



**2004 Urban Watch Monitoring Program**  
City of Pacific Grove, California

June – October 2004

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# City of Pacific Grove

## Urban Watch Monitoring Program 2004

### I. PROGRAM OVERVIEW

The City of Pacific Grove Urban Watch storm drain-monitoring program began in 1998 and is a collaborative effort between the Coastal Watershed Council, the City of Pacific Grove, and the Monterey Bay National Marine Sanctuary.

The Urban Watch Program serves as an educational tool and outreach program to the general public regarding the impacts citizens have on local water quality. This program partially fulfills the educational, public outreach, and monitoring requirements of Pacific Grove's Phase II National Pollution Discharge Elimination System (NPDES) storm water discharge permits. The program collects useful data to support local environmental management decisions, through the use of trained volunteers. Volunteers monitor dry-season storm drain discharges at selected outfalls from June through October of each monitoring year.

Pacific Grove (PG) is considered a built out community on the Monterey Peninsula and most storm water runoff from impervious surface cover is conveyed under ground through a closed storm water system. The PG storm water system also receives and discharges runoff from the City of Monterey and Monterey County.

Working with staff from the City of Pacific Grove Public Works Department, the Coastal Watershed Council, and the Monterey Bay National Marine Sanctuary (MBNMS), six sampling sites were selected based on drainage basin and safe access for volunteers (Figure 1). Four of those sites were monitored during the 2004 season. Asilomar has not been monitored for several years because of the high water flow in the riparian drainage. Lover's Point outfall was not monitored because the flow was diverted to the Monterey Regional Water Pollution Control Agency throughout the dry weather season.

The six sampling sites are outfalls of the municipal storm water system (MS4) of Pacific Grove. The sites monitored from east to west are referred to as:

**8<sup>th</sup> Street (PGSD1)** This outfall is located on Ocean View Blvd. Between 7th and 8th Street in Pacific Grove. The outfall sits just to the west of the bench under the bike path.

**Greenwood Park (CENTR-31)** This site is located on Central Avenue at the corner of 13th Street in Pacific Grove. The outfall is across the street from a large red church.

**Lover's Point (PGSD3)** This site is east (toward Monterey) of the beach and snack bar at Lover's Point just below the bike path. The outfall overhangs the cliff.

**Pico (PGSD4)** This site is located SW of Point Pinos on Sunset Drive, near Asilomar, between Arena Ave. and Pico Ave. The outfall is directly across from the house with an orange door at 1745 Sunset Blvd.

**Asilomar (PGSD5)** This site is located on Sunset Boulevard near the Asilomar Convention Center under the bridge at the last turnout before passing the golf course. The outfall is located underneath the bridge and to the right.

**Congress (PGSD6)** This site is located approximately 300 yards south of the intersection of Congress and Sunset Boulevard. The outfall is located on the west side of the Pacific Grove High School sports field.

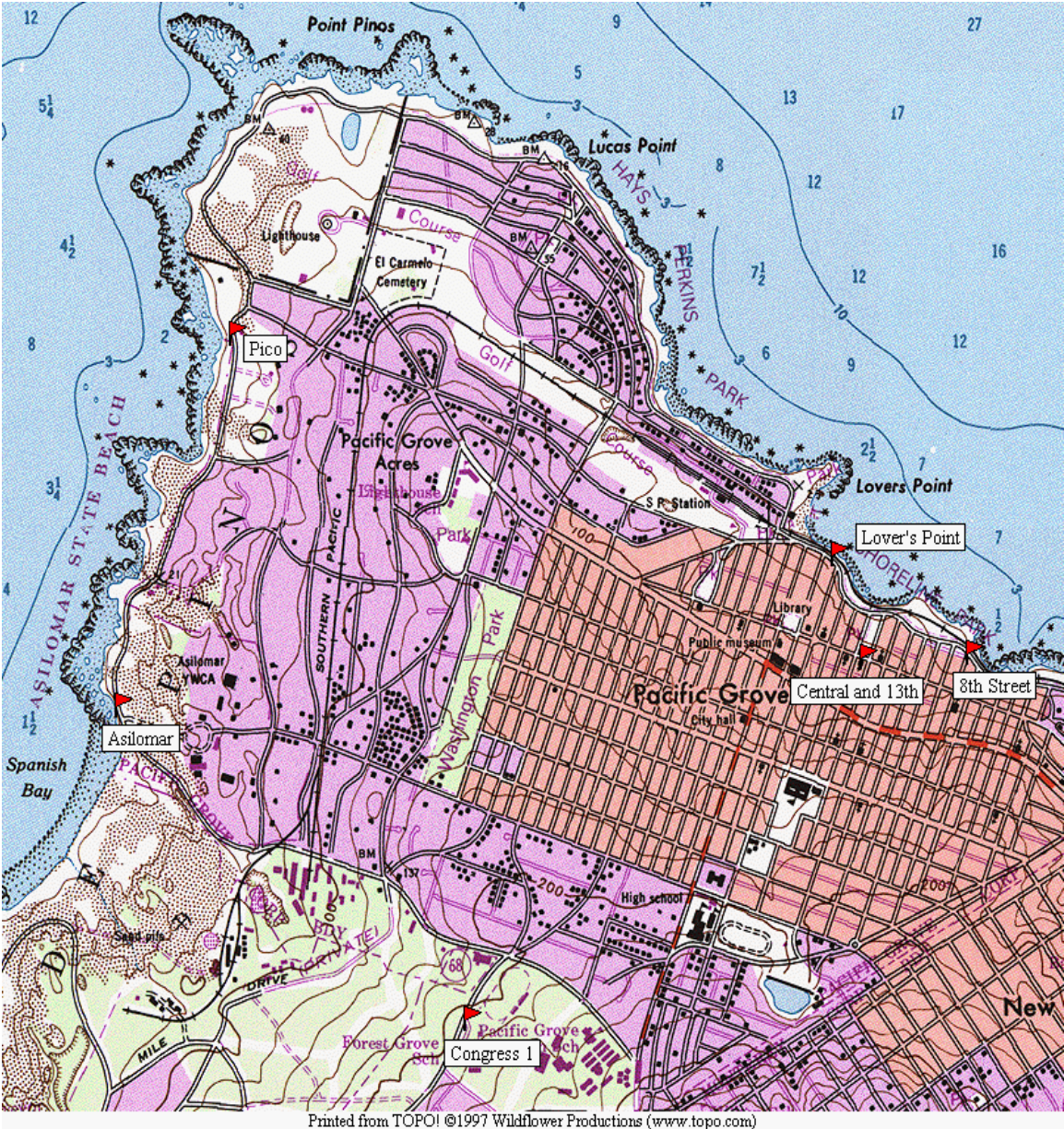


Figure 1. Locations of Urban Watch monitoring sites in the Pacific Grove

## II. PROGRAM DESIGN

Urban Watch volunteers use a storm drain monitoring test kit manufactured by the LaMotte Company (SSDK 7446) to test water samples. The kit allows volunteers, monitoring dry-season storm drain discharges, to identify the common urban pollutants and contaminants in the water. The kit was designed according to National Pollutant Discharge Elimination System (NPDES) Phase I dry weather monitoring requirements in order to detect illicit storm drain connections and discharges. In addition to the standard test kit, an Oakton 'ECTestr' conductivity meter along with pH test strips were added for measurement of conductivity and pH. Testing for phenols was discontinued in 2003 as it had not been detected in the five previous monitoring seasons. Bacterial testing was added in 2003 and was conducted four times throughout the 2004 season. Samples for bacteria analysis were collected by volunteers in and were sent to a certified laboratory for analysis.

Following a one-day training event, volunteers began sampling on a biweekly schedule. Volunteers collected and analyzed water samples twice within a one-week period, and at least 24 hours apart. Scheduling of field time was left up to the monitoring teams. Parameters monitored included detergents, ammonia, chlorine, copper, turbidity, pH, conductivity, water and air temperature, odor, and color. Volunteers noted on a field data sheet if there was oil sheen, sewage, trash, or surface scum present, as well as other observations.

The Urban Watch Program ends after the first significant rain event of the year in an event called "First Flush". Volunteers go out at the onset of the first significant rainfall, which is great enough to wash the streets and clean the gutters and storm drains of collected materials and pollutants accumulated throughout the dry-season, to monitor the "First Flush". Volunteers take in-situ measurements of water temperature, conductivity, pH, and transparency and samples are collected and sent to a professional lab for analysis. Lab samples are tested for nitrate, orthophosphate, zinc, copper, lead, total coliform, *E. coli*, total dissolved solids, and total suspended solids. Results of the analysis are compared with the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. These Action levels are not for regulatory purposes, but provide guidance for potential impacts to the health of the marine ecosystem. First Flush reports can be downloaded from the Internet at:  
<http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html>

## III. VOLUNTEER TRAINING

Tamara Doan, Program Manager for the Coastal Watershed Council along with Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Monitoring Network and Maris Sidenstecker, Water Quality Education Consultant for the city of Monterey, provided three hours of focused training for volunteers, and conduct several "hands on" field trainings throughout the first two months of monitoring. Topics included in the training were monitoring concepts, sampling procedures, purpose of parameters, use of kits in the field, and safety procedures.

Volunteers were divided into two teams of three to four members each according to skill level, general interest, and time availability. Two experienced monitors were chosen as team leaders to help coordinate volunteer scheduling, and provide feedback to the Urban Watch Coordinator. An experienced monitor accompanied each team until the groups had a thorough understanding of the sampling procedures and analysis skills outlined in the volunteer training packet.

#### **IV. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM**

The Quality Assurance/Quality Control (QA/QC) program included the following components:

- Volunteer training on monitoring concepts, safety procedures, sampling methods, use of field equipment, and field data entry.
- Periodic calibration of test equipment (calibration records available).
- Use of Instrument ID numbers to track equipment used by teams.
- Monitoring of reagent stocks, expiration dates, and waste management.
- Periodic review of data sheets to determine inconsistencies in data entry.
- Continued supervision until the trainer was confident in the volunteers' sampling and analysis skills.
- CWC Standard Operation Procedure packet for volunteers use in the field.
- Quality Control Checks of parameter tests with known standards.
- Processing and analysis of data for report.

#### **V. METHODS**

The following table (Table 1) describes the parameters which were measured in the Urban Watch program, some possible sources for these pollutants and some of the associated problems that their presence might cause, and the methods used to monitor each constituent.

All of the parameters except *E. coli* (bacteria) are measure in the field by program volunteers and staff using the equipment described above. As there is no accurate field test kit for bacteria available at this time, water samples were collected at the Urban Watch sites and taken to Monterey Bay Analytical Laboratory and analyzed for *E.coli* and total coliform bacteria.

**Table 1: A description of parameters tested for, some sources of the pollution and potential problems associated with each parameter, and the methods used and the accuracy of the tests.**

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature	Illegal discharges, standing water, large paved surface areas	Affects rates of chemical and biochemical reactions in water.	Method - Digital thermometer Accuracy $\pm 1\%$ full scale or Method- Bulb thermometer Accuracy $\pm 0.5^\circ\text{C}$
Turbidity	Microorganisms, sediment, erosion	Interferes with respiration and reproduction in fish and other aquatic life	Method - Visual Octa-Slide Viewer against turbidity standard slide bar
pH	Aerosols and dust in air, mineral substances, soils, sewer or gray water overflows, animal wastes, pesticides & fertilizers, photosynthesis	Interferes 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 lower dissolved oxygen available to aquatic life	Method - solvent extraction/ bromphenal blue indicator Accuracy $\pm 0.1$ ppm Min detection: $>0.1$ ppm
Copper	Brake pads, copper architectural elements such as roofs or gutters; pesticides or fertilizers; Illegal discharge 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: $>0.0$ ppm
Chlorine	Illegal or unintended connection to a stormdrain or draining of a swimming pool; potable water line leaks; gray water discharges	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
Ammonia Nitrogen	Wildlife, fertilizers, Illegal connections to stormdrain systems, poorly functioning septic systems	At certain concentrations can be toxic to aquatic organisms	LaMotte Code 5864 Colo-Ruler against a color standard Min detection: $>0.1$ ppm
Coliform bacteria	Wildlife, Illegal connections to stormdrain systems, poorly functioning septic systems, wildlife	Detrimental to human health and marine organisms.	IDEXX Standard Method <sup>1</sup> 9223 b Duplicates within 95% confidence limits
Conductivity	Discharges high in salts and minerals or metals, groundwater sources (water moving through local geology)	Possible agricultural, industrial or municipal wastewater runoff	Method –Electrode probe module. Accuracy $\pm 1\%$ Min detection: 10 mS
Color	Tannins from plant material, soils, dyes or chemicals	Interferes with aquatic Insects	Method - Visual Borger Color System
Odor	Product of plant decomposition; illegal discharge sources; "clean" drainage water should have no distinctive odor	Can indicate presence of contaminants	Method - Scent
Oil sheen	Hydrocarbons such as oil, gasoline, and grease; Decomposing plant materials (ex: eucalyptus); Leaking underground petroleum storage tanks	Toxic to aquatic organisms	Method - Visual
Trash, sewage, scum	Illegal discharge or illegal dumping; Scum may be result of plant material decomposition	Interferes with fish and other aquatic life	Method - Visual

## VI. RESULTS

Results for each monitoring site is presented below by location. Each parameter was tested by volunteers in the field using the LaMotte Storm Drain Monitoring Kit previously described, the Hanna orthophosphate meter, or taken to a certified lab for bacteria analysis. Over the period of June through October 2004, storm drain monitoring took place at four sites 18 times, for a total of 72 individual data sets. Volunteer availability and other factors were taken into consideration throughout the program, and therefore, not every parameter was tested on every site visit. Bacteria sampling did not always coincide with Urban Watch sampling and occurred 4 times throughout the season, for a total of 17 samples. The data collected is described in Appendix 1, which provides Summary Tables of averages, minimum-maximum values, and frequency of parameters encountered. The appendix also presents all raw data collected in the field. Monitoring protocols are available upon request.

### Urban Watch Observation Information and Monitoring Results

#### Day of Week/Time of Day

Volunteer monitoring occurred at least once everyday of the week, throughout the season, except for Sunday. The most common monitoring days were Tuesday and Wednesday. The monitoring times varied and occurred most often late in the afternoon. All samples were collected and tested between the hours of 16:30 and 20:00 (4:30-8:00 P.M.). The only morning monitoring event occurred on Saturday 08/20/04 between 10:00 A.M. and 11:30 A.M.

#### PGSD 1 (8th Street)

PGSD1 is a storm drain ocean outfall located at 8<sup>th</sup> Street and Oceanview Blvd. This outfall is a 24-inch diameter concrete pipe. Runoff into the 8<sup>th</sup> Street storm water drainage is from a 100% residential area of high (29.0 DU/Ac) to medium (17.4 DU/Ac) densities. Flow from this outfall during the dry season was usually low and often barely a trickle. On several occasions there was not enough flow to complete analysis. The site was visited a total of 17 times for storm drain monitoring and four times for bacterial sampling.

#### 8th Street Monitoring Results

**Detergents** - Seventeen samples were tested for detergent at this site during the 2004 Urban Watch Monitoring Season. Eleven of 17 samples reported values greater than non-detect. The positive hits were 0.1 mg/L on eight occasions, 0.2 mg/L on two occasions and 0.5 mg/L on one occasion.

**Ammonia Nitrogen** - Ammonia was detected 5 of 17 times at this site during the monitoring season. Ammonia values ranged from non-detect to 0.25 mg/L with an average concentration of 0.075 mg/L.

**Copper** - Copper was not detected at this site during the monitoring period.

**Residual Chlorine** - Chlorine was tested a total of 17 times and reported values did not exceed the detection limit of 0.2 mg/L at this site during the monitoring period. Only one sample gave a positive hit of 0.2 mg/L on July 13th.

**Turbidity** - All samples collected for this site during the 2004 monitoring season were recorded as low for turbidity.

**Odor** - No unusual odors were detected.

**Color** - All samples collected at this site in 2004 had no color and were recorded as clear (BCS 93).

**Flow and Discharge** - There was a very low flow at this site during the entire season. No flow was reported on July 14<sup>th</sup> and therefore no samples were collected. It was noted on the field data sheets that on August 28<sup>th</sup> there was barely a trickle and on June 30<sup>th</sup>, volunteers ran out of sample water to complete all tests. The depth of flow from this site ranged from 0.1 cm to 1.0 cm with an average measurement of 0.516 cm. The width of the flow of water ranged from 4 to 20 cm and the wetted width ranged from 17 to 36 cm.

**Air Temperature** - Air temperature values at this site ranged between 17.0 °C to 21.6° C with an average temperature value of 18.94 °C. A trend of warmer weather occurred from July 13<sup>th</sup> to September 7<sup>th</sup>.

**Water Temperature** - Water temperature at this site ranged from 16.50°C to 20.10°C. The average temperature was 18.17°C.

**Conductivity** - The conductivity values for this site varied between 1980 – 2800 µS with an average value of 2345 µS. The median conductivity value for this site was 2300 µS. Fourteen of the 17 samples taken from this site had a conductivity of 2000 µS or greater with the highest value occurring on August 28<sup>th</sup>.

**PH** - All values from this site were either 7.0 or 7.5.

**Trash** - Trash was reported 9 times at this site. The most common garbage was paper, plastic, and Styrofoam.

**Sewage** - On June 16<sup>th</sup>, a sulfur smell was noted in the area, but was not coming directly from the discharging water or the pipe.

**Surface scum** - The presence of surface scum was not detected at this site.

**Oil sheen** - Oil sheen was not observed at this particular site.

**Orthophosphate** - Thirteen samples from this site were tested for orthophosphate (PO<sub>4</sub>). The values ranged from 0.101 mg-P/L to 0.756 mg-P/L with an average value of 0.343 mg-P/L. The CCAMP action level is 0.12 mg-P/L.

**Bacteria monitoring** - Samples were taken four times from this site. The values for total coliform ranged from 12,976 to > 48,380 MPN/100ml with an average value of 16,950 MPN/100ml all of which exceeded the accepted criteria of <10,000 MPN/100ml. *E. coli* values for this site ranged from 1262 to >48,384 MPN/100ml with an average value of 18,175 MPN/100ml all of which exceeded the accepted criteria of <400 MPN/100ml.

### **CENTR-31 (Greenwood Park)**

The PGSD2 storm water outfall is located at Greenwood Park at the intersection of Central Ave. at 13th Street. The outfall is a 54-inch in diameter concrete pipe with a wooden weir. The storm water flows from the storm water system into a Eucalyptus tree lined creek bed for approximately 300 yards before discharging into the ocean. Water flow from the storm drain outfall was constant with periodic surges of water. The Greenwood Park storm water system receives runoff from an area that is 90% residential and 10% commercial. The residential areas are of high (29.0 DU/Ac) and medium densities (17.4 DU/Ac). The site was visited 18 times for storm drain monitoring and four times for *bacteria* sampling.

## **Greenwood Park Monitoring Results**

**Detergents** - Eighteen samples from this site were tested for detergent. The values ranged from non-detect to 3.30 mg/L with an average value of 0.29 mg/L. Ten of the samples were above the minimum detection limit of 0.10 mg/L. The highest value, taken on 08/23/2004, was greater than 3.30 mg/L, but analysis was stopped after obtaining this value due to time constraints.

**Residual Chlorine** - Chlorine was tested a total of 18 times and the values obtained ranged from non-detect to 0.20 mg/L. Of the 18 samples, only one sample had a detectable concentration on 8/23/04 with a concentration of 0.20 mg/L, the same day as the high detergent concentration.

**Copper** - Copper was not detected at the site during the monitoring period.

**Ammonia Nitrogen** - Eighteen samples tested had values ranging from 0.05 mg/L to 0.25 mg/L with an average ammonia value of 0.072 mg/L. Five of the 18 samples collected had detectable concentrations. Four reported values of 0.1 mg/L and one sample had a concentration of 0.25 mg/L on 9/9/04.

**Turbidity** - All but one of the 18 samples collected were in the low range for turbidity. A value of medium was recorded for the sample collected on 08/23/2004, the same day as the high detergent and chlorine measurements.

**Odor** - All samples had no odor and were recorded as 0 for odor.

**Color** - Seventeen out of the 18 samples were recorded as clear (BCS 93) for color, while one was recorded as having color (BCS 91) on 8/23/04, the same day as the high detergent and chlorine concentrations.

**Flow** - Flow depth was measured 18 times at this site during the monitoring season. The depth ranged from 0.5 to 2.5 cm with an average depth value of 0.5 cm. Wetted width ranged from 46 to 94 cm and the flow width ranged 25 to 92 cm. Flow at this site was fairly constant, with periodic surges of water.

**Air Temperature** - During 18 site visits, the air temperature values for this site ranged from 16.50 °C to 23.00 °C. Six of the temperature readings were above the average values of 18.4°C.

**Water Temperature** - Water temperatures for Greenwood Park ranged from 15.50°C to 18.50 °C with an average temperature of 16.89°C. Nine of the values were below the average with the lowest temperature reading occurring on June 15<sup>th</sup>.

**Conductivity** - The 18 conductivity values ranged from 1300 to 2200 µS with an average value of 1785 µS and a median value of 1800 µS.

**PH** - Eighteen pH measurements were taken at this site. All values were between 7.0 and 7.5.

**Trash** - Trash was reported at 15 out of 18 site visits. The most common materials found were styrofoam packing materials, plastics and paper.

**Sewage** - Sewage was not present at this site.

**Oil Sheen** - Oil sheen was not detected at this site.

**Surface scum** - Surface scum was detected three times during this site during the 2004 monitoring season. On two occasions, scum was indicated downstream from the pipe and one time the presence of suds was noted.

**Orthophosphate** - Orthophosphate was tested 16 times throughout the season. The values ranged from 0.091 to 0.515 with a mean value of 0.279 mg-P/L. The CCAMP Action Level is 0.12 mg-P/L.

**Bacteria monitoring** - Four samples were collected from this site for bacteria monitoring. The total coliform values ranged from 21,430 to 48,380 MPN/100ml with an

average value of 41,520 MPN/100ml, all of which exceeded the accepted criteria of <10,000 MPN/100ml. *E. coli* values for this site ranged from 3,360 to 17,328 MPN/100ml with an average value of 9,438 MPN/100ml all of which exceeded the accepted criteria of <400 MPN/100ml.

### **PGSD 3 (Lover's Point)**

Due to a new project being implemented to address discharges to areas of Special Biological Concern, storm water from this pipe is being diverted to the sewage treatment plant during the dry season, therefore only a trickle of water was coming from this pipe. The city of Pacific Grove confirmed this water was actually ground water seeping into the pipe. This site was tested during the first monitoring event and non-detect results for each parameter showed the water coming from the pipe was indeed fresh water seepage. Due to these changes this site was not monitored during the 2004 Urban Watch program.

### **PGSD 4 (Pico)**

PGSD 4 is a storm water ocean out fall located on the west side of Sunset Drive, approximately 60 feet north of Pico Street. The Pico storm drain outfall is a 40-inch diameter concrete pipe and receives storm water runoff from a 100% residential area of low density (5.4 DU/Ac). This site was visited eighteen times during the 2004 sampling season. Four samples were collected for *E. coli* analysis.

### **Pico Monitoring Results**

**Detergents** - Detergents were measured in samples from this site 18 times during the dry weather monitoring. The values for detergent ranged from non-detect to 0.1mg/L. Four of 18 measurements resulted in detectable concentrations of 0.1 mg/L.

**Residual Chlorine** - Chlorine tests were conducted at this site eighteen times during the 2004 monitoring season. Chlorine values ranged from non-detect to 0.2 mg/L. There was just one occurrence of chlorine being higher than the detection limit. This occurred on 8/28/04 with a concentration of 0.2 mg/L

**Copper** - Copper was measured eighteen times however no copper was detected at this site.

**Ammonia** - Ammonia was tested 18 times at this site with 7 positive results. Values ranged from non-detect to 0.25 mg/L with an average value of 0.078 mg/L. Six of the samples had concentrations of 0.1 mg/L and one had a concentration of 0.25mg/L, which occurred on September 7<sup>th</sup>.

**Turbidity** - All turbidity tests registered in the low range.

**Odor** - There was no odor detected for any of the samples.

**Color** - Seventeen of the 18 samples registered clear (BCS 93) for color. Samples taken from this site on July 26<sup>th</sup> registered color (BCS48)

**Flow and Discharge** - A steady flow was recorded at all 18 site visits. The depth of flow ranged from 0.4 to 1.0 cm with an average depth of 0.7 cm. The width of flow varied from 8 to 23cm and the wetted with values for the pipe were between 23 and 35cm.

**Air Temperature** - Seventeen readings were recorded for air temperature during the monitoring season. This site had the largest range of air temperature values 15.00 °C to 28.00 °C. The average air temperature was 20.5 °C with 8 values falling below the average and the lowest value occurring on September 21<sup>st</sup>.

**Water Temperature** - Seventeen water temperature readings were taken at this site. Values ranged from 14.50 °C to 17.00 °C, making it the site with the smallest range for

water temperature. The average value was 15.89 °C with only seven samples lower than this value.

**Conductivity** - The conductivity values from this site ranged from 980 to 1700 µS. The average value was 1231µS and the median value was 1200µS. None of the conductivity measurements from this site were considered a hit, because no value was above 2000µS.

**PH** - All of the samples tested for pH had values between 7.0 and 7.5.

**Trash** - Trash was observed only two times at this site and consisted of paper and styrofoam.

**Sewage** - No sewage was detected.

**Oil Sheen** - No oil sheen was detected.

**Surface Scum** - Surface scum was not detected at this site, however brown algae was noted in and around the pipe

**Orthophosphate** - Fifteen samples from this site were tested for orthophosphate using the Hanna phosphate meter. Values ranged from 0.055 to 0.222 mg-P/L with an average value of 0.105 mg-P/L, below the CCAMP Action Level of 0.12 mg-P/L.

**Bacteria monitoring** - Four samples were taken from this site for bacterial analysis. The total coliform values ranged from 1,226 to 7,308 MPN/100ml with an average value of 3,872 MPN/100ml. The *E. coli* values ranged from 5 to 1,684 MPN/100ml with an average value of 570 MPN/100ml. The bacterial concentrations at this site were considerably lower than the other sites.

### **PGSD 5 (Asilomar)**

The Asilomar site was not visited during the 2004 monitoring season for Urban Watch Monitoring, but was sampled once for bacterial monitoring. The results were 7,308 MPN/100ml for *E. coli* and >48,380 MPN/100ml for total coliform.

### **PGSD 6 (Congress)**

PGSD 6 storm drain outfall is located on the north side of Congress Avenue across from the Pacific Grove high school sports field. The outfall is approximately 500 feet from the intersection of Congress Avenue and Sunset Drive and is a 24-inch concrete pipe. Below the outfall, a stream channel runs through a wooded area called Rip Van Winkle Open Space. The Congress storm drain system receives runoff from an area that is almost 100% commercial (Country Club Gate Commercial Area) and institutional (Pacific Grove High School, Forest Grove School). This site was visited 18 times during the monitoring season.

### **Congress Monitoring Results**

**Detergent** - Eighteen samples were tested for detergent from this site. The values ranged from non-detect to 0.1mg/L. Four of these samples resulted in positive hits and had values greater than 0.1mg/L but less than 0.2mg/L

**Residual Chlorine** - Chlorine was measured at this site a total of 18 times throughout 2004. In seven of the samples, chlorine values ranged from 0.1 to 1.0 mg/L with an average chlorine value of 0.294 mg/L. There were positive hits at this site from 8/9/04 to 9/22/04. Previous year's data also showed high concentrations of chlorine that were traced back to the swimming pool at Pacific Grove High School. The City of Pacific Grove and the Pacific Grove School District were notified again of the chlorine detection. They investigated the problem and reduced the amount of chlorine used in the pool.

**Copper** - Copper was not detected in any of the samples.

**Ammonia Nitrogen** - Eighteen samples were tested for ammonia May- October. Of these samples, the values ranged from a low value of non-detect to 0.25mg/L with an average ammonia value of 0.086 mg/L. Seven of the samples had values equal to or greater than 0.1mg/L. Two of these samples had values greater than 0.1mg/L but less than 0.25mg/L.

**Turbidity** - All samples were within the low range for turbidity.

**Odor** - None of the samples tested positive for odor.

**Color** - Seventeen of the 18 samples registered clear (BCS 93) for color. On August 10<sup>th</sup> some color (BCS 91) was detected in the sample.

**Flow and Discharge** - A flow of water was present for every sampling event at this site. The depth of the flow ranged from 0.30 to 1.5 cm with an average value of 0.87 cm. The width of the flow ranged from 10 to 14 cm with most values approximately 12 cm. The values measured for the wetted width were between 13 and 17 cm.

**Air Temperature** - Seventeen air temperature measurements were taken and ranged from 15.00°C to 25.00°C .The average temperature for this site was 18.71°C.

**Water Temperature** - Seventeen water temperature values were recorded for this site. Water temperature values ranged from 18.20 to 20.90°C making it the site with the largest range for water temperature. The average temperature value was 19.6 °C with most values falling around this number.

**Conductivity** - The conductivity values for this site ranged from 100 to 2200 µS with an average value of 1369µS. However, most of the values were around the median value of 1500µS.

**pH** - Eighteen pH measurements were recorded between 7.0 and 7.5 for this site.

**Trash** - Ten of the eighteen site visits reported the presence of trash. The most common materials found were paper and plastic.

**Sewage** - No sewage was detected.

**Oil Sheen** - No oil sheen was detected.

**Surface Scum** - None of the field sheets indicated the presence of surface scum at this site.

**Orthophosphate** - Sixteen samples from this site were tested for orthophosphate yielding values between 0.160 and 0.287 mg-P/L. The average orthophosphate value was 0.228 mg-P/L above that of the CCAMP Action Level of 0.12 mg-P/L.

**Bacteria monitoring** - This site was visited four times to collect samples for bacteria analysis. The values for total coliform were between <1 and 6,152 MPN/100ml with an average concentration of 2,593 MPN/100ml. *E. coli* values were also considerably low and ranged from <1 to 5,818 MPN/100ml with an average concentration of 3,268 MPN/100ml. It is believed that the low bacteria concentrations were a result of the high chlorine present in the system at the time the samples were collected.

## VI. DRY WEATHER AND FIRST FLUSH MONITORING EVENT

Monitoring the “First Flush” was incorporated into the Urban Watch program starting in 2000, making 2004 the fifth year of the event. During the First Flush event volunteers monitor at the Urban Watch storm drain outfalls for conductivity, water temperature, pH, and transparency during the first significant rain each fall (>0.10 Inch), day or night. Samples are collected and sent to a certified laboratory for analysis of nitrate, orthophosphate, zinc, copper, lead, total, total dissolved solids (TDS), total suspended solids (TSS), and bacteria. The results were then compared to the Central Coast Ambient Monitoring Program’s (CCAMP) Action Levels. These action levels are not for regulatory purposes; rather they provide guidance on potential impacts to the health of the marine ecosystems.

In 2004 a “dry” weather monitoring day was added to the program. This monitoring day occurs prior to the first rain and allows for a ‘daylight’ monitoring of the storm drains and provided an in-field training day. This event served both as a field training day, as well as important data collection which provided insight to the water quality conditions of each storm drain during the dry weather season prior to the First Flush event.

The dry weather event took place on Sunday, September 26, 2004. The volunteers had been trained in the classroom to collect samples and record measurements for the First Flush event the week prior. On September 26<sup>th</sup>, coordinators met the volunteers in the field to demonstrate monitoring procedures and collection of samples, as volunteers would do during the First Flush event. Some highlights include:

- All of the sites had very low concentrations of zinc, copper and lead
- The orthophosphate water quality objective (0.16 mg/L) was exceeded at 8<sup>th</sup> Street, Asilomar, and Congress.
- The only site to exceed the nitrate water quality objective (2.25 mg/L) was 8<sup>th</sup> Street
- 8<sup>th</sup> Street, Greenwood Park, Lover’s Point and Pico all exceeded the water quality objective for *E. coli*. Greenwood Park and Lover’s Point were 10 times higher than the other PG sites and by far, the highest of all sites monitored during the Dry Weather event.

The First Flush Monitoring event occurred on Saturday, October 16, 2004 in the cities of Santa Cruz, Capitola, Monterey and Pacific Grove. Volunteers monitored storm drain outfalls for conductivity, water temperature, pH, and transparency. Samples were then collected and sent to a certified laboratory for analysis of nitrate, orthophosphate, zinc, copper, lead, total, total dissolved solids (TDS), total suspended solids (TSS), and bacteria. The results were compared to the Central Coast Ambient Monitoring Program’s (CCAMP) Action Levels. These action levels are not for regulatory purposes; rather they provide guidance on potential impacts to the health of the marine ecosystem.

A separate report has been written for the 2004 First Flush monitoring event. It will be sent to local area governments and agencies when it is finalized in early 2005. Some highlights:

- All of the sites in Pacific Grove exceeded the water quality objective for both copper and zinc.
- Each year, Asilomar has one of the highest copper concentrations. This year, it had the highest concentration at 270 mg/l and was double last year’s result.

- Nitrate concentrations were higher in PG at every site except Greenwood Park, exceeding the water quality objective of 2.25 mg/L. The concentrations ranged between 1.74 to 2.97 mg/L.
- Pico had one of the highest nitrate concentrations of all the sites at 2.97 mg-N/L.
- Lover's Point also had one of the three highest nitrate concentrations at 2.43 mg-N/L.
- Asilomar was the only site in Pacific Grove not to exceed the water quality objective for orthophosphate (0.16 mg/L).
- Lover's Point had the highest orthophosphate concentration of 11.4 mg-P/l. This is more than 5 times higher than the orthophosphate concentration at the majority of sites.
- Pico had one of the highest *E. coli* concentrations of all the sites at 198,628 MPN/100 ml.

This data will be used to assess the pollutant load of the waters flowing into the Monterey Bay National Marine Sanctuary. First Flush results are available by contacting Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Watershed Monitoring Network at (831) 883-9303. The 2004 First Flush Monitoring Report, as well as previous year's reports, can be found online at:

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

**VII. DISCUSSION-** Results from the 2004 Urban Watch Program data are discussed below on a parameter-by-parameter basis.

**Chlorine** - Chlorine was detected at Greenwood Park, and Pico on one occasion at each site and seven out of eighteen times at Congress for a total of 9 positive results for all the sites monitored. Chlorine data is comparable to the data collected last year. The highest chlorine results were at Congress and were attributed to the swimming pool at the Pacific Grove High School determined by the previous monitoring season volunteers. The high levels of chlorine at the Congress site may have influenced other parameters such as ammonia and bacteria.

**Detergents** - Detergent in the storm water system may result from residents washing automobiles in the street, use of commercial equipment outdoors, or illicit sewer connection. Although there is not regulatory criteria or CCAMP Action Level it is known that Detergents are toxic to many marine organisms. Even low concentrations of detergent can pose health threats to fish and aquatic organisms. Detergents have been shown to destroy the external mucus layers that protect the fish from bacteria and parasites, and can cause severe damage to fish gills. Detergent concentrations as low as 5mg/L can kill fish eggs and concentrations around 15mg/L will cause mortality. Therefore, it is important that volunteers continue to monitor for detergents and inform the proper people if levels are high or a trend exists.

Detergent surfactants have been detected in the storm drains monitored in this program for several consecutive program years. Detergents were found frequently throughout this year's program. Positive hits were found eleven times at 8<sup>th</sup> Street, ten times at Greenwood Park, seven times at Pico and four times at Congress, for a total of 32 positive detections, down from last year's 38 positive results. The highest individual value of 3.3mg/L was at Greenwood Park, which also had the highest average detergent of 0.29mg/L. This is consistent with last year's findings of high levels of detergent at this site. The lowest average of 0.06mg/L was found at Congress.

**Ammonia Nitrogen** - According to the Santa Cruz County Department of Environmental Health Services, as much as 0.5mg/L of Ammonium Nitrogen can be expected in the environment as background levels. Therefore samples with levels above this should be monitored more closely and evaluated to determine the source of the elevated concentrations. Natural levels of ammonia nitrogen are present in most water due to the biological decay of plant and animal matter. Higher concentrations may also be found in raw sewage and industrial effluents. Ammonia results at the outfalls are more than likely a result of runoff containing fertilizer applied to playing fields, yards and landscaped areas. From data collected in 2004, it does not appear that ammonia contamination is a problem at any of these sites.

Positive values of ammonia nitrogen were detected in 24 of the samples collected during the 2004 monitoring season, although none of the values were above 0.25mg/L. Individual sample concentrations ranged from non-detect to 0.25mg/L, while averages were between 0.072mg/L to 0.086mg/L. Ammonia concentrations at all sites were less than the previous year.

**Bacteria** - Bacteria monitoring is a key component of a watershed management program. Many sources of bacterial pollution exist including animal feces. High levels of bacteria in the storm water discharges may pose threats to the environment and to human health. Indicator organisms such as *E. coli* and total coliform are used to determine if enteric pathogens are present in the water. CCAMP uses the following criteria to identify bacteria

results that require further investigation, >400 MPN/100mL for *E. coli*, and >10,000 MPN/100ml for total coliform.

Samples from 8<sup>th</sup> Street had the highest concentration of both *E. coli* (48,380 MPN/100ml) and total coliform (48,380 MPN/100ml)—both of which are recorded as the upper limit of the analysis performed, 48,380 MPM/100mL. Congress had the lowest concentration of *E. coli* (<1 MPN/100ml) and total coliform (<1 MPN/100ml). These low levels of bacteria are expected to be due to the presence of the high concentrations of chlorine, which is an effective bacteria killing agent.

**Conductivity** - Conductivity is a measure of the free ions in the water and reflects the ability of the water to conduct electrical current. Measuring conductivity gives an indication of the amount of total dissolved solids (TDS) in the water, such as salts, sugars, mineral, and acids.<sup>1</sup> Conductivity is measured for the Urban Watch program in milli and micro Siemens (mS,  $\mu$ S), with temperature compensated meters. The collection of conductivity measurements in the Urban Watch program serves to characterize the baseline values for individual drainages, and provides for the detection of significant changes in the concentration of dissolved solids in the storm water.

During the 2004 Urban Watch season, conductivity values ranged from 980 $\mu$ S to 2800 $\mu$ S for all sites monitored. Eighth Street had the highest average of 2345 $\mu$ S; followed by Greenwood Park with 1800 $\mu$ S, Congress with 1369 $\mu$ S, and Pico with 1231 $\mu$ S. It should be noted that 8<sup>th</sup> Street had the lowest flow of all the sites monitored and drains an area of high and medium density development. The very high conductivity values as 8<sup>th</sup> Street may reflect the concentrated total dissolved solids resulting from the low flow of water at this site.

**Sewage Odor** - A sewage odor was not detected at any of the sites during the 2004 monitoring season. However a sulfur odor was noted at the Greenwood Park site but was not directly coming from the outfall.

**Trash** - Trash was frequently found at all of the sites except Pico. Trash, especially plastic, presents serious threats to the marine environment. More extensive outreach programs may help to lessen the amount of pollution entering into the storm drains and ultimately the total amount discharged into the Monterey Bay.

**Orthophosphate as Phosphorus** - This was the inaugural season for the orthophosphate Hanna low range (0.00mg/L to 2.5mg/L) portable meter that was used to measure orthophosphate as orthophosphate. Values were then converted to orthophosphate as phosphorus (PO<sub>4</sub>). Values ranged from 0.055mg-P/L to 0.756mg-P/L. The highest average orthophosphate value of 0.343mg/L was found at Greenwood Park. Phosphate concentrations in storm water discharges may be a result of fertilizer runoff. The Central Coast Ambient Monitoring Program Action Level for orthophosphate as P is 0.12 mg-P/L. Forty-five of 61 samples collected exceeded this water quality objective of 0.12 mg-P/L.

**Copper** - Copper consistently was not detected in any of the samples. This may be due to the sensitivity of the test not being in an acceptable range. This test could likely be discontinued or replaced with a more appropriate detection method.

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<sup>1</sup> State Water Resources Control Board (SWRCB), 2000. Measurements of conductivity/salinity, IP-3.3(EC). In: Watershed monitoring guidance: A Compendium of Information Papers and Standard Operating Procedures. Division of Water Quality, SWRCB, Sacramento, Ca. Sect 3.3: 10-2000

**Other considerations** - pH and water temperature are also important considerations in determining the suitability of the water for discharge. All of the pH measurements taken were in the neutral range. There were no unusually high water temperatures which may indicate illicit discharges, however, the water temperature measured during this program were generally found to be higher than normal surface flows in streams or creeks. The amount of flow from the storm water drainage may also influence the results.

## **VIII. CONCLUSIONS**

The 2004 Urban Watch season in Pacific Grove continued to provide very interesting information about the different sub-drainages in the city and the different pollutants found in urban runoff. In general, over the last three years, the number of times detergents were detected was down. Ammonia was up just slightly and chlorine detections were down by three from last year. *E. coli* concentrations were up at all four sites. Orthophosphate was a new parameter added this year using a hand held Hanna orthophosphate meter. All of the sites except for Pico regularly exceeded the orthophosphate water quality objective of 0.16 mg-P/L.

The data identify parameters of concern for each of the four sites. At 8<sup>th</sup> Street, *E. coli*, detergents, and orthophosphate were prevalent. At Greenwood Park, trash, detergents and orthophosphate were commonly detected. Chlorine and orthophosphate were detected regularly at Congress. All of the sites reported large amounts of trash. A more aggressive program should be considered to look at the relationship of contaminants to one another as well as the source of the pollution, and possible environmental hazards.

By conducting the Dry Weather monitoring event before the First Flush event we learned a little more about which other urban pollutants are flowing through the storm drains during the dry weather than those analyzed with the volunteer Urban Watch kit. Pollutants such as copper, zinc and lead, were not detectable at most of the sites. Orthophosphate and *E. coli* were common. Additional dry weather monitoring is recommended for these parameters throughout the Urban Watch program's monitoring season, perhaps quarterly or monthly.

Based on the urban watch monitoring results described above it is apparent that there is a continued need for targeted public outreach in this area to address the introduction of detergents, ammonia nitrogen, chlorine, orthophosphate and bacteria to the stormdrain system. Outreach campaigns such as the ones previously employed doing restaurant and neighborhood outreach, should continue and be expanded within the city limits as well as in the neighborhoods that feed these drainages.

In conclusion, the seventh season of Urban Watch in Pacific Grove was very successful. The teams of volunteers were reliable, enthusiastic, and very committed. Volunteers expressed a true interest and concern for the quality of water flowing from their town into the Sanctuary. Volunteers have a sense of pride and duty, which is why many come back year after year. Return volunteers would like to see even more public involvement as well as expanding the data collection to make it more useful for policy makers. Community programs where local citizens become physically involved in the health of local waterways within their city, and directly contribute to the improvement of water quality, are important to help preserve the many small watersheds of Pacific Grove and protect the Monterey Bay. Volunteers not only collect data, they become leaders in the

community and set examples for their neighbors and interested people who ask about what they are doing in the field working. This program should continue and should grow to be meet the needs of the City, the community, and the natural environment of Pacific Grove.

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## **References**

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