



**2007 Urban Watch-First Flush
Storm Drain Monitoring Program
City of Capitola
Santa Cruz County, California**

June 13 – September 20, 2007

A Program Administered by the Coastal Watershed Council:

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Capitola Urban Watch Monitoring Program

PROGRAM OVERVIEW

The Capitola Urban Watch-First Flush storm drain monitoring program was conducted by the Coastal Watershed Council (CWC) on behalf of the City of Capitola, NPDES Phase II Storm Water Management Program, and in 2007 was funded by the City's General Funds. The Capitola Urban Watch Program began in 2000, and was repeated in 2002, 2004, 2005, 2006, and 2007.

The Urban Watch Program started regionally in 1997 as a joint effort between the Coastal Watershed Council, the City of Monterey, and the Monterey Bay National Marine Sanctuary. The "First Flush" event first took place in 2000, and in 2007 it included four programs across the Monterey Bay. The goals of the Urban Watch-First Flush Program are twofold: First, to serve as a tool for education and outreach to the community regarding the impacts that the citizens have on local water quality through urban run-off; and secondly, to collect important water quality data to support environmental management decisions at the local and state levels. These goals are achieved through the participation of trained volunteers who monitor storm drain discharges at selected outflow areas throughout the program area.

In the Capitola Urban Watch program, dry-season monitoring typically occurs twice weekly from June through approximately mid-November, ending with the first significant rain. Volunteers perform water quality tests and make a series of related measurements in the field, and deliver monthly samples to a professional laboratory for additional analysis for nutrients and pathogen indicators.

The Urban Watch-First Flush Program annually culminates with the "First Flush" monitoring event, wherein volunteers monitor during the first significant rain of the wet season at the same Urban Watch program storm drains. This rain event washes the streets and 'flushes' the gutters and storm drains of collected materials and pollutants that have accumulated throughout the dry-season. Volunteers take in-field measurements and collect samples during the rain event. These samples are then sent to a professional lab where analysis for trace metals, nutrients, and pathogen indicators are performed. Although the First Flush event will be mentioned in passing throughout this report, complete Annual First Flush event summary reports are produced by our program partner, the Monterey Bay Sanctuary Citizen Watershed Monitoring Network (Network), and reports from every year's event can be downloaded from their website at:

<http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html>.

This report includes the methods and results of the 2007 Capitola Urban Watch Monitoring Program.

PROGRAM DESIGN

Equipment & Parameters

The Urban Watch Program consisted of volunteer collection of field-measured parameters twice weekly and sample collection for lab analyses once monthly. Please see Table 1 for a list of all parameters measured.

Table 1. Water Quality Parameters for the Urban Watch Monitoring Program.

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature: Air & Water	Illegal discharges	Affects rates of chemical and biochemical reactions in water; may adversely affect fish	Method – Digital thermometer Accuracy \pm 1% full scale Or Bulb Thermometer (Spirit) -5.0 – 55 oC
pH	Aerosols and dust in air, mineral substances, sewer overflows, animal wastes, pesticides & fertilizers, photosynthesis, respiration	Affects chemical and biochemical reactions in water. May interfere with fish and other aquatic life	Method – MacHery-Nagel pH-Fix 4.5-10.0 color-fixed indicator strips Accuracy \pm 0.25 units Min detection: 4.5
Detergent surfactants	Illegal or unintended discharges, car washing, cleaning of screens and grills, leaking sanitary sewers	Can be toxic to many aquatic insects, plants, and fish; can indirectly lower dissolved oxygen available to aquatic life	Method – solvent extraction/ bromphenal blue indicator Accuracy \pm 0.1 ppm Min detection: >0.1 ppm
Copper	Illegal discharges into the storm drain system; also can occur naturally in surface waters.	Concentrations over 0.025 parts per million are toxic to most freshwater fish.	Method – Diethyldithiocarbamate Octa-Slide Comparator against color standard. Accuracy \pm 10% Min detection: >0.25 ppm
Chlorine	Illegal or unintended connection or draining of a swimming pool to a storm drain; potable water line leaks	Toxic to aquatic life, can create a "sterile" environment.	Method – DPD Octa-Slide Comparator against color standard. Accuracy \pm 10% Min detection: >0.2 ppm
Orthophosphate	Illegal or unintended discharges, car washing, cleaning of screens and grills, leaking sanitary sewers, fertilizers.	Can be toxic to many aquatic insects, plants, and fish; can lower dissolved oxygen available to aquatic life	Hannah portable meter Accuracy \pm 10% Min detection: 0.0 mg/L
Conductivity	Discharges high in salts and minerals or metals, water moving through local geology.	Possible agricultural, industrial or municipal wastewater runoff.	Method – Electrode probe module. Accuracy \pm 1% Min detection: 10 mS or 10 μ S
E. coli bacteria	Wildlife, illegal connections to stormdrain systems, poorly functioning septic systems, wildlife	Detrimental to human health and marine organisms.	IDEXX Standard Method ¹ 9223 b Duplicates within 95% confidence limits
Turbidity	Microorganisms, sediment, erosion, other particulates.	Interferes with fish and other aquatic life.	Method – Visual Octa-Slide Viewer Compare to a 5 step "Low/Med/High" turbidity standard slide bar
Color	Dyes or chemicals	Interferes with aquatic Insects	Method – Visual Borger Color System
Odor	Illegal discharges or product of decomposition; "clean" drainage water should have no distinctive odor	Can indicate presence of contaminants.	Method – Scent
Oil sheen	Hydrocarbons such as oil, gasoline, and grease; leaking underground petroleum storage tanks	Toxic to aquatic organisms.	Method – Visual
Trash, sewage, scum	Illegal discharges or illegal dumping	Interferes with fish and other aquatic life.	Method - Visual
Units: ppm – parts per million; mg/L – milli grams per liter; mS – milli Siemens; μ S – micro Siemens			

The Coastal Watershed Council provides and maintains a monitoring kit for all field-measured parameters recorded by volunteers in the Urban Watch program. The kit has been designed to provide a method for volunteers to monitor dry-season storm drain discharges and identify common urban pollutants and contaminants within the study area. The program utilizes a stormdrain water quality monitoring kit manufactured by the LaMotte Company (SSDK 7446) and designed in association with the City of Ft. Worth, Texas. This kit was developed according to National Pollutant Discharge Elimination System (NPDES) Phase I dry weather monitoring requirements and is designed to detect illegal storm drain connections and discharges. To this pre-assembled kit, CWC has added equipment such as thermometers, Oakton 'ECTestr' conductivity meters, and pH strips for ease of use by volunteers. One Hanna Instruments ion meter also was added to the Capitola kit to measure orthophosphate.

The parameters field-measured by volunteers in the 2007 Capitola Urban Watch program include: detergent surfactants, orthophosphate, copper (total), chlorine (total), pH, conductivity, air and water temperature, sample water odor and color. Volunteers noted if there was oil sheen, sewage, trash, and surface scum present on the water or at the storm drain station. They also determined sample turbidity using a "Low-Medium-High" designation. As well, volunteers made other notable observations of changes to the station environment, including signs of recent 'pollution' activities or sources, and wildlife observations.

Samples were also collected by volunteers once monthly and delivered to Santa Cruz County Environmental Health Service laboratory for analysis of bacteria (total coliform and *E. coli*) and nutrients (nitrate nitrogen, orthophosphate, and ammonia).

Monitoring Locations

The Coastal Watershed Council and a representative of the City of Capitola chose five storm drain sampling sites based on drainage basin characteristics and safe access for volunteers (Figure 1 and Table 2). The monitoring sites established for this program are referred to as: (1) **Capitola Center**, east bank drain from Bay Ave. and surrounding commercial area; (2) **Stockton Bridge**, west bank drain at base of NW end of bridge at corner of East Cliff Dr. and Wharf Dr.; (3) **Creekside**, east bank drain behind Creekside plaza parking lot; (4) **Monterey Avenue**, drain from open channel along Monterey Avenue, to the north of the park; and (5) **Pier**, drain directly under the Capitola Pier. Two of these sites (Stockton Bridge and Creekside Plaza) have been monitored for the last seven years; two were added later (Monterey Ave. and Pier) and were monitored for the past three years; and one (Capitola Center) was a new storm drain in 2006 which replaced the Nob Hill location of previous years. This last storm drain manages the same flow as the Nob Hill site, but also takes in additional runoff from the local businesses and neighborhood. For the past three years there has been no flow at the former Auto Plaza site, due to installation of a stormwater separator (CDS) unit that precludes water from regularly entering the creek. That site was removed from this year's monitoring program, though volunteers were asked to visually check for flow while monitoring the Creekside stormdrain.

Figure 1. Storm drain locations for the 2007 Capitola Urban Watch Program.



Table 2. Drainage descriptions of the monitoring stations for the 2007 Urban Watch Program in the City of Capitola, Santa Cruz County.

Station Name	Station ID	Land use (Approximate)	Drainage Type (Collection point)	Discharges to:
Stockton Bridge	CSD-04	100% residential	13" corrugated metal pipe	Creek
Capitola Center	CSD-05	5% residential 95% commercial	30" corrugated plastic pipe	Creek
Creekside	CSD-06	95% residential 5% Open Space	42" corrugated concrete pipe	Creek
Monterey Avenue (Noble Gulch)	CSD-08	90% residential 10% Open Space	Surface drainage- samples collected at the entrance to a 65" corrugated metal culvert with ½" asphalt lining	Creek
Pier	CSD-09	100% residential	18" corrugated metal culvert in concrete casing (metal 'flap' gate)	Ocean

Drainage area and land use information supplied by the County of Santa Cruz Public Works Department, 2006. All drains discharge to Soquel Creek, except Pier.

Day of Week/Time of Day

A total of 125 volunteer dry weather monitoring events occurred, with the following distribution by day: Tuesdays (20), Wednesdays (20), Thursdays (35), Saturdays (20) and Sundays (30). The monitoring times varied; however, they were more frequently in the morning hours.

VOLUNTEER TRAINING

Volunteer preparation

All Urban Watch and First Flush Program volunteers attended one three-hour “classroom” training, and received a minimum of two hours “in-field” training. Volunteer training sessions cover pertinent topics including explanation of parameters to be monitored, monitoring protocols to be used, in-field and chemical safety, and a briefing on safe public encounters.

Tamara Doan and Tamara Myers of the Coastal Watershed Council (CWC) provided the three-hour hands-on training for the Urban Watch Program and, along with Colleen Sutter (CWC) and Anna Holden of the Monterey Bay Sanctuary Citizen Monitoring Network (Network), provided a two-hour classroom and three-hour field training for the First Flush programs. In each instance volunteers were presented with program materials which included: detailing station locations, explanations of monitoring equipment and materials, procedural instructions and test protocols, as well as ancillary information on the subject of urban pollutants. Topics emphasized included monitoring concepts and clean sample collection procedures, test protocols, use of kits in the field, and safety procedures. Training for the First Flush event for Capitola did not include an in-field “dry run” training at each storm drain due to the fact that the 2007 First Flush event occurred before the scheduled dry run training.

The trained Urban Watch volunteers were then scheduled into teams for monitoring over the duration of the program. A CWC staff person accompanied each Urban Watch volunteer team in the field for each station visit. Volunteers conducted the Urban Watch monitoring at all stations twice a week throughout the monitoring period, June 13 to September 20, 2007.

In the 2007 Capitola program 17 volunteers were trained and divided into four teams of three to five members each, and each team was assigned one week per month to monitor. Field observations and sample collection were completed by each team twice during their assigned week, resulting in twice weekly monitoring for the program. Randomized sample collection was achieved by incorporating a flexible monitoring schedule with volunteers; where the week of the month was assigned to a team, but day of week and time of day was left up to the monitoring teams based on the volunteer availability. Volunteers were required to sample during daylight hours, and did so both on weekdays and weekends. A monitoring event for a team consisted of two field visits to all sites within the 7-day period Monday-Sunday. One data sheet was completed at each station for each of the visits to record site observations (air temperature and trash) whether or not there was flow detected from the storm drain outfall on that occasion.

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

CWC and the Network jointly prepared a Quality Assurance Project Plan (QAPP) for the ‘Monterey Bay Regional Urban Watch-First Flush Program’. This document was approved by the Quality Assurance Officer for the Central Coast Regional Water Quality Control Board (CCRWQCB) on October 8, 2004, and will continue to be in effect as long as the program is maintained by CWC and the Network (QAPP and monitoring protocols are available upon request). The purpose of the QAPP is to outline the technical aspects of the monitoring program relating to the quality of data as assured by the implementation of the program described in the document, including but not limited to: required training, sampling methods and procedures, analytical methods, equipment maintenance, documentation protocols, and various quality control requirements. Calibration and chain of custody documents are stored at the CWC office and are available on request. Relative Percent Difference analysis for lab duplicates is included in Table 9 of the Results section of this report.

A sample of the Quality Assurance/Quality Control (QA/QC) program topics included in the QAPP:

Training (staff and volunteers)

- Monitoring concepts, parameter information
- Sampling methods: Conducting a station visit; Water sample collection; Monitoring equipment & protocols
- Use of standardized data sheets and chain of custody documents
- Safety; chemical, in-field, & public interaction

Equipment maintenance & Programmatic QA/QC Procedures (staff)

- Regular inspection of monitoring equipment and program ”kits”
- Periodic calibration of test equipment (calibration records are available)
- Monitoring of reagent stores, chemical expiration dates, and waste management.

- Completion of a Standard Operation Procedure for volunteers to use in the field while monitoring.
- Use of regulated monitoring regime (volunteer schedule)
- Continued supervision until the trainer was confident in the volunteers' sampling and analysis skills.

Data Quality Management Procedures (staff)

- Training in CWC's Citizen Water Quality MS Access database, data entry
- Use of Instrument ID numbers to track equipment used by teams
- Use of Station ID numbers to track monitoring locations
- Maintaining records of equipment calibration
- Periodic review of data entry (field data sheets and lab reports) to assure consistent data entry.
- Processing and analysis of data for report

MONITORING RESULTS

The parameters listed in the following sections were analyzed in the field using the Urban Watch monitoring kit as described above or in the Santa Cruz County Department of Environmental Health Water Quality Laboratory. Over the period of June 13 through September 20, 2007, monitoring took place at the five designated stations 25 times, for a total of 125 samples of the field-based parameters. Water samples were drawn for laboratory analysis once a month for three months, June through August (at stations with 'flowing' water at the time of the visit), and were taken to the County's lab for bacteria and nutrient analysis.

Absence of flow, volunteer availability and other factors (such as equipment availability or breakage and weather conditions) resulted in not every parameter being tested/observed for every station visit. "Frequency of exceedance" is therefore the relationship of the number of times the parameter was recorded as above the Water Quality Objective or "attention level", out of the total number of times a measurement or observation for that parameter was completed throughout the program.

The Water Quality Objectives (WQO) are listed for each parameter that has an approved "criterion" or range; we have noted the origin of each determination. These criteria originate from accepted sources such as the United States Environmental Protection Agency's (US EPA) Water Quality Criteria, the State Water Resources Control Board's (SWRCB) "California Ocean Plan", and the Central Coast Regional Water Quality Control Board's (CCRWQCB) "Basin Plan". The WQOs apply to the surface waters that the urban runoff discharges flow into - not the urban runoff discharges themselves. The comparisons to WQOs are provided for general information only, and exceedances do not indicate regulatory non-compliance for any specific storm drain discharge.

The Monterey Bay Regional Urban Watch-First Flush Program operates in the Central Coast Region of the RWQCB, and therefore also recognizes the Central Coast Ambient Monitoring Program (CCAMP) which has set non-regulatory criteria for many parameters, based on region-specific conditions or concerns in the form of "attention levels". These "attention levels" are non-regulatory

in nature, and are frequently lower than the regulatory criteria. Detections of pollutants or conditions at the “attention level” are indicators that both human and wildlife health may be compromised, and further investigation may be warranted. CWC refers to both the regulatory and non-regulatory criteria values in this report.

For the purposes of this program, “detection” is any value that is “detected” by our testing equipment or the lab procedures (i.e., a quantitative result is reported); “exceedance” is any reported value greater than the lowest identified WQO or action level criteria. In the case of parameters without criteria, such as detergent surfactants or chlorine, the minimum detection level of the test kit or tool is considered both a detection and an exceedance, as the presence of either surfactants or chlorine is considered undesirable. Water temperatures above 26°C and pH values out of the normal range (7.0-8.5) are also identified as exceedances, indicating unsatisfactory water quality conditions, based on the CCRWQCB “Basin Plan” criteria.

Please see Table 3 for a summary of average, minimum, and maximum results of detergents, chlorine, copper, and orthophosphates for each station; Table 4 for a comparison of maximum values of chlorine, copper, detergents, and orthophosphates; Table 5 for a summary of the frequency and percent of exceedances for field-measured quantitative parameters; Table 6 for frequency and percent values of qualitative measurements; Table 8 for lab results by date; Table 9 for lab results by station and QAPP analysis; and Table 10 for a summary of average, minimum, and maximum results for all parameters during the 2007 Urban Watch program. See the Appendix for a consolidated record of the field data in tabular form by station.

I. Quantitative Field Parameters

Air Temperature

WQO: None

Chlorine

WQO: None (tap water is typically 2 mg/L).

Chlorine, as Cl₂ (molecular chlorine) is highly toxic, and it is often used as a disinfectant. In combination with a metal such as sodium it becomes essential for life. Small amounts of chloride (Cl⁻) are required for normal cell functions in plant and animal life. High chloride levels can cause human illness and also can affect plant growth. Detections of molecular chlorine in storm drain discharges could be an indicator of industrial waste waters, however low concentrations may indicate a drinking water discharge from a local source.

Conductivity

WQO: None.

Electrical conductivity is a measure of a material's ability to conduct an electric current: when an electrical potential difference is placed across a conductor, its movable charges flow, giving rise to an electric current. Pure water is not a good conductor of electricity. Because the electrical current is transported by the ions in solution, the conductivity increases as the concentration of dissolved ions increases¹ (ex.: salts and minerals). This current can be measured in microSiemens (μS) or milliSiemens (mS) per cm; one milliSiemen equals 1000 microSiemens. Conductivity measurements were taken with either the Oakton ECTester low range meter (0–1990 μS) or with the Oakton

¹ Lenntech Water Treatment & Air Purification Holding B.V: <http://www.lenntech.com/water-conductivity.htm>

ECTester high range meter (0-19.90 mS; 0–19,900 μ S) to ensure no readings would be out of range. The average conductivity in discharging waters at each site is helpful in determining the influx of fresh rain water during the “First Flush” event.

Copper

WQO: CCRWQCB Basin Plan < 0.03 mg/L - Cold and Warm Water Fish Habitat.

Copper is a mineral element; however it is used in many industrial applications, and is a common urban runoff pollutant, with a wide range of sources in urban environments. Surface runoff and stormwater flows pick up copper and zinc from brake and tire wear, vehicle wash wastewater, and building materials.

Detergent Surfactants

WQO: None.

Surfactants and detergents are common contaminants of surface water due to their large consumption for use in every type of washing and cleaning operation. Surfactants constitute the most important group of detergent components as they are water-soluble surface-active agents.² Detergent products often contain more than surfactants, such as enzymes, bleaches, and dyes. Detergent surfactants are made from a variety of petrochemicals (derived from petroleum) and/or oleochemicals (derived from fats and oils).³ The presence of detergent surfactants in a stormdrain system is a strong indicator of run-off or effluent discharges

Nitrate nitrogen (NO₃-N)

WQO: CCRWQCB CCAMP Attention Level >2.25 mg/L (ppm) NO₃

Nitrate nitrogen was not tested with the in-field chemical analysis kit during most of the 2007 monitoring period, as it was in previous years. Nitrate nitrogen was tested in the lab samples, however, as is discussed in the Laboratory Analysis section below.

Orthophosphate (PO₄⁻²)

WQO: CCRWQCB CCAMP Attention level of > 0.37 mg/L orthophosphate as PO₄⁻²

Phosphorus is necessary for growth of plants and animals. Phosphorus in elemental form (P) is very toxic and is subject to bioaccumulation. Phosphates (PO₄) are formed from this element. Phosphates exist in three forms: orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate. Ortho forms are produced by natural processes and are found in sewage. Organic phosphates are important in nature. Their occurrence may also result from the breakdown of synthetic pesticides which contain phosphates. Rainfall can cause varying amounts of phosphates to wash from urban landscapes and farm soils into nearby waterways. Phosphates will stimulate the growth of plankton and aquatic plants which provide food for fish. However, if an excess of phosphate enters the waterway, algae and aquatic plants may grow excessively, choke up the waterway and use up large amounts of oxygen. This condition is known as eutrophication, or over-fertilization of receiving waters.

² Sigma-Aldrich Co. http://www.sigmaaldrich.com/Brands/Fluka_Riedel_Home/Bioscience/BioChemika_Ultra/Detergents_Surfactants.html

³ Soap and Detergent Association <http://www.sdahq.org/sdalatest/html/soapchemistry2.htm>

pH

WQO: CCRWQCB Basin Plan, >7.0 and <8.5 pH units.

The pH is a measure of the acidic or basic (alkaline) nature of a solution, with 7 being neutral, below 7 acidic, and above 7 alkaline or basic. Typical rainwater has a pH of about 5 to 6, which is slightly acidic. When pH ranges too far from neutral it can be harmful to fish and other aquatic life, especially in the acidic range. (Note: the WQO for pH is different than previous years.)

Turbidity

WQO: None

Turbidity is the cloudiness or transparency of a fluid caused by suspended particles that are generally invisible to the naked eye. Increased levels of turbidity can cause harm to fish and other aquatic organisms.

Water Temperature

WQO: CCRWQCB Basin Plan, > 26°C – Cold Water Fish Habitat.

Table 3. Positive Results: Average, Minimum, and Maximum Values for Field Measurements									
	Detergent Avg ppm	Min	Max	Chlorine Avg ppm	Min	Max	PO ₄ ⁻² Avg. ppm	Min	Max
WQO:	N/A			N/A			0.37		
Minimal Detection Limit:	>0.1			>0.2			0		
Stockton Bridge	ND	ND	ND	ND	ND	ND	0.66	0.66	0.66
Capitola Center									
Creekside	ND	ND	ND	ND	ND	ND	0.45	0.38	0.59
Monterey Ave	ND	ND	ND	ND	ND	ND	0.24	0	0.35
Pier	0.2	0.2	0.2	ND	ND	ND	0.36	0.24	0.57
	pH Avg.	Min	Max	Air Temp Avg. °C	Min	Max	Water Temp Avg. °C	Min	Max
WQO:	>7.0, <8.5			N/A			>26°		
Minimal Detection Limit:	4.5			-5			-5		
Stockton Bridge	7.0	7.0	7.0	18	14.5	24.0	20.0	20.0	20.0
Capitola Center				19	15.0	24.0			
Creekside	7.0	6.5	7.5	17	14.0	22.0	15.4	14.0	17.0
Monterey Ave	7.0	6.5	7.5	17	14.0	20.0	14.8	11.5	17.0
Pier	7.0	6.5	7.5	17	14.0	24.0	16.3	15.0	17.0
	Conductivity Avg. (µS)	Min	Max	Copper Avg. ppm	Min	Max			
WQO:	N/A			0.03					
Minimal Detection Limit:	10			>0.0					
Stockton Bridge	920	920	920	ND	ND	ND			
Capitola Center									
Creekside	640	590	660	ND	ND	ND			
Monterey Ave	700	620	780	ND	ND	ND			
Pier	530	490	580	ND	ND	ND			

Dark Gray cell = No water detected during any station visit

Light Gray cell = Exceeds the WQO for this parameter

ND = non-detect; at or below the minimum detection limit of the equipment

Minimum values do not include non-detections

	Chlorine	Copper	Detergents	PO₄⁻²
WQO:	NA	< .03 ppm	NA	< 0.37 ppm
Minimal Detection Limit:	>0.2	>0.0	>0.1	0.0
Stockton Bridge	ND	ND	ND	0.66
Capitola Center				
Creekside	ND	ND	ND	0.59
Monterey Ave	ND	ND	ND	0.35
Pier	ND	ND	0.2	0.57

Dark Gray cell = No water detected during any station visit

Light gray cell = exceeds the WQO for this parameter

ND = non-detect; at or below the minimum detection limit of the equipment

NA= No WQO determined

	Detergents (ppm)		Copper (ppm)		Chlorine (ppm)		PO₄⁻² (ppm)	
Stockton Bridge	0 out of 1	0%	0 out of 1	0%	0 out of 1	0%	1 out of 1	100%
Capitola Center								
Creekside	0 out of 24	0%	0 out of 23	0%	0 out of 25	0%	21 out of 24	88%
Monterey Ave	0 out of 24	0%	0 out of 24	0%	0 out of 25	0%	0 out of 24	0%
Pier	1 out of 5	20%	0 out of 6	0%	0 out of 6	0%	2 out of 6	33%
	Conductivity (uS)*		Turbidity (>Low)[†]		Presence of flow		pH	
Stockton Bridge	0 out of 1	0%	0 out of 1	0%	1 out of 25	4%	0 out of 1	0%
Capitola Center								
Creekside	0 out of 25	0%	0 out of 25	0%	25 out of 25	100%	5 out of 25	20%
Monterey Ave	0 out of 25	0%	0 out of 25	0%	25 out of 25	100%	3 out of 25	12%
Pier	0 out of 6	0%	0 out of 6	0%	6 out of 25	24%	3 out of 6	50%

Gray cell = No water detected during any station visit

Example of how to read these values: "7 of 8" = detergents exceeded WQO or attention levels 7 times of the 8 times measured.

* Conductivity "frequency" refers to the number of times over detectable range of 1999 microS.

[†] Turbidity visual assessment based upon Low/Med/or High values; > Low = exceedance

II. Qualitative Field Parameters

Volunteers were asked to make ‘presence or absence’ observations of the following parameters. More detailed descriptions were noted on the data sheet, and can be provided upon request. These observations were recorded even when flow was not present and samples were not collected. “Frequency” therefore is the relationship of the number of times the parameter was recorded as other than normal, out of the number of times an observation for that parameter was recorded throughout the program. Please see Table 6 for frequency results of qualitative field parameters.

Color

Volunteers matched water samples to a Borger Color System (BCS) booklet used to identify colors in nature. Generally, all samples were found to be colorless, pale yellow, pale green, pale gray, or pale tan.

Odors

The observation of ‘odor’ is taken from the sample water collected, and ‘measured’ away from the storm drain location; volunteers were instructed to determine if the water itself carries an odor, not the general location.

Sewage

The observation of ‘sewage’ indicates visual evidence or odor of human or other animal feces located in the immediate vicinity of the storm drain.

Surface scum

The observation ‘surface scum’ sighted indicates some type of ‘froth’ on the water’s surface in or near the drain outfall; this ‘scum’ may originate from any number of biological or human induced causes, and no specific information is gathered. These observations are typical of a common iron oxidizing bacteria/fungus which forms an oily or foamy ‘rust’ colored area at the water’s margin (usually indicating that the stream is being recharged from a groundwater source, and these features are most commonly seen at seeps or springs⁴).

Trash

The observation of ‘trash’ was recorded when unnaturally occurring materials were found in or near the storm drain that could potentially be blown by wind or flushed by rain into the system’s flow.

⁴ “Fairfax County Stormwater Planning Division – Perennial Streams Field Identification Protocol”, Fairfax County Public Works and Environmental Services Department
http://www.cblad.virginia.gov/docs/guidance/Perennial_Stream_Doc_Fairfax_NC/FairfaxMethod_May_03.pdf

Table 6. Frequency and Percent of Positive Observations				
	trash		sewage	
Stockton Bridge	4 out of 25	16%	0 out of 25	0%
Capitola Center	0 out of 25	0%		
Creekside	4 out of 25	16%	0 out of 25	0%
Monterey Ave.	4 out of 25	16%	0 out of 25	0%
Pier	16 out of 25	64%	2 out of 25	8%
	oil sheen		surface scum	
Stockton Bridge	0 out of 1	0%	1 out of 25	4%
Capitola Center				
Creekside	0 out of 25	0%	2 out of 25	8%
Monterey Ave.	0 out of 25	0%	0 out of 25	0%
Pier	0 out of 25	0%	0 out of 25	0%
	odor		color	
Stockton Bridge	0 out of 1	0%	0 out of 1	0%
Capitola Center				
Creekside	0 out of 25	0%	0 out of 25	0%
Monterey Ave.	0 out of 25	0%	0 out of 25	0%
Pier	0 out of 25	0%	0 out of 25	0%

Gray cell = No water detected during any station visit
 Example of how to read these values: "7 out of 8" = detergents were detected 7 times of the 8 times measured at Site X.
 Color detections are for any color other than clear

III. Laboratory Data

Water samples were collected once per month during the ‘dry’ months of the program, resulting in a total of seven monitoring events with lab analyses. These samples were collected where water was found discharging at the time of the station visit:

Table 7. Stations with water flowing during lab sample collection dates.

Station:	Code*	6/28/07	7/24/07	8/23/07
Stockton Bridge	CSD-04	Dry	Dry	Dry
Capitola Center	CSD-05	Dry	Dry	Dry
Creekside	CSD-06	X	X	X
Monterey Ave.	CSD-08	X	X	X
Pier	CSD-09	Dry	Dry	X

Once the samples were collected, they were iced and delivered to Santa Cruz County Department of Environmental Health Services Water Quality Laboratory to be tested for bacteria (*E.coli*, total coliform) and nutrients (nitrate, orthophosphate, and ammonia). Please see Table 8 for lab results listed by date and Table 9 for lab results listed by station with average, minimum, and maximum values.

Bacteria:

***E. coli* & Total Coliform**

CCRWQCB Basin Plan; E. coli – WQO: No single sample shall exceed 400 MPN – Water Body Contact Recreation

Total coliform – WQO: No single sample shall exceed 10,000 MPN – Marine Water Contact Recreation

Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of warm- and cold- blooded animals. They aid in the digestion of food. A specific subgroup of this collection is the fecal coliform bacteria, the most common member being *Escherichia coli* (*E. coli*). These organisms may be separated from the total coliform group by their ability to grow at elevated temperatures and are a specific kind of fecal coliform bacteria that live in the intestines of warm blooded vertebrates.

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other animals. At the time this occurred, the source water may have also been contaminated by pathogens or disease-producing bacteria or viruses which can also exist in fecal material. The test for total coliform is a broad measure of all forms of coliform bacteria present in human and other mammalian waste, while the analysis for *E. coli* is to determine the presence of the more specific fecal coliforms. The presence of bacteria in water is expressed in the unit “Most Probable Number” of bacteria colonies in 100 milliliters of water; MPN/mL.

Nutrients:

Nitrate nitrogen (NO₃-N)

WQO: CCRWQCB CCAMP Attention Level >2.25 mg/L (ppm) NO₃

The term nitrate nitrogen (NO₃-N) refers to the amount of elemental nitrogen present in the sample as the nitrate ion. Nitrogen is one of the most abundant of earth’s elements. About 80 percent of the air we breathe is nitrogen. It may exist in the free state as a gas N₂, or as nitrate NO₃, nitrite NO₂, and ammonia NH₃. Organic nitrogen is found in the cells of all living things as a major component of proteins and is continually recycled by plants and animals. Nitrogen is a nutrient that occurs naturally in streams and is essential for plants and animals in an aquatic ecosystem. Problems occur when large amounts nitrogen are introduced into the stream ecosystem, where it can cause excessive algal growth, depleting the available oxygen in the stream that fish and other aquatic organisms depend upon. Left unchecked, excessive algal and plant growth can lead to eutrophication.

Nitrate is a common lawn and garden fertilizer used in residential neighborhoods (a sometimes overlooked but significant source) as well as an agricultural fertilizer, and nitrate nitrogen can result from the seepage of water through soil containing nitrate-bearing minerals. Nitrate is also one of the products of decomposition of animal and human wastes. In the process of decomposition, raw manure undergoes a chemical change and among the end products is nitrate nitrogen.

When nitrate occurs in a fresh water body at a concentration above the attention level, it is considered evidence of pollution from septic tank fields, cesspools, animal agricultural operations, or fertilizer runoff from agricultural or urban land uses. Where a groundwater is known to contain little or no nitrate nitrogen naturally, the appearance of any significant increase is a probable indication of pollution.

Ammonia (NH₃)

WQO: US EPA <0.025mg/L (ppm) NH₃

Ammonia nitrogen (NH₃-N) is the elemental nitrogen concentration within the ammonia (NH₃) present in the sampled water. Ammonia is excreted by animals and produced during decomposition of plants and animal waste. Its natural breakdown thus returns nitrogen to the aquatic system. It is rapidly oxidized in natural water systems by bacterial groups that produce nitrite (NO₂) and nitrate (NO₃), which are then used as nutrients by plants; therefore ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that may overload the natural system. The unionized form of ammonia (NH₃) is the preferred nitrogen-containing nutrient for plant growth but is toxic to animals, causing lower reproduction and growth, or death to fish and other aquatic life.

Ammonia nitrogen is present in various concentrations in many surface and ground water supplies and is sometimes accepted as chemical evidence of pollution when encountered in natural waters. The main uses of ammonia are in the production of fertilizers, explosives and polymers and it is also an ingredient in certain household cleaners.⁴

Orthophosphate (PO₄-P)

WQO: US EPA; Attention level > 0.12 mg/L-PO₄ as PO₄⁻²-P

Please refer to the description of the Orthophosphate parameter located in the Quantitative Parameters section of this report (Section I).

Table 8. Bacteria/Nutrient Monitoring Results by Date						
Monitoring Date: 6/29/11						
Parameter	WQO	Stockton	Capitola Center	Creekside	Monterey Ave	Pier
E.coli (MPN/100ml)	² 400			195	246	754
Total Coliform (MPN/100ml)	² 10,000			4884	5794	19863
Nitrate (mg/L)	< 2.25			5.694	0	2.121
Ortho-Phosphates (mg/L)	< 0.12			ND	ND	0
Ammonia (mg/L)	< 0.025			ND	0.662	0
Monitoring Date: 7/25/11						
Parameter	WQO	Stockton	Capitola Center	Creekside	Monterey Ave	Pier
E.coli (MPN/100ml)	² 400	41		1782	733	14136
Total Coliform (MPN/100ml)	² 10,000	24192		> 24,192	10,462	24196
Nitrate (mg/L)	< 2.25	3.049		5.952	0.631	1.748
Ortho-Phosphates (mg/L)	< 0.12	0.342		ND	ND	N.D.
Ammonia (mg/L)	< 0.025	0.031		ND	ND	N.D.
Monitoring Date: 8/24/11						
Parameter	WQO	Stockton	Capitola Center	Creekside	Monterey Ave	Pier
E.coli (MPN/100ml)	² 400			5	2143	3448
Total Coliform (MPN/100ml)	² 10,000			1291	3076	15531
Nitrate (mg/L)	< 2.25			5.023	0	0.9
Ortho-Phosphates (mg/L)	< 0.12			ND	ND	ND
Ammonia (mg/L)	< 0.025			ND	ND	ND
Dark gray cell = No water detected during station visits on these days						
WQO = water quality objective						
ND = non-detect						
N/A = was not measured						
Light gray cell = exceedance						

Table 9. Lab Results for Monthly Bacteria and Nutrient Samples (by Station)							
Sampling Information		Nutrients			Bacteria		
Sample ID	Date	NO ₃ mg/L	PO ₄ SP (Lab results) mg/L	NH ₃ mg/L	E.coli MPN/mL	T.coliform MPN/mL	
WQO:		< 2.25 mg/L	< 0.12 mg/L	< 0.025 mg/L	< 400 MPN/mL	< 10000 MPN/mL	
CSD-06	6/29/11	5.694	ND	ND	195		4884
CSD-06	7/25/11	5.952	ND	ND	1782	>	OD
CSD-06	8/24/11	5.023	ND	ND	< 5		1291
CSD-08	6/29/11	0.662	ND	ND	246		5794
CSD-08	7/25/11	0.631	ND	ND	733		10462
CSD-08	8/24/11	0.685	ND	ND	2143		3076
CSD-09	8/24/11	1.277	ND	0.354	3448		15531
Average		2.846		0.354	1222		6840
Minimum		0.631		0.354	< 246	<	1291
Maximum		5.952		0.354	3448	>	15531
Median		1.277		0.354	733		5339
Exceedances		3	0	1	4		3
% Exceedance		43%	0%	14%	57%		43%
Lab QA	Date	NO₃	Op	NH₃	E.coli	T.coliform	
<i>Field Blanks</i>							
CSD-06FB	6/29/11	ND	ND	ND	< 5	<	5
CSD-06FB	7/25/11	ND	ND	ND	no growth		no growth
CSD-06FB	8/24/11	ND	ND	ND	no growth		no growth
<i>Duplicates</i>							
CSD-08	6/29/11	0.662	ND	ND	246		5794
CSD-08FD	6/29/11	0.655	ND	ND	213		3873
RPD		1%	0%	0%	14%		40%
CSD-08	7/25/11	0.631	ND	ND	733		10462
CSD-08FD	7/25/11	0.631	ND	ND	906	>	12033
RPD		0%	0%	0%	21%		14%
CSD-06	8/24/11	5.023	ND	ND	< 5		1291
CSD-06FD	8/24/11	5.167	ND	ND	41		2247
RPD		3%	0%	0%	157%		54%

FB= Field Blank; FD = Field Duplicate.
 ND= Below detection limit of test; NA= test not done for this sample
 OD= Over detection limit of test
 RPD = Relative Percent Difference (Should be less than 10% difference)
Gray cell = Exceedance of WQO

Table 10: Summary of Results for All Stations																				
Station ID	Trash	Sewage	Oil Sheen	Scum	CHL ppm	Cond uS	CU ppm	DET ppm	< >	NH ₃ -N Lab mg/l	NO ₃ -N Lab mg/l	pH	PO4-P Lab mg/L	PO ₄ -PO ₄ ppm	ECOLI MPN/100 ml	Tcoli MPN/100 ml	Color	Odor	Air Temp °C	Water Temp °C
WQO					NA	<2000	<0.03	NA		<0.03	<2.25	7.0-8.5	<0.12	<0.37	<400	<10,000	NA	NA	NA	NA
Total Visits																				
Total Tests	125	125	125	125	57	57	53	54		7	7	57	7	55	7	7	49	47	125	57
Minimum						490		0.2	<	0.030	0.631	6.5	ND	0	5	1291			14	11.5
Maximum						920		0.2	<	0.030	5.952	7.5	ND	0.66	3448	24192			24	20
Average						655		0.2	<	0.030	2.846	7	ND	0.35	1222	9319			17	15
Median						650					1.277	7	ND	0.35	733	5794			17	15
Total Exceedances	28	2	0	3	0	0	0	1		0	3	11	0	27	3	3	0	0		
Percent Exceedance	22%	2%	0%	2%	0%	0%	0%	2%		0%	43%	19%	0%	49%	43%	43%	0%	0%		

IV. First Flush Event

During the First Flush event, rainfall washes the streets, gutters and storm drains of collected materials and pollutants that have accumulated throughout the dry season. Field measurements of water temperature, conductivity, pH, and transparency are taken by volunteers at the monitoring sites. Samples are collected and sent to a professional lab where analysis for nutrients (nitrate, urea and orthophosphate), metals (zinc, copper, and lead), bacteria (total coliform, Enterococcus and *E. coli*), hardness, total dissolved solids, and total suspended solids are performed. The results are compared to the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. These action levels are not used for regulatory purposes. Rather, they provide guidance on potential impacts to the health of the marine ecosystem. First Flush results illustrate the impact of non-point source pollution generated through our daily interactions in the environment, including the local population as well as the many visitors that come to this region each year.

The First Flush monitoring event was held in the cities of Monterey, Pacific Grove, Capitola, and Santa Cruz. In 2007 this event occurred on different days in different cities: on Saturday, September 22, 2007 at approximately 3:30 pm in the cities of Capitola, Pacific Grove, and Monterey; and on Thursday, October 12 at approximately 1:15 am in the city of Santa Cruz. For the 2007 Capitola First Flush event, ten trained volunteers and three staff members participated in the collection of samples in Capitola. Please see Table 11 for lab results of the 2007 First Flush event in Capitola.

Table 11. Capitola FIRST FLUSH 2007																			
StationID	Time	Trash	Sewage	Oil Sheen	Scum	H ₂ O Temp	HARD	CA	CU	ECOLI	ECUS	MG	NO ₃ -N	PB	pH	PO ₄ ⁻² -P	TRANS	TSS	ZN
Units							mg/L	mg/L	ppb	MPN/100ml		mg/L	mg/L	ppb		ppm	cm	mg/L	ppb
WQO Attention level:							NA	NA	<30	<4000	NA	NA	<2.25	<30		<0.12	<25	<500	<200
Date all samples: 9/22/07																			
304-CSD-03	12:00	N	N	N	N	16.5	26	7	28	6896	948	2	0.47	5	6	0.35	17	12	155
304-CSD-03	11:30	N	N	N	N	16	26	7	24	4962	975	2	0.43	5	6	0.09	13.4	16	155
304-CSD-03	12:30	N	N	N	N	16.5	31	9	35	7308	1466	2	0.52	5	6	0.31	23.6	11	186
304-CSD-05	11:27	N	N	N	N	16	19	6	26	12263	5510	1	0.47	5	7	0.45	10.3	31	350
304-CSD-05	11:57	N	N	N	N	16	26	7	33	18417	5618	2	0.48	5	7	0.5	7.9	30	414
304-CSD-05	12:25	N	N	N	N	17	31	9	42	48391	13733	2	0.56	7	7	0.49	7	30	485
304-CSD-08	12:30	N	N	N	N	15.5	161	38	14	241957	31062	16	1.27	5	6.5	0.5	19.6	21	71
304-CSD-08	12:00	N	N	N	N	15.5	156	36	16	241960	81641	16	1.29	5	6.5	0.18	20.2	31	83
304-CSD-08	11:30	N	N	N	N	16	140	33	16	241960	77010	14	1.26	5	6.5	0.13	13.4	59	89
304-CSD-09	11:19	N	N	N	N	16	36	8	60	4374	3700	4	0.52	10	7	0.09	9.5	33	279
304-CSD-09	11:49	N	N	N	N	16	51	12	70	6896	3214	5	0.69	11	6.5	0.15	7	35	327
304-CSD-09	12:19	N	N	N	N	17	66	15	77	4285	4978	7	0.88	21	7	0.08	7.8	36	364
Total	12 samples																		
Min						15.5	19	6	14	4285	948	1	0.43	5	6	0.08	7	11	71
Max						17	161	38	77	241960	81641	16	1.29	21	7	0.5	23.6	59	485
Average						64.1	16	37	69972.4	19154.6	6.1	0.74	7.4	6.6	0.28	13.1	28.75	247	
Exceedance									50%	100%			0%	0%		67%	0%	0%	50%
Shaded values = exceed WQO or Attention level																			

A separate report including discussion and analysis of results from all cities in the CWC 2007 First Flush Program will be made available to the public and sent to local area governments and agencies. The results of previous First Flush events are available by contacting Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Watershed Monitoring Network at (831-883-9303). Reports can also be downloaded from the Internet at:

<http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html>.

DISCUSSION

The 2007 Urban Watch season for the City of Capitola had a total of 125 individual monitoring events (a decrease from 225 monitoring events in 2006). Volunteer availability and other factors, such as equipment availability or breakage and weather conditions, resulted in not every parameter being tested/observed for every station visit. The following section summarizes the results from discharge monitoring during the station visits, and breaks the program results into the two main qualitative groups for review: by parameter and by station.

Discharge at Monitoring Stations

Of the five stations visited during the 2007 Urban Watch monitoring period, only two exhibited enough flow to measure water quality conditions throughout the entire course of the program. Flow was detected at the Creekside and Monterey Avenue stations during every station visit, as these two stations carry perennial base flows derived from groundwater or unknown surface sources. The Pier station exhibited flow intermittently throughout the monitoring period. The Stockton Bridge station only exhibited flow during one visit (7/7/2007), possibly due to excess irrigation observed up the road from the storm drain site. There were a total of 57 monitoring events in which measurable flow was produced for field measurements. Laboratory analysis was conducted for seven of these events.

Parameter Detections

The WQOs used in this report apply to the surface waters that the urban runoff discharges flow into—not the urban runoff discharges themselves. The following comparisons to WQOs are provided for general information only, and exceedances do not indicate regulatory non-compliance for any specific storm drain discharge.

- **Chlorine** was never detected during the dry monitoring season, which is also a slight decrease from 2006 in which there was one detection of chlorine during the monitoring season.
- There were no detections of **copper** in the 53 samples measured, a slight decrease from last year's result of one detection of 2.0 ppm.
- **Detergent surfactants** were detected in just one (2%) of the 54 samples tested, with a result of 0.02 ppm, at the Pier on 8/23/07. Detergent measurements were below the detection limit of our kit in 62 out of 63 tests. Tests for Monterey Avenue and Creekside did not result in any detections of detergent. This result is similar to the 2006 program, when 1% of samples had detected surfactants.
- 49% of all 55 samples tested, and ranged between 0.0 and 0.66 ppm. This is a substantial decrease from the 2006 maximum of 2.75 ppm. All stations with flow had orthophosphate exceedances except Monterey. The Stockton Bridge and Creekside stations had the highest frequency of exceedances with all samples testing above the WQO: one out of one for Stockton and 24 out of 24 for Creekside. The field tests for Creekside resulted in an average of 0.47 ppm, which is similar to the 2006 results. The highest result was from Stockton (7/7/2007).
- Field measurements of **pH** were below the WQO (7.0 – 8.5) in 19% of 57 samples tested, with all exceedances at 6.5 pH. All stations except Stockton had pH measurements below the lower

WQO, with the Pier at 50%, Creekside at 20%, and Monterey at 12%. The average pH for the program was 7.0. In 2007, we used the more stringent WQOs of the CRWQCB Basin Plan for comparison of pH tests. Therefore, the number of exceedances for 2007 are greater than in past years. Urban runoff is directly affected by the pH of rainfall, which tends to be in the 5.6-6.0 range due to dissolution of CO₂ from the atmosphere. Once the runoff enters a natural stream and has a chance to contact the native geology, the pH is typically moderated. Additionally, there is some degree of uncertainty with the pH strip tests used for our measurements, therefore these exceedances are not great enough to be of concern.

- The ‘visual’ observation of **turbidity** (Hi/Med/Low) was consistently ‘Low’ for all measurable stations during the 2007 program.
- From the **qualitative observations**, no distinct **odor**, or intense **color** was detected during all station visits.
 - **Oil sheen** was not recorded on any visits during the 2007 Urban Watch Program.
 - **‘Sewage sighted’ or ‘sewage smell’** was recorded in two of 125 site visits (2%). Both occurrences were at the Pier station where volunteers noted bird droppings on the concrete outflow basin.
 - Volunteers reported 3 findings of the presence of **surface scum** (2%) in 125 site visits, however most were associated with areas of high algae and an ‘orange biological function’ typical of a common iron-oxidizing bacteria/fungus which forms an oily or foamy rust- colored area at the water’s margin.
 - **Trash** was observed at all of the monitoring stations except Capitola Center, in 22% of overall station visits (about the same as 2006). Observed trash consisted mostly of food wrappers, paper and plastic packaging, drink containers, yard clippings, and cigarette butts. The Pier exhibited the highest frequency of trash of all 5 stations: 64% of the visits (the same percentage as last year). A large amount of trash was also found in between the Creekside and Auto Plaza stations, an area under the highway 1 overpass that has frequent evidence of vandalism (graffiti). This was not recorded in the data sheets because it was not found directly in the flow of either storm drain, but on the pathway going from one site to the other site. The trash at this location consisted of plastic cord, paint containers and supplies, as well as plastic food containers, and was of a more toxic and potentially damaging nature than that found at the other sites. On some occasions spray paint cans were seen exuding bubbles into the water near the shore and paint rollers were pulled out of the creek when volunteers crossed to check on the discontinued Auto Plaza site.
- Monthly samples were delivered to the laboratory for analysis of **total coliform** bacteria. Lab analysis of total coliform ranged between 1291 to 15,531 MPN/mL, with an average of 6840 MPN/mL for those samples that were within the detection limits of this test. One out of seven samples tested (14%) had results above the upper limit of quantification (>24,192 MPN/mL) in this method of analysis (Creekside, 7/24/2007) .

Three samples of 7 (43%) were identified in exceedance of the WQO (10,000 MPN/mL in any one sample). Each site was over the WQO on one visit: on 7/24/2007 for Monterey Avenue (10,462 MPN/mL) and Creekside (greater than 24,192 MPN/mL), and on 8/23/2007 for the Pier (15,531 MPN/mL). These results are similar to those from 2006.

- Monthly samples were also analyzed for *E. coli* bacteria. Lab analysis of *E. coli* ranged from 246 MPN to 3448 MPN/100ml, with an average of 1222 MPN/100ml for the samples that were within the upper quantification limits of this test.

Four samples of 7 (57%) were identified in exceedance of the *E. coli* WQO (400 MPN/100ml in any one sample): Monterey Avenue (733 MPN/100mL) and Creekside (1782 MPN/100mL); and on 8/23/2007 Monterey (2143 MPN-100mL) and Pier (3448 MPN/100mL). It should be noted that on 8/23/2007 there was a dead rat seen at the outflow of the Pier storm drain pipe.

- Monthly samples were delivered to the laboratory for analysis of **ammonia (NH₃)**. These test results were not detected (less than 0.030 mg/L; n=7) for all station visits. This is a substantial decrease from the 2006 tests for ammonia, which resulted in 43% of the samples measuring over the WQO of 0.025 ppm.
- Monthly samples were delivered to the laboratory for analysis of **nitrate nitrogen (NO₃-N)**. Lab analysis of nitrate nitrogen averaged 2.846 mg/L (n=7, range 0.631 – 5.952, 1.277 mg/L median). Three samples of the seven detected (43%) had nitrate nitrogen in exceedance of the WQO of 2.25 ppm, all from Creekside: 6/28/07 (5.694 ppm), 7/24/07 (5.952 ppm), and 8/23/07 (5.023 ppm). Results for Monterey Ave. and the Pier were all below the WQO. These results show a substantial decrease in the average of 3.437 ppm and the maximum value of 12.076 ppm for 2006, though the number of tests in 2007 (seven tests total) were also smaller than 2006, which had 13 detected tests.
- Samples were delivered to the laboratory for analysis of **orthophosphate (PO₄-P)**. None of the 7 samples tested (0%) exceeded the WQO (0.12 mg/L) during the 2007 monitoring period. This is a decrease from 2006, which averaged 0.188 mg/L with two samples in exceedance of the WQO (15%).

Station Summaries

- **Stockton Bridge:** Flow occurred only once, on 7/7/2007. Orthophosphates (PO₄⁻²) were measured above the WQO (0.37ppm) for this visit at 0.66 ppm. All other test results were below the WQO. Trash was observed during four out of 25 visits (16%) and surface scum was seen on one out of 25 visits (4%).
- **Capitola Center:** Flow was never observed during any visit for the 2007 monitoring period, though on a few occasions there was a puddle of water at the bottom of the outflow and water stains in the pipe, indicating some previous flow.
- **Creekside:** Flow was observed at Creekside on every visit (25 out of 25). The most frequent exceedances were for the orthophosphate tests done in the field, in which results were over the WQO (0.37 ppm) on 24 out of 24 visits (100%), with an average of 0.45 ppm and a range of 0.38 to 0.59 ppm. The lab tests for orthophosphate had no exceedances in three out of three samples. Nitrate nitrogen results were in exceedance of the WQO (less than 2.25 mg/L) in three out of three samples (100%), with an average of 5.694 mg/L and a range of 5.023 to 5.952 mg/L. Trash was reported in four out of 25 visits (16%) and surface scum in two out of 25 visits (8%),

consisting of algal growth on the concrete substrate. Measurements for pH were slightly below the WQO in 20% of all tests taken, recorded at 6.5 pH. However, the average pH was within the recommended range of the CRWQCB Basin Plan. All other tests and measurements resulted in non-detections.

- **Monterey Ave. :** Flow was observed on every visit, as this is a perennial streambed (also known as Noble Gulch). The most remarkable results at this site were for bacteria, with total coliform exceeding the WQO (10,000 MPN/mL) in one out of three lab samples (7/24/2007) and averaging 6794 MPN/mL, with a range of 3076 to 10,462 MPN/mL. *E. Coli* also tested well above the WQO (400 MPN/mL) in one out of three lab samples (on 8/23/2007) with an average of 733 and a range of 246 to 2143 MPN/mL. Results for pH were slightly below the WQO in 12% of all tests, recorded at 6.5 pH. The average pH was within the WQO recommendations. The creek bottom was consistently covered with decaying leaves and the presence of duckweed increased significantly towards the end of the monitoring period. All other tests resulted in non-detections or values below the WQO.
- **Pier:** Flow was observed during 6 visits, a sharp decrease from the 29 visits with flow in 2006. The most notable results were the high bacteria levels, with the only sample collected exceeding the WQO for both total coliform and *E. Coli* (10,000 and 400 MPN/mL, respectively). Total coliform results were 15,531 MPN/mL and results for *E. Coli* were 3448 MPN/mL, which was the highest result for all samples collected. It should be noted that a dead rat was observed in the storm drain on this visit and bird feces were often noted on the concrete outflow. Orthophosphates (PO_4^{2-}) were found to be in exceedance of the WQO (0.37 ppm) on two out of six visits, with an average of 0.31 ppm and a range of 0.24 to 0.57ppm. Lab results for orthophosphates ($\text{PO}_4\text{-P}$) were non-detect for the only sample collected. The only detection for detergents (0.2 ppm) was also from the Pier location. The pier also had the highest incidence of trash, recorded in 16 out of 25 visits (64%) as food wrappers, cans, bottles, caps, cigarette butts, glass, and most frequently, yard clippings which were piled at the base of the outflow. Sewage was recorded on two out of 25 visits (8 %), and was noted as bird feces. Finally, pH measurements were below the WQO in 50% of all tests taken, recorded at 6.5 pH. However, the average pH was within the recommended range of the CRWQCB Basin Plan.

CONCLUSIONS AND RECOMMENDATIONS

The 2007 Capitola Urban Watch program has had another successful year of monitoring storm drains and informing volunteers and community members of ways they can decrease non-point source pollution. The volunteers were committed to the program and their efforts to improve water quality in the Soquel Creek watershed and surrounding Monterey Bay National Marine Sanctuary. The City has successfully eliminated dry season flow from two storm drain sites by installing a CDS unit at the discontinued Auto Plaza site and an entire new system with storage tanks for parking lot runoff at Capitola Center. These actions were based on data collected from previous years of Urban Watch monitoring. While improvements have been made at these two sites, results from the data collected at the remaining sites showed that bacteria, nitrates, phosphates, and trash are the most common contaminants entering storm drains within this study area. This is consistent with the results from previous years, though many of the tests in 2007 resulted in lower averages and maximum values than 2006. As a result of the data collected from the Urban Watch program, the City of Capitola is continuing to look for solutions to the problem of high nutrient contamination discovered at the Pier site, presumably caused by excessive fertilization.

Trash continued to be an obvious ‘public’ pollutant in the study area, especially along Soquel Creek, under the freeway bridge and between the Auto Plaza and Creekside stations. Since this trash has been an ongoing problem and is particularly harmful to the health of the creek and its aquatic life, we strongly encourage the City of Capitola to work with Santa Cruz County and the Transportation District to find a more effective method of encouraging visitors to dispose of trash appropriately. As is true in most urban environments, the presence or absence of trash receptacles directly affects the amount of trash pollution in a given area. Locating and maintaining the presence of trash cans in the areas where community use is obvious, as well as making sure they are emptied, is an important component in reducing trash as a pollutant in our waterways. Other ideas may include outreach to public schools with education about watershed pollution, working with local newspapers to publish weekly monitoring results from the Urban Watch program, and working with the Chamber of Commerce or other business associations to promote clean water practices. Frequent community ‘Stream Clean-Up’ days or targeted notices posted to point out the problem could be beneficial in trash abatement. Development of a Public Service Announcement for the local cable channel detailing information about storm water and urban runoff pollution is also a possible avenue for outreach to a wider audience.

Another trash-related problem is the disposal of yard clippings found at the Pier site. Encouraging the neighbors to dispose of yard waste in appropriate containers at the Venetian Court complex may help to alleviate this additional source of nutrient-rich runoff into the Monterey Bay. The Pier had the greatest recordings of trash, even though there are receptacles nearby that are emptied frequently. Perhaps the above-mentioned activities to raise public awareness or more specifically targeted measures could be helpful at this site.

In addition, further investigation for solutions to prevent high levels of bacteria at the Monterey and Pier sites, and to find the sources of high nutrient levels at Creekside could help to prevent these contaminants from entering Soquel Creek and the Monterey Bay. It is possible that the phosphate levels are at a normal concentration for Creekside as a result of natural breakdown of soils and rocks in the local substrate.

Since car washing was observed on one occasion at the Creekside site, it is suggested that a more proactive approach be taken with the landowners at that site to inform them of the problems caused by this activity. Providing information of appropriate locations with the ability to treat car-washing waste water may help groups who are considering car washes as a business or a fund-raising event to make alternative choices in the future. Targeting sports teams, schools and clubs with this information could reduce this source of pollution to the creek and ocean.

Because there has been no flow at the Capitola Center location for two years, and the Auto Plaza site was removed from the program, it is suggested that a new site be added to the 2008 Urban Watch Program. The City of Capitola is acknowledged for taking such effective measures to eliminate discharge into the creek by installing the new drainage systems at these sites. The continual monitoring of Capitola Center by the Urban Watch volunteers will provide helpful feedback to the City of Capitola in determining the continued effectiveness of these practices. As volunteers are monitoring the Creekside location in 2008, it is still recommended that they walk to where they can observe the Auto Plaza storm drain site from across the creek, and if any discharge is observed, to immediately notify Steve Jesberg at the City of Capitola.

The 2007 City of Capitola Urban Watch Monitoring Program joined the ongoing efforts of the cities of Pacific Grove and Monterey in looking at non-point source pollutants entering the waterways of the Monterey Bay. The LaMotte Urban Watch kit, which was used by volunteers to monitor dry-weather storm drain flow, is easy to use and provides consistent data for cities and interested parties. It provides a vehicle for community involvement in data collection, which contributes critical data not otherwise collected by other programs in the City of Capitola. In addition, interest from observers of the outdoor laboratory provides continual opportunities for public education of the problems and possible solutions of non-point source pollution of the local watershed. The monitoring results demonstrate the need for continued public outreach for urban runoff control within the city limits as well as in the neighborhoods that feed these drains. The continuation of this program in 2008 will supplement the data presented in this report and provide further information regarding the state of water health in the Soquel Creek watershed.

The First Flush event proved to be a useful avenue for data collection as well as public education, and demonstrated a need to continue further monitoring with the Urban Watch program. This program not only provides data on pollutants that may be used in future decisions affecting the local watershed, but also is a educational tool to show volunteers how the storm drain system works and what they can do to improve its functionality. As an aid to the City of Capitola, the data collected from previous First Flush monitoring events provided evidence of metals contaminating Soquel Creek through the storm drain system at the Capitola Center site. This knowledge was useful in making the decision to install a clarifier at that site to remove the metals.

In conclusion, the City of Capitola is commended for continuing the Urban Watch monitoring program for an eighth season in 2007 to augment data collected during previous programs. Recommendations for the 2008 program include: 1) continue to assess upstream sources of illicit discharges and pollutant sources and look for alternative ways to decrease the influx of pollutants; 2) continue outreach programs targeting local businesses, schools and residents to further reduce sources of pollution from entering the Monterey Bay National Marine Sanctuary; (3) work with the County of Santa Cruz and the Transportation District to decrease trash under the Highway 1 overpass; and (4) continue to work closely with the Urban Watch Program to coordinate public education events such as creek and beach clean-up days.

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