

Tracking California's Trash Project: Testing Trash Monitoring Methods in Flowing Water Bodies

Trash Monitoring Workshop

April 17, 2017



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Env. Programs Director

MORE  CEAN
LESS PLASTIC
THE 5 GYRES INSTITUTE

The 5 Gyres Institute

MISSION

Empowering action against the global health crisis of plastic pollution through science, art, education and adventure.

HIGHLIGHTS

- ❖ 17 Expeditions (2010 - now)
- ❖ Citizen Scientists around the world using our trawls
- ❖ First global estimate of plastic pollution
- ❖ 2017/2018 San Francisco Bay Microplastic Project with SFEI



Project Goals / Outcomes

1. Develop and evaluate monitoring methods designed to assess the amount of trash transported via receiving waters

2. Monitoring methods should be scientifically sound, repeatable and cost effective.

3. Monitor four water bodies in California during dry + wet periods.

4. Aim to monitor entire water column.

Overview of Project

- ❖ Literature Review
- ❖ Project Design Development with input from Expert / Technical Advisory Committee
- ❖ Obtain Permits / Logistics
- ❖ Storm Monitoring / Field Sampling – 2015/2016
- ❖ Final Report

Literature Review

- ❖ Little to no research
- ❖ Most research focuses on microplastics
- ❖ Since TCT Project began in 2012/2013, new projects have been established that monitor receiving waters in Great Lakes (USGS), Corpus Christi Bay in Texas (Texas A&M), NY-NJ Harbor Estuary (EPA, BayKeeper), ...



Manta Trawl



Weighted Rectangular Trawl

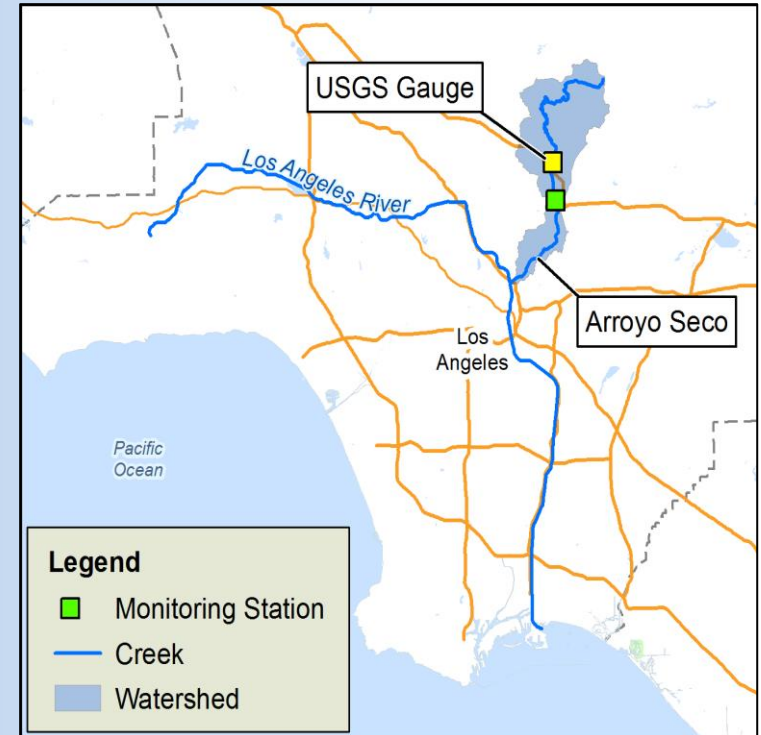
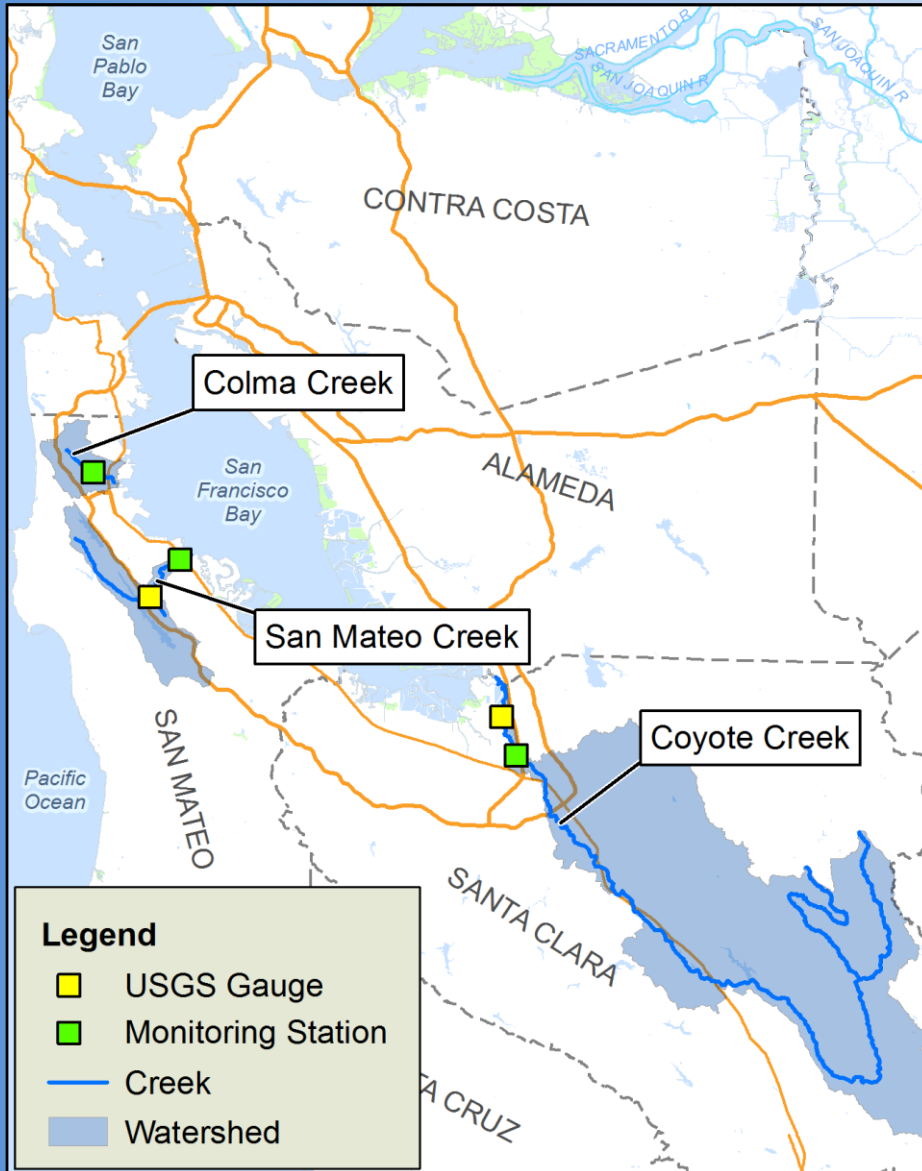


Hi Speed Trawl



Rectangular Trawl

Monitoring Sites



Note: Colma Gauge located adjacent to monitoring site

Monitoring Sites

Region	Receiving Water	Water Body Type
San Francisco Bay	Colma Creek	Small Channelized Creek
	Coyote Creek	Large Riparian Creek
	San Mateo Creek	Small Riparian Creek
Los Angeles	Arroyo Seco	Large Channelized Creek

Site Requirements

- ❖ Variety of Water Body Types
- ❖ Active Nearby Flow Gauges
- ❖ Year Round Flow
- ❖ Bridgeway with Enough Area for Equipment
- ❖ Cities Willing to Participate



Colma Creek



San Mateo



Arroyo Seco



Coyote Creek

Receiving Water Monitoring Questions

1. What type of sampling equipment provides for the most accurate and representative measures of surface, water column and bedload flux in the different channel types and sizes?
2. What is the variability in trash loading within and among storms, and is there a first flush effect?
3. How much time and resources are required to do the receiving water assessment (sample collection and characterization)?

Overview: 57 Samples, Four Wet Weather Events

Event	Receiving Water	Date	Samples Collected	Equipment Used	Rainfall (inches)	Wet/Dry Event	Days since last Rain
1	Colma Creek	3/4/15	4	Manta, Rectangular	Trace	Dry	24
2	Colma Creek	4/7/15	7	Manta, Rectangular	0.59*	Wet	2
3	Colma Creek	11/24/15	11	High Speed, Mini Hi Speed, Manta, Rectangular	0.25	Wet	9
4	San Mateo	1/29/16	6	Manta, Rectangular	Trace	Dry	6
5	San Mateo	2/17/16	8	Manta, Rectangular	0.45	Wet	15
6	Arroyo Seco	3/7/16	7	Rectangular	1.75**	Wet	n/a
7	Arroyo Seco	3/8/16	7	Manta, Weighted Rectangular	0.02	Dry	n/a
8	Coyote Creek	5/6/16	7	Weighted Rectangular	0.17***	Wet	9
		TOTAL	57				

*Rain occurred several hours prior to sampling with little to no stormwater runoff during sampling

**Most of the rainfall occurred prior to sampling. Hydrograph was falling when the sampling began.

***Analyzed as a rain event



Arroyo Seco



San Mateo Creek



Arroyo Seco



San Mateo Creek



Typical Wet Weather Samples







Sample Processing

Trash Characterization Data Collection Form

BASMAA ID #: COLMA-MT-02
 Sample Date: 11/24/15

Staff: Martine Today's Date: 12/4/15 Time: 1:25pm

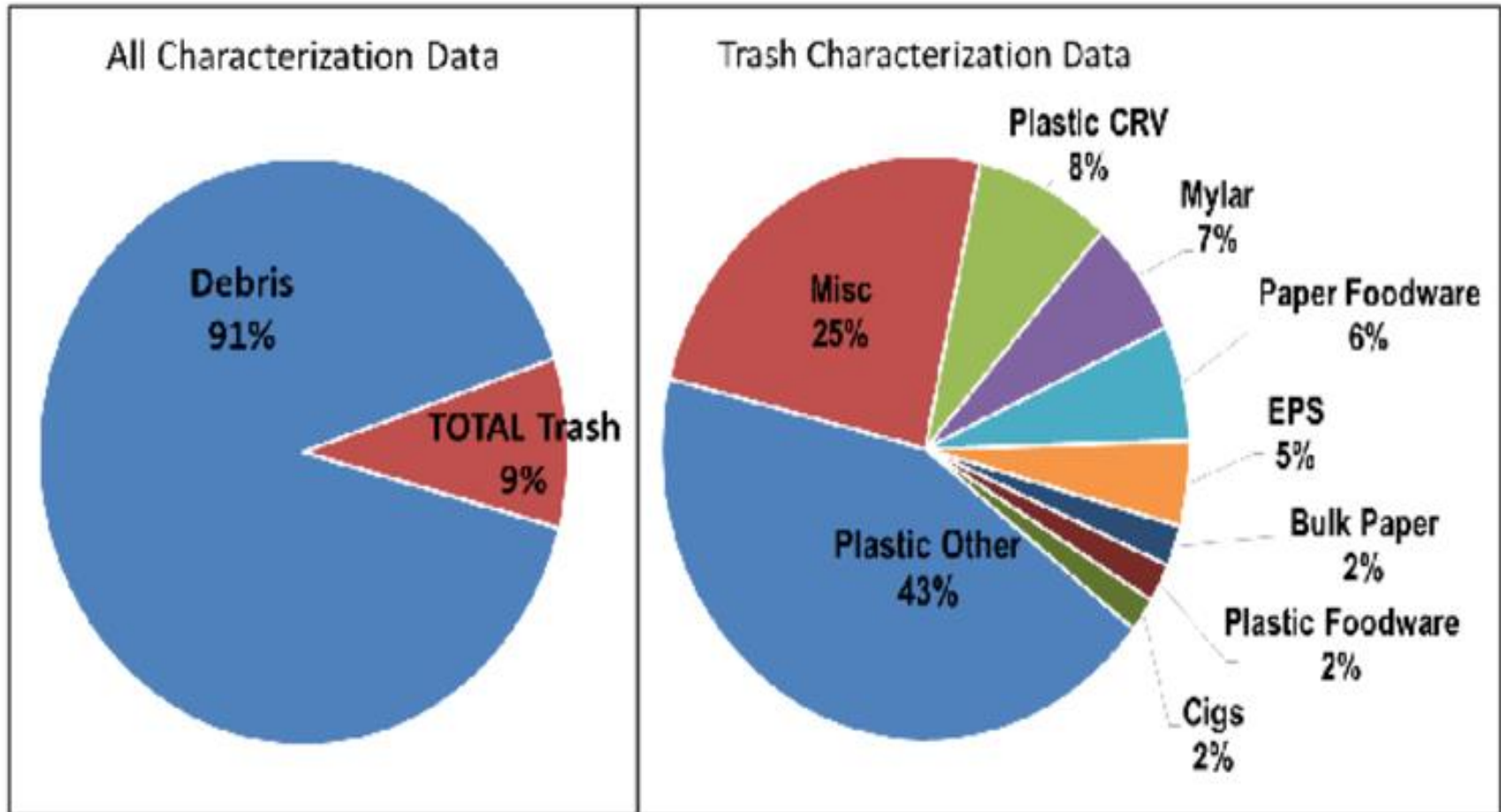
Debris	Moisture Content ¹			Number of Bucket(s) ² (5 gal)
	Dry	Damp	Wet	
			✓	Wt 2

Debris	Bucket #	1	2	3	4	5	6
	Volume (inches)	6 in	9.25 in	—	—	—	—
Weight (pounds)	6.782	7.594	—	—	—	—	—

Trash Category/Type	Item Count		Weight		Volume	
	# Items	Volume(s) of Items	Container Size (gal/oz)	Weight (lbs)	Container Size (gal/oz)	Depth (in/ml)
Plastic - Recyclable Beverage Containers (CRV-labeled)	—	—	—	—	—	—
Glass - Recyclable Beverage Containers (CRV labeled)	—	—	—	—	—	—
Single Use Plastic Carryout Bags	—	—	—	—	—	—
EPS Disposable Food & Beverage Ware	—	—	—	—	—	—
Rigid Plastic Disposable Food and Beverage Ware	—	—	—	—	—	—
Mylar (Non-recyclable) Film Food Wrappers	2 pcs	—	100 ml	0.022	100 ml	70 ml
Other Plastic Items	61 pcs	—	2 gal.	1.188	2 gal.	3.75 in
Paper Food/Beverage Ware	1 pc	—	1000 ml	0.209	1000 ml	950 ml
Bulk Paper and Cardboard	—	—	50 ml	0.028	50 ml	45 ml
Cigarette Butts	10 pcs	—	50 ml	0.052	50 ml	50 ml
Other Glass Items	—	—	—	—	—	—
Metal Items	—	—	—	—	—	—
Miscellaneous Items	—	—	100 ml	0.039	100 ml	40 ml



Trash Characterization from Sampling



(By Volume)

Project Success: *New Weighted Rectangular Trawl*



Project Success: Equipment Suggestions

	High flow, Channelized	Low flow, Channelized	High flow, Riparian	Low flow, Riparian
Surface Water	(1) Manta Trawl, (2) Weighted Rectangular Trawl	(1) Manta Trawl, (2) Rectangular	(1) Manta Trawl, (2) Weighted Rectangular Trawl	(1) Manta Trawl, (2) Rectangular
Mid Water / Bottom	(1) Weighted Rectangular	(1) Rectangular (both weighted and not weighted)	(1) Weighted Rectangular	(1) Rectangular (both weighted and not weighted)



Trash Rates and Precipitation at Colma Creek

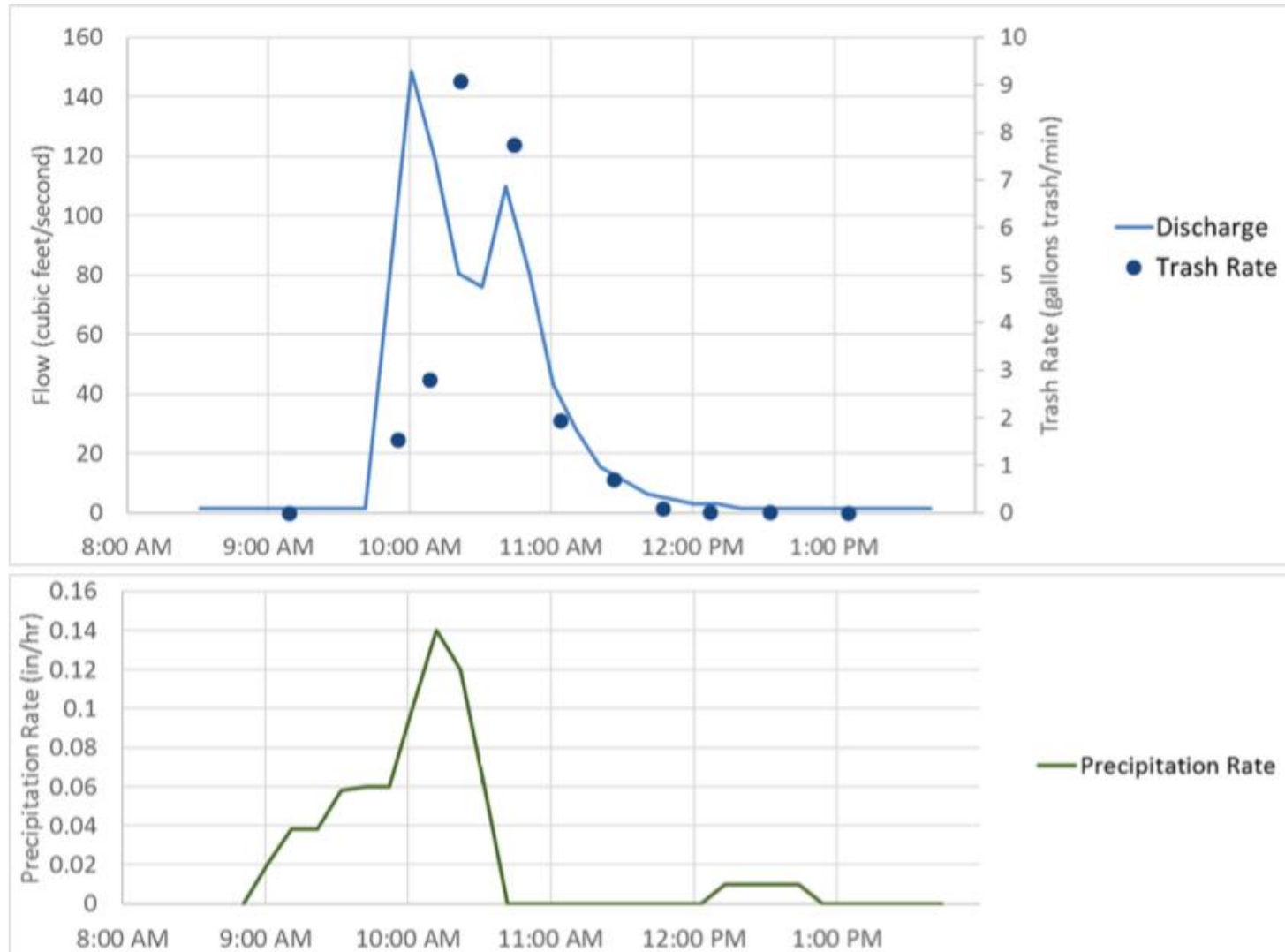


Figure 21. Trash rates, flow, and precipitation at the event on Colma Creek November 24, 2015

Can this Method Estimate Trash Loading / Storm?

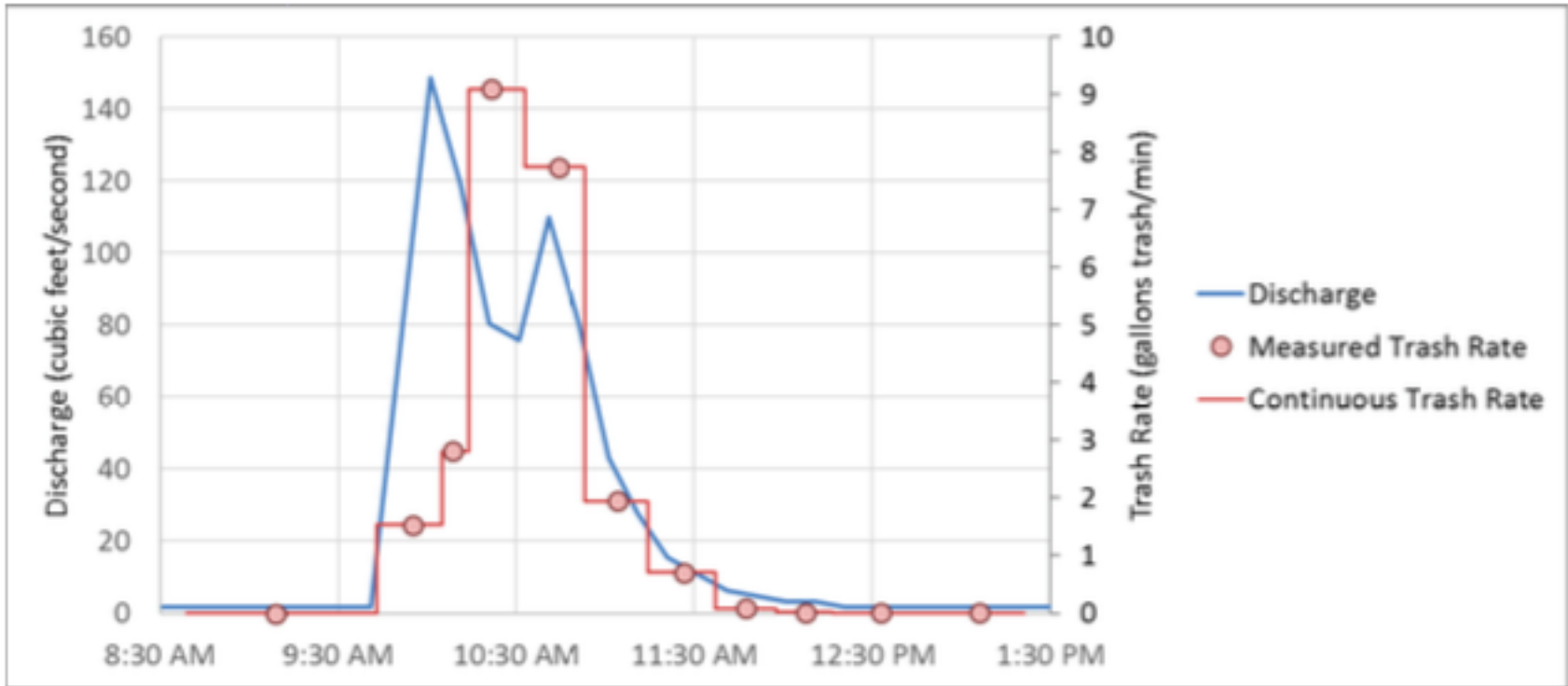
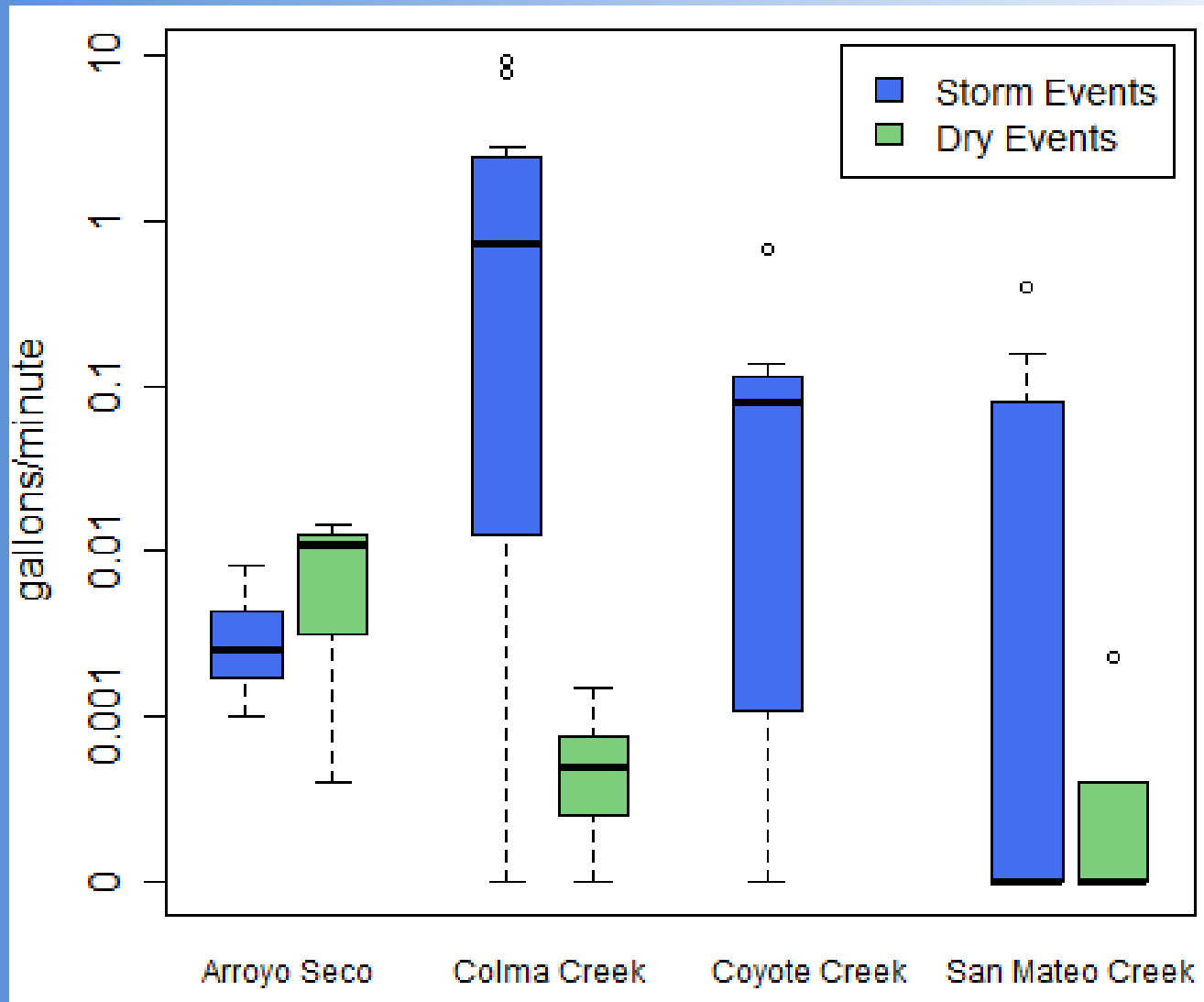
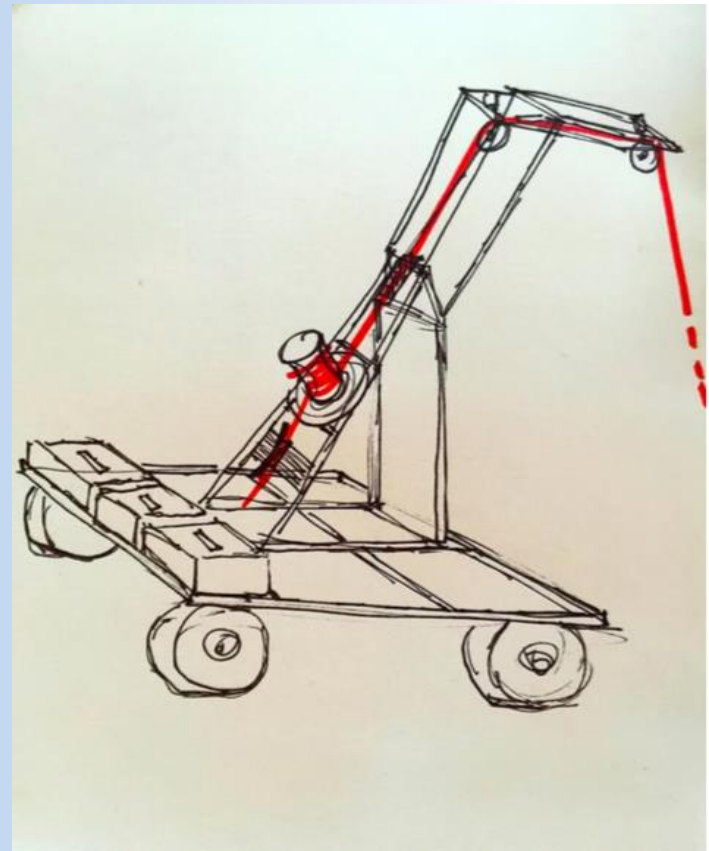


Figure 25. Trash loading estimate method for the Colma Creek storm event November 24, 2015



What would I do differently?

- ❖ Focus on **LESS** monitoring sites. Colma Creek was a great monitoring site and it may have been helpful to sample during an entire wet season and attempt to calculate an annual trash flux.
- ❖ Improve the USGS Crane for safety and ease (too bulky / not safe)
- ❖ Hire someone to track storms
- ❖ Used the Weighted Rectangular Trawl at more sites and during rainy monitoring
- ❖ Sample throughout water column + look at composite samples



Moving Forward

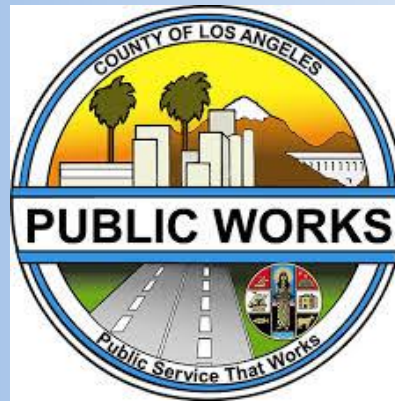
- ❖ More field testing on Weighted Rectangular Trawl (Sample entire water column)
- ❖ Real time velocity is important (flow meters are essential to research)
- ❖ Explore innovative techniques (Cameras, Robots, Pump, Citizen Science)
- ❖ Can we sample at the end of the Receiving water?



BAY AREA
STORMWATER MANAGEMENT
AGENCIES ASSOCIATION



Environmental and Public Health Engineering



THE CITY OF PASADENA

Questions/Comments?



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