Monterey Bay Sanctuary Citizen Watershed Monitoring Network
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First Flush Report

October 30, 2001

In the Cities of
Monterey, Pacific Grove and Santa Cruz, CA

Made Possible by the:

Monterey Bay National Marine Sanctuary, Cities of Monterey, Pacific Grove, and Santa Cruz, Central Coast Regional Water Quality Control Board, Coastal Watershed Council, CA State Water Resources Control Board, Monterey Bay Sanctuary Foundation, and the University of California at Santa Cruz

Executive Summary

Long before the break of dawn on Tuesday, October 30th, 2001, thirty-nine monitors around the Monterey Bay donned foul weather gear and collected water samples from storm drain outfalls during the first storm of the season, the First Flush. First Flush occurs when sheeting rain flushes roadways and impermeable surfaces and carries months of accumulated contaminants and debris into the ocean.

The Monterey Bay Sanctuary Citizen Watershed Monitoring Network and the Coastal Watershed Council in collaboration with the Cities of Monterey, Pacific Grove and Santa Cruz coordinated First Flush. When the skies opened up, 14 storm drain outfalls in Monterey, Pacific Grove, and Santa Cruz were monitored for conductivity, water temperature, pH, transparency, nitrate, orthophosphate, total coliform, *E. coli*, total dissolved solids, total suspended solids, oil and grease, zinc, copper and lead. One site in each city (called "time series") was monitored three to four times in 30 minute intervals to determine if there was a change in constituents over time.

This storm produced approximately 0.2 inches of rain in the Monterey area and 0.8 inches of rain in the Santa Cruz area. The rain began to fall at approximately 3:00 AM on Tuesday morning. The team leaders were contacted and told to mobilize their team. Teams arrived at their first monitoring sites around 4:30 AM. It was dark, wet and water was gushing from the outfalls.

This was the second annual First Flush monitoring event in Monterey and Pacific Grove and the first annual in Santa Cruz. The results at each monitoring site are very similar to the previous year's results. Asilomar was the only outfall in Monterey and Pacific Grove to have high lead concentrations for two years in a row. Orthophosphate and copper concentrations exceeded Central Coast Ambient Monitoring Program (CCAMP) action levels at the majority of the sites. *E. coli* levels at all of the sites were very high, most greater than 20,000 MPN/100ml with two sites in Santa Cruz reporting 141,000 MPN/100 ml. Zinc levels were higher than in 2000 and were found at more sites. Nitrate levels were consistently low except in Santa Cruz. Soap bubbles were commonly observed at the outfalls, but overall, less trash was reported.

Steinbeck Plaza, Monterey, CA

Results from the time series locations indicated that it is important to collect more than one set of samples at each location in order to be representative of what is actually flowing from the outfall. Time series results in Santa Cruz at Woodrow, clearly showed parameters either increasing or decreasing over time. The time series sites in Monterey and Pacific Grove changed over time but not in a consistent manner.

The First Flush monitoring event provides very important information about the constituents of the water flowing off of our streets into the Monterey Bay National Marine Sanctuary. With two years of data, trends are present and further investigation and action is warranted. Without the dedication and commitment of our volunteers, this information would not be possible. Their enthusiasm and willingness to venture out in the rain and darkness was astonishing. The Network, Coastal Watershed Council and the Cities are very grateful to them!

Background

Urban runoff, a type of non-point source pollution, is the nation's leading threat to water quality. This pollution may contain toxic metals, hydrocarbons, nutrients, suspended solids and many other constituents that are detrimental to the marine environment. Urbanization and increases in population directly affect the type of pollution that enters storm drains. Impermeable surfaces such as roads, prevent storm water from soaking into the ground. These surfaces become conduits for toxics. Some examples include oil and grease that wash off roads, fertilizers and pesticides from lawns, and detergents from restaurants.

It is important to learn what is in the urban runoff flowing into the Monterey Bay National Marine Sanctuary. A dry weather monitoring activity, called Urban Watch, has been conducted by citizen monitors for the past five years in Monterey, three years in Pacific Grove, one year in Santa Cruz and one year in Capitola. The pollution detection kit that is used for Urban Watch was developed according to the National Pollutant Discharge Elimination System (NPDES) Phase 1 dry weather monitoring requirements and is designed to detect illegal storm drain connections and discharges. Because of this program, it is generally known which outfalls commonly discharge urban runoff that contains contaminants and education efforts are under way to reduce the pollutants.

This First Flush event was the second time an organized wet weather monitoring was conducted in Monterey and Pacific Grove and the first time in Santa Cruz. This is vital information because the heavy rains flush the impermeable surfaces and the pollutants are washed into the storm drains. The samples collected during the First Flush are a good indication of what is flowing into the Sanctuary when it rains throughout the year.

Central & 13th (Greenwood Park) Pacific Grove, CA

Methods

The same storm drain outfalls that are regularly monitored by the Urban Watch volunteers were chosen for this event. Three sets of water samples were taken at three stations (one in each city) to determine any differences in constituents over time. They are described below as "time series". In Monterey, the stations included the Twin 51's, Major Sherman (aka El Dorado), Library, Steinbeck Plaza (time series) and San Carlos Beach. In Pacific Grove, the stations were Asilomar, Pico, Central & 13th (aka Greenwood) (time series), Lover's Pt., and 8th Street. Santa Cruz stations included Bay Street, Delaware, Merced and Woodrow (time series). (See Attachment 1 for information about the stations).

A total of ten teams were assigned to the Cities of Monterey, Pacific Grove and Santa Cruz. Each team had a team leader responsible for the monitoring equipment and sample bottles. The criteria used for mobilization included sheeting water on the roadways, heavy flow through the storm drain system and conductivity levels below 500 µS (background conductivity levels commonly exceed 2000 µS at the outfalls in Pacific Grove and Monterey).

Two teams in Monterey and Pacific Grove were each responsible for two stations. The third team in those two cities were responsible for just one station (listed above as "time series") to document the change in the discharge over time. At the "time series" stations in Monterey and Pacific Grove, three samples were gathered

at 30 minute intervals, observations made continuously, and changes recorded**.** In Santa Cruz, four teams were assigned just one site to monitor. The time series site in Santa Cruz was at Woodrow. An automatic sampler, provided by the University of California at Santa Cruz, was placed into the storm drain prior to the storm. The automatic water sampler is an ISCO 2900 (Lincoln, NE). A team was also on site at this location to record physical parameters and document observations**.**

The conductivity measurements determined if it was indeed storm water runoff flowing out of the outfalls. The field data sheet was used by all of the monitoring teams to follow a standard protocol (See Attachment 2-Field Data Sheet). Based on past "First Flush" events conducted by Region 2 and 3 of the Regional Water Quality Control Board, a list of monitoring parameters was developed. On station, the volunteers measured water temperature using a Comark DT300 digital thermometer. Conductivity was measured using an Oakton TDSTester 3 or 4. The pH was measured using Macherey-Nagel pH test strips with a range of 4.5-10. Transparency was measured using a one-meter transparency tube as described in the GLOBE program. Physical observations such as trash, odor, bubbles, scum, and oil sheen were also recorded on the field data sheet. As the on-station measurements were being collected, sample bottles were filled for later analysis in a certified laboratory. The lab analysis included total suspended solids (TSS), total dissolved solids (TDS), oil and grease, copper, lead, zinc, total coliform, *E. coli*, orthophosphate as phosphorus, and nitrate as nitrogen (See Attachment 3 for analytical methods).

Quality Assurance/Quality Control

Each team had a leader with experience in water quality monitoring. All volunteers were trained in the use of the monitoring instruments and protocols for collecting water samples. The conductivity meters were calibrated before being assigned to each team. Field data sheets were provided with written instructions on how to complete them so that each team followed the same protocols. Field duplicates and blanks were provided to each lab for analysis. All lab data was reviewed for QA/QC and validated by the Network Coordinator.

Results and Discussion

At approximately 3:30 AM on the morning of October 30, 2002, team leaders in all three cities were called and told to mobilize their team members.

The first flush of the season in the Monterey area amounted to approximately 0.2 inches of rain in a 24 hour period. The Santa Cruz area received 0.8 inches. There had been some light showers of rain in the days preceding the event. By early Tuesday morning, it began to rain hard and sufficient water had been flowing to free accumulated contaminants and carry them into the storm drain system.

Currently, there are no regulatory discharge limits for storm water runoff. In order to evaluate the results of the data that were collected during this event, total coliform, *E. coli*, nitrate, orthophosphate, TSS and TDS results were compared with the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels and metal results were compared to the Central Coast Basin Plan standards. CCAMP's Action Levels are set at levels which may potentially impact beneficial uses, and are typically either levels representing existing regulatory standards, levels derived from the literature or other agency references, or levels which are elevated relative to the data distribution for that parameter on the Central Coast.

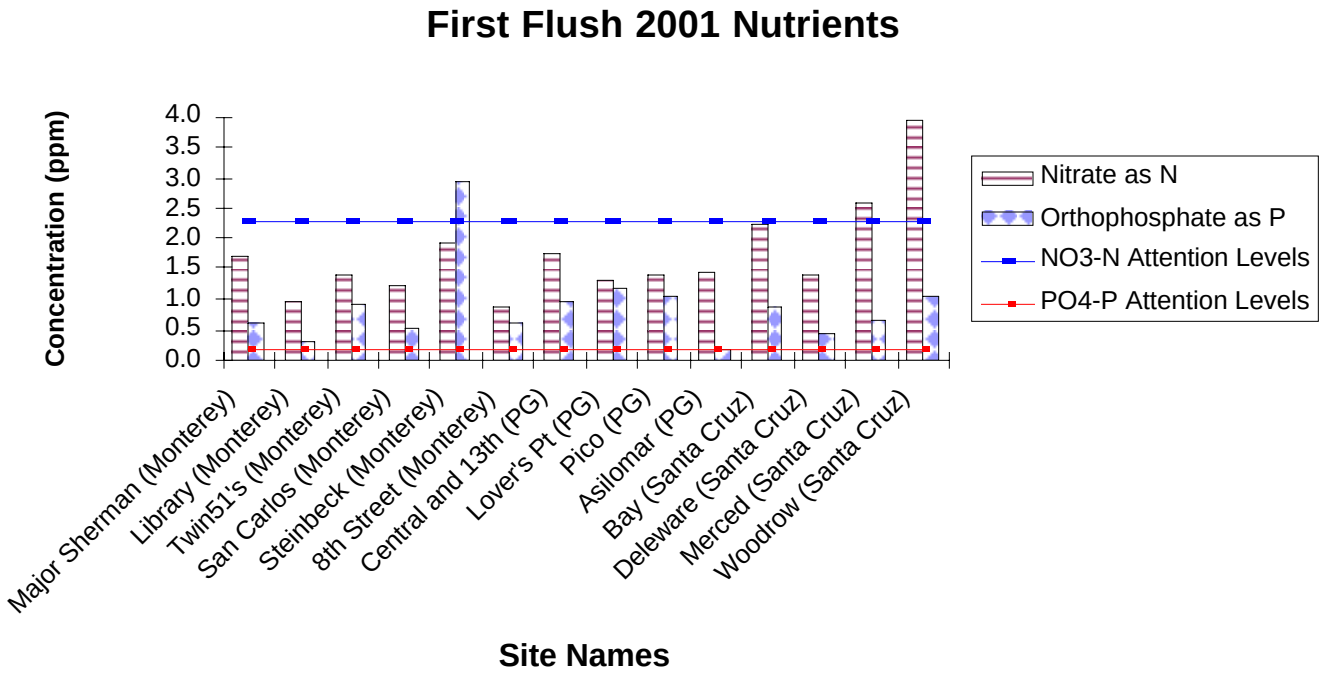
Both Basin Plan standards and CCAMP Action Levels are established for receiving waters and NOT for discharge waters. It is logical to assume that storm water may have higher concentrations of pollutants than the receiving water.

Nutrients

Phosphorus is a critical element for growth in plants. It is usually the growth-limiting factor for plants because it is present in very low concentrations in the environment. Orthophosphate is a form of phosphorus commonly found bound to soil particles, in sewage, fertilizers and in detergents that contain phosphates. Orthophosphate is rapidly taken up by algae and other larger marine plants. With excessive amounts present, large algal blooms occur. The CCAMP Action Level for orthophosphate (PO_4^{3-}-P) is 0.16 ppm (mg/l). This year, all of the stations exceeded 0.16 ppm. For the second year in a row, Asilomar had the lowest orthophosphate level at 0.18 ppm and Steinbeck Plaza was significantly higher than the other sites with a concentration of 2.9 ppm (See Figure 1).

Nitrogen is also an element that is needed for plant growth. It is much more readily available in the environment than phosphorus. Nitrogen is more readily available than phosphorus because nitrate is more soluble than phosphate. Plant growth is generally limited by phosphate, and not nitrate concentrations. Some sources of nitrate include runoff from fertilized lawns, agricultural and pasture lands, construction stations and septic leachate. The Action Level established by CCAMP for nitrate (NO_3-N) is 2.25 mg/l. All of the stations in Monterey and Pacific Grove were below this action level. In Santa Cruz, the Merced site had a concentration of 2.58 ppm and Woodrow reported 3.93 ppm. Bay Street was also very close to exceeding the action level at 2.24 ppm (See Figure 1). In 2000, no sites exceeded this action level.

Figure 1. Orthophosphate as P and Nitrate as N concentrations (ppm) at storm drain outfalls during the First Flush Event. The stations are listed in order traveled from east to west by city. The straight lines depict the CCAMP Action Levels. The values for time series locations reflect the maximum result.



Bacteria

Total coliform and *E. coli* are types of bacteria. They are pollutants of concern mostly because of their human health impacts. Bacteria can also cause cloudy water, unpleasant odors and increased oxygen demand. Because of its aquatic effects, the CCAMP Action Level for Total Coliform is 10,000 MPN/100 ml. The CCAMP action level for *E. coli* is 400 MPN/100 ml.

Every station in all three cities exceeded the action level for both Total coliform and *E. coli*. Major Sherman, in Monterey, had the lowest *E. coli* level of 470 MPN/100 ml. Many of the sites were 100 times higher than the CCAMP action level for *E. coli* with Delaware and Merced in Santa Cruz being the highest with 141,360 MPN/100 ml. (See Table 1).

Table 1. Depicts bacteria values for all stations listed in order traveling from east to west by city. The concentrations are in MPN/100 ml (Most Probable Number). Those stations with multiple listings are time series locations.

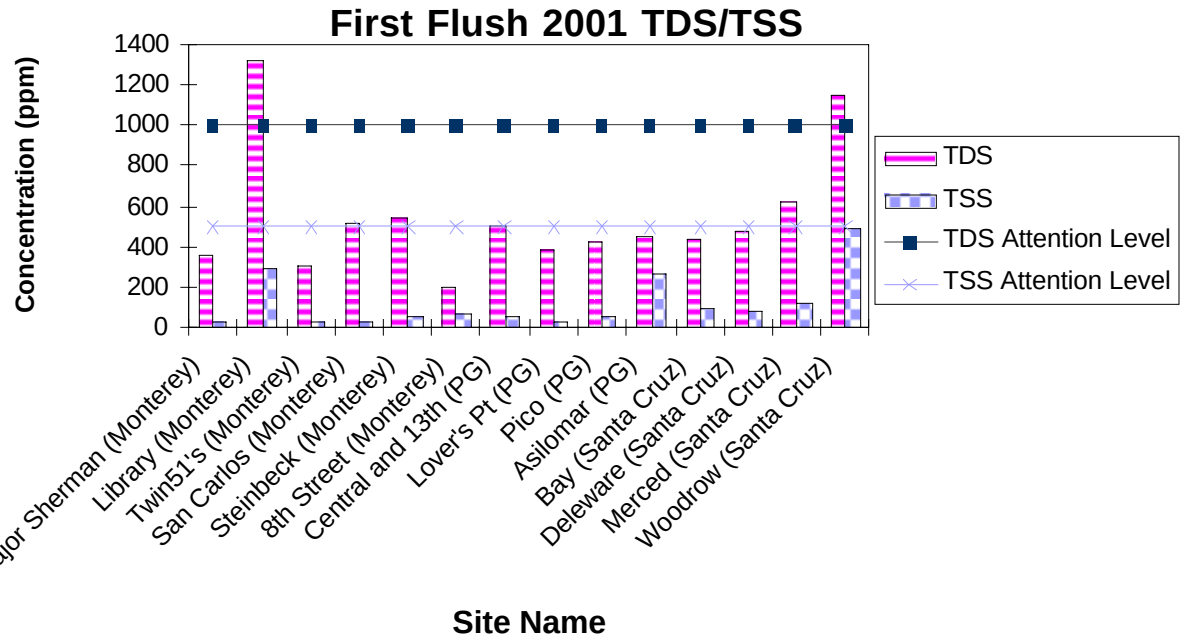
Station:	E. coli. (MPN/100ml)	Total Coliform (MPN/100 ml)
Major Sherman	470	>240000
Library	36540	>240000
Twin 51's	26130	>240000
San Carlos Beach	4040	199000
Steinbeck Plaza T1	38730	>240000
Steinbeck Plaza T2	36550	>240000
Steinbeck Plaza T3	30760	>240000
8th Street	14550	>240000
Central & 13th T1	27550	>240000
Central & 13th T2	23820	>240000
Central & 13th T3	54750	>240000
Lover's Point	27550	>240000
Pico	43520	>240000
Asilomar	25820	>240000
Woodrow T1	520	98040
Woodrow T2	7120	>240000
Woodrow T3	11190	>240000
Woodrow T4	8800	>240000
Merced	141360	>240000
Bay Street	14830	>240000
Delaware	141360	>240000

Total Dissolved Solids / Total Suspended Solids

TDS and TSS are important because they are sometimes indicative of the presence of pollutants. They provide a media or polar charges to attract contaminants. They also indicate high amounts of sediment which is harmful to fish populations because it destroys habit, it can suffocate eggs and/or limit the food supply.

TDS and TSS both were in very low concentration at most of the sites. The CCAMP Action Levels are 1000 ppm for TDS and 500 ppm for TSS. In 2000, no stations exceeded these levels. This year, Library and Woodrow exceeded the TDS action level. The first sample taken in the time series for Woodrow was the highest for TDS at 1148 ppm and the last sample taken was the highest for TSS at 487 ppm. (See Figure 2).

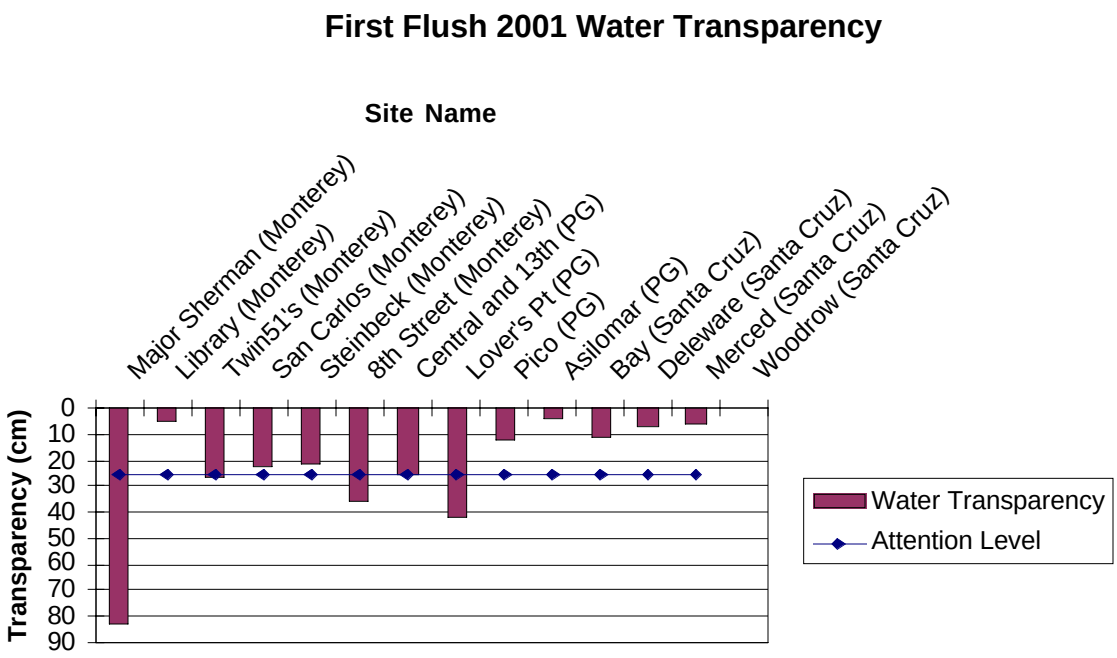
Figure 2. Total dissolved solids and total suspended solids in concentrations (ppm) by site. The sites are listed by city traveling from east to west. The values for time series locations reflect the maximum result.



Transparency

Transparency is another method of measurement to determine the amount of sediment suspended in the water column. Nine of the fourteen sites reported values less than the CCAMP Action Level for transparency of 25 cm. That means that the water was so turbid that a miniature secchi disc could not be viewed through 25 centimeters of water. The Library, Asilomar, and Merced sites had transparency less than 6 cm.

Figure 3. Transparency measured in cm by site. The sites are listed by city traveling from east to west. The values for time series locations reflect the minimum result.



Field Observations

While on site, volunteers recorded observations of bubbles and scum, trash, sewage, and oil sheen. Bubbles were observed at nine of the fourteen stations indicating the possible presence of detergents. Three sites recorded a sewage odor and seven sites observed trash. Water temperature ranged between 14.7 – 16.5 °C. PH measurements ranged between 6.5 and 7.5 at all of the sites. Conductivity measurements ranged between 50 – 500 µS with an average of 441 µS. No oil sheen was recorded.

Metals

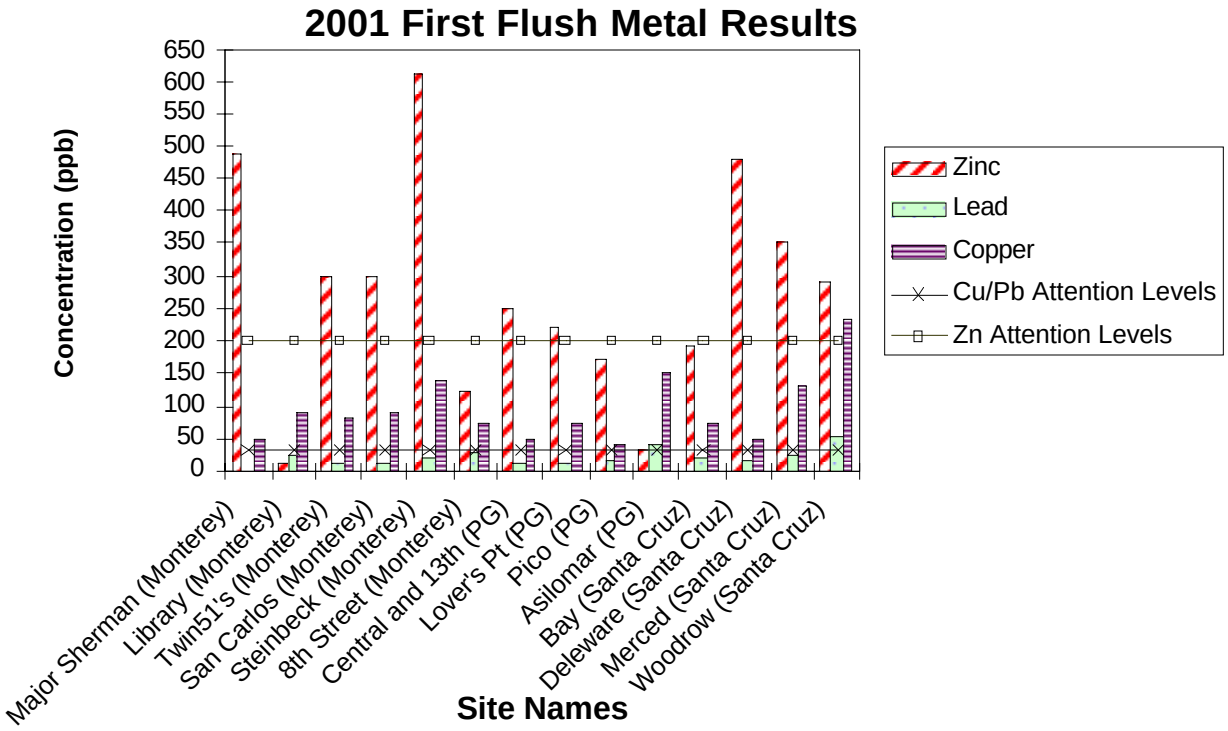
Storm water runoff in coastal urban areas has been known to produce significant toxicity to early life stages of aquatic organisms due to the presence of total metals. The effects include reduced reproduction, developmental deformities, and mortality. In this monitoring event, samples were analyzed for copper (Cu), zinc (Zn), and lead (Pb). The California Basin Plan has established water quality criteria for these metals.

The background concentration for Cu in sea water is 2 parts per billion (ppb). Copper concentrations ranged from 40 – 230 ppb. The Basin Plan standard established for Cu is 30 µg/l (ppb) so every site monitored exceeded this standard. The highest concentration was 230 ppb found at Woodrow in Santa Cruz. Woodrow was one of the sites chosen to be a "time series" station. The time series results were; sample #1 – 230 ppb, sample #2 – 170 ppb, sample #3 – 100 ppb and sample #4 – 100 ppb. Other locations with levels four times greater than the action level included Steinbeck Plaza, Asilomar and Merced(See Figure 4). Steinbeck Plaza and Asilomar recorded the highest concentration of copper in First Flush 2000 as well.

The background concentration for zinc (Zn) in sea water is 8 ppb. The Basin Plan standard for Zn is 200 ppb (_g/l). In 2000, this value was exceeded at just one station, Steinbeck Plaza in Monterey. In 2001, nine of the fourteen sites exceeded the action level. Zinc concentrations ranged from 10 – 610 ppb(See Figure 4). Steinbeck Plaza, once again had the highest concentrations, with a time series of 610 ppb, 440 ppb, and 490 ppb respectively.

Lead (Pb) concentrations ranged from non-detect to 52 ppb. The Basin Plan standard for lead is 30 ppb. For the second year, Asilomar was the only site in Monterey and Pacific Grove to exceed this value with a concentration of 41 ppb. The level at Asilomar in 2000 was 35 ppb (See Figure 4). Woodrow, in Santa Cruz, also exceeded this action level in the final two of four time series samples with concentrations of 32 ppb and 52 ppb.

Figure 4. Depicts metal concentrations (µg/l or ppb). They are listed in order traveling from east to west. The lines represent the Basin Plan standard. The values for time series locations reflect the maximum result.



Conclusion

This was the second annual First Flush monitoring event in the Monterey Bay area. Ironically, it occurred almost exactly as the first year. The rains began falling lightly on and off throughout most of Monday. By the evening, forecasters were predicting significant rains by morning. At approximately 3:00 AM on Tuesday, October 30th,the heavy rain began to fall from Santa Cruz to Pacific Grove. Sample locations were the same in Monterey and Pacific Grove as the previous year. However, in Santa Cruz County, because Capitola did not have an Urban Watch program, the sites previously monitored the year before were not monitored for First Flush. The City of Santa Cruz Urban Watch sites were monitored instead. All teams were mobilized and on station between 4:30 and 5:00 AM. The outfalls were gushing with brown water and conductivity measurements were at or below 500 µS at most outfalls.

The results of the laboratory analysis indicated similar concentrations of pollutants as the previous year. As expected after a storm, total coliform and *E. coli* concentrations were high at all of the sites and exceeded CCAMP action levels. *E. coli* concentrations ranged from 470 to over 140,000 MPN/100 ml. Unexplainably, two outfalls in Santa Cruz, Merced and Delaware, had the highest *E. coli* concentrations of all of the outfalls monitored. The only sample to detect trace amounts of oil and grease was in the first sample collected at Steinbeck Plaza, a time series location. It was not detected in the other two samples at that outfall or at any of the other outfalls. Metal concentrations were higher in 2001 than in 2000. Nine of fourteen sites had high zinc concentrations. Every site exceeded the CCAMP action level for copper and two sites exceeded the CCAMP action level for lead. Asilomar was the only site to have high lead levels for two years in a row. Overall, *E. coli*, orthophosphate, zinc, copper and transparency action levels were exceeded at almost every site. Nitrate and lead were not found to be a common problem.

All of the sites had at least four CCAMP exceedances. The Merced site in Santa Cruz was the only outfall to have six exceedances. The time series sites did demonstrate that it is important to sample more than one time. Depending on the location and parameter, concentrations varied significantly between samples (See First Flush 2001 Summary- Attachment 4). At Woodrow, TDS, copper, zinc, and nitrate decreased over time while TSS and lead increased over time. At Steinbeck Plaza, *E. coli* decreased over time. At Central & 13th zinc and orthophosphate decreased over time. Parameters not mentioned showed no consistent patterns.

This second annual First Flush event was very successful. All of the sites were monitored by trained volunteers who responded on a moments notice to collect storm water samples from gushing outfalls in the cold, wet, pre-dawn light. New information was learned about sites as well as existing knowledge confirmed. Two years of data revealed consistent problem areas that warrant further sampling and investigation. Once again, dedicated citizens prove that their actions do make a difference. Their enthusiasm has provided information that will hopefully benefit the inhabitants of the Monterey Bay National Marine Sanctuary as well as everyone living on the Central Coast.

Attachment 1

Station Name	Station ID	Drainage Area (acres)	Primary Land Use	Location	Description
Major Sherman (aka El Dorado) (Monterey)	MSD1		80% residential 20% commercial	Major Sherman Lane south of HWY 1 and Don Dahvee Park	Surface drainage
Twin's (Monterey)	MSD3	365	90% residential 10% commercial	Below walking path at Heritage Harbor	Two 51' diameter concrete pipes
San Carlos (Monterey)	MSD4	70	40% commercial 35% residential 25% public land	On the beach adjacent to the west side of Coast Guard pier.	36' diameter concrete pipe
Steinbeck (Monterey)	MSD5	37	90% commercial 10% residential	At Steinbeck Plaza on Cannery Row	36' diameter concrete pipe
Library (Monterey)	MSD6	467	100% residential	665 Pacific Street adjacent to the Monterey Public Library on the Northeast side of Pacific Street.	Surface drainage
8th Street (Pacific Grove)	PGSD1	35	100% residential	West of Ocean View Blvd. between 7th and 8th.	Concrete pipe
Central & 13th (aka Greenwood) (Pacific Grove)	PGSD2	250	90% residential 10% commercial	Greenwood Park at the corner of 13th and Central Ave.	Concrete pipe
Lover's Pt (Pacific Grove)	PGSD3	222	90% residential 10% commercial	At the top of the cliff on the SE side of main beach at Lover's Pt	Concrete pipe
Pico (Pacific Grove)	PGSD4	131	100% residential	On the W side of Sunset Drive approx. 60 ft. N of Pico St.	Concrete pipe
Asilomar (Pacific Grove)	PGSD5	94	90% residential 10% commercial	On the W side of Sunset Drive due W of the Asilomar Convention Ctr.	Surface drainage
Delaware (Santa Cruz)	SCSD1	352	90% residential 5% commercial 5% open space	On S side of W. Cliff Dr. at Monterey St.	Concrete pipe
Merced Ave (Santa Cruz)	SCSD2	1289	40% residential 10% commercial 50% open space	On S. side of W. Cliff Dr. at Merced Ave.	Concrete pipe
Bay Street (Santa Cruz)	SCSD3	285	95% commercial 5% residential	On S side of W. Cliff Dr. at Bay St.	Surface drainage
Woodrow (time series) (Santa Cruz)	SCSD4	736	80% residential 10% commercial 10% open space	On S side of W. Cliff Dr. at Woodrow Ave.	Surface drainage

Monterey Bay National Marine Sanctuary
First Flush 2001
Field Data Sheet

Date:

City		**Arrival Time**	
Station ID		**Departure Time**	
Time Rain Began		**Station Name**	

Team Members with phone #'s

1	4
2	5
3	6

Detailed description of weather:

Sample Collection:

Instrument ID:	Time

	Parameter	Taken by:
H20 Temp	F or C	
pH		
Conductivity	µS	
Transparency	cm	

Sample ID	Time	Collected by:	Comments

Duplicates or blanks collected: Yes or No

Notes (include any observations from back side, ie. types of trash, biological observations, etc.

Attachment 3

ANALYTICAL METHODS USED IN THE FIRST FLUSH 2001 SAMPLING EVENT

Constituent		Detection Limits	Units	Laboratory	Method #	Method Principles
Total Metals						
	Copper	20	µg/l	Monterey Bay Analytical	SM3111B	acid digestion, AA flame
	Lead	2	µg/l	Monterey Bay Analytical	SM3113B	acid digestion, graphite furnace
	Zinc	10	µg/l	Monterey Bay Analytical	SM3111B	acid digestion, AA flame
WQ parameters						
	total suspended solids (TSS)	10	mg/l	MRWPCA	SM2540D	Gravimetric: filtration thru 1.1um, glass fiber drying and weighing of particulates
	total dissolved solids (TDS)	10	mg/l	MRWPCA	SM2540C	Gravimetric: drying and weighing of 1.1um filtrate
	Oil&Grease as HEM	5	mg/l	Monterey Bay Analytical	EPA 1664	Gravimetric: liquid-liquid extraction with Hexane, volatilization of solvent, weighing of residue
Nutrients						
	Orthophosphate as P	0.05	mg/l	Monterey Bay Analytical	EPA 300.0	
	Nitrate as N	0.02	mg/l	Monterey Bay Analytical	EPA 300.0	
Bacteria						
	Total coliform	1	MPN/100 ml	MRWPCA	Colilert	Chromogenic Substrate
	E. coli	1	MPN/100 ml	MRWPCA	Colilert	Chromogenic Substrate

Attachment 4

First Flush 2001 Summary

0 = did not exceed CCAMP action level

1= exceeded CCAMP action level

2= exceeded CCAMP action level and was w/in 10% of highest measured concentration

Sites	Nitrate (10 ppm*)	PO4-P (0.16 ppm*)	E. coli (400 MPN*)	Zn (0.20 ppm*)	Cu (0.03 ppm*)	Pb (0.03 ppm*)	Transparency (< 25 cm*)	Oil & Grease	TDS (1000 ppm*)	TSS (500 ppm*)	Exceedences	Totals
8th Street	0	1	1	0	1	1	0	0	0	0	5	4
Asilomar	0	0	1	0	2	2	2	0	0	0	4	7
Bay	0	1	1	0	1	0	1	0	0	0	4	4
Central and 13th PG	0	1	1	1	1	0	1	0	0	0	5	5
Deleware	0	1	2	2	1	0	1	0	0	0	5	7
El Dorado	0	1	1	1	1	0	1	0	0	0	5	5
Library	0	1	1	0	1	0	2	0	0	0	4	5
Lover's Pt	0	1	1	1	1	0	0	0	0	0	4	4
Merced	**1**	**1**	**2**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**6**	**7**
Pico	0	1	1	0	1	0	1	0	0	0	4	4
San Carlos	0	1	1	1	1	0	1	0	0	0	5	5
Steinbeck	**0**	**2**	**1**	**2**	**2**	**0**	**1**	**0**	**0**	**0**	**5**	**8**
Twin's	0	1	1	1	1	0	0	0	0	0	4	4
Woodrow	2	1	1	1	2	0		0	0	0	5	7

*** These values represent CCAMP or Basin Plan action levels.**

	TDS (h-l)	TSS (l-h)	CU (h-l)	PB (l-h)	ZN (h-l)	NO3 (h-l)	PO4	E. coli.
Woodrow T1	1148	101	0.23	0.014	0.29	3.93	0.89	520
Woodrow T2	800	173	0.17	0.018	0.16	3.56	0.73	7120
Woodrow T3	472	203	0.1	0.032	0.14	2.09	1.05	11190
Woodrow T4	376	487	0.1	0.052	0.02	1.25	0.76	8800

	TDS	TSS	CU	PB	ZN	NO3	PO4	E.coli (l-h)
Steinbeck T1	536	18.6	0.14	0.008	0.61	1.93	2.91	38730
Steinbeck T2	300	48.2	0.09	0.014	0.44	1.26	1.69	36550
Steinbeck T3	420	21	0.1	0.02	0.49	1.44	2.04	30760

	TDS	TSS	CU	PB	ZN (h-l)	NO3	PO4 (h-l)	E.coli
Central (Greenwood) T1	416	23.5	0.05	0.012	0.25	1.58	0.94	27550
Central (Greenwood) T2	492	13.2	0.05	0.011	0.23	1.75	0.87	23820
Central (Greenwood) T3	356	48	0.04	0.012	0.17	1.12	0.73	54750