Urban Watch Monitoring Program
City of Monterey, California

Program Summary for the years 1997-2006

Program Administered by:
Tamara Doan
Coastal Watershed Council

And Implemented by:
Maris Sidenstecker
Water Quality Education Consultant for the City of Monterey

For:
The City of Monterey Public Works Department
Rick Riedl
City of Monterey Public Works Department

Report prepared by:
Bridget Hoover, Monterey Bay Sanctuary Citizen Monitoring Network
Tamara Doan, Coastal Watershed Council
Tamara Myers, Coastal Watershed Council

CITY of MONTEREY URBAN WATCH PROGRAM OVERVIEW

The City of Monterey Urban Watch storm drain monitoring program was initiated in June 1997 as a collaborative effort between the Coastal Watershed Council (CWC), the City of Monterey, and the Water Quality Protection Program of the Monterey Bay National Marine Sanctuary. The purpose of this project is twofold; first, to serve as a tool for education and outreach to the general community regarding the impacts that the citizens have on local water quality, and second, to collect useful data to support local environmental management decisions. This has been accomplished through the use of trained volunteers to monitor dry-season storm drain discharges at selected outflow areas from June through November of each monitoring year. As such, it partially fulfills the educational, public outreach, and monitoring requirements of the Phase II National Pollution Discharge Elimination System (NPDES) storm water discharge permits.

Working with staff from the City of Monterey Public Works Department, six sampling sites were initially established over the years. Monitoring locations were selected for their drainage basin and safe access for volunteers. The six sampling sites are referred to as: (1) *Steinbeck Plaza* located at the end of Prescott Street on Cannery Row; (2) *Twins* located near the recreation trail at Heritage Harbor, west of Fisherman's Wharf; (3) *San Carlos* at San Carlos Beach near the Breakwater; (4) *El Dorado* on Major Sherman Lane at El Dorado Street, North of Highway 1, Del Monte Shopping Center and Don Dahvee Park; (5) *Library*, Pacific Street and Madison Street; and (6) *Monte Vista* on the corner of Soledad and Via Esperanza near St. Timothy's church. Figure 1 shows the locations of these sites.

Table 1. Each site of the 1997-2005 Urban Watch monitoring site locations are characterized as follows:

Station Name	Station ID	Drainage Area (acres)	Primary Land Use	Description	Location	Receiving Water
El Dorado (Major Sherman)	MSD1 *or* MAJOR-31	NA	80% residential 20% commercial	Drainage ditch	Intersection of Major Sherman Lane & El Dorado Street	Lake (manmade)
Monte Vista	Monte Vista	NA	NA	NA	Corner of Soledad Drive and Via Esperanza	Ocean
Twin's	MSD3	365	90% residential 10% commercial	Two 51' diameter concrete pipes	Below walking path at Heritage Harbor-adjacent to Wharf I, west ~ 500ft.	Ocean
San Carlos	MSD4	70	40% commercial 35% residential 25% public land	36' diameter concrete pipe	On the beach adjacent to the west side of Coast Guard Pier	Ocean
Steinbeck	MSD5	37	90% commercial 10% residential	36' diameter concrete pipe	At Steinbeck Plaza on Cannery Row at the end of Pacific Street	Ocean
Library	MSD6 *or* LIBRA-31	467	100% residential	Drainage ditch	665 Pacific Street adjacent to the Monterey Public Library on the northeast side of Pacific Street	Ocean

NA = Information not available or unknown at this time.

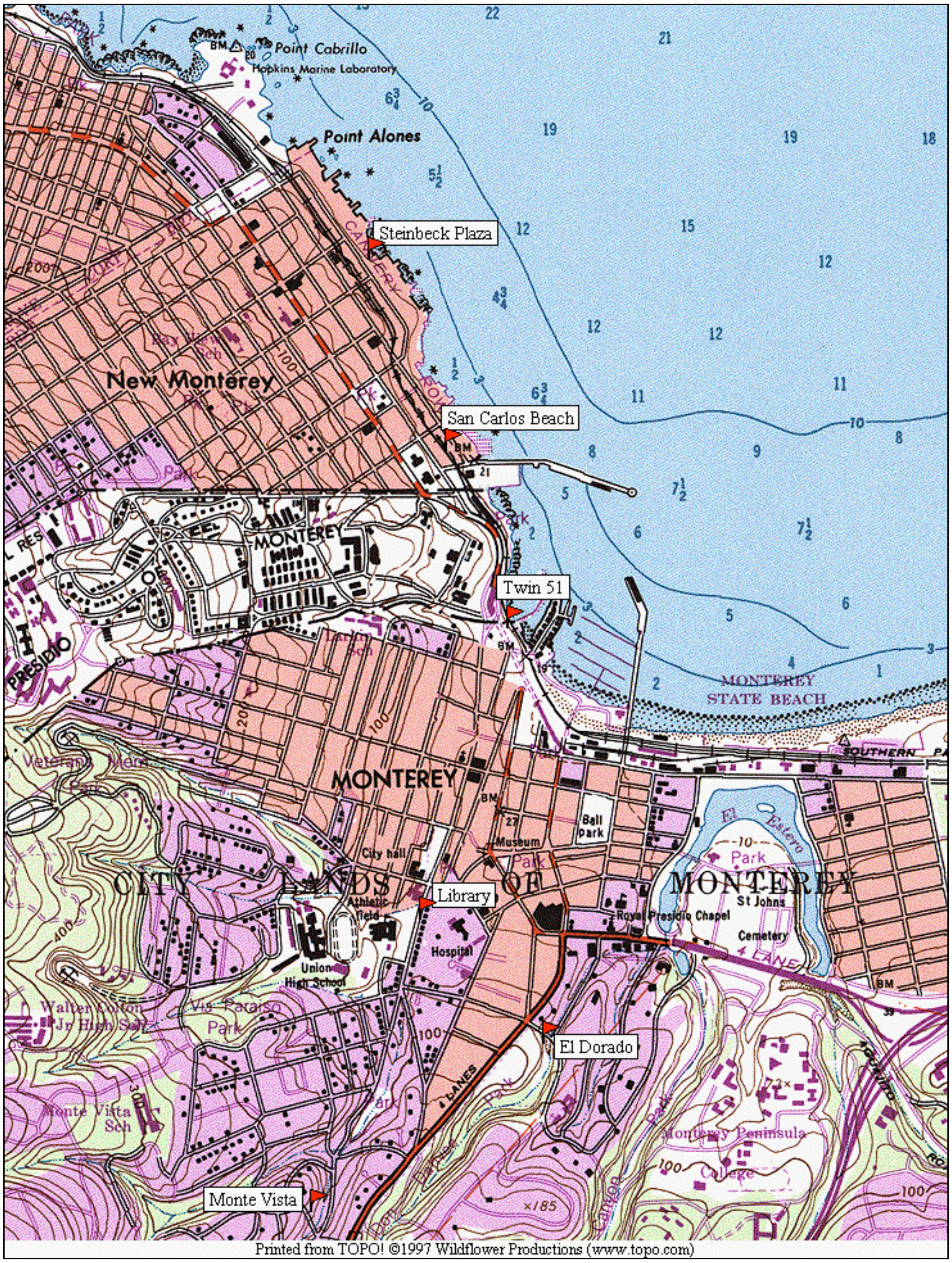


Figure 1. Locations of monitoring sites in the Monterey Urban Watch Program.

MONITORING PROGRAM DESIGN

The Urban Watch program originated with the use of the storm drain monitoring kit manufactured by the LaMotte Company (SSDK 7446) and designed in association with the City of Ft. Worth, Texas and the US EPA in 1990. The monitoring kit is designed to provide a method for volunteers to monitor dry-season storm drain discharges for identification of common urban pollutants and contaminants within the study area according to NPDES Phase I dry weather monitoring requirements and to detect illegal storm drain connections and discharges. Over the years we replaced the Oakton 'pHTestr' meter with pH strips for ease of use by volunteers, and added to this pre-assembled kit items such as digital and bulb thermometers, Oakton 'ECTestr' conductivity meters, and two Hanna Instruments hand-held meters: a Low Reading Orthophosphate for reading orthophosphates (PO_4^{-2}) and an Ammonia Nitrogen meter for measuring ammonia nitrogen (NH_3-N).

The Urban Watch program has always ended with the onset of the first significant winter rains, and since 2000 the Urban Watch Program has culminated with the "First Flush" monitoring event, wherein volunteers capture water samples from the storm drains monitored for the Urban Watch program during the first significant rain of the wet season. This rain covers the streets and flushes the gutters and storm drains of collected materials and pollutants that accumulate throughout the dry-season. Infield measurements of water temperature, conductivity, pH, and an assessment of transparency are taken by volunteers at the site, and samples are collected and sent to a professional lab where analysis of trace metals, nutrients, and pathogens are performed. The complete First Flush Event Annual Summary reports are produced by our program partner, the Monterey Bay Sanctuary Citizen Watershed Monitoring Network (Network), and summary reports from each year's First Flush event can be downloaded from their web site at: http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html

VOLUNTEER TRAINING

Volunteer trainings are hosted each year by the Monterey Bay National Marine Sanctuary, at their Monterey Facility on Foam Street. Topics include monitoring concepts, sampling procedures, the meaning of each parameter monitored, use of kits in the field, and safety protocols. Following a half-day classroom training and a formal in-field training, volunteers are divided into teams of three to five members each. From 1997-1998 volunteers were instructed to conduct sampling on a 10-12 day schedule. Volunteers conducted sampling twice within a 24-hour period with at least 4-hours between each sampling event. In 1999 volunteers were shifted to a bimonthly schedule; and in 2002 the schedule was again modified, wherein volunteers were instructed to conduct their monitoring twice within their assigned week, but no longer as two visits within the 24 hr period. Currently the monitoring program is implemented every other week during daylight hours, with volunteers monitoring twice within their assigned week (Monday-Sunday) at times of their own scheduling. Sample times and dates are randomized through this flexible schedule with the volunteers.

Volunteers were placed in teams according to general skill level, interest and time availability. An experienced water quality coordinator accompanied each team to provide a better level of quality control and coordination with City and Sanctuary staff. Team Leaders help coordinate volunteer scheduling.

PARAMETERS MONITORED

Parameters monitored include detergent surfactants, ammonia nitrogen, chlorine, turbidity (determined visually using a "Low-Medium-High" designation), pH, conductivity, water and air temperature, water odor, and water color. In 2004 orthophosphate was added, with volunteers using a Hanna ion specific colorimeter. During the first five years of the program Phenols were tested for; however few detections were ever recorded so that parameter was dropped from the analysis. Volunteers record visual observations of the following qualitative parameters: presence of an oil sheen or surface scum, sewage (sighted or smelled), and trash at the storm drain outfall; as well as any other observations specific to the sampling environment. The results are compared to the Central Coast Basin Plan and the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. Table 2 includes information on each of the parameters monitored and methods used for monitoring.

Table 2: Water Quality Parameters

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature (Water)	Illegal discharges, standing water, large paved surface areas	Affects rates of chemical and biochemical reactions in water; may adversely affect fish	Method - Digital thermometer Accuracy ± 1% full scale
Turbidity	Microorganisms, sediment, erosion, other particulates	Interferes with 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 overflows, animal wastes, pesticides & fertilizers, photosynthesis, respiration	Affects chemical and biochemical reactions in water; may interfere with fish and other aquatic life	Method – MacHerey-Nagel pH-Fix 4.5-10.0 color-fixed indicator strips Accuracy ± 0.25 units Min detection: 4.5
Detergent surfactants	Illegal or unintended discharges, car washing, cleaning of screens and grills, leaking sanitary sewers, cleaning of restaurant mats	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 ± 0.1 ppm Min detection: >0.1 ppm
Copper	Brake pads, copper architectural elements such as roofs or gutters; 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± 10%. Min detection: >0.25 ppm
Phenols	Disinfectants, toothpaste, mouthwash from domestic water	Interferes with fish and other aquatic life	Method- Aminoantipyrine Octa-Slide Comparator against color standard. Accuracy ± 10% Min detection: 0.5 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	Hanna Portable Meter Accuracy ± 10% mg/L Min detection: 0.0 mg/L
Chlorine	Illegal or unintended connection or draining of a swimming pool to a stormdrain; potable water line leaks	Toxic to aquatic life, can create a "sterile" environment	Method – DPD Octa-Slide Comparator against color standard. Accuracy ± 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
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
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 ± 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 (ie: 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, bacterial byproduct, or mineral deposits	Interferes with fish and other aquatic life	Method – Visual

SITES MONITORED

In the City of Monterey UW program's first year, 1997, the sampling sites were "Twins", "San Carlos" and "Steinbeck Plaza" only. From 1997-2001 the sampling site "Monte Vista" was added but then discontinued in 2002 due to unsafe access. Starting in 2001, the "Library" site was added to the program. From 2002-2006, the El Dorado, Twins, San Carlos, Steinbeck and Library sampling sites were monitored.

Volunteer monitoring occurred between Monday and Saturday. No Sunday data was collected for the 2006 program. Most events occurred in the middle of the week with the most common monitoring day being Wednesday; 2 on Monday (10%), 4 on Tuesday (20%), 7 on Wednesday (35%), 4 on Thursday (20%), 2 on Friday (10%), and 1 on Saturday (5%). The monitoring times varied; however, they were in the afternoon hours except for one monitoring day in the morning.

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

In 2004 CWC and the Network jointly submitted a Quality Assurance Project Plan (QAPP) for the 'Monterey Bay Regional Urban Watch-First Flush Monitoring Program' (MBRUW-FFMP). This document was approved by the Quality Assurance Officer for the Central Coast Regional Water Quality Control Board 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 assured by the implementation of the program as 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. Prior to this, many of the following activities were ongoing and new QA/QC procedures were being added until the formalization of the MBRUW-FFMP QAPP in 2004.

A sample of the Quality Assurance/Quality Control (QA/QC) program requirements included the Monterey Bay Regional Urban Watch-First Flush Program 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
- Continued supervision until the trainer was confident in the volunteers' sampling and analysis skills.
- Use of a Standard Operation Procedure for all UW volunteers to use in the field while monitoring.

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
- Storage of all original datasheets on the CWC premises for a minimum of 3 years

MONITORING RESULTS FOR 2006

Over the period of June 21, 2006 through October 25, 2006, monitoring took place at the five sites 20 times and a total of 100 individual monitoring events occurred. Volunteer availability and other influencing factors were taken into consideration throughout the program and not every parameter was tested on every site visit. Please see the appendix for a more detailed accounting of the data and a statistical analysis of the parameters measured. Appendix 1 includes Tables 1-7: Tables 1-4 provide comparisons of the parameters monitored, showing averages, minimum-maximum values, and frequency of exceedences or detections; Table 5 presents a consolidated record of the data collected in the field in tabular form by station; Table 6 presents filed data of detections with average, maximum, and minimum values; Table 7 presents a summary of all locations monitored, with average, minimum, and maximum values, and frequencies of all data collected for 2006. Appendix 2 presents data for the entire duration of the program from 1997 through 2006 and includes charts comparing parameter averages for each year.

The Water Quality Objectives (WQO) are listed for each parameter that has an approved 'criteria' or range; we have noted the origin of each determination. These criteria originate from accepted sources such as the United States Environmental Protection Agency (US EPA), the State Water Resources Control Board's (SWRCB) "California Ocean Plan", the Central Coast Regional Water Quality Control Board's (CCRWQCB) "Basin Plan", and the California Department of Fish and Game's (CDFG) "Salmonid Recovery Plan" (used predominantly where discharges flow directly to a salmonid stream).

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 of levels of a constituent where both human and wildlife health may be compromised and usually warrant further investigation. CWC refers to both the regulatory and non-regulatory 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; 'exceedence' is any 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 a detection and an exceedence. As well, pH values out of the normal range (6.5-8.0), or water temperatures above 26^{o}C are also identified as an 'exceedence,' or detection of unsatisfactory water quality conditions, based on the Salmonid Recovery Plan.

Of the five sites monitored throughout the duration of the program, all five consistently exhibited flow to be measured. Therefore, the following results reflect measurements taken at all five sites.

I. Quantitative Parameters

The parameters listed below were analyzed in the field using the LaMotte kit described in the Program Design section of this report.

Detergent Surfactants

WQO: None

Surfactants and detergents are common contaminants of surface water due to their common usage 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.[1] Detergent surfactants were developed in response to a shortage of animal and vegetable fats and oils during World War I and World War II. In addition, a substance that was resistant to hard water was needed to make cleaning more effective. At that time, petroleum was found to be a plentiful source for the manufacture of these surfactants. Modern detergents contain more than surfactants. Cleaning products may also contain enzymes to degrade protein-based stains, bleaches to de-color stains and add power to cleaning agents, and blue dyes to counter yellowing. Detergent surfactants are made from a variety of petrochemicals (derived from petroleum) and/or oleochemicals (derived from fats and oils).[2] The presence of detergent surfactants in a storm drain system is a strong indicator of run-off or effluent discharges.

There were 100 samples tested for detergent from the five sampling sites. Of those, 26 tested positive for detergent, or 26% of all samples tested. The site that detected the highest level of detergents was Steinbeck Plaza on 10/24/06 (2.0 ppm). Steinbeck Plaza detergents were detected 14 of 20 times (70%), yielding the highest frequency throughout the program. Detergent detections ranged between 0.20 ppm to 2.0 ppm at Steinbeck Plaza; of the 14 detections, with an average of 0.6 ppm; eight were between 0.5 ppm and 0.7 ppm, with a median value of 0.6 ppm. At San Carlos, detergents were detected in 8 of 20 samples (40%), with an average (median in parentheses) value of 0.5 (0.3) ppm. At Twins, detergents were identified in three of 20 samples (15%), with an average (median) of 0.2 ppm (0.2) ppm. At El Dorado detergents were only detected once (5%) with a value of 0.2 ppm. At the remaining site, El Dorado, detergents were not detected during the monitoring period (0%).

Ammonia Nitrogen (NH_3–N)

WQO: US EPA < 0.025 ppm for NH_3

Ammonia is excreted by animals and produced during decomposition of plants and animals. Its natural breakdown thus returns nitrogen to the aquatic system. It is rapidly oxidized in natural water systems by special bacterial groups that produce the ions of nitrite (NO_2), nitrate (NO_3), and ammonia nitrogen (NH_3–N), which are then used 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 overload the natural system and cause eutrophication. The unionized form of ammonia (NH_3) is the preferred nitrogen-containing nutrient for plant growth and is also one of the most important pollutants because it is relatively common, but can be toxic to animals, causing lower reproduction and growth, or death to fish and other aquatic life.

Ammonia nitrogen (NH_3–N) is the concentration of ammonia (NH_3) expressed in terms of the amount of nitrogen present in the sampled water. Ammonia nitrogen, often referred to as "total ammonia" 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]

---

[1] Sigma-Aldrich Co. http://www.sigmaaldrich.com/Brands/Fluka___Riedel_Home/Bioscience/BioChemika_Ultra/Detergents_Surfactants.html

[2] Soap and Detergent Association http://www.sdahq.org/sdalatest/html/soapchemistry2.htm

Because the WQO is only given for unionized ammonia (NH_3), it is necessary to convert the ammonia nitrogen (NH_4–N) data obtained from the Hanna meter to the unionized form of ammonia with a series of calculations based on water temperature and pH at the time of sampling[3]. The formula is as follows, where

$$pK = 0.09018 + \frac{2729.92}{273.2+T}$$ (T = temperature in Centigrade units) and $pH = -\log_{10}[H^+]$:

$$f\,NH_3 = \frac{1}{1 + 10^{pK-pH}} \quad \text{and} \quad f\,NH_4^+ = \frac{1}{1+ 10^{pH-pK}} \quad \text{and} \quad f\,NH_3 + f\,NH_4^+ = 1$$

During the course of the program ammonia-nitrogen was tested in the field using a Hanna Instruments ion specific meter with the following results: The highest detected value across all sites was 16.6 ppm, (obtained from a lab sample) located at San Carlos on 7/19/06. The average range of detection of ammonia nitrogen for all five sites was between 0.05 ppm (El Dorado) and 1.14 ppm (San Carlos). When the conversion was performed to the data collected, ammonia levels exceeded the WQO of less than 0.025 ppm NH_3 in 2 of the 100 samples collected (2%): at the San Carlos location on 7/19/06 (0.038 ppm) and at the Steinbeck site on 6/21/06 (0.035 ppm). Because the San Carlos reading in the field was so high, a sample was taken to the lab for verification and the result of 16.6 ppm of NH_4-N, after conversion to NH_3, was equivalent to 0.191 ppm of unionized ammonia, well above the WQO for this parameter.

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. Specific to this program is the fact that surface runoff and stormwater flows pick up copper and zinc from brake and tire wear and other chemicals in vehicle wash wastewater.

Copper was detected two times in the 100 samples tested (2%), once each at the Steinbeck and Library sites, both with a measurement of 0.25 ppm. There were no other detections of copper in the 2006 Urban Watch program.

Chlorine

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

Chlorine, as Cl_2 (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. Taste threshold is about 250 mg/l for most people, however, calcium or magnesium chloride are not usually detected by taste until levels of 1000 mg/l are reached. Public drinking water standards require chloride levels not to exceed 250 mg/l.[4] Very high detections 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.

Chlorine was detected four times out of 100 visits (4%), on 9/11/06 at El Dorado (0.2 ppm); on 9/26/06 at San Carlos (0.2 ppm); on 6/21/06 at Steinbeck (0.6 ppm); and on 6/21/06 at Library (0.2 ppm).

Orthophosphate (PO_4^{-2})

WQO: CCRWQCB CCAMP Attention level of > 0.37 mg/L orthosphosphate as PO_4^{-2}

[3] http://www.epa.gov/waterscience/criteria/ammonia/99update.pdf

[4] Leonardo Tequila, A Training Course For Water Quality Experts, Italy: http://www.italocorotondo.it/tequila/module2/pollution/forms_water_pollution.htm#Chlorides

Phosphorus is one of the key elements necessary for growth of plants and animals. Phosphorus in elemental form (P) is very toxic and is subject to bioaccumulation. Phosphates (PO_4) are formed from this element. Phosphates exist in three forms: orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate. Each compound contains phosphorous in a different chemical formula. Ortho forms are produced by natural processes and are found in sewage. Poly forms are used for treating boiler waters and in detergents. In water, these change into the ortho form. Organic phosphates are important in nature. Their occurrence may also result from the breakdown of synthetic pesticides which contain phosphates. They may exist in solution, as particles, loose fragments, or in the bodies of aquatic organisms. Rainfall can cause varying amounts of phosphates to wash from farm soils into nearby waterways. Phosphates will stimulate the growth of plankton and aquatic plants which provide food for fish. This increased growth may cause an increase in the fish population and improve the overall water quality. However, if an excess of phosphate enters the waterway, algae and aquatic plants will grow wildly, choke up the waterway and use up large amounts of oxygen. This condition is known as eutrophication, or over-fertilization of receiving waters. The rapid growth of aquatic vegetation can cause the death and decay of vegetation and aquatic life because of the decrease in dissolved oxygen levels.[5]

Orthophosphates are produced by natural processes and are found in animal wastes. Orthophosphates are often a limited resource, especially in fresh water systems. When naturally occurring levels become elevated, algal blooms can occur which may lead to oxygen depletion and to fish kills. During the course of the program orthophosphate was tested in the field using a Hanna Instruments ion specific meter and, on one occasion, in the laboratory when the field measurements were unusually high (7/19/06). The following are results from the in-field tests with the ion meter.

Of the 99 measurements taken, 78 of the samples (79%) indicated the presence of orthophosphates were over the WQO of 0.37 ppm. The highest detected value was 2.75 ppm at Steinbeck on 10/24/06. The average values across all sites ranged between 0.38 ppm (El Dorado) and 1.7 ppm (Steinbeck). The frequency of exceedences at Steinbeck were the highest at 19 out of 20 tests (95%), but measurements for Twins and Library resulted in 18 out of 20 tests (90%) exceeding the WQO, and at San Carlos 16 out of 19 tests (84%) were in exceedence. The lowest frequency of detections was for El Dorado, where eight out of 20 tests were exceedences, but the average of 0.38 ppm was still above the WQO.

II. Measured Values

Flow Presence

In the five storm drains that were monitored, flow was detected in 100 of 100 site visits (100%).

Air Temperature

Air temperature averages ranged between 18.9°C (Twin 51) and 21.3°C (Steinbeck) for all sites throughout the program. The lowest recorded temperature was 14.1°C at the Library site on 9/26/06, and the highest recorded temperature was 32.0 at El Dorado on 6/22/06. Averages for the other sites were: El Dorado (20.4°C), San Carlos (20.4°C), and Steinbeck (21.3°C).

Water Temperature

WQO: CCRWQCB Basin Plan > 26°C - Cold Water Fish Habitat

Water temperature averages ranged between 15.6°C (Library) and 19.0°C (Steinbeck) for all sites throughout the program. The lowest recorded temperature was 13.5°C at the Library site on 7/6/06, and the highest recorded temperature was 29.0°C at Steinbeck on 8/31/06. Averages for the other sites were: El Dorado (16.7°C), Twin 51 (17.4°C), and San Carlos (18.0°C).

[5] Kentucky "Water Watch": WWW.KYWATER.ORG; http://www.state.ky.us/nrepc/water/wcetp.htm

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 increases[6] (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 a temperature compensating Oakton ECTestr low range meter (0-1990 µS) or with an Oakton ECTestr high range meter (0-19.90 mS; 0-19,900 µS) to ensure no readings would be out of range.

A total of 100 samples were measured across all five sites. Conductivity readings averaged between 1339 µS (El Dorado) and 2590 µS (Library) for all 100 samples collected. The lowest recorded conductivity was 400 µS at San Carlos on 8/14/06, and the highest measurable conductivity value was 5800 µs, also at San Carlos on 10/24/06. The sites with the widest range of conductivity measurements were at the following: San Carlos (400–5800 µS), Library (1900 – 3800 µS), and Twins (1100–2800 µS). Measurements taken at Steinbeck for conductivity ranged between 1000–2200 µS, and El Dorado had the narrowest range of conductivity at 100 – 2200 µS. Overall, 24 out of 100 conductivity results (24%) were above the attention level of 2000 µS, with tests at the Library site resulting in the highest frequency of exceedences (16 out of 20 tests or 80%) .

pH
WQO: >6.5 or <8 pH units.
The pH is a measure of the acidic or basic (alkaline) nature of a solution. A pH range of 6.0 to 8.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates. It is also worth noting that both ocean water and human blood has an average pH of 7.0. Typical rainwater has a pH of 5.6 to 5.8, making it normally slightly acidic. There are both natural and non-natural sources of materials that cause rain pH to deviate from this, however, values of below 5.6 are considered "acid rain".[7]

The values for pH throughout the program averaged from 7.0 (Twins) to 7.4 (Steinbeck). The highest measurement was 7.5 at all sites. The most common pH measurement for all five sites was 7.0, which was recorded on 63 out of 97 monitoring events (65%).

III. Qualitative Parameters
(Visual observations)

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. "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.

Odor
The observation of "Odor" is taken from the sample water collected, and 'measured' away from the storm drain location; volunteers are instructed to determine if the water itself carries an odor, not the general location. Odors were reported in 12 out of 100 monitoring events at the five sites (12%). The odor was mostly reported at Steinbeck, and was noted as being a musty or septic odor.

[6] Lenntech Water Treatment & Air Purification Holding B.V: http://www.lenntech.com/water-conductivity.htm
[7] Department of Geology & Geophysics, University of Hawaii: "Ask an Earth Scientist": www.soest.hawaii.edu/GG/ASK/rain-creek-pH.html

Color
Water samples were compared to a Borger Color System (BCS) booklet used to identify colors in nature. Sixty-one of the 100 samples were reported as colorless (61%). Of the remaining 39 samples, volunteers indicated the water samples to be a pale yellow and pale tan, to drab grays and drab browns.

Oil sheen
Oil sheens were detected two times out of the 100 samples collected over the monitoring period. Oil sheens were detected twice at the Steinbeck site, on 7/19/06 and 8/3/06.

Sewage
Sewage smell was noted on 5 of 100 monitoring events (5%). Three of those detected were reported at El Dorado and two were reported at Steinbeck Plaza..

Surface scum
Surface scum was reported 30 times of 100 monitored events at the five sites (30%), up from 14 % in 2005. In most cases 'bubbles,' 'algal scum' and 'foam' were reported to be a component of the surface scum. The highest indicator of surface scum was detected at the Library site, in 17 of 20 visits (85%). Surface scum was reported at all other sites, but with much lower frequencies (25% at Steinbeck, 20% at Twins, 10% at San Carlos, and 5 % at El Dorado).

Trash
Trash was reported in 84 of 100 site visits (84%), an increase from 76% in 2005. Trash was noted at all five sites with high frequency: Steinbeck Plaza had trash sited in 19 of 20 visits (95%); Library had trash sited in 19 of 20 visits (95%); San Carlos had trash sited in 17 of 20 visits (85%); Twins had trash sited in 18 of 20 visits (90%); and El Dorado had trash sited in 11 of 20 visits (55%). The most common trash observations included Styrofoam, aluminum, cigarette butts and plastic wrappers.

Turbidity
Out of the 100 samples, turbidity was consistently low for all sites during the monitoring season.

IV. Additional Data

Laboratory Analysis
Samples were taken for lab analysis on one monitoring day, 7/19/06, because field measurements for orthophosphates, detergent surfactants, and ammonia nitrogen were unusually high. The lab results confirmed that these parameters were all much higher than the WQO. Orthophosphate (PO_4^{-2}–P) measured 1.15 ppm (WQO < 0.12 ppm); ammonia nitrogen measured 16.6 ppm, which converts to 0.191 ppm of unionized ammonia (WQO < 0.025); and detergent surfactants measured 0.16 ppm.

V. First Flush Event

During the First Flush event, rainfall is sufficient to wash the streets and clean the gutters and storm drains of collected materials and pollutants that have accumulated throughout the dry-season. Infield measurements of water temperature, conductivity, pH, and transparency are taken by volunteers at the site. 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 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. The pollutants detected, in part, are a result of the daily activities of the local population as well as the many visitors that come to this region each year. High metal concentrations may be attributed to car brake linings; high nutrient concentrations may be linked to fertilizers; and high bacteria concentrations can be generated by failing sewer and septic lines, wildlife and pet waste.

The 2006 First Flush event was held in the cities of Monterey, Pacific Grove, Seaside, Capitola, Half Moon Bay, and Santa Cruz. In 2006 this event occurred on different days in different cities: October 4, 2006 in Half Moon Bay and Santa Cruz; on November 2, 2006 in Capitola; on November 3 in Pacific Grove and parts of Monterey; and on November 11th for the eastern part of Monterey and Seaside. For the 2006 Monterey First Flush event, nineteen trained volunteers participated in the collection of samples and measurements.

A separate report will be written for the 2006 First Flush monitoring event which will be made available to the public and sent to local area governments and agencies. This data will be used to assess the pollutant load in the waters flowing into the Monterey Bay National Marine Sanctuary. The results of First Flush event are available by contacting Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Watershed Monitoring Network at (831-883-9303). Previous First Flush reports can be downloaded from the Internet at: http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html.

MONITORING PROGRAM RESULT DISCUSSION

Results from the 1997–2006 Urban Watch Program data indicate that orthophosphates and detergent surfactants were the most common pollutants detected. Detergent surfactants are still being detected, though at a slightly lower frequency (26%), and the averages have dropped over the last few years. Copper detections have decreased significantly this year, and chlorine detections have continued to stay low over the past 6 years. The following section will present a discussion of results by parameter and by station.

Parameter Detections

- **Detergent** surfactants have consistently been detected in the storm drains monitored in this program for all monitoring years, though the averages have been declining since the beginning of the program in 1997. Detergents were found most frequently throughout the program and in high concentrations at the Steinbeck Plaza, San Carlos, and Twins sites. However, in 2005 there was a significant decrease in detergent detections across all sites except Steinbeck; in 2006 26% of the test results were detections, in 2005 detergents were detected in 18% of the samples, in 2004 detergents were detected in 29% of the samples and in 2003 detergents were detected in 46% of the samples (from 97'-'02 detergent detections ranged from 16-71%). The most frequent site for detergent through all years was consistently Steinbeck Plaza, which also yielded the highest concentrations of detergents throughout the program (ranging from 1.6 to 4.6 ppm). During the program, a site known for its high frequency of detergent detections, Twins, had results that decreased from 42% in 2003 to 25% in 2004 to 0% in 2005, and then rose slightly to 3% in the 2006 program.

  Detergents are a significant inhibitor to fish health. In concentrations as low as 2.0 ppm, detergents can cause fish to absorb double the amount of chemicals they would normally absorb. All detergents destroy the external mucus layers that protect the fish from bacteria and parasites. Detergents can also cause severe damage to fish gills. Detergent concentrations as low as 5 ppm will kill fish eggs; when detergent concentrations near 15 ppm, most fish will die.

- **Ammonia nitrogen** levels have remained somewhat consistent over the most recent years. It should be noted that in earlier years the test was not done as frequently as in more recent years. Steinbeck Plaza and Twins sites continue to be the largest contributors of ammonia nitrogen to the marine environment (highest levels ranging from 0.8 - 4.0 ppm), though in 2006 the maximum result for the entire program (16.6 ppm) was at San Carlos. According to the Santa Cruz County Department of Environmental Health Services as much as 0.50 ppm of ammonium nitrogen can be expected in the native system as background levels, and detections above 0.50 ppm should be looked at more carefully (Peters 2001).

Low-level ammonia nitrogen may be present in water naturally as a result of the biological decay of plant and animal matter. Higher concentrations may be found in raw sewage and industrial effluents, particularly from petroleum refineries where ammonia is a by-product of the refining process. Ammonia is also a major component of fertilizers. High concentrations in surface waters can indicate contamination from waste treatment facilities, industrial effluents or fertilizer run off. Excessive ammonia concentrations are toxic to aquatic life. (CHEMetrics, Inc.: webpage)

- In 2004, the Urban Watch monitoring program added the analysis for **phosphates** in the form of orthophosphates. Phosphates can accumulate from runoff of fertilizers or car washing chemicals, and can be toxic to aquatic flora and fauna at concentrations of 0.37 mg/L or higher (using CCAMP action levels for PO_4^{-2}). The frequency of exceedences for phosphates over this criterion across all five sites was 97% in 2004, decreased to 82% in 2005, and decreased further to 79% in 2006. Volunteers reported the highest frequency of phosphate exceedences and the highest concentration of phosphates at Steinbeck Plaza and Twins sites. Once again, Steinbeck Plaza and Twins sites continue to be the largest contributors of pollutants to the marine environment during the ten years of the Urban Watch monitoring program.

- **Copper** was detected twice in 2006, eight times in 2005, once in 2004, and five times in 2003. Copper detections can be caused by brake pads, copper architectural elements such as roofs or gutters, illegal discharge into the storm drain system and can also occur naturally in surface waters. Concentrations over 0.025 ppm are toxic to most freshwater fish. Copper detections have been found at all sites through the years, though in 2001 there were no detections and in 2002 and 2004 there was only one detection.

- Although the Twins, San Carlos, and Steinbeck outfalls drain to the ocean, none are inundated with seawater during the dry-season monitoring period. The affect of ocean 'spray' may be a contributing factor in higher **conductivity** findings than in other locations; therefore, upstream measurements are recommended to clarify this factor. The El Dorado and Library sites are inland a mile or more and would therefore not have any sea influence. Identifying the source(s) of water flowing through the storm drains in question and understanding the local geological and environmental influences would provide a more detailed insight to the conductivity of the water flowing at these sites to determine if this is a natural state or if some anthropogenic influence is artificially raising conductivity at these sample collection sites.

- It should also be noted that **pH** levels have been recorded above 8.0 throughout the monitoring period, with the exception of 2006 and 2003. In 1997-2000 testing resulted in average pH values of 7.8 - 8.2, with a maximum of 8.9. The average pH dropped in 2001 to 7.5, and was at 7.3 - 7.4 from 2002 through 2005, and dropped again in 2006 to 7.2. pH values above 8.5 can be harmful to many animals, affecting cellular metabolism and changing solubility of other toxic substances in the water. High pH levels can be caused by high algal growth, increased water temperature, or from manmade influences that increase nutrient levels in the water.

- The frequencies of **trash** throughout the years of the program have consistently been high, ranging from 74% to 89% across all sites monitored. The presence of trash can severely affect water quality as it interferes with the natural cycle of fish and other aquatic life, thereby reducing their chance of survival.

- **Color** was recorded as being other than clear at frequencies of 25 to 55% for the 2006 program.

- **Odor** was detected mostly at the Steinbeck site in 2006, at 11 out of 20 samples tested (55%), and was recorded as being a musty or septic odor. The frequency of this observation is up from 0% in 2005, and close to the frequency of observations of 14% in 2004.

Detections by Site

- **El Dorado:** In 2006 the only noteworthy exceedence at El Dorado was orthophosphate, at a frequency of 40%. Trash was reported during 11 out of 20 visits (55%) and a slight sewage odor during three out of 20 visits (15%). Though chlorine averages were high (ranging .45–6.4 ppm) before 2000, the averages have been near the detection limit of the test from 2000 through 2006. This site had the lowest ammonia nitrogen average of all sties in 2006 (0.05 ppm), as well as the lowest detergent detections (0%), and orthophosphate average (0.38 ppm).

- **Twins:** Results of tests at Twins in 2006 were some of the highest in frequencies of exceedence, with 90% for orthophosphates, 15% for detergents, and 90% for recordings of trash. Most parameters have had fairly consistent averages each year, though detergent averages have declined somewhat since 2003. In addition, pH testing resulted in one measurement at the lowest attention level limit of 6.5 in 2006. The average orthophosphate result was 1.4 ppm in 2006, well above the WQO of 0.37 ppm. Also surface scum was reported on 4 out of 20 visits (20%).

- **San Carlos:** The parameter with the highest exceedence frequency at San Carlos in 2006 was orthophosphate, with 16 out of 19 visits (84%) in exceedence of the WQO, an average of 0.7 ppm (significantly above the 0.37 ppm WQO), and the second highest orthophosphate maximum of all five sites (2.6 ppm). Detergents were detected in 40% of all tests in 2006 (average of 0.5 ppm) and have been detected with some of the highest program averages throughout the ten year period. The ammonia nitrogen average increased in 2006 to 1.1 ppm, with the highest maximum value in the history of the program of 16.6 ppm; this was a lab result recorded on 7/19/06 after field testing results were over the detection ability of the meter. Conductivity readings were in exceedence of the attention level of less than 2000 µS during 4 out of 20 measurements (20%), with a maximum of 5800 µS. Trash was observed on 17 out of 20 visits (85%).

- **Steinbeck:** Again, the highest frequency of exceedences at Steinbeck was for orthophosphates in the 2006 program, at 19 out of 20 (95%), with an average of 1.7 ppm (also well above the WQO f 0.37 ppm), and the highest maximum result in the 2006 program of 2.75 ppm. Testing at this site for ammonia nitrogen resulted in an average of 0.7 ppm and a maximum of 3.3 ppm (both the highest in the 2006 program). The second highest frequency of detergent detections was also at this site, at 14 out of 20 (70%), with an average detection of 0.6 ppm and a maximum value of 2.0 ppm (the highest detergent result in 2006). In addition, the highest detection for chlorine (0.6 ppm) was found at Steinbeck, though there was only one chlorine detection in 2006 at this site. Over the course of the program, detergent test results have consistently been at values higher than recommended for healthy aquatic ecosystems. Also at this site was the only record in 2006 of water temperature above the attention level (26^{o}C): 29.0 ^{o}C. Copper was detected once in 2006 (0.25 ppm), though it was below the WQO of 0.3 ppm. Trash was recorded for 19 out of 20 visits (95%), surface scum at five out of 20 visits (25%), oil sheen at two out of 20 visits (10 %), and sewage smell at one out of 20 visits (5%) in 2006. Odor was also detected in 11 out of 20 samples tested (55%), and was described as being musty or septic.

- **Library:** The Library site had the second highest frequency of exceedences for orthophosphates in 2006, at 18 out of 20 tests (90%), though the average and maximum values were much lower than the other sites with high frequencies: 0.55 and 0.84 ppm, respectively. Ammonia nitrogen results had an average of 0.28 ppm and a maximum of 0.84 ppm. Detergents were detected once in 2006 at 0.2 ppm , copper was detected once at 0.25 ppm, and chlorine was detected once at 0.2 ppm, all near the lower detection limit of the test or below the WQO for that parameter. Trash was observed during 19 out of 20 visits (95%), and surface scum at 17 out of 20 visits (85%), the highest frequency for this parameter in 2006. Over the years the ammonia nitrogen averages have been rising, but the other parameters averages have stayed consistently near the detection limits of the testing equipment used.

CONCLUSION

This year marks another successful year for the Urban Watch program, and a opportunity to reflect on ten years of citizen monitoring and the collection of data in the City of Monterey. Through an extensive network of public education activities, there have been many advances made in raising awareness of the storm drain system. The volunteers have been committed to the monitoring and ensuring their efforts result in improved water quality in the City of Monterey and surrounding Monterey Bay National Marine Sanctuary.

The 2006 monitoring program findings for the City of Monterey have continued to indicate a trend in decreasing results for many parameters as compared to earlier monitoring events. In the earlier years of the Urban Watch program, volunteers at Twins were detecting some of the highest frequencies of detergents throughout the program. During more recent years, and especially in the 2006 monitoring season, detections of detergents at Twins have continued to remain low: from 29% in 2004 to 10% in the 2005 program, and 15% in 2006. However, it is important to stress the recurrent detection of detergents, ammonia nitrogen and orthophosphates at Steinbeck Plaza as well as at Twins. Steinbeck Plaza detected detergent surfactants in 85% of samples tested in 2005 and 70% in 2006, and also yielded the highest concentration of detections and had the highest frequency and highest concentrations in ammonia nitrogen and orthophosphates. Storm drain water from these two sites continues to be the largest contributors of detergents, ammonia nitrogen and orthophosphates found during the monitoring program. In addition, further investigation by the City of Monterey Public Works Department to strategically locate some new sites “up the watershed” is warranted in order to determine where these pollutants enter the system. With ten years of data collected, we recommend looking further into the drain system to identify more localized sources of flow. Furthermore, outreach should continue to be directed at businesses and increase in the neighborhoods that drain into this part of the storm drain system, such as the extensive work being done by the Storm Water and Education Alliance (SEA).

In order to increase in the quality and/or quantity of data collected during the Urban Watch Program, steps may need to be taken in order to modify the current tests to include new parameters, expand the detection ranges with new monitoring equipment, or to eliminate parameters that have rarely or never been detected over the ten-year period. Suggestions include purchasing new and improved test kits for ammonia, oil and grease, nitrate, and kits to detect for lower limits of copper. This should be done as the result of a data review with the city of Monterey Public Works Department and the Coastal Watershed Council as the first step of establishing the 2007 program.

Trash proved to be an obvious ‘public’ pollutant in the study area. Encouragement of frequent community ‘Stream Clean-Up’ days, or targeted notices posted to point out the problem could be beneficial in trash abatement. 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 the 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 and to the ocean.

In 1997-1998, the City of Monterey paid for the cost of video production for local restaurant outreach. The seven minute bilingual video went to restaurants and their staff which detailed proper BMP’s along with posters and brochures that were given out. The video was designed from a direct request from restaurant managers to use in training their staff, and it proved to be the easiest tool in training as there is such a high turnover rate in the restaurant industry. The video was produced in 1999 and was distributed in 2000, but since then the outreach to restaurants has been more sporadic. The Monterey Bay Marine Sanctuary has recently received a grant to hire a part time employee to do restaurant outreach. By having one person that can dedicate their time to restaurant outreach, all restaurants will be given the proper tools to educate their employees about storm drain pollution. The video (created in 1997) has also recently been adapted and is being used by the Cities of Santa Barbara and Watsonville and the Green Business Outreach Program which targets Santa Cruz and Monterey Counties.

In addition to restaurant outreach, the Storm Water and Education Alliance (SEA) also started a hands-on school outreach program in 2004 for 4th-6th graders. The program consists of a classroom visit to educate students on storm water pollution, followed by a second visit to take the students into the field for stencil application to the local storm drains. Since 2004, as part of the SEA Program, the City of Monterey has also done an excellent job utilizing specific marketing techniques and other outreach materials as public education tools in pollution prevention. Examples of these are press ads in local newspapers, radio ads partnered with the County of Santa Cruz, and bus and theatre ads in Monterey and Salinas. In an effort to educate the public about alternatives to toxic pesticide use, Our Water Our World (OWOW) was also started in 2004 to provide displays and educational resources to local garden stores, including Orchard Supply. Along with the literature, Orchard Supply also specially marks the non-toxic choices on the store's shelves. Since starting this program, Orchard Supply saw a 20% increase in sales of the non-toxic pesticides within one year.

Although there is significant outreach being done, the data results continue to show the need for a targeted public education program for urban runoff control within the city limits as well as in the neighborhoods that feed these drains. Other prevention methods to continue include working with the Chamber of Commerce and other business associations to promote clean water practices, such as widely available brochures and community storm drain stenciling events .

In conclusion, the City of Monterey is to be commended for continuing the Urban Watch monitoring program for an eleventh season in 2007 to augment the data presented here. Recommendations for the 2007 program include: 1) assess upstream sources of illicit discharges and pollutant sources; 2) support the investigation of additional parameters for study; and 3) continue outreach programs targeting local businesses, schools and residents to further reduce detergent concentrations and other sources of pollution from entering the Monterey Bay National Marine Sanctuary.

Resources

Katzneslon, R. PhD, State Water Resources Control Board, State of California. Personal communication. 1/10-17/2003.

Peters, Steve. Water Quality Specialist, Santa Cruz Department of Environmental Health Services, Santa Cruz County, CA. Personal communication. 12/18/2001. T. C. Doan.

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

Camp, Brian. Environmental Supervisor, Water Quality Division, Department of Environmental Management, City of Fort Worth, Texas. 4/6/2000.

Karen Worcester, Central Coast Ambient Monitoring Program, Personal communication, 3/12/2007, T.C. Doan http://www.epa.gov/waterscience/criteria/ammonia/99update.pdf

City of Monterey Urban Watch Storm Drain Monitoring Program
Data Results June 21 - October 25, 2006

Appendix 1: 2006

Summary Table 2

Urban Watch Monitoring Maximum Values (ppm)

	Chlorine	Copper	Detergents	PO_4^{-2}	NH_3-N
WQO:	**NA**	**> .03 ppm**	**> 0.0**	**0.37 ppm**	**NA**
Minimal Detection Limit:	**>0.2**	**>0.0**	**>0.1**	**0.0**	**>0.01**
El Dorado	**0.2**	ND	ND	**0.85**	0.21
Twins	ND	ND	**0.2**	**2.54**	**0.94**
San Carlos	**0.2**	ND	**1.5**	**3.00**	**16.60**
Steinbeck	**0.6**	**0.3**	**2.0**	**2.80**	**3.30**
Library	**0.2**	**0.3**	**0.2**	**0.84**	**1.53**

Gray cell with bold font = Exceedence of WQO

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

NA = WQO not available for this parameter

Summary Table 3
Urban Watch Monitoring Exceedence Frequency Values

	Detergents (ppm)		Copper (ppm)		Chlorine (ppm)		Ammonia Nitrogen (ppm)	
El Dorado	0 out of 20	0%	0 out of 20	0%	1 out of 20	5%	0 out of 20	0%
Twins	3 out of 20	15%	0 out of 20	0%	0 out of 20	0%	0 out of 20	0%
San Carlos	8 out of 20	40%	0 out of 20	0%	1 out of 20	5%	1 out of 20	5%
Steinbeck	14 out of 20	70%	1 out of 20	5%	1 out of 20	5%	1 out of 20	5%
Library	1 out of 20	5%	1 out of 20	5%	1 out of 20	5%	0 out of 20	0%

	PO_4^{-2}		Turbidity (>Low)[t]		Conductivity (uS)*		Presence of flow	
El Dorado	9 out of 20	45%	0 out of 20	0%	0 out of 20	0%	20 out of 20	100%
Twins	18 out of 20	90%	0 out of 20	0%	4 out of 20	20%	20 out of 20	100%
San Carlos	15 out of 20	75%	0 out of 20	0%	4 out of 20	20%	20 out of 20	100%
Steinbeck	19 out of 20	95%	0 out of 20	0%	1 out of 20	5%	20 out of 20	100%
Library	18 out of 20	90%	0 out of 20	0%	16 out of 20	80%	20 out of 20	100%

Example of how to read these values: "7 out of 8" = detergents were detected 7 times of the 8 times measured at Site X.

Summary Table 4
Urban Watch Monitoring Frequency Values

	trash		sewage	
El Dorado	11 out of 20	55%	3 out of 20	15%
Twins	18 out of 20	90%	0 out of 20	0%
San Carlos	17 out of 20	85%	0 out of 20	0%
Steinbeck	19 out of 20	95%	1 out of 20	10%
Library	19 out of 20	95%	0 out of 20	0%

	oil sheen		surface scum	
El Dorado	0 out of 20	0%	1 out 20	5%
Twins	0 out of 20	0%	4 out of 20	20%
San Carlos	0 out of 20	0%	2 out of 20	10%
Steinbeck	2 out of 20	10%	5 out of 20	25%
Library	0 out of 20	0%	17 out of 20	85%

	odor		color	
El Dorado	1 out of 20	5%	5 out of 20	25%
Twins	0 out of 20	0%	8 out of 20	40%
San Carlos	0 out of 20	0%	5 out of 20	25%
Steinbeck	11 out of 20	55%	11 out of 20	55%
Library	0 out of 20	0%	9 out of 19	47%

Example of how to read these values: "7 out of 8" = detergents were detected 7 times of the 8 times measured at Site X.

T5: UW 2006 Monterey Field Data By Station (2 pages)

StationID	Date	Time	Trash		Sewage		OilSheen		Scum		AirTemp	CHL	Color		Cond	CU	DET	NH_3-N	pH	PO_4-P	PO_4^{-2}	H_2OTemp
Units											C⁰	ppm	BCS		uS	ppm	ppm	ppm		ppm	ppm	C⁰
WQO												< 0.2			< 2000	< 0.03	< 0.1	NA	6.5-8.0	< 0.12	< 0.37	< 26
EL DORADO																						
309-MSD-01	6/21/06	12:34 PM	TRUE	1	FALSE		FALSE		FALSE		27	0.2	93		1300	0	0.1	0.07	7.5		0.45	15.2
309-MSD-01	6/22/06	4:36 PM	TRUE	1	FALSE		FALSE		FALSE									0				
309-MSD-01	*6/22/06*	*4:36 PM*	*TRUE*		*FALSE*		*FALSE*		*FALSE*		32	0.2	93		1300	0	0.1	*0.03*	7		0.36	20
309-MSD-01	7/5/06	5:50 PM	TRUE	1	FALSE		FALSE		FALSE		20.2	0.2	93		950	0	0.1	0.03	7		0.39	14.8
309-MSD-01	7/7/06	5:57 PM	FALSE		FALSE		FALSE		FALSE		18	0.2	93		1230	0	0.1	0.01	7		0.44	14.5
309-MSD-01	7/19/06	4:36 PM	FALSE		FALSE		FALSE		FALSE		21.6	0.2	92		1100	0	0.1	0	7		0.85	17.5
309-MSD-01	7/20/06	3:55 PM	FALSE		FALSE		FALSE		FALSE		18.4	0.2	93		1100	0	0.1	0	7.5		0.56	18.4
309-MSD-01	8/1/06	6:00 PM	FALSE		FALSE		FALSE		FALSE		17	0.2	92	1	1400	0	0.1	0.04	7		0.23	15.5
309-MSD-01	8/3/06	5:40 PM	FALSE		FALSE		FALSE		FALSE		22	0.2	92	1	1250	0	0.1	0.1	7		0.26	15.5
309-MSD-01	8/14/06	11:02 AM	TRUE	1	FALSE		FALSE		FALSE		20	0.2	93		1400	0	0.1	0.01	7		0.5	18
309-MSD-01	8/16/06	4:10 PM	FALSE		FALSE		FALSE		FALSE		20	0.2	36	1	1200	0	0.1	0.04	7		0	19
309-MSD-01	8/31/06	5:40 PM	TRUE	1	FALSE		FALSE		FALSE		16.5	0.2	93		1400	0	0.1	0.03	7		0.28	15.9
309-MSD-01	9/1/06	4:30 PM	TRUE	1	TRUE	1	FALSE		FALSE		18.4	0.2	93		1240	0	0.1	0	7		0.53	16.6
309-MSD-01	9/11/06	4:03 PM	FALSE		FALSE		FALSE		FALSE		25	0.2	91	1	1300	0	0.1	0.11	7		0.27	19
309-MSD-01	9/12/06	4:07 PM	TRUE	1	FALSE		FALSE		FALSE		25.1	0.2	93		1200	0	0.1	0.02	7		0.37	19.6
309-MSD-01	9/26/06	4:30 PM	TRUE	1	TRUE	1	FALSE		FALSE		17.7	0.2	92	1	1700	0	0.1	0.21	7		0.61	16.3
309-MSD-01	9/27/06	4:30 PM	TRUE	1	TRUE	1	FALSE		TRUE	1	18.6	0.2	93		1900	0	0.1	0.12	7		0.42	17.5
309-MSD-01	10/11/06	4:20 PM	FALSE		FALSE		FALSE		FALSE		21.5	0.2	93		1400	0	0.1	0.02	7		0.32	17
309-MSD-01	10/14/06	9:07 AM	TRUE	1	FALSE		FALSE		FALSE		16.1	0.2	93		1500	0		0.08	7		0.32	14.1
309-MSD-01	10/24/06	4:59 PM	TRUE	1	FALSE		FALSE		FALSE		15.3	0.2	93		1500	0	0.1	0.01	7		0.28	15.2
309-MSD-01	10/25/06	5:29 PM	FALSE		FALSE		FALSE		FALSE		16.6	0.2	93		1400	0	0.1	0.09			0.25	14.4
Total Visits	20		20		20		20		20		20	20	20		20	20	19	20	19		20	20
Detections				11		3		0		1	0	1		5	0	0	0	0	0		9	0
Average											20.4	0.2			1339	0	0.1	0.05	7.1		**0.38**	16.7
Minimum											15.3	0.2			950	0	0.1	0	7		0.00	14.1
Maximum											32	0.2			1900	0	0.1	0.21	7.5		**0.85**	20
Median											19.3	0.2			1300	0	0.1	0.03	7		0.37	16.5
Frequency				55%		15%		0%		5%		5%		25%	0%	0%	0%	0%	0%		45%	0%
TWINS																						
309-MSD-03	6/21/06	12:57 PM	TRUE	1	FALSE		FALSE		TRUE	1	22.5	0.2	93		1660	0	0.2	0.49	7		1.06	16.5
309-MSD-03	6/22/06	5:11 PM	TRUE	1	FALSE		FALSE		TRUE	1	22	0.2	93		1300	0	0.1	0.28	7.5		1.29	17
309-MSD-03	7/5/06	5:47 PM	TRUE	1	FALSE		FALSE		FALSE		16.3	0.2	91	1	2000	0	0.1	0.43	7		1.77	17.1
309-MSD-03	7/6/06	6:04 PM	TRUE	1	FALSE		FALSE		FALSE		15.9	0.2	93		2400	0	0.1	0.64	7		0.27	17.2
309-MSD-03	7/19/06	5:20 PM	TRUE	1	FALSE		FALSE		TRUE	1	21	0.2	93		1200	0	0.1	0.61	7		1.36	17.2
309-MSD-03	7/20/06	4:35 PM	TRUE	1	FALSE		FALSE		FALSE		22.9	0.2	93		1500	0	0.2	0.39	6.5		1.48	17.4
309-MSD-03	8/1/06	5:45 PM	TRUE	1	FALSE		FALSE		FALSE		16.9	0.2	92	1	1600	0	0.1	0.53	7		1.09	17.8
309-MSD-03	8/3/06	5:40 PM	TRUE	1	FALSE		FALSE		FALSE		16.9	0.2	92	1	1500	0	0.1	0.73	7		1.72	17.4
309-MSD-03	8/14/06	11:54 PM	TRUE	1	FALSE		FALSE		TRUE	1	22.5	0.2	107	1	1500	0	0.1	0.71	7		1.66	18
309-MSD-03	8/16/06	4:43 PM	TRUE	1	FALSE		FALSE		FALSE												*0.95*	
309-MSD-03	*8/16/06*	*4:43 PM*	TRUE		*FALSE*		*FALSE*		*FALSE*		22	0.2	36	1	1600	0	0.1	0.88	7		1.47	19
309-MSD-03	8/31/06	5:43 PM	TRUE	1	FALSE		FALSE		FALSE		16	0.2	93		1100	0	0.1	0.46	7		1.44	17.1
309-MSD-03	9/1/06	4:13 PM	TRUE	1	FALSE		FALSE		FALSE		17.4	0.2	93		1200	0	0.1	0.35	7		1.54	17.3
309-MSD-03	9/11/06	5:01 PM	TRUE	1	FALSE		FALSE		FALSE		20.3	0.2	92		2800	0	0.1	0.19	7		1.38	17.4
309-MSD-03	9/12/06	5:09 PM	TRUE	1	FALSE		FALSE		FALSE		22	0.2	92	1	2500	0	0.1	0.7	7		0.45	18.8
309-MSD-03	9/26/06	4:30 PM	TRUE	1	FALSE		FALSE		FALSE												*0.95*	
309-MSD-03	*9/26/06*	*4:30 PM*	*TRUE*		*FALSE*		*FALSE*		*FALSE*		18	0.2	91	1	2000	0	0.1	0.33	7		2.54	18.1
309-MSD-03	9/27/06	4:46 PM	TRUE	1	FALSE		FALSE		FALSE		17.1	0.2	91	1	2000	0	0.1	0.65	7		1.4	17.5
309-MSD-03	10/11/06	4:58 PM	TRUE	1	FALSE		FALSE		FALSE		18.5	0.2	93		2100	0	0.1	0.94	7		1.57	16.9
309-MSD-03	10/14/06	9:38 AM	FALSE		FALSE		FALSE		FALSE		16.8	0.2	93		1900	0	0.2	0.09	7		1.92	17
309-MSD-03	10/24/06	4:36 PM	TRUE	1	FALSE		FALSE		FALSE		15.3	0.2	93		1800	0	0.1	0.36	7		1.62	17
309-MSD-03	10/25/06	5:10 PM	FALSE		FALSE		FALSE		FALSE		17.8	0.2	93		1600	0	0.1	0.3	7			16.4
Total Visits	20		20		20		20		20		20	20	20		20	20	20	20	20		20	20
Detections				18		0		0		4		0		8	4	0	3	0	1		18	0
Average											18.9	0.2			1763	0	0.12	0.50	7		**1.38**	17.4
Minimum											15.3	0.2			1100	0	0.1	0.09	6.5		0.27	16.4
Maximum											22.9	0.2			**2800**	0	**0.2**	**0.94**	7.5		**2.54**	19.0
Median											17.9	0.2			1630	0	0.1	0.48	7		**1.44**	17.3
Frequency			90%		0%		0%		20%			0%		40%	20%	0%	15%	0%	5%		90%	0%
SAN CARLOS																						
309-MSD-04	6/21/06	12:40 PM	TRUE	1	FALSE		FALSE		FALSE		20	0.2	91	1	1250	0	0.1	0.17	7		0.53	19
309-MSD-04	6/22/06	6:15 PM	TRUE	1	FALSE		FALSE		FALSE		22.5	0.2	93		1240	0						
309-MSD-04	7/5/06	6:31 PM	TRUE	1	FALSE		FALSE		FALSE		16	0.2	91	1	1300	0	0.1	0.15	7.5		0.65	18
309-MSD-04	7/6/06	5:40 PM	TRUE	1	FALSE		FALSE		FALSE		22.5	0.2			1240	0	0.1	0	7		0.59	19
309-MSD-04	*7/6/06*	*6:20 PM*	*TRUE*		*FALSE*		*FALSE*		*FALSE*		*19*	*0.2*	93		*1420*	*0*	*0.1*	*0*	*7.5*		*0.48*	*19.6*
309-MSD-04	7/19/06	6:27 PM	TRUE	1	FALSE		FALSE		FALSE								0.9	3.3			1.65	
309-MSD-04	*7/19/06*	*6:27 PM*	*TRUE*		FALSE		FALSE		FALSE		24	0.2	91	1	1400	0	*0.9*	*3.3*	7.5		*2.64*	19
309-MSD-04	*7/19/06*	*6:27 PM*															*0.16*	*16.6*		1.15	3.55	
309-MSD-04	7/20/06	5:02 PM	TRUE	1	FALSE		FALSE		FALSE		23.7	0.2	93		1400	0	0.2	0.05	7		0.43	21.2
309-MSD-04	8/1/06	6:10 PM	TRUE	1	FALSE		FALSE		FALSE		19	0.2	92	1	1450	0	0.1	0.06	7.5		0.46	18
309-MSD-04	8/3/06	5:53 PM	TRUE	1	FALSE		FALSE		FALSE		22	0.2	92	1	1520	0	1.5	0.94	7.5		0.15	18
309-MSD-04	8/14/06	12:04 PM	TRUE	1	FALSE		FALSE		FALSE		27	0.2	93		400	0	0.1	0	7.5		0.53	20
309-MSD-04	8/16/06	4:46 PM	TRUE	1	FALSE		FALSE		FALSE		19	0.2	93		1100	0	0.1	0	7		0	18.9
309-MSD-04	8/31/06	6:06 PM	TRUE	1	FALSE		FALSE		TRUE	1	18	0.2	93		1500	0	0.1	0.01	7.5		0.29	19.5
309-MSD-04	9/1/06	4:21 PM	TRUE	1	FALSE		FALSE		TRUE	1	21	0.2	93		1400	0	0.2	0.03	7.5		0.22	18
309-MSD-04	9/11/06	4:50 PM	TRUE	1	FALSE		FALSE		FALSE		22	0.2	93		1600	0	0.2	0.11	7		0.41	17.9
309-MSD-04	9/12/06	4:50 PM	TRUE	1	FALSE		FALSE		FALSE		20.5	0.2	93		2200	0	0.1	0.01	7		0.35	19.8
309-MSD-04	9/26/06	4:47 PM	TRUE	1	FALSE		FALSE		FALSE		22	0.2	91	1	2000	0	0.1	0.04	7.5		0.65	17.1
309-MSD-04	9/27/06	4:36 PM	FALSE		FALSE		FALSE		FALSE		21	0.2	93		1600	0	0.3	0.14	7		0.73	17.3
309-MSD-04	10/11/06	5:15 PM	TRUE	1	FALSE		FALSE		FALSE		18	0.2	93		3000	0	0.1	0.05	7		1.06	16.6
309-MSD-04	10/14/06	9:55 AM	TRUE	1	FALSE		FALSE		FALSE		16.5	0.2	93		2500	0	0.1	0	7		1.06	17
309-MSD-04	10/24/06	4:37 PM	FALSE		FALSE		FALSE		FALSE		15.3	0.2	93		5800	0	0.3	0	7		0.81	15.4
309-MSD-04	10/25/06	4:37 PM	FALSE		FALSE		FALSE		FALSE		21	0.2	93		700	0	0.1	0.05	7.5		0.81	14.2
Total Visits	20		20		20		20		20		20	20	20		20	20	20	20	18	1	20	18
Detections				17		0		0		2	0	1		5	4	0	8	1	0	1	15	0
Average											20.5	0.2			1715	0	**0.3**	1.14	7.3	**1.2**	**0.82**	18
Minimum											15.3	0.2			400	0	0.1	0.00	7.0	**1.2**	0.00	14
Maximum											27.0	0.2			**5800**	0	**1.5**	**16.6**	7.5	**1.2**	**3.55**	21
Median											21.0	0.2			1420	0	0.1	0.05	7.3	**1.2**	**0.56**	18
Frequency				85%		0%		0%		10%	0%	5%		25%	20%	0%	40%	5%	0%	100%	75%	0%

T5: UW 2006 Monterey Field Data By Station (2 pages)

StationID	Date	Time	Trash		Sewage		OilSheen		Scum		AirTemp	CHL	Color		Cond	CU	DET	NH_3-N	pH	PO_4-P	PO_4^{-2}	H_2OTemp
Units											C^0	ppm	BCS		uS	ppm	ppm	ppm		ppm	ppm	C^0
WQO												< 0.2			< 2000	< 0.03	< 0.1	NA	6.5-8.0	< 0.12	< 0.37	< 26
STEINBECK																						
309-MSD-05	6/21/06	12:23 PM	TRUE	1	FALSE		FALSE		FALSE		22.5	0.6	92	1	1100	0	0.7	3.3	7.5		0.44	18
309-MSD-05	6/22/06	5:20 PM	TRUE	1	FALSE		FALSE		FALSE		19	0.2	93		1350	0	0.7	0.94	7.5		2.46	18
309-MSD-05	7/5/06	5:50 PM	TRUE	1	FALSE		FALSE		TRUE	1	17	0.2	91	1	1420	0	0.5	0.33	7.5		2.01	17.5
309-MSD-05	7/6/06	5:50 PM	TRUE	1	FALSE		FALSE		TRUE	1	20.5	0.2	92	1	1120	0	0.4	0.26	7.5		2.25	18
309-MSD-05	7/19/06	5:47 PM	TRUE	1	FALSE		TRUE	1	FALSE		22	0.2	91	1	1160	0	0.1	0.57	7.5		1.28	19
309-MSD-05	7/20/06	4:52 PM	TRUE	1	FALSE		FALSE		FALSE		26	0.2	93		1200	0	0.1	0.35	7.5		1.11	19
309-MSD-05	8/1/06	5:40 PM	TRUE	1	FALSE		FALSE		TRUE	1							0.1					
309-MSD-05	*8/1/06*	*5:40 PM*	*TRUE*		*FALSE*		*FALSE*		*TRUE*		19	0.2	91	1	1200	0	*0.1*	0.67	7.5		2.44	18.5
309-MSD-05	8/3/06	5:32 PM	TRUE	1	FALSE		TRUE	1	FALSE		26	0.2	91	1	1400	0	0.6	0.79	7.5		2.45	18
309-MSD-05	8/14/06	12:22 PM	TRUE	1	FALSE		FALSE		FALSE		27	0.2	93		1200	0	0.4	0.23	7.5		1.54	19
309-MSD-05	8/16/06	5:05 PM	TRUE	1	FALSE		FALSE		FALSE		20	0.2	36	1	1000	0	0.1	1.75	7.5		0.51	20
309-MSD-05	8/31/06	5:44 PM	TRUE	1	FALSE		FALSE		TRUE	1	22.5	0.2	93		1300	0	0.6	0.63	7.5		2.8	29
309-MSD-05	9/1/06	3:59 PM	TRUE	1	FALSE		FALSE		TRUE	1	23	0.2	93		1400	0	0.2	0.03	7.5		1.85	18
309-MSD-05	9/11/06	4:45 PM	TRUE	1	FALSE		FALSE		TRUE	1	20	0.2	120	1	1600	0	0.1	0.63	7		2.29	19.8
309-MSD-05	9/12/06	4:31 PM	TRUE	1	FALSE		FALSE		FALSE		21	0.2	92	1	1900	0	0.1	0.17	7		1.23	19.3
309-MSD-05	9/26/06	4:20 PM	TRUE	1	FALSE		FALSE		FALSE		26	0.2	91	1	1400	0	0.3	0.29	7.5		1.62	18.4
309-MSD-05	9/27/06	4:14 PM	TRUE	1	TRUE	1	FALSE		FALSE		25	0.2	93		1400	0	0.2	0.23	7		0.15	18.2
309-MSD-05	10/11/06	5:00 PM	TRUE	1	FALSE		FALSE		FALSE		20	0.2	92	1	1400	0	0.7	0.11	7		2.33	18
309-MSD-05	10/14/06	9:45 AM	TRUE	1	FALSE		FALSE		FALSE		16.4	0.2	93		1500	0	0.6	0.31	7		1.51	17.1
309-MSD-05	10/24/06	4:18 PM	TRUE	1	TRUE	1	FALSE		FALSE												1.79	
309-MSD-05	*10/24/06*	*4:18 PM*	*TRUE*		*TRUE*		*FALSE*		*FALSE*		15.4	0.2	93		1170	0.25	2	1.31	7.5		*2.75*	17
309-MSD-05	10/25/06	5:00 PM	FALSE		FALSE		FALSE		FALSE		18.2	0.2	93		2200	0	0.2	0.84			1.25	16.6
Total Visits	20		20		20		20		20		20	20	20		20	20	20	20	19		20	20
Detections				19		1		2		5	1	1		11	1	1	14	1	0		19	1
Average											21.3	0.2			1371	0.0	**0.4**	**0.69**	7.4		**1.72**	19
Minimum											15.4	0.2			1000	0.0	0.1	0.03	7.0		0.15	17
Maximum											27.0	**0.6**			**2200**	**0.3**	**2.0**	**3.3**	7.5		**2.80**	**29.0**
Median											20.8	0.2			1375	0.0	**0.3**	0.46	7.5		**1.79**	18
Frequency				95%		5%		10%		25%	5%	5%		55%	5%	5%	70%	5%	0%		95%	5%
LIBRARY																						
309-MSD-06	6/21/06	12:56 PM	TRUE	1	FALSE		FALSE		TRUE	1	25	0.2	93		2000	0	0.1	0.23	7		0.55	17
309-MSD-06	6/22/06	4:51 PM	FALSE		FALSE		FALSE		TRUE	1	20	0.2	93		2000	0	0.1	0.08	7		0.3	18
309-MSD-06	7/5/06	6:10 PM	TRUE	1	FALSE		FALSE		TRUE	1	17.2	0.2	91	1	1900	0	0.1	0.12	7		0.52	14.6
309-MSD-06	7/6/06	6:22 PM	TRUE	1	FALSE		FALSE		TRUE	1	16.5	0.2	91	1	2300	0	0.1	0.44	7		0.52	13.5
309-MSD-06	7/19/06	4:51 PM	TRUE	1	FALSE		FALSE		TRUE	1	21.2	0.2			2400	0	0.1	0.18	7		0.57	16.5
309-MSD-06	7/20/06	4:20 PM	TRUE	1	FALSE		FALSE		FALSE		24	0.2	91	1	2000	0	0.1	0.18	7.5		0.78	17
309-MSD-06	8/1/06	5:42 PM	TRUE	1	FALSE		FALSE		TRUE	1	17.5	0.2	91	1	2500	0	0.1	0.19	7.5		0.5	15
309-MSD-06	8/3/06	5:53 PM	TRUE	1	FALSE		FALSE		TRUE	1	18.5	0.2	91	1	2700	0	0.1	0	7.5		0.43	15
309-MSD-06	8/14/06	11:20 AM	TRUE	1	FALSE		FALSE		TRUE	1	25	0.2	93		2400	0	0.1	0.13			0.6	17
309-MSD-06	8/16/06	4:30 PM	TRUE	1	FALSE		FALSE		FALSE		20.5	0.2	91	1	2200	0	0.1	0.14	7		0.33	15.8
309-MSD-06	8/31/06	6:00 PM	TRUE	1	FALSE		FALSE		TRUE	1	16.3	0.2	93		2900	0	0.1	0.11	7		0.64	15.5
309-MSD-06	9/1/06	4:55 PM	TRUE	1	FALSE		FALSE		TRUE	1	17.4	0.2	93		2400	0	0.1	0.02	7		0.65	15.7
309-MSD-06	9/11/06	4:30 PM	TRUE	1	FALSE		FALSE		FALSE		21		97	1	2400	0	0.1	0.11	7		0.84	15.8
309-MSD-06	9/12/06	4:00 PM	TRUE	1	FALSE		FALSE		TRUE	1	30	0.2	92	1	2400	0	0.1	0.14	7.5		0.52	16.8
309-MSD-06	9/26/06	4:45 PM	TRUE	1	FALSE		FALSE		TRUE	1	14.1	0.2	92	1	3800	0	0.1	1.08	7		0.48	15.4
309-MSD-06	9/27/06	4:50 PM	TRUE	1	FALSE		FALSE		TRUE	1	17.3	0.2	93		3700	0	0.1	0.18	7		0.43	15.6
309-MSD-06	10/11/06	4:38 PM	TRUE	1	FALSE		FALSE		TRUE	1	19.5	0.2	93		2900	0	0.1	0.21	7.5		0.54	14.8
309-MSD-06	10/14/06	9:20 AM	TRUE	1	FALSE		FALSE		TRUE	1	16	0.2	93		3300	0	0.1	1.53	7		0.51	14.5
309-MSD-06	10/24/06	5:13 PM	TRUE	1	FALSE		FALSE		TRUE	1	15	0.2	93		2900	0.25	0.1	0.28	7		0.58	14.5
309-MSD-06	10/25/06	5:48 PM	TRUE	1	FALSE		FALSE		TRUE	1	16.1	0.2	93		2700	0	0.2	0.21	7		0.67	14.3
Total Visits	20		20		20		20		20		20	19	19		20	20	20	20	19		20	20
Detections				19		0		0		17	NA	1		9	16	1	1	0	0		18	0
Average											19.4	0.2			**2590**	0.0	0.1	0.28	7.1		**0.55**	15.6
Minimum											14.1	0.2			1900	0.0	0.1	0.00	7.0		0.30	13.5
Maximum											30.0	0.2			**3800**	**0.3**	**0.2**	**1.53**	7.5		**0.84**	18.0
Median											18.0	0.2			**2400**	0.0	0.1	0.18	7.0		**0.53**	15.6
Frequency				95%		0%		0%		85%		5%		47%	80%	5%	5%	0%	0%		90%	0%

Blue font in italics = replicate

Gray cells = over WQO/ detection

T6: UW 2006 Monterey Chlorine and Detergent Detections (2 pages)

StationID	Date	Time	CHL	DET
Units			ppm	ppm
Exceedence			**≥ 0.2**	**≥ 0.1**
EL DORADO				
309-MSD-01	6/21/06	12:34 PM	ND	ND
309-MSD-01	6/22/06	4:36 PM		
309-MSD-01	6/22/06	4:36 PM	ND	ND
309-MSD-01	7/5/06	5:50 PM	ND	ND
309-MSD-01	7/7/06	5:57 PM	ND	ND
309-MSD-01	7/19/06	4:36 PM	ND	ND
309-MSD-01	7/20/06	3:55 PM	ND	ND
309-MSD-01	8/1/06	6:00 PM	ND	ND
309-MSD-01	8/3/06	5:40 PM	ND	ND
309-MSD-01	8/14/06	11:02 AM	ND	ND
309-MSD-01	8/16/06	4:10 PM	ND	ND
309-MSD-01	8/31/06	5:40 PM	ND	ND
309-MSD-01	9/1/06	4:30 PM	ND	ND
309-MSD-01	9/11/06	4:03 PM	**0.2**	ND
309-MSD-01	9/12/06	4:07 PM	ND	ND
309-MSD-01	9/26/06	4:30 PM	ND	ND
309-MSD-01	9/27/06	4:30 PM	ND	ND
309-MSD-01	10/11/06	4:20 PM	ND	ND
309-MSD-01	10/14/06	9:07 AM	ND	
309-MSD-01	10/24/06	4:59 PM	ND	ND
309-MSD-01	10/25/06	5:29 PM	ND	ND
Total Visits	20		20	19
Detections			1	0
Average			**0.2**	ND
Minimum			**0.2**	ND
Maximum			**0.2**	ND
Median			**0.2**	ND
Frequency			5%	0%

Blue font= replicate

Gray cell with Bold font= over WQO/ detection

StationID	Date	Time	CHL	DET
Units			ppm	ppm
Exceedence			**≥ 0.2**	**≥ 0.1**
STEINBECK				
309-MSD-05	6/21/06	12:23 PM	**0.6**	**0.7**
309-MSD-05	6/22/06	5:20 PM	ND	**0.7**
309-MSD-05	7/5/06	5:50 PM	ND	**0.5**
309-MSD-05	7/6/06	5:50 PM	ND	**0.4**
309-MSD-05	7/19/06	5:47 PM	ND	ND
309-MSD-05	7/20/06	4:52 PM	ND	ND
309-MSD-05	8/1/06	5:40 PM		ND
309-MSD-05	8/1/06	5:40 PM	ND	ND
309-MSD-05	8/3/06	5:32 PM	ND	**0.6**
309-MSD-05	8/14/06	12:22 PM	ND	**0.4**
309-MSD-05	8/16/06	5:05 PM	ND	ND
309-MSD-05	8/31/06	5:44 PM	ND	**0.6**
309-MSD-05	9/1/06	3:59 PM	ND	**0.2**
309-MSD-05	9/11/06	4:45 PM	ND	ND
309-MSD-05	9/12/06	4:31 PM	ND	ND
309-MSD-05	9/26/06	4:20 PM	ND	**0.3**
309-MSD-05	9/27/06	4:14 PM	ND	**0.2**
309-MSD-05	10/11/06	5:00 PM	ND	**0.7**
309-MSD-05	10/14/06	9:45 AM	ND	**0.6**
309-MSD-05	10/24/06	4:18 PM		
309-MSD-05	10/24/06	4:18 PM	ND	**2**
309-MSD-05	10/25/06	5:00 PM	ND	**0.2**
Total Visits	20		20	20
Detections			1	14
Average			**0.6**	**0.6**
Minimum			**0.6**	**0.2**
Maximum			**0.6**	**2.0**
Median			**0.6**	**0.6**
Frequency			5%	70%

StationID	Date	Time	CHL	DET
Units			ppm	ppm
Exceedence			**≥ 0.2**	**≥ 0.1**
SAN CARLOS				
309-MSD-04	6/21/06	12:40 PM	ND	ND
309-MSD-04	6/22/06	6:15 PM	ND	
309-MSD-04	7/5/06	6:31 PM	ND	ND
309-MSD-04	7/6/06	5:40 PM	ND	ND
309-MSD-04	7/6/06	6:20 PM	ND	ND
309-MSD-04	7/19/06	6:27 PM		**0.9**
309-MSD-04	7/19/06	6:27 PM	ND	**0.9**
309-MSD-04	7/19/06	6:27 PM		**0.16**
309-MSD-04	7/20/06	5:02 PM	ND	**0.2**
309-MSD-04	8/1/06	6:10 PM	ND	ND
309-MSD-04	8/3/06	5:53 PM	ND	**1.5**
309-MSD-04	8/14/06	12:04 PM	ND	ND
309-MSD-04	8/16/06	4:46 PM	ND	ND
309-MSD-04	8/31/06	6:06 PM	ND	ND
309-MSD-04	9/1/06	4:21 PM	ND	**0.2**
309-MSD-04	9/11/06	4:50 PM	ND	**0.2**
309-MSD-04	9/12/06	4:50 PM	ND	ND
309-MSD-04	9/26/06	4:47 PM	**0.2**	ND
309-MSD-04	9/27/06	4:36 PM	ND	**0.3**
309-MSD-04	10/11/06	5:15 PM	ND	ND
309-MSD-04	10/14/06	9:55 AM	ND	ND
309-MSD-04	10/24/06	4:37 PM	ND	**0.3**
309-MSD-04	10/25/06	4:37 PM	ND	ND
Total Visits	20		20	19
Detections			1	8
Average			**0.2**	**0.5**
Minimum			**0.2**	**0.2**
Maximum			**0.2**	**1.5**
Median			**0.2**	**0.3**
Frequency			5%	42%

T6: UW 2006 Monterey Chlorine and Detergent Detections (2 pages)

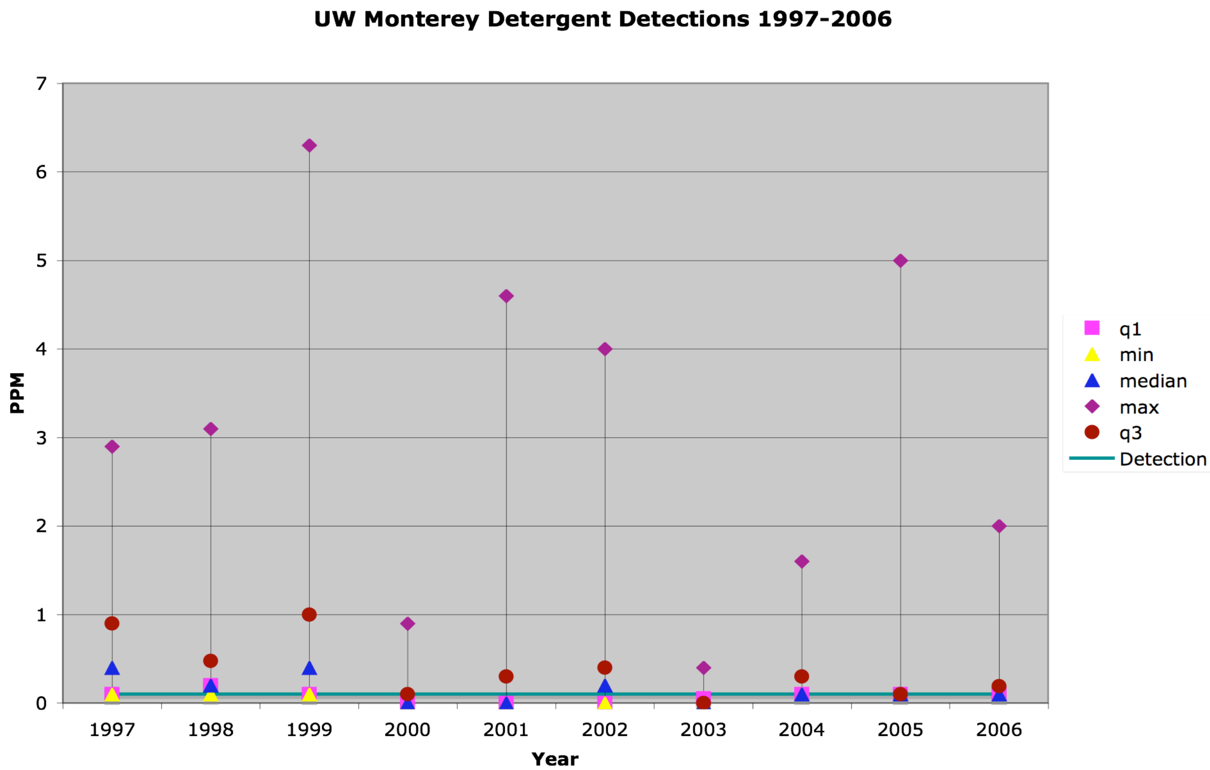
StationID	Date	Time	CHL	DET
Units			ppm	ppm
Exceedence			**≥ 0.2**	**≥ 0.1**
TWINS				
309-MSD-03	6/21/06	12:57 PM	ND	0.2
309-MSD-03	6/22/06	5:11 PM	ND	ND
309-MSD-03	7/5/06	5:47 PM	ND	ND
309-MSD-03	7/6/06	6:04 PM	ND	ND
309-MSD-03	7/19/06	5:20 PM	ND	ND
309-MSD-03	7/20/06	4:35 PM	ND	**0.2**
309-MSD-03	8/1/06	5:45 PM	ND	ND
309-MSD-03	8/3/06	5:40 PM	ND	ND
309-MSD-03	8/14/06	11:54 PM	ND	ND
309-MSD-03	8/16/06	4:43 PM		
309-MSD-03	8/16/06	4:43 PM	ND	ND
309-MSD-03	8/31/06	5:43 PM	ND	ND
309-MSD-03	9/1/06	4:13 PM	ND	ND
309-MSD-03	9/11/06	5:01 PM	ND	ND
309-MSD-03	9/12/06	5:09 PM	ND	ND
309-MSD-03	9/26/06	4:30 PM		
309-MSD-03	9/26/06	4:30 PM	ND	ND
309-MSD-03	9/27/06	4:46 PM	ND	ND
309-MSD-03	10/11/06	4:58 PM	ND	ND
309-MSD-03	10/14/06	9:38 AM	ND	**0.2**
309-MSD-03	10/24/06	4:36 PM	ND	ND
309-MSD-03	10/25/06	5:10 PM	ND	ND
Total Visits	20		20	20
Detections			0	3
Average			ND	**0.2**
Minimum			ND	**0.2**
Maximum			ND	**0.2**
Median			ND	**0.2**
Frequency			0%	15%

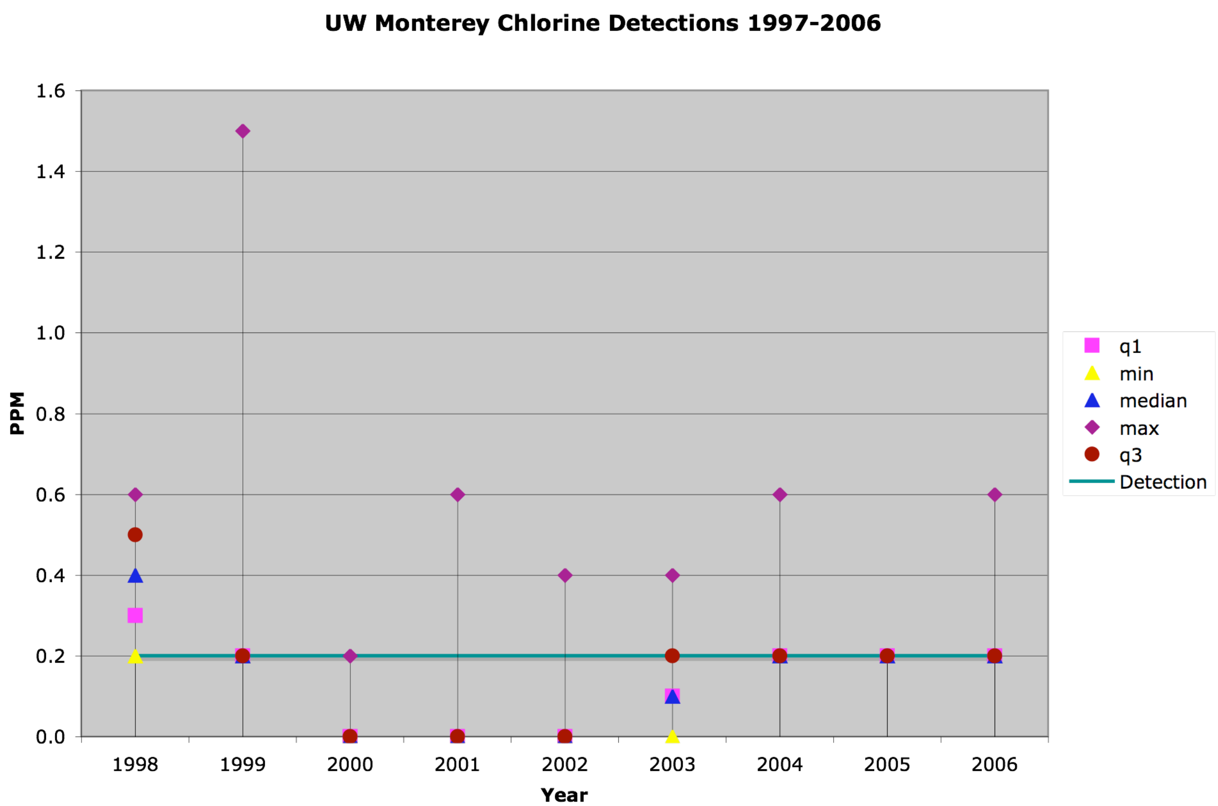
Gray cell with Bold font= over WQO/ detection

StationID	Date	Time	CHL	DET
Units			ppm	ppm
Exceedence			**≥ 0.2**	**≥ 0.1**
LIBRARY				
309-MSD-06	6/21/06	12:56 PM	**0.2**	ND
309-MSD-06	6/22/06	4:51 PM	ND	ND
309-MSD-06	7/5/06	6:10 PM	ND	ND
309-MSD-06	7/6/06	6:22 PM	ND	ND
309-MSD-06	7/19/06	4:51 PM	ND	ND
309-MSD-06	7/20/06	4:20 PM	ND	ND
309-MSD-06	8/1/06	5:42 PM	ND	ND
309-MSD-06	8/3/06	5:53 PM	ND	ND
309-MSD-06	8/14/06	11:20 AM	ND	ND
309-MSD-06	8/16/06	4:30 PM	ND	ND
309-MSD-06	8/31/06	6:00 PM	ND	ND
309-MSD-06	9/1/06	4:55 PM	ND	ND
309-MSD-06	9/11/06	4:30 PM		ND
309-MSD-06	9/12/06	4:00 PM	ND	ND
309-MSD-06	9/26/06	4:45 PM	ND	ND
309-MSD-06	9/27/06	4:50 PM	ND	ND
309-MSD-06	10/11/06	4:38 PM	ND	ND
309-MSD-06	10/14/06	9:20 AM	ND	ND
309-MSD-06	10/24/06	5:13 PM	ND	ND
309-MSD-06	10/25/06	5:48 PM	ND	**0.2**
Total Visits	20		19	20
Detections			1	1
Average			**0.2**	**0.2**
Minimum			**0.2**	**0.2**
Maximum			**0.2**	**0.2**
Median			**0.2**	**0.2**
Frequency			5%	5%

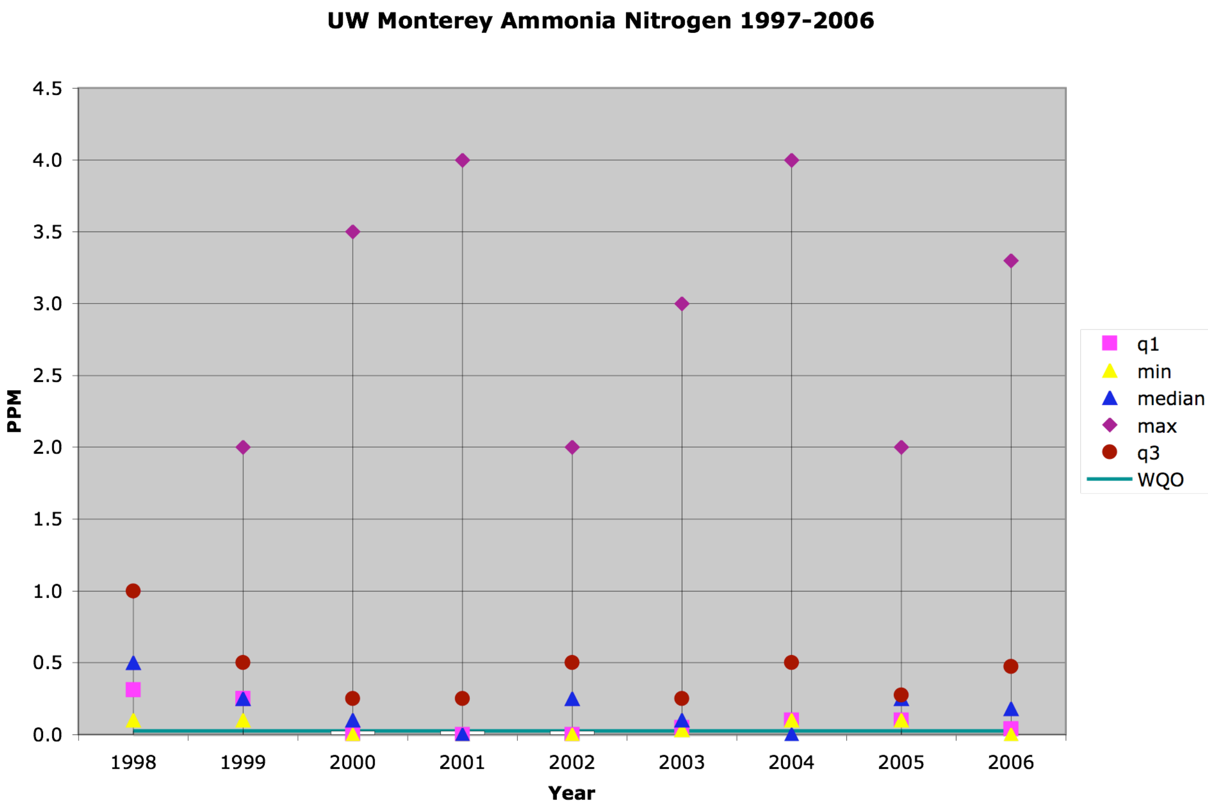
UW 2006 Monterey : Table 7 Summary																	
StationID	Date	Time	Replica	Trash	Sewage	OilSheen	Scum	AirTemp	CHL	Color	Cond	CU	DET	NH_3-N	pH	PO_4^{-2}	H2OTemp
Units								C^0	ppm	BCS	uS	ppm	ppm	ppm		ppm	C^0
Exceedence									> 0.2		> 2000	> 0.03	> ND	>0.025	< 6.5,> 8.0	> 0.37	> 26
Total visits	100								100	99	100	100	100	100	97	99	100
Minimum									0.2	36	400	0	0.1	0	6.5	0	13.5
Maximum									0.6	120	5800	0.25	2	16.6	7.5	2.80	29
Average									0.204	91.182	1755.1	0.00	0.2	0.54	7.2	0.95	17.3
Exceedence				84	5	2	30		4	39	24	2	26	2	1	78	0
Frequency				84%	5%	2%	30%		4%	39%	24%	2%	26%	2%	1%	79%	0%

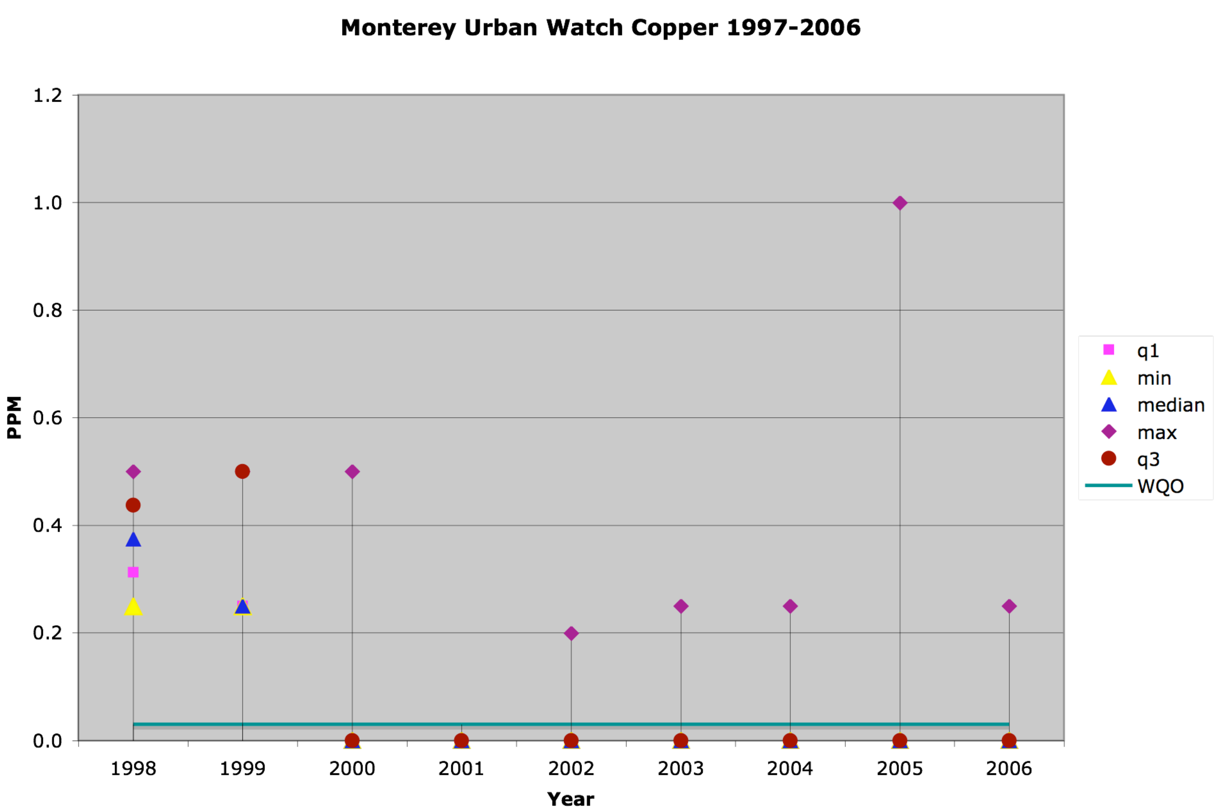
2006 Monterey Urban Watch Program
Appendix 2





2006 Monterey Urban Watch Program
Appendix 2





2006 Monterey Urban Watch Program
Appendix 2