2018 Southern California Bight Regional Marine Monitoring Survey (Bight ’18)

Draft Bight '18 Trash Workplan

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Prepared by the Bight '18 Trash Committee

Bight '18 Trash Committee

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Introduction

The Southern California Bight (SCB) is an important and unique ecological resource as well as a substantial economic resource. This open embayment along the coast stretches from Point Conception to Punta Colonet (south of Ensenada), Baja California. The SCB has a complex topography that provides a variety of habitats, such as offshore islands, submarine canyons, ridges, basins, bays, and estuaries. The diverse habitats in the SCB allow for the coexistence of a broad spectrum of species, including more than 500 species of fish and several thousand species of invertebrates. In addition, Los Angeles/Long Beach Harbor is the largest commercial port in the United States, and San Diego Harbor is home to one of the largest US Naval facilities in the country. More than 100 million people visit southern California beaches and coastal areas annually, bringing an estimated $9B into the economy. Recreational activities include diving, swimming, surfing, and boating, with tourism and recreational activities in Southern California valued at nearly $5 billon (Kildow and Colgan 2005).

The SCB is also one of the most densely populated coastal regions in the country; with over 21 million people inhabiting coastal Southern California (US Census Bureau 2010). Population growth generally results in conversion of open land into non-permeable surfaces. This "hardening of the coast" increases the rate of runoff and can impact water quality through the addition of sediment, toxic chemicals, pathogens, and nutrients to the ocean. Besides the impacts of land conversion, the SCB is already home to fifteen municipal wastewater treatment facilities, eight power generating stations, 10 industrial treatment facilities, 4 desalinization plants, and 18 oil platforms that discharge to the open coast.

There have been five previous regional monitoring efforts to address environmental concerns at larger spatial scales. The first regional monitoring survey in 1994, called the Southern California Bight Pilot Project (SCBPP), was a compilation of 12 agencies that cooperatively sampled 261 sites along the continental shelf between Point Conception and the United States/Mexico border. The second regional monitoring survey, called the Southern California Bight 1998 Regional Monitoring Program (Bight '98), was comprised of 64 agencies that cooperatively sampled 416 sites between Point Conception and Punta Banda, Mexico and included new habitats such as ports, bays, and marinas. The third regional monitoring survey, called the Southern California Bight 2003 Regional Monitoring Program (Bight '03), was comprised of 65 agencies that cooperatively sampled 391 sites between Point Conception and the United States/Mexico border, expanding the number of habitats from Bight '98 to include estuaries and deep ocean basins.

The fourth regional monitoring survey, called the Southern California Bight 2008 Regional Marine Monitoring Program (Bight '08), was comprised of 61 organizations that sampled 383 sites between Point Conception and the United States/Mexico border, and included new contaminants of emerging concern. The fifth survey, the Southern California Bight 2013 Regional Marine Monitoring Program (Bight '13), was comprised of 34 organizations that sampled 397 sites between Point Conception and the United States/Mexico border, including the new habitats of submarine canyons and marine protected areas.

2018 Survey

The proposed Southern California Bight 2018 Regional Monitoring Program (Bight '18) is a continuation of the successful cooperative regional-scale monitoring in southern California. Bight '18 builds upon the previous successes and expands on the 2013 program by including new participants, answering additional questions, and measuring more parameters. Forty-six organizations, including international and volunteer organizations, have agreed to participate. The inclusion of multiple participants, many of them new to regional monitoring, provides several benefits. Cooperative interactions among many organizations with different perspectives and interests, including a combination of regulators and dischargers, ensure that an appropriate set of regional-scale questions will be addressed by the study.

The Bight '18 Program is organized into five technical components: 1) Sediment Quality (formerly Contaminant Impact Assessment/ Coastal Ecology); 2) Microbiology; 3) Ocean Acidification; 4) Harmful Algal Blooms; and 5) Trash. The Trash component focuses on the types, amounts, and extent of trash in the ocean and in coastal rivers and streams. This Workplan provides a summary of the trash project design. The Workplan is supported by three companion documents including the Sediment Quality Workplan, the Field Methods and Logistics Manual, and the Information Management Plan. Separate Workplans are also available for the other elements of Bight '18.

Study Objectives

The overall objective of the Bight '18 Trash Survey is to characterize the extent and magnitude of debris in SCB watersheds and marine environments and to determine any linkages. Within this objective, there are 3 questions of interest:

1. What are the quantities and types of trash in the epibenthos, rivers, and streams?
2. What are the trends of trash types and amounts in the epibenthos, rivers, and streams?
3. Are there any factors that may be contributing to larger amounts of trash in rivers and streams?

The first question seeks to understand current conditions by evaluating the differences in the abundance and types of debris found in the epibenthos as well as within rivers and streams. The second question looks to compare results of this study with those of previous studies to understand the effectiveness of current trash policies. The third question seeks to examine factors that may contribute to higher or lower levels of trash within given areas. This study leverages trash surveys conducted through the Stormwater Monitoring Coalition (SMC) Regional Stream Bioassessment program at approximately 100 urban, agricultural, and open land use sites per year, conducted in the spring/summer.

Trash in Rivers and Streams

Background and Objectives

Trash on land has recently become a focus of policy throughout the state of California. These policies include three main areas: 1) bans; 2) total maximum daily loads (TMDLs); and 3) the Statewide Trash Amendments. While these policies all involve reducing trash on land, they all work at different levels. Bans on specific items include the statewide ban on plastic bags, and local bans throughout the state on items such as polystyrene and cigarettes. TMDLs have been passed by regional water quality control boards on many contaminants and specifically on trash for at least 15 water bodies. The most well-known TMDL for the Los Angeles River was one of the nation's first trash TMDLs and was established in 2001. The goal of 100% trash load reduction for this TMDL was set to be accomplished by September 2016. Many jurisdictions have accomplished this using full trash capture devices or alternative institutional controls such as street sweeping, education, etc. The Statewide Trash Amendments take the TMDLs to a larger scale, as jurisdictions throughout the state now must either install full trash capture devices (Track 1) or partial capture devices and institutional controls (Track 2). For those opting for Track 2, monitoring is required to ensure they are attaining results comparable to Track 1 areas.

Few studies have been done to look at trash in rivers and streams within urban settings. Much of the information on trash in these systems comes from Public Works Agencies and are estimated based on gross measurements, such as the weight and/or volume of the overall or categorical loads. In 2011-2013 the Southern California Stormwater Monitoring Coalition, as part of their larger Regional Stream Survey, incorporated a trash survey and sampled sites throughout southern California in a wide variety of habitats. These surveys were incorporated into the Bight 2013 Regional Survey, which included other participants, such as the Coastkeepers throughout southern California. The results from this survey showed that there is a high likelihood of finding trash in urban areas (> 80%) and that stream sites near roads, particularly larger roads (4+ lanes), had higher amounts of trash. While this study provided a baseline for Southern California stream trash, more information is necessary to determine if trash numbers are going up, staying the same, or declining.

The goal of this component for the Bight '18 Trash survey will be to determine the quantities and types trash in the channels of wadeable streams. Trash deposited in riverine habits occurs through several primary processes, including but not limited to 1) land use-based sources, 2) incidental or wind-blown debris from adjacent areas, and 3) direct deposit of debris through littering and illegal dumping. Understanding the quantity and types of debris in riverine habits is a first step in making the connections between land based sources and debris that is ultimately transported to the ocean.

The Bight Trash Riverine study complements the existing Stormwater Monitoring Coalition (SMC) effort to assess trash with a greater focus on the urban stratum. The objectives of this riverine habit study component include three main questions focusing not only the magnitude and extent of trash in rivers but also on factors that may influence them (Table 1).

Table 1. Management questions, study objectives and information application.

Management Question	Study Objective	Application
1) What is the extent and magnitude of trash in SCB streams?	Assess the amount and spatial distribution of trash in rivers and streams.	This information will be used to determine overall condition of streams and rivers relative to trash.
2) Have the types and/or amounts of trash changed in relation to policy?	Compare amounts of policy related trash to conditions before policy(s) were passed.	This information will be used to determine if conditions are getting better or worse.
3) How does the amount and type of trash correlate with site specific factors?	Evaluate different factors to see if amounts and types of trash vary given different factors, such as proximity to homeless encampments, Track 1 vs Track 2.	Conduct comparisons between areas up and downstream of given factors.

Conceptual Approach

Methods selected for this portion of the Bight ’18 Trash Survey include both quantitative and qualitative measurements. Existing monitoring efforts by the Southern California Stormwater Monitoring Coalition (SMC) will be leveraged, and additional efforts will be provided by other Bight ‘18 Trash participatory agencies. The methods developed by the SMC for the 2011-2013 surveys will be used again, with slight modifications (see below).

The sampling approach required to conduct the trash assessment in streams will include trash tallies, which involves categorizing and counting trash items in a 30.5-meter (100-foot) swath of stream to determine a visual assessment score based on the amount of trash seen while walking the same 30.5-meter swath. Both sampling approaches are based in part on the Surface Water Ambient Monitoring Program’s (SWAMP) Rapid Trash Assessment method developed in 2004 (SFBRWQCB 2004). The trash tally method was modified by the SMC in 2011 (Moore et al. 2016) and again in 2018 (see methods below) in preparation for this survey. The visual assessment method was modified in 2017 by the Bay Area Stormwater Management Agencies Association (BASMAA) Trash Monitoring Program (BASMAA 2017).

Target Population, Sample Frame Development, and Site Selection

Because this study component is being leveraged over resources in place through the SMC Regional Watershed Monitoring Program, the target population, sample frame, and site selection has been pre-determined by that workgroup. The target population for the 2018 SMC survey is wadeable and Strahler second order or higher classification streams across the Southern California watersheds. The sample frame will include the major strata used in previous SMC surveys, which are as follows:

1. Strahler Order
2. Land Use
    1. Urban
    2. Agriculture
    3. Open
3. Watershed Jurisdiction (Hydrologic Unit Boundaries)
4. County Jurisdictional Boundaries
5. Regional Water Quality Control Board Jurisdiction Boundaries

Sample sites were selected using a probabilistic approach weighting by watershed, land use, and stream order. The sampling frame includes watershed units located from Ventura to San Diego and as far east as San Bernardino and Riverside Counties. These watersheds equate to combinations of management units utilized by the Regional Water Quality Control Boards (RWQCB) or SMC member agencies. Altogether, these 15 watershed units are comprised of roughly 28,051 km^2. The streamlines used to define the sampling frame were derived from the National Hydrography Dataset (NHD Plus). Altogether, there are 9,492 stream miles of Strahler order 2 and greater in the sampling frame. Land use was defined as either urban, agriculture, or open based on CCAP remote imaging algorithms (National Oceanic and Atmospheric Administration 1995). CCAP defines 35 different land use classes that have been aggregated into the three categories for this study (i.e., open, agriculture, and urban). The dominant land use within a 500-m buffer was assigned to each stream reach. Additional sites will be assigned to non-SMC groups based on either the SMC site assignment list or on targeted locations to best sample areas of interest.

Sampling and Analysis Methods

The sampling approach required to conduct the stream trash assessment will utilize the Bight 13 Riverine Trash Survey (Moore et al. 2016) and the Bay Area Stormwater Management Agencies Association (BASMAA) Trash Monitoring Program Plan (BASMAA 2017) protocols. This sampling approach is based on combination of field methods incorporating qualitative assessment and an associated item tally. In addition to the qualitative analysis, individual debris items will be recorded according to specific item categories on the Stream Trash Item Tally Sheet. All data sheets can be found in the Appendix section.
Suggested equipment for field teams includes:

01. Clipboard
02. Datasheets
03. Pens/Pencils
04. GPS
05. Camera

06. Transect Tape/Rope
07. Rangefinder or Measuring Tape
08. Survey Flags
09. Waders/Rain Boots
10. Gloves
11. Trash Grabbers
12. Sunblock
13. Hand Sanitizer
14. Bug Spray
15. Drinking Water

General Site Information

Sites will be either probabilistic or targeted, and include surveying a 30.5-meter stream reach. Before the trash assessment begins, the monitoring reach will be identified. For probabilistic surveys associated with the Surface Water Ambient Monitoring Program (SWAMP) bioassessment surveys, the designated stream reach for trash assessment coincides with transects A to C. These sites may be moved up or downstream up to 300 meters from the nominal coordinates for reasons such as safety, accessibility, tributaries or obstacles. If the nominal coordinates fall near the streambed, but not on the streambed itself, the site may be shifted to the nearest point on the streambed. A rangefinder or measuring tape will be used to determine the reach length (30.5 meters). The bottom (transect A), middle (transect B) and end (transect C) of the reach will be identified with a marker (e.g., wire-stemmed survey flags, line, etc.). If the assessment is not part of the SWAMP Bioassessment Survey, the team will go to the site location, regardless of whether probabilistic or targeted, and mark this as the downstream extent. Then, the team will go upstream 30.5 meters and mark that location as the upstream extent. The 30.5-meter segment may be broken up into smaller segments using lines if a larger amount of trash is present to make the survey area smaller for individual teams.

The team will fill out the General Site Information on the trash survey field form (Figure 1). The team will record the Station ID, Start and Stop Time, Latitude and Longitude (in decimal degrees to at least 5 places), and the Datum (GIS projection used as a point of reference for the site locations). The survey also will document members of the field crew conducting the survey as well as a brief River/Site Description and the location of the Watershed site. Access to the site will be described based on ease of access from both the right and left banks. Channel Type is based on the channel substrate and consists of natural (no apparent modifications made to the stream bed), earthen (natural stream bed that has been modified), and concrete. Finally, the type of site being surveyed (probabilistic versus targeted) and whether the stream is flowing will also be recorded.

General Site Information

Station ID: _____ Date: _____

Start Time: _____ End Time: _____

Latitude: _____ Longitude: _____ Datum: □ NAD 83 □WGS 84

Field Crew: _____

_____

River/Site Description: _____ Watershed: _____

Access:
Left Bank (circle one): Easy Mod Hard Right Bank (circle one): Easy Mod Hard

Channel Type:
□ Natural □ Earthen □ Concrete/Earthen □ Concrete □ Other

Type of Site: □ Probabilistic □ Targeted Is stream flowing? Yes / No

Figure 1. General Site Information form.

Setting up the Assessment Area

The assessment area width extends to the bankfull width of the stream (Figure 2). Bankfull width is determined by estimating the maximum water inundation in a one to two-year flood event (Ode et al., 2016; https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/combined_sop_2016.pdf). The team will walk beyond the wetted width of the stream to look for evidence of one to two-year flood events. Evidence for bankfull locations includes: topography, vegetation, sediment type, changes in bank slope, and location of water stains on concrete or bedrock. Field crews may want to view the video "A Guide for Field Identification of Bankfull Stage in the Western United States" (https://www.youtube.com/watch?v=UuS7H2NxJIM). The team will measure the wetted and bankfull width of the stream (Figure 3 and Figure 4) using a measuring tape (a range finder may be used for larger streams) and record the measurement on the datasheet. Wetted and bankfull widths are measured at transects A, B, and C. Record if trash is being collected during the assessment.

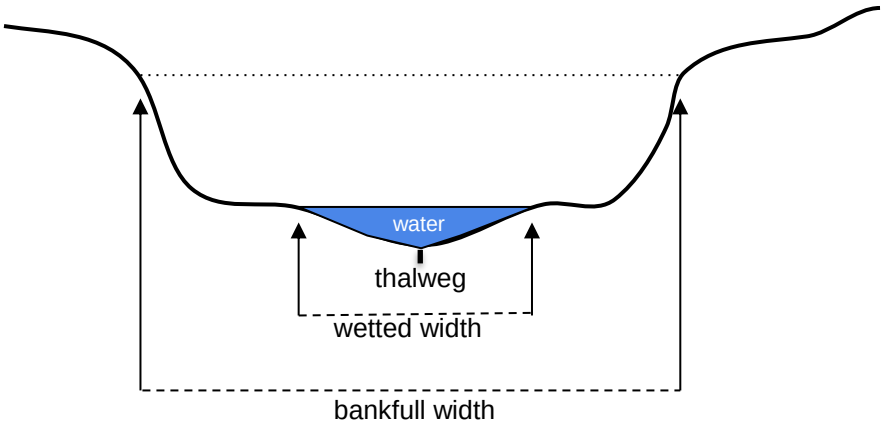

Figure 2. Stream cross sectional diagram of a typical stream channel showing the locations of wetted and bankfull width measurements.

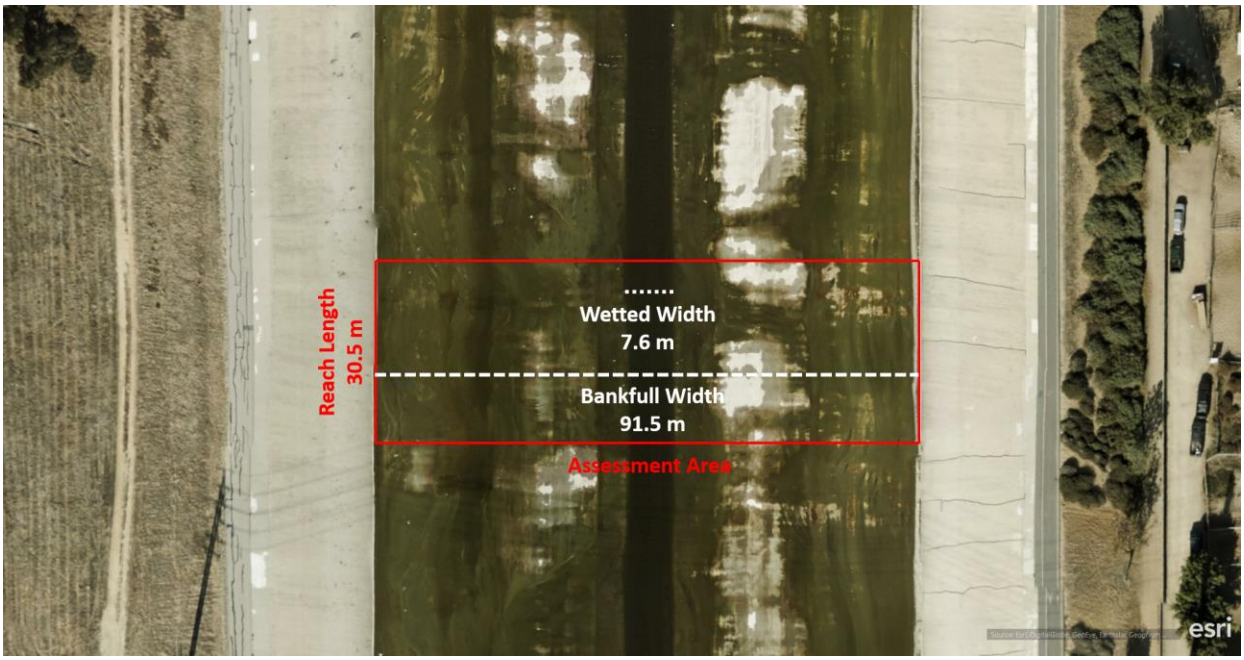

Figure 3. Measurements taken in the Los Angeles River as an example site.

Assessment Area					
Reach Length (m)	_____				
Wetted Width (m)	Transect A	_____	Transect B	_____	Transect C _____
Bankfull Width (m)	Transect A	_____	Transect B	_____	Transect C _____
Trash picked-up during assessment? Yes / No					

Figure 4. Assessment Area form.

Stormwater Outfalls/Encampments

The team will record the number and size of stormwater outfalls (greater than 18 inches) in the assessment area (Figure 5). Outfalls include any pipes or discharge areas from outside of the river/stream. Outfall categories are as follows: 18 - 24 inches; 25 - 36 inches; 37 - 48 inches; >48 inches. The team will record if there is trash at the outfalls and the amount of trash present. Trash amount categories are as follows: <10; <50; <100; >100. The team will determine if there is a homeless encampment in the assessment area or within 200 meters of the assessment area, either up or downstream.

Stormwater Outfalls/Encampments

Number of stormwater outfalls in the assessment area >18" in diameter

18-24" _____ 25-36" _____ 37-48" _____ >48" _____

Trash at Outfalls? Yes / No

Amount of Trash Present: <10 <50 <100 >100
(circle one)

Homeless encampment within 200 meters of assessment area? Yes / No

If yes, where is the encampment: Upstream / Downstream / Within AA

Figure 5. Stormwater Outfalls/Encampments form.

Trash Condition Category and Site Score (Qualitative)

The qualitative assessment is a visual survey technique performed by at least two crew members (one being the Field Crew Supervisor) that documents the levels of trash within the survey area and estimates the relative contribution of trash. The Field Crew Supervisor will first walk the entire assessment area and score the site based on their "first impression" of the amount of trash observed. The trash condition is divided into four condition categories (Figure 6) that include narrative descriptions of trash levels associated with a scoring range (1 – 12) as follows: Low (1-3), Moderate (4-6), High (7-9), Very High (10-12). Trash will be categorized into one of these levels based on the overall amount of trash at a site. If trash is in piles in the assessment area, imagine the trash spread out through the entire area for assigning a score. Figures 7-10 include photos representing the amounts of trash found in each category.

Station: _____ **Sample Date:** _____

Visual Assessment - Trash Condition and Pathways												
	Trash Condition Category											
	Low			Moderate			High			Very High		
Description	• Effectively no or very little trash • On first glance, little or no trash is visible • Little or no trash is evident when streambed and stream banks are closely examined for litter and debris • One individual could easily remove all trash observed within 10 minues (100ft AA*) or 30 minutes (300ft AA)			• Predominantly free of trash except for a few littered areas • On first glance, trash is evident in low levels • After close inspection, small levels of trash are evident in stream bank and/or streambed. • On average, all trash could be removed by two individuals within 10 to 20 minutes (100ft AA) or 30 minutes to one hour (300ft AA) • Approximately 2-3 times more trash than the low condition category			• Predominantly littered except for a few clean areas • Trash is evident upon first glance in moderate levels along streambed and banks • Evidence of site being used by people: scattered cans, bottles, food wrappers, plastic bags etc. • On average, would take a more organized effort (more than 2 people, but less than 5) to remove all trash from the area. Removal of trash would take 10 to 30 mins (100ft AA) or 30 mins to 2 hours (300ft AA) • Approximately 2-6 times more trash than the moderate condition category			• Trash is continuously seen throughout the assessment area • Trash is distracts the eye on first glance • Substantial levels of litter and debris in streambed and banks • Evidence of site being used frequently by people (e.g., many cans, bottles, food wrappers, plastic bags, clothing; piles of garbage and debris) • On average, would take a large number of people (more than 5) during an organized effort to remove all trash from the area. Removal of all trash would take >40 minutes (100ft AA) or > 2 hours (300ft AA) • Approximately >2 times more trash than the high condition category		
Site Score (30 meter)	1	2	3	4	5	6	7	8	9	10	11	12
Site Score (100 meter)	1	2	3	4	5	6	7	8	9	10	11	12

Figure 6. Trash Condition Categories and Scoring System form.

Figure 7. Photo of "Low" trash category condition. Photo taken from the BASMAA Receiving Water Trash Monitoring Program Plan for the San Francisco Bay Region.

Figure 8. Photo of "Moderate" trash category condition. Photo taken from the BASMAA Receiving Water Trash Monitoring Program Plan for the San Francisco Bay Region.

Figure 9. Photo of "High" trash category condition. Photo taken from the BASMAA Receiving Water Trash Monitoring Program Plan for the San Francisco Bay Region.

Figure 10. Photo of "Very High" trash category condition. Photo taken from the BASMAA Receiving Water Trash Monitoring Program Plan for the San Francisco Bay Region.

Observers will physically walk on both banks and within or near the site (where feasible) to observe trash throughout the assessment area. Feasible conditions refer to flow conditions that allow the stream to be wadeable, in addition to conditions that would avoid impacts to migratory nesting birds and spawning fish. Trash that is visible outside of the assessment area will not to be included in the trash condition scor but will be noted in the comments section of the data form (BASMAA 2017).

Trash Tally Method (Quantitative)

Trash is quantified by recording the specific types of material and their quantities on the trash assessment tally datasheet. Trash is divided into nine major categories, which include Plastic, Miscellaneous, Fabric & Cloth, Biodegradable, Biohazard, Construction, Glass, Large, and Metal (Figure 11). Items within each category will be counted and recorded on the tally datasheet. If multiple pieces trash in the same approximate area appear to come from the same item, the recorder will count it as one; however, if the pieces appear to come from different items the recorder will count them separately. For example, if multiple pieces of plastic bags are present and they all are the same color and thickness, and all appear to be weathered similarly, the item will be counted as one. Otherwise, they should be counted separately. A subset of items (Table 1) may be estimated if there are greater than 10 pieces at a site using the following categories: M = 11-100 pieces, H >100 pieces.

Riverine Trash Assessment

StationID:_____ **Date:**_____ **Initials:**_____

Plastic	Left Bank	Right Bank
Bag - reusable		
Bag - single use		
Bag pieces*		
Balloons		
Beverage bottles		
Chip Bags		
Cigar Tips		
Cigarette Butts		
Container Cap/Pieces		
Cups		
Foam balls		
Foam cups		
Foam Food Containers		
Foam Plates		
Foam Other Containers		
Foam Packing Peanuts*		
Foam Pieces/Pellets*		
Hard Plastic container		
Hard plastic pieces		
Lid		
Lighters		
Other Plastic Bottles		
Pens/Markers		
Plastic 6-Pack Holder		
Plastic Pipe		
Plastic Straw Wrapper		
Plates		
Single use container		
Soft Plastic Pieces*		
Straw/Stirrer		
Tarp		
Tobacco wrapper/pieces		
Wrapper		
Wrapper Pieces*		
Plastic Other		
Fabric and Cloth	Left Bank	Right Bank
Natural (Cotton, Wool)		
Shoes		
Synthetic Fabric		
Tent/Sleeping bag		
Fabric Other		
Large	Left Bank	Right Bank
Furniture/Appliances		
Garbage Bags of Trash		
Shopping Carts		
Tires		
Large Other		
	Left Bank	Right Bank
Total Items:		

Biodegradable	Left Bank	Right Bank
Food Waste		
Paper/ cardboard		
Yard Waste/Leaf piles*		
Biodegradable Other		
Biohazard	Left Bank	Right Bank
Condoms		
Dead Animals		
Human Waste/Diapers		
Medical waste		
Pet Waste		
Biohazard Other		
Construction	Left Bank	Right Bank
Bricks		
Concrete/Asphalt		
Fabricated Wood		
Rebar		
Construction Other		
Glass	Left Bank	Right Bank
Glass Bottles		
Glass Pieces*		
Metal	Left Bank	Right Bank
Aluminum Foil pieces*		
Aluminum or Steel Cans		
Auto Parts		
Metal Bottle Caps		
Metal Pipe/Bar Segments		
Nails, Screws, Bolts, etc.		
Small Batteries		
Spray Paint Cans		
Wire (barb, chicken, etc.)		
Metal Other		
Miscellaneous	Left Bank	Right Bank
Ceramic Pots/Shards		
E-waste		
Foam rubber		
Hose/Hose Pieces		
Mylar balloons		
Rubber/Rubber Pieces		
Sports Balls		
Waxed Paper Cups/Plates		
Misc. Other		
	Left Bank	Right Bank
Total Items:		

*** This items may be binned if abundance is greater than 10 pieces as follows:**
M = 11-100 pieces
H => 101 pieces

Figure 11. Trash Tally form.

Table 2. Items that may be estimated on the Trash Tally form.

Estimated Trash Item	Estimated Trash Item
Bag Pieces	Yard Waste/Leaf Piles
Foam Pieces	Glass Pieces
Soft Plastic Pieces	Aluminum Foil Pieces
Wrapper/Wrapper Pieces	

The survey area is delineated from the thalweg (line of lowest elevation within a watercoarse; Figure 2) to bankfull width on the left and right bank (face downstream to determine left or right bank). The team will begin on either the right or left bank, walking slowly while visually scanning for trash. The team will scan an area within a shoulder width zone in heavily vegetated sites to avoid missing small or partially covered items. A larger scan width may be used at sites with little or no vegetation. A systematic scan approach will be used while walking the assessment area.

Pictures

Trash conditions will be photographed during each assessment. A minimum of 4 photographs will be taken at each site at the beginning (upstream), middle (upstream and downstream), and end (downstream) of the assessment area (Figure 12). Additional photographs may be taken to document site conditions. Each Photograph ID should use the following naming convention: Unique Site ID-Transect Location-Sample Date. For example: SMC00000-B-Down-06.12.2018. Photographs will be uploaded via SCCWRP's File Exchange System (http://sccwrp.org/Data/FileExchange.aspx) at the end of the sampling season.

Photo Documentation		
Segment	Location	Photograph ID
Bottom (A)	Upstream	
Middle (B)	Upstream	
	Downstream	
Top (C)	Downstream	
Other Photos	Misc. 1	
	Misc. 2	
	Misc. 3	

Figure 12. Photo Documentation form.

Safety

Safety is of the utmost importance while conducting the trash assessments. Sampling will always be conducted in teams of at least two people. The site will not be assessed if team members feel unsafe or threatened. Teams sampling in areas outside of cell phone ranges may want to have a satellite phone, personal locator beacons, or satellite messengers. The site and banks will be inspected before entering an assessment area. If the site is too steep or unstable,

the assessment will not be conducted, and this will be noted on the field data sheet. Many sites with heavy brush may have ticks, rattlesnakes, stinging nettle and poison oak, so the team will wear protective clothing while in the field, including field boots/waders, long sleeved shirts and long pants. Team members will watch their step and always check for ticks after leaving a site.

Quality Assurance Requirements

Lead trash assessors should attend a trash assessment training class before assessments begin. It is recommended that each assessment team conduct a duplicate trash assessment at one randomly selected site per year.

Invasive Species

There are various aquatic invasive species in southern California streams, including the New Zealand mudsnail (*Potamopyrgus antipodarum*). To prevent the spreading of aquatic invasives, gear (i.e. boots/waders) will be decontaminated before and after entering a stream using protocols developed by the California Department of Fish and Wildlife (CDFW). There are three equipment decontamination methods for gear. The options are as follows:

Option 1: Dry

- Scrub gear with a stiff-bristled brush to remove all dirt and debris. Thoroughly brush small crevices such as boot laces, seams, net corners, etc.
- Allow equipment to thoroughly dry (i.e., until there is complete absence of moisture), preferably in the sun. Keep dry for a minimum of 48 hours to ensure any organisms are desiccated.

Option 2: Hot water soak

- Scrub gear with a stiff-bristled brush to remove all dirt and debris. Thoroughly brush small crevices such as boot laces, seams, net corners, etc.
- Immerse equipment in 140° F or hotter water. If necessary, weigh it down to ensure it remains immersed.
- Soak in 140° F or hotter water for a minimum of five minutes.

Option 3: Freeze

- Scrub gear with a stiff-bristled brush to remove all dirt and debris. Thoroughly brush small crevices such as boot laces, seams, net corners, etc.
- Place in a freezer 32°F or colder for a minimum of eight hours.

More information is available at the Department's Invasive Species Program webpage at www.dfg.ca.gov/invasives.

Proposed Deliverables and Timeline

Deliverable	**Due Date**
Task 1. Refine Methods	May 2018
Task 1. Field deployment	Summer 2018
Task 2. Collection and Laboratory analysis	Fall 2018
Task 3. Review of data	Winter 2018
Task 4. Draft report	Spring 2019
Task 5. Final report	Fall 2019

Epibenthic Debris in the Ocean

Background and Objectives

Trash has become a focal point for many jurisdictions in southern California due to recent policy limiting the amounts of trash in the environment (i.e. CRWQCB 2007, CRWQCBLA 2015, SWRCB 2015). While most of these policies are specific to land-based trash, they ultimately have a direct impact on the amounts of trash that make it to the ocean and become marine debris. Most coastal studies quantifying marine debris have been localized, short-term surveys focused primarily on beach debris (Gabrielides et al., 1991; Moore et al., 2001; Ribic et al., 1992;) and floating debris (Aliani et al., 2003; Barnes, 2002; Barnes and Milner, 2005; Day and Shaw, 1987; Lecke-Mitchel and Mullin, 1992; Thiel and Haye, 2006). Few coastal studies have focused on epibenthic habitats of the continental shelf (Galgani et al., 1995, 1996; Keller et al., 2010; Moore and Allen, 2000; Stefatos et al., 1999; Watters et al., 2010), and only one, the Bight Regional Trash Survey, has been implemented on a regional and temporal scale. Regional and temporal assessments are necessary to assess the effectiveness of regulation, which requires information about the extent and magnitude of marine debris collected over sufficient time periods to determine trends.

Debris on the seafloor has been a part of the Bight survey since its inception in 1994. Trends over five Bight surveys (1994, 1998, 2003, 2008, and 2013) indicate that the amount (percent of area) of anthropogenic debris found on the continental shelf is not going down (Figure 13). In 2013, Moore et al. (2016) estimated that anthropogenic debris was found in about 25% of the Bight with plastics being the largest component (about 20%). Continuing to monitor these trends is a crucial part of determining whether policies regarding trash are effective.

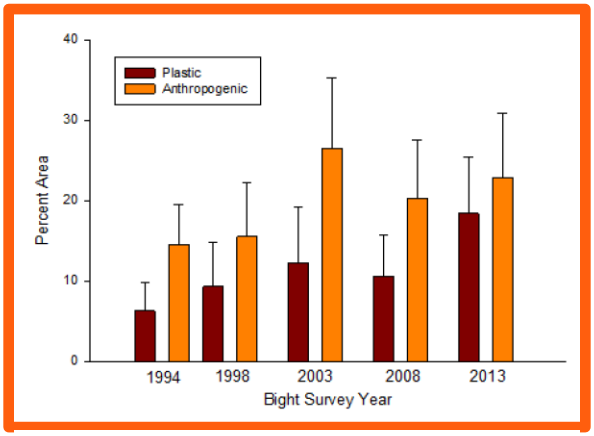

Figure 13. Trends in anthropogenic trash and plastic for each Bight survey.

The overall goals of the Epibenthic Debris Survey as part of the larger Bight Regional Survey are listed in Table 2 and include looking at the extent and magnitude of debris as well as debris trends over all Bight surveys.

Table 2. Study objectives and questions relevant to management questions.

Management Question	Study Objective	Application
1) How much debris is found on the continental shelf of the Southern California Bight?	Assess the types and amounts of debris.	This information will be used to assess anthropogenic debris types of concern.
2) What is on the continental shelf of the Southern California Bight?	Assess the spatial extent of debris.	This information will be used to assess areas of concern.
3) What are the trends in debris on the continental shelf of the Southern California Bight?	Assess whether the extent and magnitude have changed over time.	The information collected in 2018 will be compared with previous Bight Survey results to assess trends.

Approach

To collect epibenthic debris data the Bight Trash Committee will collaborate and coordinate with the Bight ‘18 Sediment Quality Committee. Epibenthic debris will be collected as a subcomponent of the trawl surveys conducted to obtain information on benthic fish and invertebrate communities. Field crews will process debris samples at the same time they process fish and invertebrates and will report the data to the Trash Committee. Results collected will be analyzed to answer the questions put forth by the Debris Committee (Table 1).

Standardized methods to enumerate epibenthic debris were developed during the first Bight Regional Survey in 1994 and have remained the same for every Bight Survey since. These methods are detailed below. Debris will be categorized, quantified, and recorded on standardized data forms (Appendix 1).

Target Population, Sample Frame Development, and Site Selection

This study component is being leveraged over resources in place through the Bight ‘18 Sediment Quality Subcommittee, therefore the target population, sample frame, and site selection has been pre-determined by that workgroup. The target population for the 2018 Sediment Quality survey is all marine or marine-influenced, subtidal waters along the Southern California Bight to a depth of 500 m, excluding the Channel Islands. The sample frame for the epibenthic debris study will be the same as that for trawls (Figure 14) and will include five strata used in previous Bight surveys. A target of 30 sites sampled has been set for each stratum. The trawl strata are as follows:

1. Bays
2. Inner Shelf
3. Middle Shelf
4. Outer Shelf
5. Upper Slope

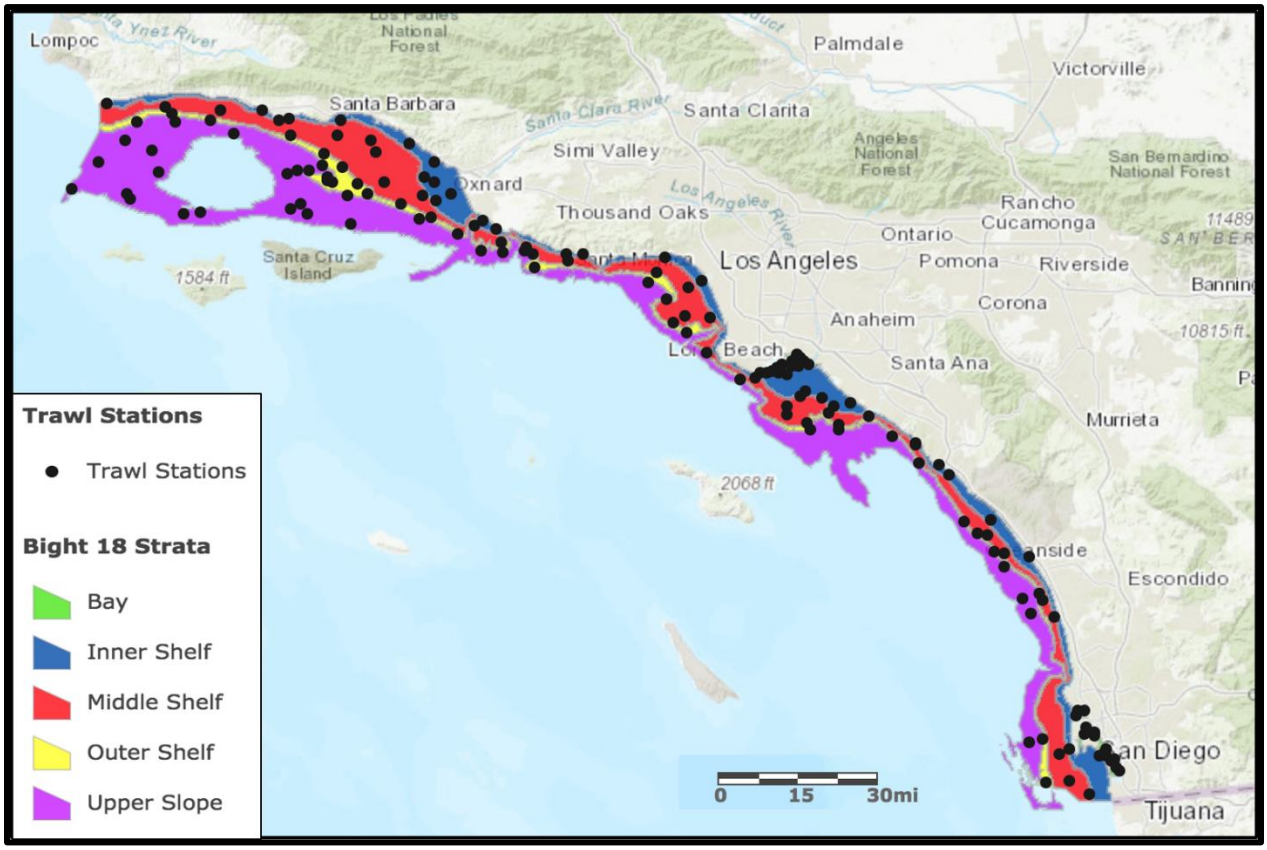

Figure 14. Bight '18 Sediment Quality Sampling Strata and trawl stations.

Sites were selected randomly using a generalized random tessellation stratified (GRTS) procedure to ensure spatial balance among sampled sites, allow for inference into regional condition, to avoid bias, and to allow for extrapolation of the response to the entire stratum. Although sites were selected randomly, a systematic component was added to the selection process to minimize clustering of sample sites. The systematic element was accomplished by using an extension of the sampling design used in the SCBPP and in EPA's Environmental Monitoring and Assessment Program (EMAP) (Stevens 1997). A hexagonal grid is randomly placed over a map of the sampling area, a subsample of hexagons is chosen from this population, and samples are obtained at randomly selected sites within grid cells. The hexagonal grid structure ensures systematic separation of the sampling, while the random selection of sites within grid cells ensures an unbiased estimate of ecological condition.

Sampling Methods

Sample collection methods in the field will follow the Bight ‘18 Field Operations Manual during the summer of 2018 (July-September).

Trawls will be conducted using a semi-balloon otter trawl with a 7.6-m headrope (25 ft), 8.8-m footrope (29 ft), 3.8-cm (1.5 in) body mesh, and a 1.3-cm cod-end mesh (0.5 in). Trawls will be towed along isobaths at a speed-over-ground of 1.0 m/second (or 1.5 to 2.0 kn) for 10 minutes. At the end of the prescribed trawl time, the net is retrieved and brought onboard the vessel. Any debris caught on the cable/doors/chain should be noted, but not included in the tally. The cod-end is then opened and the catch is deposited into a tub or holding tank. The criteria used to evaluate the success of any trawl includes making sure that proper depth, scope, speed, and distance (or duration) were maintained, whether the net was fouled (net tangled), and whether the catch shows evidence that it was on the bottom (*e.g.*, rocks, benthic invertebrates, benthic fish).

The catch should initially be rough sorted into major categories (*e.g.*, urchins, shrimp, other invertebrates, flatfishes, rockfishes, other fishes, debris). Trawl debris will be sorted for processing. Debris collected during any trawl will be quantified as well as qualified by recording the specific types of debris on the Bight ‘18 Trawl Debris Form. The larger categories on this form match those on the form used by the Stormwater Monitoring Coalition (SMC) for collecting debris information for land-based sources, in an effort to make comparisons of land-based trash versus ocean-based debris. For Bight ‘18 the form was modified to include Single Use Food Container and remove Pull Tab based on knowledge from the Debris Subcommittee participants with trawling programs. The major categories include Plastic, Glass, Metal, Miscellaneous Items, Marine Origin, and Terrestrial Origin. Items within these categories include those commonly found in previous surveys (Appendix 1).

Types of items within each of these categories will be counted and recorded. If an item is not on the list it will be placed in the appropriate “Other” category with a required comment made to describe the item. In the case of items that could fit into multiple categories, count the item in the category that the item consists most of, and document any of the other categories it would fit into in the comments field. Please note additional descriptive information regarding the debris such as brand names in the comments section for that item. For debris of marine or terrestrial origin, counts of each should be made; however, estimates are acceptable as well. For counts of ten or less, record the item count, for counts higher than ten record a qualifier in the estimate box based on the following categories: M for Moderate abundance (11-100 items); and H for High abundance (>100 items). In cases where counts were not easily made, a comment explaining the difficulty would be helpful. No debris items will be weighed for Bight ‘18, but comments that better describe the debris such as estimated size (e.g. the size of a basketball), condition (e.g. decayed kelp frond in pieces), or type/species (e.g. *Macrocystis pyrifera*) are encouraged.

Proposed Deliverables and Timeline

Deliverable	**Due Date**
Task 1. Field deployment	Summer 2018
Task 2. Data compilation	Fall 2018
Task 3. Review of data	Winter 2018
Task 4. Draft report	Spring 2019
Task 5. Final report	Fall 2019

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APPENDICES

Appendix I. Trawl Debris Field Data Sheet

BIGHT'18 TRAWL DEBRIS FORM **Agency:**_____ **Page**_____**of**_____

Station:_____ **Trawl #:**_____ **Date:**_____ ☐ **CHECK HERE IF NO DEBRIS PRESENT IN SAMPLE**

Anthropogenic Debris - include Brand names in Comments if known

Plastic	**Count**	**Comment**
Bag		
Bandaid		
Balloon (mylar/latex)/Ribbon		
Bottle		
Buoy		
Cap/Lid		
Cigarette box/Wrapper		
Cup		
Filmstrip (movie)		
Fishing Line/Net		
Food Bag/Wrapper		
Polypropylene Rope		
Single use food container		
Toy		
Utensil		
Plastic Piece (unid.)		
Other Plastic *(comment req.)*		
Glass		
Beer Bottle		
Other Glass Bottle/Jar		
Glass Piece (unid.)		
Other Glass *(comment req)*		

Misc. Items/Pieces	**Count**	**Comment**
Boat/Ship/Engine Part		
Clothing		
Concrete/Asphalt		
Fiberglass		
Food		
Leather		
Lumber		
Paper		
Rag/Cloth		
Rubber		
Shoe		
Tape		
Tire		
Other Misc. *(comment req.)*		
Metal	**Count**	**Comment**
Drink Can		
Can - other		
Fishing Gear		
Wire		
Metal Piece (unid.)		
Other Metal (comment req.)		

Natural Debris

Marine Origin	**Count**	**Est.***	**Comment**
Foliose Algae - not kelp			
Gorgonian Sea Fan (dead)			
Kelp Holdfast			
Kelp Stipe/Blade			
Other Foliose Algae			
Rock			
Seagrass			
Other Marine *(comment req.)*			

Terrestrial Vegetation	**Count**	**Est.***	**Comment**
Leaves/Seed Pod			
Stick/Branch/Driftwood			
Other Terrestrial *(comment req.)*			

****For Natural Debris only*** , if the count is >10 and an exact count cannot be made, leave the "Count" column blank and estimate the amount (M or H) in the "Est." column

Moderate: **M** = 11-100

High: **H** = >100

Completed by: _____

Appendix II. Trawl Debris Category Lookup List

Method	Debris Origin	Debris Category	Debris Type	Comment Required?
Trawl	Anthropogenic	Plastic	Bag	N
Trawl	Anthropogenic	Plastic	Bandaid	N
Trawl	Anthropogenic	Plastic	Balloon (mylar/latex)/Ribbon	N
Trawl	Anthropogenic	Plastic	Bottle	N
Trawl	Anthropogenic	Plastic	Buoy	N
Trawl	Anthropogenic	Plastic	Cap/Lid	N
Trawl	Anthropogenic	Plastic	Cigarette box/wrapper	N
Trawl	Anthropogenic	Plastic	Cup	N
Trawl	Anthropogenic	Plastic	Filmstrip (movie)	N
Trawl	Anthropogenic	Plastic	Fishing Line/Net	N
Trawl	Anthropogenic	Plastic	Food Bag / Wrapper	N
Trawl	Anthropogenic	Plastic	Polypropylene Rope	N
Trawl	Anthropogenic	Plastic	Single use food container	N
Trawl	Anthropogenic	Plastic	Toy	N
Trawl	Anthropogenic	Plastic	Utensil	N
Trawl	Anthropogenic	Plastic	Plastic Piece (unid.)	N
Trawl	Anthropogenic	Plastic	Other Plastic (comment req.)	Y
Trawl	Anthropogenic	Glass	Beer Bottle	N
Trawl	Anthropogenic	Glass	Glass Bottle/Jar -other	N
Trawl	Anthropogenic	Glass	Glass Piece (unid.)	N
Trawl	Anthropogenic	Glass	Other Glass (comment req.)	Y
Trawl	Anthropogenic	Misc. Items/Pieces	Boat/Ship/Engine part	N
Trawl	Anthropogenic	Misc. Items/Pieces	Clothing	N
Trawl	Anthropogenic	Misc. Items/Pieces	Concrete/Asphalt	N
Trawl	Anthropogenic	Misc. Items/Pieces	Fiberglass	N
Trawl	Anthropogenic	Misc. Items/Pieces	Food	N
Trawl	Anthropogenic	Misc. Items/Pieces	Leather	N
Trawl	Anthropogenic	Misc. Items/Pieces	Lumber	N
Trawl	Anthropogenic	Misc. Items/Pieces	Paper	N
Trawl	Anthropogenic	Misc. Items/Pieces	Rag/Cloth	N

Method	Debris Origin	Debris Category	Debris Type	Comment Required?
Trawl	Anthropogenic	Misc. Items/Pieces	Rubber	N
Trawl	Anthropogenic	Misc. Items/Pieces	Shoe	N
Trawl	Anthropogenic	Misc. Items/Pieces	Tape	N
Trawl	Anthropogenic	Misc. Items/Pieces	Tire	N
Trawl	Anthropogenic	Misc. Items/Pieces	Other Misc. (comment req.)	Y
Trawl	Anthropogenic	Metal	Drink Can	N
Trawl	Anthropogenic	Metal	Can – other	N
Trawl	Anthropogenic	Metal	Fishing Gear	N
Trawl	Anthropogenic	Metal	Wire	N
Trawl	Anthropogenic	Metal	Metal Piece (unid.)	N
Trawl	Anthropogenic	Metal	Other Metal (comment req.)	Y
Trawl	Natural	Marine Origin	Foliose Algae - not kelp	N
Trawl	Natural	Marine Origin	Gorgonian Sea Fan (dead)	N
Trawl	Natural	Marine Origin	Kelp Holdfast	N
Trawl	Natural	Marine Origin	Kelp Stipe/Blade	N
Trawl	Natural	Marine Origin	Rock	N
Trawl	Natural	Marine Origin	Seagrass	N
Trawl	Natural	Marine Origin	Other Marine (comment req.)	Y
Trawl	Natural	Terrestrial Vegetation	Leaves/Seed Pod	N
Trawl	Natural	Terrestrial Vegetation	Stick/Branch/Driftwood	N
Trawl	Natural	Terrestrial Vegetation	Other Terrestrial (comment req.)	Y

Appendix III. Site Information Data Sheet

Riverine Trash Assessment

General Site Information

Station ID: _____ Date: _____

Start Time: _____ End Time: _____

Latitude: _____ Longitude: _____ Datum: □ NAD 83 □WGS 84

Field Crew: _____

_____

River/Site Description: _____ Watershed: _____

Access:

Left Bank (circle one): Easy Mod Hard Right Bank (circle one): Easy Mod Hard

Channel Type:

□ Natural □ Earthen □ Concrete/Earthen □ Concrete □ Other

Type of Site: □ Probabilistic □ Targeted Is stream flowing? Yes / No

Assessment Area

Reach Length (m) _____

Wetted Width (m) Transect A _____ Transect B _____ Transect C _____

Bankfull Width (m) Transect A _____ Transect B _____ Transect C _____

Trash picked-up during assessment? Yes / No

Stormwater Outfalls/Encampments

Number of stormwater outfalls in the assessment area >18" in diameter

18-24" _____ 25-36" _____ 37-48" _____ >48" _____

Trash at Outfalls? Yes / No

Amount of Trash Present: <10 <50 <100 >100
(circle one)

Homeless encampment within 200 meters of assessment area? Yes / No

Comments/Notes

Appendix IV. Visual Assessment Data Sheet

Station: _____ **Sample Date:** _____

Visual Assessment - Trash Condition and Pathways				
	Trash Condition Category			
	Low	**Moderate**	**High**	**Very High**
Description	• Effectively no or very little trash • On first glance, little or no trash is visible • Little or no trash is evident when streambed and stream banks are closely examined for litter and debris • One individual could easily remove all trash observed within 10 minues (100ft AA*) or 30 minutes (300ft AA)	• Predominantly free of trash except for a few littered areas • On first glance, trash is evident in low levels • After close inspection, small levels of trash are evident in stream bank and/or streambed. • On average, all trash could be removed by two individuals within 10 to 20 minutes (100ft AA) or 30 minutes to one hour (300ft AA) • Approximately 2-3 times more trash than the low condition category	• Predominantly littered except for a few clean areas • Trash is evident upon first glance in moderate levels along streambed and banks • Evidence of site being used by people: scattered cans, bottles, food wrappers, plastic bags etc. • On average, would take a more organized effort (more than 2 people, but less than 5) to remove all trash from the area. Removal of trash would take 10 to 30 mins (100ft AA) or 30 mins to 2 hours (300ft AA) • Approximately 2-6 times more trash than the moderate condition category	• Trash is continuously seen throughout the assessment area • Trash is distracts the eye on first glance • Substantial levels of litter and debris in streambed and banks • Evidence of site being used frequently by people (e.g., many cans, bottles, food wrappers, plastic bags, clothing; piles of garbage and debris) • On average, would take a large number of people (more than 5) during an organized effort to remove all trash from the area. Removal of all trash would take >40 minutes (100ft AA) or > 2 hours (300ft AA) • Approximately >2 times more trash than the high condition category
Site Score (30 meter)	**1 2 3**	**4 5 6**	**7 8 9**	**10 11 12**
Site Score (100 meter)	**1 2 3**	**4 5 6**	**7 8 9**	**10 11 12**

Photo Documentation		
Segment	**Location**	**Photograph ID**
Bottom (A)	Upstream	
Middle (B)	Upstream	
	Downstream	
Top (C)	Downstream	
Other Photos	Misc. 1	
	Misc. 2	
	Misc. 3	

Appendix V. Trash Tally Data Sheet

StationID:_____ **Date:**_____ **Initials:**_____

Plastic	Left Bank	Right Bank
Bag - reusable		
Bag - single use		
Bag Pieces*		
Balloons		
Beverage Bottles		
Chip Bags		
Cigar Tips		
Cigarette Butts		
Container Cap/Pieces		
Cups		
Foam Balls		
Foam Cups		
Foam Food Containers		
Foam Other Containers		
Foam Packing Peanuts*		
Foam Pieces/Pellets*		
Foam Plate		
Hard Plastic Container		
Hard Plastic Pieces		
Lid		
Lighters		
Pens/Markers		
Plastic 6-Pack Holder		
Plastic Bottles		
Plastic Pipe		
Plastic Straw Wrapper		
Plates		
Single Use Container		
Soft Plastic Pieces*		
Straw/Stirrer		
Tarp		
Tobacco Wrapper/Pieces		
Wrapper/Wrapper Pieces*		
Plastic Other		

Fabric and Cloth	Left Bank	Right Bank
Natural (Cotton, Wool)		
Shoes		
Synthetic Fabric		
Tent/Sleeping bag		
Fabric Other		

Large	Left Bank	Right Bank
Furniture/Appliances		
Garbage Bags of Trash		
Shopping Carts		
Tires		
Large Other		

	Left Bank	Right Bank
Total Items:		

Biodegradable	Left Bank	Right Bank
Food Waste		
Paper/ cardboard		
Yard Waste/Leaf piles*		
Biodegradable Other		

Biohazard	Left Bank	Right Bank
Condoms		
Dead Animals		
Human Waste/Diapers/TP		
Medical waste		
Pet Waste		
Biohazard Other		

Construction	Left Bank	Right Bank
Bricks		
Concrete/Asphalt		
Fabricated Wood		
Rebar		
Construction Other		

Glass	Left Bank	Right Bank
Glass Bottles		
Glass Pieces*		
Glass Other		

Metal	Left Bank	Right Bank
Aluminum Foil pieces*		
Aluminum or Steel Cans		
Auto Parts		
Metal Bottle Caps		
Metal Pipe/Bar Segments		
Nails, Screws, Bolts, etc.		
Small Batteries		
Spray Paint Cans		
Wire (barb, chicken, etc.)		
Metal Other		

Miscellaneous	Left Bank	Right Bank
Ceramic Pots/Shards		
E-waste		
Foam rubber		
Hose/Hose Pieces		
Mylar balloons		
Rubber/Rubber Pieces		
Sports Balls		
Waxed Paper Cups/Plates		
Misc. Other		

	Left Bank	Right Bank
Total Items:		
GRAND TOTAL:		

*** These items may be binned if abundance is greater than 10 pieces as follows:**
M = 11-100 pieces
H = > 101 pieces