream accumulation is subjective unless enumerated as the assessment is being conducted.

Table 1. Revisions to trash assessment parameters made in the development of the Urban RTA.

Parameter	Type of Revision		Rationale	Comments
	Quantitative	Qualitative		
(1) Level of Trash Assessment	Remove numerical thresholds of trash items	No change	Considered redundant with "Actual Trash Item" parameter; keep as qualitative parameter	Assess prior to enumeration to prevent trash enumeration from influencing score
(2) Actual Number of Trash Items	Use new scoring ranges based on distribution of existing data	No change	-Number of trash items more representative of trash problem areas in urban streams -Enhance ability to distinguish changes in trash condition over time	Consider future documentation of estimated number of trash bags collected (i.e., volume) for potential use as another "subparameter" to score
(3) Threat to Aquatic Life	Use new scoring ranges based on distribution of existing data (i.e., plastic and miscellaneous items)	-Change parameter name to "*Transportable, Persistent, Buoyant Trash Items*" -Remove reference to biodegradable, metal, glass and toxic trash	-See rationale for "Actual Number of Trash Items" -No documented linkage between magnitude of transportable and persistent trash items to aquatic life use impairment in freshwater streams;	-Parameter is intended to assess condition of sites based on problematic trash items; these data can influence management actions
(4) Threat to Human Health	Use new scoring ranges based on distribution of existing data (i.e., biohazards, glass and metal)	-Change parameter name to "*Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use*" -Remove reference to mosquito production - Add new subparameter that addresses potential for public access and create four condition categories	-See "Actual Number of Trash Items" -No documented linkage between the magnitude of hazardous and toxic trash items to human health - Relative risk of exposure is critical for understanding potential impacts to human health	-Parameter is intended to assess condition of sites based on problematic trash items; these data can influence management actions
(5) Illegal Dumping and Illegal Littering	Remove numerical thresholds of trash items	No change	No existing data to support using numerical thresholds (i.e., source of trash items are not tallied)	-The condition categories are typically assessed by best professional judgment - Tally types of trash sources
(6)Accumulation of Trash	Remove numerical thresholds of trash items	No change	No existing data to support using numerical thresholds (i.e., source of trash items are not tallied)	-The condition categories are typically assessed by best professional judgment - Tally types of trash sources

CONCLUSION AND RECOMMENDATIONS

Conclusions and recommendations for the development of the Urban RTA include:

- New scoring ranges for assessment parameters #2, #3 and #4 were developed using existing RTA data. These new scoring ranges provide a more evenly distributed range of trash conditions (compared to the Water Board RTA Protocol) in urban creeks and increase the resolution of the Urban RTA to better evaluate changes at trash impacted sites.

- Qualitative descriptions for parameters #3 and #4 were modified to remove any potential linkage between the type or number of trash items in a reach to the impairment of aquatic life use and/or human health. These changes were intended to focus the assessment on problematic trash items (e.g., persistent, floatable trash) and to assist in identifying potential management actions to address potential sources of trash.

- Qualitative descriptions were added to parameter #4 to better assess potential public exposure to trash items that are potentially biohazardous, toxic or physically harmful (i.e., metal and glass).

- Scoring ranges were removed from parameter #1. Scoring is now based on visual "first impression" or aesthetic quality of the site. Scoring ranges were removed from parameters #5 and #6 since no existing data was available to support the numerical thresholds used in the Water Board RTA Protocol.

- Document total volume of trash collected at each site (i.e., number of trash bags using standard bag size). Following one year of data collection, develop condition categories for new subparameter entitled "Volume of Trash" to supplement existing parameter entitled "Number of Items".

- Estimate relative number and type of trash source (i.e., litter from adjacent land use, litter accumulation from upstream sources and illegal dumping) for the trash collected at each site. Following one year of data collection, develop condition categories using distribution of existing data for parameters #5 and #6.

- Review Urban RTA protocol methods prior to field visit to promote standardization of data collection procedures. Use summary protocol for additional guidance of methodology in the field. Coordinate with other agencies and organizations to leverage existing staff resources in conducting RTAs; and collecting and disposing of trash.

NEXT STEPS

1. Co-permittees begin implementing the Urban RTA Protocol for trash evaluations planned during FY 05-06.
2. Modify RTA scores from trash assessments conducted during FY 04-05 based on the scoring system defined in the Urban RTA Protocol.

ATTACHMENT A

URBAN RAPID TRASH ASSESSMENT PROTOCOL
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Adapted from the San Francisco Bay Regional Water Quality Control Board Rapid Trash Assessment Protocol, Version 8.

Monitoring Design:

The urban rapid trash assessment can be used for a number of purposes, such as ambient monitoring, evaluation of management actions, determination of trash accumulation rates, or comparing sites with and without public access. Ambient monitoring efforts should provide information at sites distributed throughout a waterbody, and several times a year to characterize spatial and temporal variability. Additionally, the ambient sampling design should document the effects of episodes that affect trash levels such as storms or community cleanup events. Pre- and post-project assessments can assist in evaluating the effectiveness of management practices ranging from public outreach to structural controls, or to document the effects of public access on trash levels in waterbodies (e.g., upstream/downstream). Trash accumulation rates may be determined by conducting trash assessments before and after the summer or dry weather index (to capture rates of littering) and the winter or rainy index (to capture rates of accumulation from upstream sources). This method was developed for sections of wadeable streams, but can be adapted to shorelines of lakes, beaches, or estuaries. This adapted version of the San Francisco Bay Regional Water Quality Control Board Rapid Trash Assessment Protocol, Version 8 was developed by SCVURPPP to more effectively assess trash problem areas and to detect changes in trash conditions over time as a result of management actions.

Site Definition:

A team of two people or more defines or verifies a 100-foot section of the stream or shoreline to analyze. When a site is first established, it is recommended that the 100-foot distance be accurately measured. The length should be measured not as a straight line, but as 100 feet of the actual stream or shore length, including sinuous curves. Where possible, the starting and ending points of the stream section should be easily identified landmarks, such as an oak tree or boulder, and noted on the worksheet ("Upper/Lower Boundaries of Reach"), or documented using a global positioning system (GPS), so that future assessments are made at the same location. The team should confer and document the upper boundary of the banks to be surveyed, based on evaluation of whether trash can be carried to the waterbody by wind or water (e.g., an upper terrace in the stream bank). The team documents the location of the high water line based on site-specific physical indicators, such as a debris line found in the riparian vegetation along the stream channel. If the high water line cannot be determined, it is suggested that bankfull height be documented, noting that the high water line could not be determined. Trash located below the high water line can be expected to move into the streambed or to be swept downstream during the next winter season. Visually extend all boundaries in order to encompass the 100' section. Defining site characteristics will facilitate the comparison of trash assessments conducted at the same site at different times of the year.

Survey:

It is highly recommended that all trash items within an assessed site be picked up, so that the site can be re-assessed to evaluate usage patterns, trash return rates, and management actions. A survey, including notes and scoring, will take approximately one to two hours based on how trash-impacted the site is and how many people are working together. The first time a reach is assessed, the process will generally take longer than on subsequent visits. Begin the survey at the downstream end of the selected reach so that trash can be seen in the undisturbed stream channel. Tasks can be divided according to the number of team members. If there are two team members, one team member begins walking along the bank or in the water at the edge of the stream or shore, looking for trash on the bank up to the upper bank boundary, and above and below the high water line. This person picks up trash and tallies the items on the trash assessment worksheet as either above or below the high water line based on the previously determined boundary. The other person walks in the streambed and up and down the opposite bank, picking up and calling out specific trash items found in the water body and on the opposite bank both above and below the high water line, for the tally person to mark down appropriately on the

trash assessment sheet. All team members pick up the trash items as they are found. All team members should wear gloves to avoid injuries.

The person tallying the trash indicates on the sheet whether the trash was found above the high water line on the bank, or below the high water line either on the bank or in the stream (i.e., tally dots or circles (•) for above high water line, tally lines (|) for below). If it is evident that items have been littered, dumped, or accumulated via downstream transport, make a note in the designated rows near the bottom of the tally sheet - this will help when assessing scores. A trash grabber, metal kitchen tongs, or a similar tool should be used to help pick up trash. Be sure to look under bushes, logs, and other plant growth to see if trash has accumulated underneath. The ground and substrate should be inspected to ensure that small items such as cigarette butts and pieces of broken glass or Styrofoam are picked up and counted. The tally count is an important indicator of trash impairment and should be used in conjunction with the total score to assist in site comparisons.

Sometimes items are broken into many pieces. Transportable, persistent, and buoyant, fragments such as plastics should be individually counted, while paper and broken glass, with lower persistence and/or mobility, should be counted based on the parent item(s). Broken glass pieces that are scattered, with no recognizable original shape, should be counted individually. The judgment of whether to count all fragments or just one item also depends on the potential exposure to downstream fish and wildlife, or to waders and swimmers at a given site. Concrete is trash when it is dumped, but not when it is placed. Consider tallying only those items that would be removed in a restoration or cleanup effort.

Once the team is finished with the tallying, use the tally sheet margins to count up two totals for each trash item line: one total for items found above the high water line, and one total for items found below the high water line. Now sum the totals of above and below for each trash category, and write in next to each trash category. Complete the worksheets before leaving the site in order to remember pertinent details. The team should discuss each parameter and agree on a score based on a discussion of the condition categories. Discuss and document possible influential factors affecting trash levels at the site, such as a park, school, or nearby residences or businesses. Within each trash parameter, narrative language is provided to assist with choosing a condition category. The worksheet provides a range of numbers within some of the categories, allowing for a range of conditions encountered in the field. Note that trash located in the water leads to lower scores than trash above the high water line. Not all specific trash conditions mentioned in the narratives need to be present to fit into a specific condition category (e.g., “site frequently used by people”), nor do the narratives describe all possible conditions. Scores of “0” should be reserved for the most extreme conditions. Once the scores are assigned for the six categories, sum the final score and include specific notes about the site at the end of the sheet. To characterize the variability, persistence, and return rate of trash it is necessary to assess a site three to four times, bracketing different seasons.

Trash Assessment Parameters:

The rapid trash assessment includes a range of parameters that capture the breadth of issues associated with trash and water quality. The first two parameters focus on qualitative and quantitative levels of trash, the second two parameters characterize trash levels of certain types of trash that may affect water quality, and the last two parameters estimate sources of trash (adjacent land use-related littering, dumping or upstream sources).

1. **Level of Trash.** This assessment parameter is intended to reflect a qualitative “first impression” of the site, after observing the entire length of the reach. Sites scoring in the “poor” range are those where trash is one of the first things noticeable about the waterbody and where trash is evident in very large amounts. Sites that score in the “optimal” range appear to have little or no trash. This parameter should be assessed prior to the collection and enumeration of trash done for subsequent parameter.

2. **Actual Number of Trash Items Found.** Based on the tally of trash along the 100-foot stream reach, total the number of items both above and below the high water line, and choose a score within the appropriate condition category based on the number of tallied items. Where more than 500 items have been tallied, assign the following scores: 5: 501-600 items; 4: 601-700 items; 3: 701-800 items; 2: 801-

900 items; 1: 901-1000 items; 0: over 1000 items. Use similar guidelines to assign scores in other condition categories.

3. **Transportable, Persistent, Buoyant Trash.** As indicated in the technical notes, below, certain characteristics of trash make it more harmful to aquatic life. If trash items are persistent in the environment, buoyant (floatable), and relatively small, they can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. All of these factors are considered in the narrative descriptions in this assessment parameter.

4. **Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use.** This category is concerned with items that are dangerous to people who wade or swim in the water, and with pollutants that could accumulate in fish in the downstream environment. Medical waste, diapers, and human or pet waste could potentially adversely affect water quality. Site accessibility and site use is considered in the scoring of this condition category. Sites with very difficult or restricted human access and no evidence of recreational use will receive higher scores due to reduced risk of human exposure at the site.

5. **Illegal Dumping and Littering.** This assessment category relates to direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations based on adjacent land use practices or site accessibility.

6. **Accumulation of Trash.** Trash that accumulates from upstream locations is distinguished from dumped trash by indications of age and transport. Faded colors, silt marks, trash wrapped around roots, and signs of decay suggest downstream transport, indicating that the local drainage system facilitates conveyance of trash to water bodies, in violation of clean water laws and policies.

Technical Notes on Trash and Water Quality:
Trash is a water pollutant that has a large range of characteristics of concern. Not all litter and debris delivered to streams are of equal concern to water quality. Besides the obvious negative aesthetic effects, most of the harm of trash in surface waters is imparted to aquatic life in the form of ingestion or entanglement. Some elements of trash can negatively affect water quality such as discarded medical waste, and human or pet waste. Also, some household and industrial wastes may contain toxic substances that may influence water quality, such as batteries, pesticide containers, and fluorescent light bulbs that contain mercury. Sharp glass and metal objects are potential puncture and laceration hazards. Larger trash such as discarded appliances can present physical barriers to natural stream flow, causing physical impacts such as bank erosion. From a management perspective, the persistence and accumulation of trash in a waterbody are of particular concern and signify a priority area for prevention of trash discharges. Also of concern are trash "hotspots" where illegal dumping, littering, and/or accumulation of trash occur in very large amounts.

Rapid Trash Assessment. Trash assessment includes a visual survey of the waterbody (e.g., streambed and banks) and adjacent areas from which trash elements can be carried to the waterbody by wind, water, or gravity. The delineation of these adjacent areas is site-specific and requires some judgment and documentation. The rapid trash assessment worksheet is designed to represent the range of effects that trash has on the physical, biological, and chemical integrity of water bodies, in accordance with the goals of the Clean Water Act and the California Water Code. The worksheet also provides a record for evaluation of the management of trash discharges, by documenting sites that receive direct discharges (i.e., dumping or littering) and those that accumulate trash from upstream locations.

Trash Characteristics of Concern. Buoyant (floatable) elements tend to be more harmful to water quality than settleable elements, due to their ability to be transported throughout the waterbody and ultimately to the marine environment. Elements such as plastics, synthetic rubber and synthetic cloth, because of their persistence, have a more adverse effect on water quality than degradable elements such as paper or organic waste. Glass and metal are less persistent, even though they are not biodegradable, because wave action and rusting can cause them to break into smaller pieces. Natural rubber and cloth can degrade but not as quickly as paper (U.S. EPA, 2002).

Smaller elements such as plastic resin pellets (a by-product of plastic manufacturing) and cigarette butts are often more harmful to aquatic life than larger elements, since they can be ingested by a large number of small organisms which can then suffer malnutrition or internal injuries. Larger plastic elements such as plastic grocery bags are also harmful to larger aquatic life such as sea turtles, which can mistake the trash for floating prey and ingest it, leading to starvation or suffocation. Floating debris that is not trapped and removed will eventually end up on the beaches or in the ocean, repelling visitors and residents from the beaches and degrading coastal and open ocean waters.

Leaf litter is trash when there is evidence of intentional dumping. Leaves and pine needles in streams provide a natural source of food for organisms, but excessive levels due to human influence can cause nutrient imbalance and oxygen depletion in streams, to the detriment of the aquatic ecosystem. Clumps of leaf litter and yard waste from trash bags should be treated as trash in the water quality assessment, and not confused with natural inputs of leaves to streams. If there is a question in the field, check the type of leaf to confirm that it comes from a nearby riparian tree. In some instances, leaf litter may be trash if it originates from dense ornamental stands of nearby human planted trees that are overloading the stream's assimilative capacity for leaf inputs. Other biodegradable trash, such as food waste, also exerts a demand on dissolved oxygen, but aquatic life is unlikely to be adversely affected unless the dumping of food waste is substantial and persistent at a given location.

Wildlife impacts due to trash occur in creeks, lakes, estuaries, and ultimately the ocean. The two primary problems that trash poses to wildlife are entanglement and ingestion. Marine mammals, turtles, birds, fish, and crustaceans all have been affected by entanglement in or ingestion of floatable debris. Many of the species most vulnerable to the problems of floatable debris are endangered or threatened by extinction.

Entanglement results when an animal becomes encircled or ensnared by debris. It can occur accidentally, or when the animal is attracted to the debris as part of its normal behavior or out of curiosity. Entanglement is harmful to wildlife for several reasons. Not only can it cause wounds that can lead to infections or loss of limbs; it can also cause strangulation or suffocation. In addition, entanglement can impair an animal's ability to swim, which can result in drowning, or in difficulty in moving, finding food, or escaping predators (U.S. EPA, 2001).

Ingestion occurs when an animal swallows floatable debris. It sometimes occurs accidentally, but usually animals feed on debris because it looks like food (i.e., plastic bags look like jellyfish, a prey item of sea turtles). Ingestion can lead to starvation or malnutrition if the ingested items block the intestinal tract and prevent digestion, or accumulate in the digestive tract, making the animal feel "full" and lessening its desire to feed. Ingestion of sharp objects can damage the mouth, digestive tract and/or stomach lining and cause infection or pain. Ingested items can also block air passages and prevent breathing, thereby causing death (U.S. EPA, 2001).

Common settled debris includes glass, cigarettes, rubber, construction debris and more. Settleables are a problem for bottom feeders and dwellers and can contribute to sediment contamination. Larger settleable items such as automobiles, shopping carts, and furniture can redirect stream flow and destabilize the channel.

In conclusion, trash in water bodies can adversely affect humans, fish, and wildlife. Not all water quality effects of trash are equal in severity or duration, thus the trash assessment methodology was designed to reflect a range of trash impacts to aquatic life, public health, and aesthetic enjoyment. When considering the water quality effects of trash while conducting a trash assessment, remember to evaluate individual items and their buoyancy, degradability, size, potential health hazard, and potential hazards to fish and wildlife. Utilize the narratives in the worksheet, refer to the technical notes and trash parameter descriptions in the text as needed, and select your scores after careful consideration of actual conditions.

References:

U.S. Environmental Protection Agency, 2001. Draft Assessing and Monitoring Floatable Debris.

U.S. Environmental Protection Agency, 2002. The Definition, Characterization and Sources of Marine Debris. Unit 1 of Turning the Tide on Trash, a Learning Guide on Marine Debris.

Urban Rapid Trash Assessment Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

WATERSHED/STREAM: _____ DATE/TIME: _____
MONITORING GROUP, STAFF: _____ STATION ID_____
STATION NAME /LOCATION:_____

	CONDITION CATEGORY			
Trash Assessment Parameter	**Least Disturbed (Optimal Urban)**	**Sub optimal Urban**	**Marginal Urban**	**Poor**
1. Level of Trash	On first glance, little or no trash visible. Little or no trash evident when streambed and stream banks are closely examined for litter and debris, for instance by looking under leaves.	On first glance, trash is evident in low levels. After close inspection small levels of trash evident in stream bank and streambed.	Trash is evident in medium on first glance. Stream, bank surfaces, and riparian zone contain litter and debris. Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, clothing.	Trash distracts the eye on first glance. Stream, bank surfaces, and immediate riparian zone contain substantial levels of litter and debris Evidence of site being used frequently by people: many cans, bottles, and food wrappers, blankets, clothing.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Actual Number of Trash Items Found	0 to 100 trash items found based on a trash assessment of a 100-foot stream reach.	101 to 250 trash items found based on a trash assessment of a 100-foot stream reach.	251 to 500 trash items found based on a trash assessment of a 100-foot stream reach.	Over 500 trash items found based on a trash assessment of a 100-foot stream reach.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Transportable, Persistent, Buoyant Litter	Little or no (< 25 pieces) transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Low to medium presence (26-75 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Medium prevalence (76-200 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, styrofoam, balloons, cigarette butts.	Large amount (>200 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, balloons, styrofoam, cigarette butts;
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Biohazard, Toxic and Sharp Objects	B: Trash contains no medical waste, diapers, pet or human waste. No evidence of toxic substances such as chemical containers or batteries. Only 1 piece of broken glass or metal debris, if any, is present.	B: No toxic substances, but small presence (2-10 pieces) of sharp objects such as broken glass and metal debris.	Presence of **any one** of the following: hypodermic needles or other medical waste; used diaper, pet waste, or human feces; any toxic substance such as chemical containers, batteries, or fluorescent light bulbs. Medium to high prevalence (11-50 pieces) sharp objects.	Presence of **more than one** of the items described in the marginal condition category, and/or high prevalence of (> 50) sharp objects.
Site Accessibility	A: Access is difficult, restricted by locked gate or some other physical barrier like steep banks or thick riparian veg. Site reach does not appear to be used by people. Might be private property or protected watershed.	A: Access is limited and site reach does not appear to be used by people. No trails down to creek.	A: Public access to reach is fair to good but site does not appear to be used frequently, **or** private access is good without any public access.	A: Excellent reach access including trails down to and adjacent creek and creekside space for sitting down. Some evidence that reach is used frequently by the public (e.g. rope swings, many beer/soda cans and food wrappers left on the banks, etc.).
B SCORE	10 9	8 7 6	5 4 3	2 1 0
A SCORE	10 9	8 7 6	5 4 3	2 1 0

Urban Rapid Trash Assessment Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

	CONDITION CATEGORY			
Trash Assessment Parameter	**Least Disturbed (Optimal Urban)**	**Sub optimal Urban**	**Marginal Urban**	**Poor**
5. Illegal Dumping	D: No evidence of illegal dumping. No bags of trash, no yard waste, no household items placed at site to avoid proper disposal, no shopping carts.	D: Some evidence of illegal dumping. Limited vehicular access limits the amount of potential dumping, or material dumped is diffuse paper-based debris.	D: Presence of **one** of the following: furniture, appliances, shopping carts, bags of garbage or yard waste, coupled with vehicular access that facilitates in-and-out dumping of materials to avoid landfill costs.	D: Evidence of chronic dumping, with **more than one** of the following items: furniture, appliances, shopping carts, bags of garbage, or yard waste. Easy vehicular access for in-and-out dumping of materials to avoid landfill costs.
Illegal Littering	L: Any trash is incidental litter or carried downstream from another location.	L: Some evidence of litter within creek and banks originating from adjacent land uses	L: Prevalent in-stream or shoreline littering that appears to originate from adjacent land uses.	L: Large amountof litter within creek and on banks that appears to originate from adjacent land uses.
D-SCORE	10 9	8 7 6	5 4 3	2 1 0
L-SCORE	10 9	8 7 6	5 4 3	2 1 0
6. Accum-ulation of Trash	There does not appear to be a problem with trash accumulation from downstream transport. Trash, if any, appears to have been directly deposited at the stream location.	Some evidence that litter and debris have been transported from upstream areas to the location, based on evidence such as silt marks, faded colors or location near high water line.	Evidence that trash is carried to the location from upstream, as evidenced by its location near high water line, siltation marks on the debris, or faded colors.	Trash appears to have accumulated in substantial quantities at the location based on delivery from upstream areas, and is in various states of degradation based on its persistence in the waterbody. A large percentage of trash items have been carried to the location from upstream.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total Score _____

SITE DEFINITION:

UPPER/LOWER BOUNDARIES OF REACH: _____

HIGH WATER LINE: _____

UPPER EXTENT OF BANKS OR SHORE: _____

_____

NOTES:

_____

_____

_____

_____

_____

_____

_____

Trash Item Talley Worksheet

Santa Clara Valley Urban Runoff Pollution Prevention Program

TRASH ITEM TALLY (Tally with (•) if found above high water line, and (|) if below)

PLASTIC # Above___ # Below____	**METAL** # Above___ # Below____
Plastic Bags	Aluminum Foil
Plastic Bottles	Aluminum or Steel Cans
Plastic Bottle Caps	Bottle Caps
Plastic Cup Lid/Straw	Metal Pipe Segments
Plastic Pipe Segments	Auto Parts (specify below)
Plastic Six-Pack Rings	Wire (barb, chicken wire etc.)
Plastic Wrapper	Metal Object
Soft Plastic Pieces	**LARGE (specify below)** # Above___ # Below____
Hard Plastic Pieces	Appliances
Styrofoam cups pieces	Furniture
Styrofoam Pellets	Garbage Bags of Trash
Fishing Line	Tires
Tarp	Shopping Carts
Other (write-in)	Other (write-in)
BIOHAZARD # Above___ # Below____	**TOXIC** # Above___ # Below____
Human Waste/Diapers	Chemical Containers
Pet Waste	Oil/Surfactant on Water
Syringes or Pipettes	Spray Paint Cans
Dead Animals	Lighters
Other (write-in)	Small Batteries
CONSTRUCTION DEBRIS#Above___#Below__	Vehicle Batteries
Concrete (not placed)	Other (write-in)
Rebar	**BIODEGRADABLE** # Above___ # Below____
Bricks	Paper
Wood Debris	Cardboard
Other (write-in)	Food Waste
MISCELLANEOUS # Above___ # Below____	Yard Waste (incl. trees)
Synthetic Rubber	Leaf Litter Piles
Foam Rubber	Other (write-in)
Balloons	**GLASS** # Above___ # Below____
Ceramic pots/shards	Glass bottles
Hose Pieces	Glass pieces
Cigarette Butts	**FABRIC AND CLOTH** # Above___# Below____
Golf Balls	Synthetic Fabric
Tennis Balls	Natural Fabric (cotton, wool)
Other (write-in)	Other (write-in)
Total pieces Above: **Below:**	**Grand total:**
Tally all trash in above rows; make notes below as needed to facilitate scoring.	
Littered:	
Dumped:	
Downstream Accumulation:	

SPECIFIC DESCRIPTION OF ITEMS FOUND:_____

_____

ATTACHMENT B

URBAN RAPID TRASH ASSESSMENT – PROTOCOL SUMMARY
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

Note: All field teams should read the Urban Rapid Trash Assessment Protocol before conducting trash assessments. This summary should be used as a tool in the field. It provides the key points from the protocol that should be considered in the field before starting conducting a survey.

Site Definition:

- Establish or confirm 100-foot sampling reach and identify the downstream starting point, (Lower Reach Boundary), and the upstream ending point, (Upper Reach Boundary).
- Confer and document the upper bank boundary of the survey area, taking the entire 100-foot reach into account. The boundary should include the area where trash can be carried to the waterbody by wind or water.
- Confer and document the high water line. Trash below this line should be expected to move into the streambed or downstream during next winter season (use bankfull height if unsure).
- Detailed site definition will facilitate data comparison from the same sampling reach over time.

Conducting a Trash Survey:

- Select a score from within the condition categories for the first Trash Assessment Parameter, Level of Trash. Do this before picking up any trash so that the score represents a true first impression (see Trash Assessment Parameter #1).
- Remove all trash from the 100-foot Reach (note items that physically cannot be removed so that trash accumulation rate analyses can be performed accurately).
- Wear protective clothing including waders and gloves. Use tongs or grabbers to help pick up trash items.
- Divide tasks between team members, designating one person to tally the trash items.
- During the survey all team members should make mental and written notes about apparent trash item sources (Did an item originate from upstream sources? Was it littered or dumped?). The person recording should use the space provided under the trash item categories on the Trash Item Tally Worksheet to record rough tallies of trash item sources.
- Trash collectors should call out trash items based on the items listed under the trash categories in the Trash Tally Worksheet. Specify whether a trash item was collected from above or below the high water line.
- Tally dots or circles (•) for above high water line, tally lines (|) for below.
- Look for trash under bushes, logs, and other plant growth for accumulated trash. Inspect ground and substrate for items such as cigarette butts, pieces of broken glass or Styrofoam.
- For items broken into many pieces: paper and broken glass should be counted based on the parent item(s). Broken glass pieces that are scattered, with no recognizable original shape, should be counted individually.
- For each trash item, count tallies and record totals in the margins of the Trash Tally Worksheet. Record separate totals for items collected above and below the high water

mark. Record above and below totals for trash categories in the spaces provided on the Trash Tally Worksheet.

- Team members should discuss and agree on a condition category score for each Trash Assessment Parameter based on results from the Trash Tally Worksheet and on impressions about trash sources and adjacent and upstream land uses.
- Read narrative descriptions to help guide condition category score selection.

Trash Assessment Parameters:

1. **Level of Trash.** Reflects qualitative "first impression" of the site after observing the entire length of the reach. Sites scoring in the "poor" range are those where trash is one of the first things noticeable about the waterbody and where trash is evident in very large amounts. Sites that score in the "optimal" range appear to have little or no trash.

2. **Actual Number of Trash Items Found.** Based on the tally of trash along the 100-foot stream reach, total the number of items both above and below the high water line, and choose a score within the appropriate condition category based on the number of tallied items. Note that trash located in the water leads to lower scores than trash above the high water line. Where more than 500 items have been tallied, assign the following scores: 5: 501-600 items; 4: 601-700 items; 3: 701-800 items; 2: 801-900 items; 1: 901-1000 items; 0: over 1000 items. Use similar guidelines to assign scores in other condition categories.

3. **Transportable, Persistent, Buoyant Trash.** As indicated in the technical notes, below, certain characteristics of trash make it more harmful to aquatic life. If trash items are persistent in the environment, buoyant (floatable), and relatively small, they can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. All of these factors are considered in the narrative descriptions in this assessment parameter.

4. **Biohazards, Toxic Items, Sharp Objects and Site Accessibility/Use.** This category is concerned with items that are dangerous to people who wade or swim in the water, and with pollutants that could accumulate in fish in the downstream environment. Medical waste, diapers, and human or pet waste could potentially adversely affect water quality. Site accessibility and site use is considered in the scoring of this trash assessment parameter. Sites with very difficult or restricted human access and no evidence of recreational use will receive higher scores due to reduced risk of human exposure at the site.

5. **Illegal Dumping and Littering.** This assessment category relates to direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations based on adjacent land use practices or site accessibility.

6. **Accumulation of Trash.** Trash that accumulates from upstream locations is distinguished from dumped trash by indications of age and transport. Faded colors, silt marks, trash wrapped around roots, and signs of decay suggest downstream transport, indicating that the local drainage system facilitates conveyance of trash to water bodies, in violation of clean water laws and policies.