



**2005 Urban Watch-First Flush  
Storm Drain Monitoring Program  
in the City of Scotts Valley  
Santa Cruz County, California**

**Program Period:**  
June 29 – October 28, 2005

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# Scotts Valley Urban Watch Monitoring Program

## **PROGRAM OVERVIEW**

The Scotts Valley Urban Watch-First Flush storm drain monitoring program was initiated by the Coastal Watershed Council (CWC) in April 2005 on behalf of the County of Santa Cruz, NPDES Phase II Storm Water Management Program, and funded under the County's Proposition 13 - Coastal Non-Point Source Pollution Control Grant (Agreement: 03-221-553-0). The area of Carbonera Creek within the City of Scotts Valley was highlighted for this monitoring program based on input from Central Coast Regional Water Quality Control Board staff.

The Urban Watch Program started in 1997 as a joint effort between the Coastal Watershed Council, the City of Monterey, and the Monterey Bay National Marine Sanctuary. The "First Flush" event first took place in 2000, and the program has expanded regionally to include eight programs across the Monterey Bay in 2005. The goals of the Urban Watch-First Flush Program are twofold: First, to serve as a tool for education and outreach to the community regarding the impacts that citizens have on local water quality thru urban run-off; and secondly, to collect important water quality data to support environmental management decisions at the local and state levels. These goals are achieved through the participation of trained volunteers who monitor dry-season storm drain discharges at selected outflow areas throughout the Scotts Valley area. Urban Watch monitoring typically occurs twice weekly from June through approximately November, ending with the first significant rain. Annual Urban Watch reports can be downloaded from CWC's website at: [http://www.coastal-watershed.org/CWC\\_Library/index.htm](http://www.coastal-watershed.org/CWC_Library/index.htm)

The Urban Watch-First Flush Program culminates with the "First Flush" monitoring event wherein volunteers monitor during the first significant rain of the wet season at four chosen Urban Watch program storm drains. This rain event washes the streets and 'flushes' the gutters and storm drains of collected materials and pollutants that have accumulated throughout the dry-season. Volunteers take in-field measurements and collect samples during the rain event. These samples are then sent to a professional lab where analysis for trace metals, nutrients, and pathogens, are performed. Although the First Flush event will be mentioned in passing in this report, 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>

## **PROGRAM DESIGN**

### *Equipment & Parameters*

CWC's Urban Watch monitoring kit has been designed to provide a method for volunteers to monitor dry-season storm drain discharges and identify common urban pollutants and contaminants within the study area. The Urban Watch Program utilizes a stormdrain water quality monitoring kit manufactured by the LaMotte Company (SSDK 7446) which was designed in association with the City of Ft. Worth, Texas. This kit was developed according to National Pollutant Discharge Elimination System (NPDES) Phase I dry weather monitoring requirements and is designed to detect illegal storm drain connections and discharges. To this pre-assembled kit CWC has added equipment such as thermometers, Oakton 'ECTestr' conductivity meters (high & low range) and replaced the Oakton 'pHTestr' meter with pH strips for ease of use by volunteers. As well, a LaMotte Ammonia-Nitrogen test kit (3304) and a LaMotte Nitrate/Nitrite test kit (3519) were added to the Scotts Valley kit in August 2005.

The parameters volunteers monitored include: detergent surfactants, phenols, nitrate-nitrogen, ortho-phosphate, ammonia-nitrogen, copper (total), chlorine (total), pH, conductivity, air and water temperature, sample water odor and color (Table 1). Volunteers also noted if there was oil sheen, sewage, trash, and surface scum, present on the water, or at the storm drain station. They also determined sample turbidity using a "Low-Medium-High" designation. As well, volunteers made other notable observations of changes to the station environment, including signs of recent 'pollution' activities or sources, and wildlife observations.

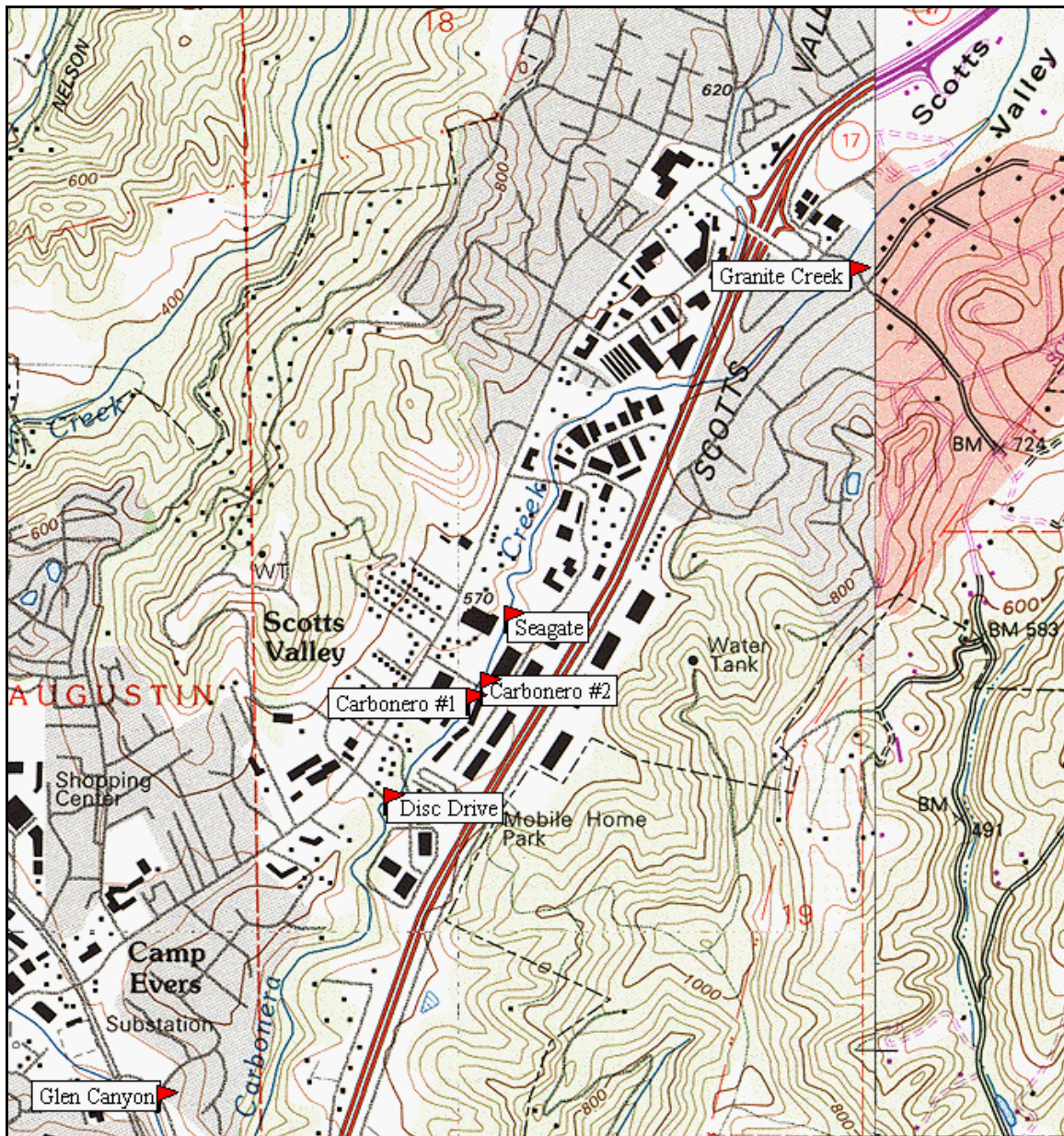
**Table 1: Water Quality Parameters for the Urban Watch Monitoring Program.**

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature: Air & Water	Illegal discharges	Affects rates of chemical and biochemical reactions in water.	Method – Digital thermometer Accuracy ± 1% full scale Or Bulb Thermometer (Spirit) Range: -5.0 – 55 °C
pH	Aerosols and dust in air, mineral substances, sewer overflows, animal wastes, pesticides & fertilizers, photosynthesis	Interferes 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	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 ± 0.1 ppm Min detection: >0.1 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
Nitrate-Nitrogen	From wastewater and sewer overflows and non-point sources such as agriculture and urban runoff; including fertilizers, confined livestock/animal wastes, septic systems and sewage treatment systems.	Toxic to aquatic and human life. Concentrations stimulate growth of algae and aquatic plants which can negatively affect creek health.	LaMotte Code 3519; NCR-2 Method – 3109 Nitrate Comparator against color standard. Min detection: 0.25 ppm to 10.0 ppm
Copper	Illegal discharges into the storm drain system; also can occur naturally in surface waters.	Concentrations over 0.025 parts per million are toxic to most freshwater fish.	Method – Diethyldithiocarbamate Octa-Slide Comparator against color standard. Accuracy ± 10% Min detection: >0.0 ppm
Chlorine	Illegal or unintended connections to a Storm drain or draining of a swimming pool.	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	Illegal connections to storm drain systems, poorly functioning septic systems, wildlife.	At certain concentrations can be toxic to aquatic organisms.	LaMotte Code 5864 Method – Octa-Slide Comparator against color standard scale 3441. Min detection: >0.1 ppm
Ammonia -Nitrogen	Illegal connections to Storm drain systems, poorly functioning septic systems, wildlife.	At certain concentrations can be toxic to aquatic organisms.	LaMotte Code 3304 Salicylate method- Colo-Ruler Method – Octa-Slide Comparator against a color standard Min detection: >0.0 ppm to 2.0 ppm (NH <sub>3</sub> -N)
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 or 10 µS
Turbidity	Microorganisms, sediment, erosion.	Interferes with fish and other aquatic life.	Method – Visual Octa-Slide Viewer Compare to a 5 step "Low/Med/High" turbidity standard slide bar
Color	Dyes or chemicals	Interferes with aquatic Insects	Method – Visual Borger Color System
Odor	Illegal discharges or product of decomposition; "clean" drainage water should have no distinctive odor	Can indicate presence of contaminants.	Method – Scent
Oil sheen	Hydrocarbons such as oil, gasoline, and grease; leaking underground petroleum storage tanks	Toxic to aquatic organisms.	Method – Visual
Trash, sewage, scum	Illegal discharges or illegal dumping	Interferes with fish and other aquatic life.	Method - Visual

Units: ppm – parts per million; mg/L – milli grams per liter; mS – milli Siemens; µS – micro Siemens

### Monitoring Locations

The Coastal Watershed Council and representatives from the City of Scotts Valley and the County of Santa Cruz chose six sampling stations based on drainage basin and safe access for volunteers (Figure 1). The monitoring stations established for this program are referred to as: (1) **Glen Canyon**, which captures surface run-off from a residential neighborhood off Glen Canyon Road on NW side of Highway 17 and discharges into Evers Creek which discharges to Carbonera Creek; (2) **Disc Drive**, located along a commercial complex and receives surface drainage from the commercial/light industrial area off Disc Drive and from the east side of Scotts Valley Drive; (3) **Carbonero #1**, is in a commercial/light industrial area and receives surface drainage as well as flows from the west side of Highway 17; (4) **Carbonero #2**, is across the Carbonera Creek channel from Carbonero #1, and receives surface drainage from this commercial/light industry area off Carbonero Way and flows from Scotts Valley Dr.; (5) **Seagate**, is in a commercial/light industrial area and receives surface drainage off El Pueblo Dr. as well as flows from the west side of Highway 17 as well, this pipe is connected to all stormwater drainage from the north east area on east side of Highway 17; (6) **Granite Creek**, drains a rural residential neighborhood to the north east of Highway 17 and south of Granite Creek Road. All six stations ultimately drain directly into Carbonera Creek. Table 2 details the, type of drain, outlet, and receiving water of the Scotts Valley stations.



**Figure 1:** Monitoring station locations for the Scotts Valley Urban Watch Program, Santa Cruz County (TOPO!, 1997)

**Table 2:** Drainage descriptions of the monitoring stations for the 2005 Urban Watch Program in the City of Scotts Valley, Santa Cruz County.

Station Name	Station ID	Drainage Type (Collection point)	Discharges to:
Glen Canyon	SVSD-01	Metal culvert discharging to Evers Creek Creek; Off Glen Canyon Rd.; End of culvert; mid-system.	Creek
Disc Drive	SVSD-02	Concrete culvert discharging to Carbonera Creek; Off Disc Dr.; End of culvert; mid-system.	Creek
Carbonero #1	SVSD-03	Metal culvert discharging to Carbonera Creek; Off Carbonero Way; End of culvert; mid-system.	Creek
Carbonero #2	SVSD-04	Concrete culvert discharging to Carbonera Creek; Off Carbonero Way; End of culvert; mid-system.	Creek
Seagate	SVSD-05	Metal culvert discharging to Carbonera Creek; Along El Pueblo Dr.; End of culvert; mid-system.	Creek
Granite Creek	SVSD-06	Metal culvert discharging to Carbonera Creek; Off Granite Creek Rd.; End of culvert; mid-system.	Creek

*Program drainages are all "mid-system" as Carbonera Creek is a tributary of the San Lorenzo River which discharges to the ocean. Ever's Creek discharges to Carbonera Creek.*

## **VOLUNTEER TRAINING**

### *Volunteer preparation*

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

Tamara Doan of the Coastal Watershed Council (CWC) and Bridget Hoover of the Monterey Bay Sanctuary Citizen Monitoring Network (Network) provided a four-hour classroom training for both the Urban Watch and First Flush programs. In each instance, volunteers are presented with program materials which included: detailing station locations, explanations of monitoring equipment and materials, procedural instructions and test protocols, as well as ancillary information on the subject of urban pollutants. Topics emphasized include monitoring concepts and clean sample collection procedures, test protocols, use of kits in the field, and safety procedures. In 2005 this included the NOAA Hazard Communication training (29 CFR 1910.1200). Training for the First Flush event was identical in format, and also included an in-field "dry run" training at each storm drain.

### *Volunteer monitoring*

The trained Urban Watch volunteers were then scheduled into teams for monitoring over the duration of the program. A CWC staff person or trained "team leader" accompanied each Urban Watch volunteer teams in the field for each station visit. Volunteers conducted the Urban Watch monitoring at all stations twice a week throughout the monitoring period June to November 2005.

In the Scotts Valley program 18 volunteers were trained and divided into four teams of between 3-5 members each, and each team was assigned one week per month to monitor. Field analysis, measurements, observations and sample collection were completed by each team twice during their assigned week, resulting in twice weekly monitoring for the program. A somewhat randomized sample collection was achieved by incorporating a flexible monitoring schedule with volunteers; where the week of the month was assigned to a team, but day of week and time of day was left up to the monitoring teams based on the volunteer availability. Volunteers were required to sample during daylight hours, and did so both on weekdays and weekends. A monitoring event for a team consisted of two field visits to all six stations within the 7-day period Monday-Sunday. One data sheet was completed at each station for each of the two visits whether or not there was flow detected from the storm drain outfall on that occasion.

## **QUALITY ASSURANCE/QUALITY CONTROL PROGRAM**

In 2004 CWC and the Network jointly submitted at Quality Assurance Project Plan (QAPP) for the ‘Monterey Bay Regional Urban Watch-First Flush Program’. This document was approved by the Quality Assurance Officer for the Central Coast Regional Water Quality Control Board 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.

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 data sheets and chain of custody documents
- Safety; chemical, in-field, & public interaction

### Equipment maintenance & Programmatic QA/QC Procedures (staff)

- Regular inspection of monitoring equipment and program "kits"
- Periodic calibration of test equipment (calibration records are available)
- Monitoring of reagent stores, chemical expiration dates, and waste management.
- Completion of a Standard Operation Procedure for volunteers to use in the field while monitoring.
- Use of regulated monitoring regime (volunteer schedule)
- Continued supervision until the trainer was confident in the volunteers' sampling and analysis skills.

### Data Quality Management Procedures (staff)

- Training in CWC's Citizen Water Quality MS Access database, data entry
- Use of Instrument ID numbers to track equipment used by teams
- Use of Station ID numbers to track monitoring locations
- Maintaining records of equipment calibration
- Periodic review of data entry (field data sheets and lab reports) to assure consistent data entry.
- Processing and analysis of data for report
- Storage of all original datasheets on the CWC premises for a minimum of 3 years

## **MONITORING RESULTS**

The parameters listed in the following sections were analyzed in the field using the Urban Watch monitoring kit as described above or in the Santa Cruz County Department of Environmental Health Water Quality Laboratory. Over the period of June 29 through October 28, 2005, monitoring took place at the six designated stations 1-6 between 36 and 40 times, therefore a total of 230 individual monitoring events occurred during the program. Water Samples were drawn once a month for four months, July and October (at stations with

‘flowing’ water at the time of the visit), and were taken to the County’s lab for bacteria and nutrient analysis.

Volunteer availability and other technical factors (such as equipment availability or breakage or weather conditions) were taken into account throughout the program resulting in not every parameter being tested/observed for every station visit. “Frequency” of detection is therefore the relationship of the number of times the parameter was recorded as other than normal or non-detect, out of the total number of times a measurement or observation for that parameter was completed throughout the program. Please see the Appendix for Summary Tables 1-6: Tables 1-4 provide monitoring result of the parameters monitored, showing averages, minimum-maximum values, and frequency of detection; Table 5 presents the lab analysis results; Table 6 presents a consolidated record of the data collected in the field in tabular form by station.

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 “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’ and we therefore also recognize the CCRWQCB’s ‘Ambient Monitoring Program’ which has also set 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 regulator and non-regulatory values in this report. For the purposes of this program; a ‘detection’ is any value greater than the lowest identified WQO criteria.

In the case of parameters without criteria, such as Detergent surfactants or Phenols (man made chemical substances), then a ‘detection’ is noted when the value exceeds the minimum detection level of the test kit or tool used to make the analysis or measurement. As well, pH values out of the normal range (6.5-8.0), or water temperatures above 26°C are also identified as a ‘detection’ of unsatisfactory water quality conditions. All stations monitored throughout the program exhibited discharging flows on at least one occasion; therefore the following results reflect measurements taken at all six sampling stations.

In Santa Cruz County, 2005 was characterized as a “wet” water year (Oct 04-Sept 05), receiving over 119,000 acre feet of rainfall in the area, and rainfall was distributed throughout the 2004-2005 water year, not concentrated in winter storms.<sup>1</sup> Although ‘rain’ waters were not monitored except during the First Flush event, this provides some context for pollution concentrations detected during the program. Figure 2 shows the nearest monthly average rainfall distribution for the general area<sup>2</sup>.

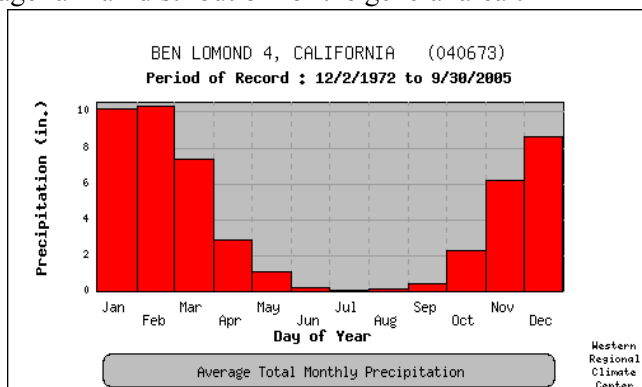


Figure 2. Historic distribution of ‘average total monthly precipitation’ or rainfall for the weather station in Ben Lomond, CA <sup>2</sup>.

<sup>1</sup> City of Santa Cruz Water Department, 2005 Urban Water Management Plan (January 2006), (Pers. Comm. Toby Goddard, 2/22/06). <http://www.ci.santa-cruz.ca.us/wt/wtcon/2005managementplan.html>

<sup>2</sup> Western Regional Climate Center; <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cabnl+nca>

## **I. Quantitative Parameters**

*(In-field chemical kit/meter analysis)*

The following parameters were analyzed in the field during the 230 individual monitoring events. Please see the Appendix for Summary Tables 1-6: Tables 1-4 provide monitoring result of the parameters monitored, showing averages, minimum-maximum values, and frequency of detection; Table 5 presents the lab analysis results; Table 6 presents a consolidated record of the data collected in the field in tabular form by station.

### **Detergent Surfactants**

*WQO: None.*

Surfactants and detergents are common contaminants of surface water due to their large consumption for use in every type of washing and cleaning operation. Surfactants constitute the most important group of detergent components as they are water-soluble surface-active agents.<sup>3</sup> 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).<sup>4</sup> The presence of detergent surfactants in a stormdrain system is a strong indicator of run-off or effluent discharges

There were 171 samples tested for detergent from the six sampling stations. Of those 171 samples tested, 24 samples detected detergent surfactants (14%). Detergent surfactants were detected at all but one of the stations sampled (Granite Creek) during the course of the monitoring program. Detergent surfactants were detected at Glen Canyon in 3 of 37 samples (8%); at Disc Drive in 6 of 36 samples (17%); at Carbonero #1 in 6 of 13 samples (46%); at Carbonero #2 in 3 of 35 samples (9%); at Seagate in 6 of 14 samples (43%). The highest detection was 0.4 ppm at Disc Drive on August 31, 2005 (11:55 am). The range of detection for detergent surfactants for all stations was between 0.2 ppm and 0.4 ppm.

On a 6 instances detergent like “bubbles” were sited in the vicinity of the storm drain but were not detected in the sample collected (3 at Glen Canyon, 2 at Disc Drive, and 1 at Granite Creek). During three of these times the Volunteer Coordinator took additional samples from this water and detergent surfactants were detected at measurable level once when no detergents were detected in the pipe discharge (Glen Canyon, 8/10/05, 1:03 pm); possibly indicating a different source in the vicinity of the stormdrain pipe monitored.

### **Phenols**

*WQO: None.*

Phenol is a manufactured substance. It is a colorless-to-white solid when pure. The commercial product is a liquid. It has sickeningly sweet and tarry odor. You can taste and smell it at levels lower than those that are associated with harmful effects. Phenol evaporates more slowly than water, and a moderate amount can form a solution with water. Phenol can catch fire. Phenol is used primarily in the formation of phenolic resins. It is also used in the manufacture of nylon and other synthetic fibers. It is also used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant, as an antiseptic, and in medicinal preparations, such as mouthwash and sore throat lozenges. You may be exposed to phenol if you work with or manufacture it.

You may be exposed to very low levels in your home because it is found in a number of products, including some medicines, lotions, and ointments. Low levels of phenol are found in some foods, including smoked summer sausage, fried chicken, mountain cheese, and some species of fish. Phenol enters the lungs when you inhale tobacco smoke and it can be present in low levels in air and drinking water.<sup>5</sup> The presence of phenols in a stormdrain system is a strong indicator of run-off or effluent discharges.

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<sup>3</sup> Sigma-Aldrich Co. [http://www.sigmaaldrich.com/Brands/Fluka\\_Riedel\\_Home/Bioscience/BioChemika\\_Ultra/Detergents\\_Surfactants.html](http://www.sigmaaldrich.com/Brands/Fluka_Riedel_Home/Bioscience/BioChemika_Ultra/Detergents_Surfactants.html)

<sup>4</sup> Soap and Detergent Association <http://www.sdahq.org/sdalatest/html/soapchemistry2.htm>

<sup>5</sup> The Agency for Toxic Substances and Disease Registry (ATSDR), <http://www.atsdr.cdc.gov/tfacts115.html>

There were 170 samples were tested for Phenols; however no phenols were detected on volunteer station visits during the monitoring period.

### **Nitrate nitrogen (NO<sub>3</sub>-N)**

*WQO: CCRWQCB CCAMP Attention Level >2.25 mg/L (ppm) NO<sub>3</sub>*

Nitrogen is one of the most abundant elements. About 80 percent of the air we breathe is nitrogen. It is found. Inorganic nitrogen may exist in the free state as a gas N<sub>2</sub>, or as nitrate NO<sub>3</sub>, nitrite NO<sub>2</sub>, and ammonia NH<sub>3</sub>. Organic nitrogen is found in the cells of all living things as a major component of proteins and is continually recycled by plants and animals. Nitrogen is a nutrient that occurs naturally in streams and is essential for plants and animals in an aquatic ecosystem. Problems occur when large amounts nitrogen are introduced into the stream ecosystem and can cause excessive algal growth depleting the available oxygen in the stream that fish and other aquatic organisms depend upon.

The term nitrate nitrogen (NO<sub>3</sub><sup>-</sup>N) is used to refer to the nitrogen present in the nitrate ion. This nomenclature is used to differentiate nitrate nitrogen from nitrogen in the form of ammonia (ammonia nitrogen, NH<sub>3</sub>), from nitrogen in the form of nitrite (nitrite nitrogen, NO<sub>2</sub><sup>-</sup>). Nitrate nitrogen is a commonly used lawn and garden fertilizers used is residential neighborhoods (a sometimes overlooked but significant source) as well as agricultural fertilizer, and nitrate nitrogen can result from the seepage of water through soil containing nitrate-bearing minerals. It may also occur as the result of using certain fertilizers in the soil; however, nitrates are also one of the products of decomposition of animal and human wastes. Thus, the presence of nitrates in a water supply indicates possible pollution of the water.

As well, in the process of decomposition, raw sewage undergoes a chemical change and among the end products is nitrate nitrogen. When nitrate nitrogen occurs in a fresh waterbody, it is considered evidence of pollution either from septic tank fields, cesspools or other sewage sources. Where a groundwater is known to contain little or no nitrate nitrogen naturally, the appearance of any significant increase is a probable indication of pollution. Common non-point sources for both nitrates and orthophosphate is weathering of natural soils and rocks, and surface runoff from urban and agricultural lands. During the course of the program nitrate-nitrogen was tested in the field using a LaMotte test kit and in the Laboratory. The following are results from the in-field tests with the test kit.<sup>6</sup>

Nitrate nitrogen (NO<sub>3</sub>-N) was measured in the field and was detected in 34 of the 81 samples collected (42%). Glen Canyon, Disc Drive, Cabonero #1, and Cabonero #2 were the only sampling stations to detect nitrate nitrogen during the course of the program.

Nitrate nitrogen was detected at Glen Canyon in 10 of 18 samples (56%) ranging from 1.10-2.20 mg/L- NO<sub>3</sub>-N. At Disc Drive nitrate nitrogen was detected in 17 of 19 samples (89%), ranging from 1.10-17.60 mg/L- NO<sub>3</sub>-N; 6 of these exceeded the WQO of 2.25 mg/L-NO<sub>3</sub>-N: these notable detections in discharging waters were: 4.40 mg/L-NO<sub>3</sub>-N (9/1/05, 9/17, 9/23), 8.8 mg/L-NO<sub>3</sub>-N (9/5/05, 9/7), to 17.60 mg/L-NO<sub>3</sub>-N (8/31). At Carbonero #1 Nitrate nitrogen was detected in one sample of 8 (13%), at 1.10 mg/L-NO<sub>3</sub> on 10/15/05 (1:48pm). At Carbonero #2 Nitrate nitrogen was detected in 8 of 18 samples (28%); twice at 1.10 mg/L-NO<sub>3</sub>-N (9/17/05, 10/17) and three times at 2.20 mg/L-NO<sub>3</sub>-N (8/26/05, 8/29, 9/5). The highest detection of nitrate nitrogen measured was 4.0 ppm, or 17.60 mg/L- NO<sub>3</sub>-N, found at Disc Drive on August 31, 2005 (11:55am). The range of detection for nitrate nitrogen for all stations was between 1.10-17.60 mg/L- NO<sub>3</sub>-N (measured as: 0.25 to 0.40 mg/L- NO<sub>3</sub>-N).

### **Ammonia (NH<sub>3</sub>)**

*WQO: US EPA >0.025mg/L (ppm) NH<sub>3</sub>*

Ammonia is excreted by animals and produced during decomposition of plants and animals, thus returning nitrogen to the aquatic system. It is rapidly oxidized in natural water systems by special bacterial groups that produce the ions of nitrite (NO<sub>2</sub>), nitrate (NO<sub>3</sub>), and ammonia nitrogen (NH<sub>3</sub>-N), which are then used by plants; therefore ammonia is an additional source of nitrogen as a nutrient which may contribute to the

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<sup>6</sup> Kentucky "Water Watch": [WWW.KYWATER.ORG](http://WWW.KYWATER.ORG); <http://www.state.ky.us/nrepc/water/wcpno.htm>

expanded growth of undesirable algae and other forms of plant growth that overload the natural system and cause pollution. The un-ionized form of ammonia ( $\text{NH}_3$ ) 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 in animals; causing lower reproduction and growth, or death to fish and other aquatic life.

Ammonia nitrogen ( $\text{NH}_3\text{-N}$ ) is the nitrogen-ion concentration within the ammonia ( $\text{NH}_3$ ) present in the sampled water. Ammonia nitrogen is present in various concentrations in many surface and ground water supplies and is sometimes accepted as chemical evidence of pollution when encountered in natural waters. The main uses of ammonia are in the production of fertilizers, explosives and polymers and it is also an ingredient in certain household cleaners.<sup>4</sup> During the course of the program ammonia-nitrogen was tested in the field using a LaMotte test kit and in the Laboratory. The following are results from the in-field tests with the test kit.

Ammonia nitrogen ( $\text{NH}_3\text{-N}$ ) was measured in the field and the resulting values were converted to Ammonia ( $\text{NH}_3$ ) to match the WQO unit. Ammonia was detected in 22 of the 112 samples collected (20%), and all measurable detections exceeded the WQO of 0.025 mg/L- $\text{NH}_3$  when converted from the measured ammonia nitrogen ( $\text{NH}_3\text{-N}$ ) values.

The highest detected value across all stations was 0.56 mg/L- $\text{NH}_3$ : measured on 10/25/05 at Glen Canyon (8:16 am), Disc Drive (9:32 am), Carbonero 1 (9:04 am), Carbonero 2 (9:15 am), as well as twice at Disc Drive on 9/29 (12:45 pm, and 2:33 pm). The highest frequencies of ammonia nitrogen detection were at Disc Drive in 7 of 26 samples (27%), and at Glen Canyon in 8 of 26 samples (31%). The range of calculated values for ammonia for all six stations was between 0.06 mg/L- $\text{NH}_3$  and 0.56 mg/L- $\text{NH}_3$ .

### **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 too many industrial applications to mention here. Specific to this program is the fact that surface runoff and stormwater flows pick up copper and zinc from brake and tire wear, nitrogen emitted from exhaust pipes, and other chemicals in vehicle wash wastewater.

There were 171 samples tested for copper; however copper was detected only one time during the course of the monitoring period, at Carbonero #2 at 0.5 mg/L on July 27, 2005 (11:29 am).

*(Note: As no other detections of copper had been made throughout the program a repeat analysis was performed in the field. Discharging water was observed to be 'dirty-brown' at the time of collection).*

### **Chlorine**

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

Chlorine alone as  $\text{Cl}_2$  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 chlorides are required for normal cell functions in plant and animal life. High chloride levels can cause human illness and also can affect plant growth at levels in excess of 1000 mg/l. 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.<sup>7</sup> 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.

There were 171 samples tested for chlorine; however no chlorine was detected during the course of the monitoring period.

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<sup>7</sup> Leonardo Tequila, A Training Course For Water Quality Experts, Italy:  
[http://www.italocorotondo.it/tequila/module2/pollution/forms\\_water\\_pollution.htm#Chlorides](http://www.italocorotondo.it/tequila/module2/pollution/forms_water_pollution.htm#Chlorides)

## **II. Measured Values**

*(In-field measurement)*

The following parameters were measured in the field during the 230 individual monitoring events. Please see the Appendix for Summary Tables 1-6: Tables 1-4 provide monitoring result of the parameters monitored, showing averages, minimum-maximum values, and frequency of detection; Table 5 presents the lab analysis results; Table 6 presents a consolidated record of the data collected in the field in tabular form by station.

### **Flow**

*WQO: None.*

For the six storm drains sampled, flow was observed during 181 of the 230 station visits (79%). Flowing discharge waters were detected during all station visits to Disc Drive, Carbonero #2, and Granite Creek. Discharge waters were detected during 39 of 40 visits to Glen Canyon (98%), 14 of 38 times at Carbonero #1 and Seagate stations (37%).

### **Air Temperature**

*WQO: None.*

Air temperature was taken during 229 station visits. Air temperature ranges fell between: 9.0-33.0 °C at Glen Canyon; 11.5-27.0 °C at Disc Drive; 13.0-30.0 °C at Carbonero #1; 11.5-29.5 °C at Carbonero #2; 14.0-30.0 °C at Seagate; and 10.0-28.0 °C at Granite Creek. The lowest recorded temperature was 9.0 °C at Glen Canyon station on 10/17/05 (8:07 am) and the highest recorded temperature was 33.0 °C also at Glen Canyon station on 7/23/05 (2:14 pm).

### **Water Temperature**

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

Water temperature was taken at 179 of 181 station visits with discharging water (99%). Water temperature ranges fell between: 15.5-21.5 °C at Glen Canyon; 13.0-23.5 °C at Disc Drive; 13.5-19.5 °C at Carbonero #1; 14.5-20.0 °C at Carbonero #2; 15.0-22.0 °C at Seagate; and 12.0-20.0 °C at Granite Creek. The lowest recorded water temperature was 12.0 °C at Glen Canyon station on 10/17/05 (8:07 am) and the highest recorded temperature was 23.5 °C at the Disc Drive station on 8/29/05 (2:07 pm).

### **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<sup>8</sup> (ex.; salts and minerals). Conductivity measurements were taken with an Oakton ECTester low range meter (0-1990 µS) or with an Oakton ECTester high range meter (0-19.90 mS; 0-19,900 µS) to ensure no readings would be out of range.

Conductivity was measured in all 181 station visits where discharging water was found. The range of conductivity measurements were between 360 µS (Granite Creek) and 1050 µS (Carbonero #1).

The average conductivity in discharging waters at each site is helpful in determining the influx of fresh rain water during the "First Flush" event. Conductivity averages (and median values) were calculated as follows: 648 (650) µS at Glen Canyon; 824 (825) µS at Disc Drive; 889 (870) µS at Carbonero #1; 625 (630) µS at Carbonero #2; 606 (605) µS at Seagate; and 412 (400) µS at Granite Creek.

### **pH**

*WQO: <6.5 or >8 pH units.*

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<sup>8</sup> Lenntech Water Treatment & Air Purification Holding B.V: <http://www.lenntech.com/water-conductivity.htm>

pH is a measure of the acidic or basic (alkaline) nature of a solution. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates. Typical rainwater has a pH of about 5 to 6. This means that it is naturally a neutral, slightly acidic liquid.<sup>9</sup>

pH was measured in all but one of the 181 station visits where discharge water was flowing (99%). pH values throughout the entire program ranged from 6.0 to 8.0 for all six stations. The highest pH measured was 8.0 (Glen Canyon on 8/17/05; Carbonero #1 on 7/11/05 and 9/16; and Carbonero #2 on 10/28/05) and the lowest was 6.0 (Carbonero #2 on 7/1/05 and 7/7; Granite Creek on 8/16/05).

Of the 180 measurements, 30 were at the threshold or in exceedence of the WQO (17%): 23 measurements were at the lower 6.5 limit, and 4 were at the 8.0 higher limit of safe water quality conditions. Additionally, 3 of these 30 measurements were 6.0 (10%), below the lower pH threshold of 6.5 (Carbonero #2 on 7/1/05, 2:28 pm, and 7/7/05, 6:52 pm; and Granite Creek, 8/16/05, 10:29 am).

### **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. Many of these observations were recorded even when water was not detected and samples were not collected. “Frequency” therefore is the relationship of the number of times the parameter was recorded as other than normal, out of the number of times an observation for that parameter was recorded throughout the program.

#### **Odors**

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 noted one time in the 181 water samples collected, at Carbonero #1 on August 9, 2005 (12:05 pm). The odor was recorded as having a “musty” smell. Numerous notations of “chemical” smells in the air were detected in the Carbonero #1 and #2 station vicinities, as well as a “sulfur” smell in the Disc Drive vicinity.

#### **Oil sheen**

An unnatural ‘oil sheen’ was observed in the discharging waters or in the immediate vicinity of the outfall or drain on 14 occasions: during 4 of 38 station visits to Disc Drive (11%); 7 of 38 station visits to both Carbonero #2 and Seagate (18%); and during 3 of 38 station visits to Granite Creek (8%). Volunteers were made aware of a similar looking ‘natural’ opalescent sheen, which is typical of a common iron oxidizing bacteria/fungus, and made an attempt to record only the petroleum or chemical ‘sheen’ and not the biological sheen.

#### **Sewage**

The observation of ‘sewage sighted’ or ‘sewage smell’ in the discharging waters was recorded 11 times during the 230 station visits (5%), to all stations except for Glen Canyon. In all instances a musky or ‘sewer’ odor was ‘smelled’ in the water collected from the sites and no sewage was observed at or near the outfall sites. Sewage ‘smelled’ was recorded on 1 of 38 station visits to Carbonero #1, Carbonero #2 and Granite Creek (3%), 3 of 38 visits to Seagate (8%), and on 5 of 38 visits to Disc Drive (13%).

#### **Surface scum**

The observation surface ‘scum’ sighted indicates some type of ‘froth’ on the water’s surface in or near the drain outfall; this ‘scum’ may be originate from any number of biological or human induced causes, and no specific information is gathered. The lowest frequency of surface scum was observed 3 of 38 visits at Disc Drive and at Seagate (8%). The highest frequency of surface sum observed was 4 of 38 visits to Carbonero #1 and Granite Creek (11%). No surface scum was observed at Glen Canyon or Carbonero #2 during the program.

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<sup>9</sup> Lenntech Water Treatment & Air Purification Holding B.V: <http://www.lenntech.com/Water-Pollution-FAQ.htm>

Most, but not all, of these observations were either yellow foamy bubbles typical sediment churned in turbulent waters, or was found in or around surface forming fungi and algae<sup>10</sup>. Once water was said to be ‘viscous’ however no other notable observations were made regarding the discharging water’s condition.

**Trash**

Trash was found at all stations in the program at least once. Items of trash were recorded on 60 of 228 station visits (26%). The highest frequency of trash being present during a station visit was found at Carbonero #2, where trash was detected during 13 of 38 of the visits (34%). Trash was recorded at Glen Canyon on 10 of 40 station visits (25%), at Disc Drive on 12 of 38 station visits (32%), at Carbonero #1 on 8 of 38 station visits (21%), at Seagate on 9 of 38 visits (24%) and at Granite Creek on 8 of 38 station visits (21%). The most common observations included paper (food wrappers and packaging), plastics, Styrofoam, cigarette butts, and recyclables such as aluminum cans and glass bottles.

**Turbidity**

Turbidity was compared to a visual scale and was consistently recorded as “low” for all six stations during the monitoring period.

**Day of Week/Time of Day**

During each monitoring day, or “trip”, volunteers would visit each of the six stations to make observations of site conditions, and take measurements and perform analysis of discharging waters. The 40 individual volunteer monitoring ‘trips’ occurred on every day of the week except Thursday and Sunday. These trips occurred on: Mondays (8), Tuesdays (6), Wednesdays (7), Fridays (6), and Saturday (3). The individual station arrival and monitoring times varied; however, the monitoring trips were predominantly started in the morning hours and ended by early afternoon.

**IV. Additional Data**

*(Laboratory Analysis)*

**Laboratory Analysis**

Water samples were collected once per month from all stations during the four ‘dry’ months of the program. These samples were collected where water was found discharging at the time of the station visit:

Station:	Code*	7/27/05	8/29/05	9/29/05	10/26/05
Glen Canyon	SVSD-01	X	X	X	X
Disc Drive	SVSD-02	X	X	X	X
Carbonero #1	SVSD-03	Dry	Dry	X	X
Carbonero #2	SVSD-04	X	X	X	X
Seagate	SVSD-05	X	Dry	Dry	Dry
Granite Canyon	SVSD-06	X	X	X	X

Once the samples were collected, they were iced and delivered to Santa Cruz County Department of Environmental Health Services Water Quality Laboratory to be tested for bacteria (*E.coli*, total coliform), and nutrients (nitrate, orthophosphate, and ammonium nitrogen. (Please see Appendix Table 5 for all lab results).

**Bacteria**

*E. Coli & Total Coliform*

*CCRWQCB Basin Plan;*

*E. coli - WQO: No single sample shall exceed 400 MPN - Water Body Contact Recreation*

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

Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of man and warm- and cold-blooded animals. They aid in the digestion of food. A specific subgroup

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<sup>10</sup> “Fairfax County Stormwater Planning Division – Perennial Streams Field Identification Protocol”, Fairfax County Public Works and Environmental Services Department [http://www.cblad.virginia.gov/docs/guidance/Perennial\\_Stream\\_Doc\\_Fairfax\\_NC/FairfaxMethod\\_May\\_03.pdf](http://www.cblad.virginia.gov/docs/guidance/Perennial_Stream_Doc_Fairfax_NC/FairfaxMethod_May_03.pdf)

of this collection is the fecal coliform bacteria, the most common member being *Escherichia coli* (*E. coli*). These organisms may be separated from the total coliform group by their ability to grow at elevated temperatures and are a specific kind of fecal coliform bacteria that live in the intestines of warm blooded vertebrates.

Although these bacteria which naturally exist in human intestines are harmless and helpful in digestion, ingesting water tainted with *E. coli* can cause severe food poisoning or even death in humans. The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals. At the time this occurred, the source water may have also been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. The test for total coliform is a measure all forms of coliform bacteria present in human and other mammal waste while the analysis for *E.coli* is to determine the presence of the more specific fecal coliforms.<sup>11</sup> The presence of bacteria in water is expressed in the unit “Most Probable Number” of bacteria colonies in 100 milli-liter of water; MPN/100mL<sup>12</sup>.

Results from the laboratory analysis indicated the presence of *E.coli* and total coliform to be under the water quality objectives in 11 of the 19 water samples analyzed during the program (58%). Granite Creek was the only station which never had a measurable value of bacterial higher than the appropriate WQO.

Measurable values for *E.coli* ranged from 10 MPN/100mL (Granite Creek, 7/27/05) to 2613 MPN/100mL (Seagate, 7/27/05). The values for total coliform ranged from 637 MPN/100mL (Granite Creek) to ‘greater than’ the upper detectable range of the test, where 24192 MPN/100mL equals the upper limit of the analysis performed (Glen Canyon, 10/25/05; Disc Drive, 9/29/05, 10/25/05; and Seagate, 7/27/05). Glen Canyon had the highest frequency of bacteria ‘detections’ overall with values which exceeded the WQO of 400 MPN/100mL for *E. coli* (in 2 of 4 samples tested), and over 10,000 MPN/100mL for total coliform (3 of 4 samples tested).

Five of the 19 samples (26%) analyzed in the Scotts Valley program exceeded the water quality objective of  $\leq 400$  MPN/100ml for *E.coli*: Glen Canyon, 8/29/05 - 2481, and 10/25/2005 - 537 MPN/100mL; Carbonero #1, 10/25/05 - 631 MPN/100ml; Carbonero #2, 7/2705 - 432 MPN/100mL; and Seagate, 7/25/05 - 2613 MPN/100mL.

Eight of the 19 samples (42%) analyzed in the Scotts Valley program exceeded the water quality objective of  $\leq 10,000$  MPN/100ml for total coliform: Glen Canyon, 7/27/05 - 14,136, 8/29/05 - 12,997, and 10/25/2005, - >24,192 MPN/100mL; Disc Drive, 9/29/05 - >24,912, and 10/25/05 - >24,192 MPN/100mL; Carbonero #1, 10/25/05 - 19,863 MPN/mL; Carbonero #2, 10/25/05 - 14,136 MPN/100mL; and Seagate, 7/25/05 - >24,192 MPN/100mL.

## Nutrients

### Nitrate-nitrogen, Orthophosphate & Ammonia-Nitrogen

WQO: CCRWQCB CCAMP;

Nitrate nitrogen - Attention Level  $> 2.25$  mg/L-  $NO_3-N$  (10 mg/L-N in CCRWQCB Basin Plan)

Orthophosphate - Attention level  $> 0.37$  mg/L- $PO_4$  as  $PO_4$

WQO: US EPA;

Ammonia  $> 0.025$  mg/L- $NH_3$

Also tested in the lab were the nutrients nitrate nitrogen ( $NO_3-N$ ), orthophosphate ( $PO_4-PO_4$ ), and ammonia ( $NH_3$ ).

All but one of the 19 values for nitrate nitrogen were found to be under their water quality objective of  $\leq 2.25$  mg/L (Disc Drive, 7/27/05 - 2.831 mg/L). All other detectable nitrate nitrogen values ranged from 0.05 to 1.389 mg/L. None of the nitrate nitrogen values measured for the program exceeded the Central Coast Basin Plan WQO of  $\leq 10.0$  mg/L- $NO_3-N$ .

<sup>11</sup> Suburban Water Testing Labs: <http://www.h2otest.com/factsheets/coliform.html>

<sup>12</sup> John Lindquist, Department of Bacteriology, University of Wisconsin, Madison: <http://www.jlindquist.net/generalmicro/102dil3.html>

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<sub>4</sub>) 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, they change into the ortho form. Organic phosphates are important in nature. Their occurrence may result from the breakdown of organic 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. Phosphate 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.<sup>13</sup>

Concentrations of orthophosphate were found to be above the water quality objective of  $\leq 0.37$  mg/L in 11 of 19 samples tested (58%). All detectable orthophosphate values ranged from 0.100 to 0.666 mg/L. The samples with detectable values found to exceed this WQO were: 4 of 4 from the Disc Drive (7/27/05, 0.468 mg/L; 8/29, 0.470 mg/L; 9/29/05, 0.938 mg/L; and 10/25/05, 0.466); 1 of 2 samples from Carbonero #1 (9/29/05, 0.666 mg/L); and in 2 of 4 samples Carbonero #2 (7/27/05, 0.601 mg/L; and 9/29/05, 0.430 mg/L).

Ammonia nitrogen concentrations were found to be above the water quality objective of  $\leq 0.025$  mg/L in 6 of 15\* samples tested (40%). All detectable ammonia nitrogen values ranged from 0.015 to 0.712 mg/L. All samples from the Disc Drive, Carbonero #1, and Carbonero #2, were found to exceed this WQO. The samples with detectable values found to exceed this WQO were: 1 of 2 at Glen Canyon (9/29/05, 0.410 mg/L); 2 of 3 from the Disc Drive (7/27/05, 0.712 mg/L; 9/29/05, 0.367 mg/L), and 1 of 2 samples Carbonero #2 (7/27/05, 0.108 mg/L); in the one sample at Seagate (7/27/05, 0.460 mg/L); and in 1 of 2 samples from Granite Creek (7/27/05, 0.460 mg/L). Detectable values of ammonia-nitrogen ranged from .015 to 0.712 mg/L (Disc Drive, 7/27/05). \*On 8/29/05 and 10/25/05 not every sample collected by the program was analyzed for ammonia-nitrogen at the laboratory.

## **V. First Flush Event**

The First Flush monitoring event occurred began on Tuesday, November 8, 2005 at approximately 3:30 am in Santa Cruz County and closer to 4:30 am in Monterey County. The event was held in the cities of Monterey, Pacific Grove, Capitola, Live Oak and Santa Cruz. , and The cities of Scotts Valley and Seaside mobilized the next one day later on Wednesday, November 9, 2005. For the 2005 Scotts Valley First Flush event, six trained volunteers and two staff members participated in the collection of samples along Carbonera Creek. The actual First Flush event began at approximately 4:30 pm. on the 8<sup>th</sup> and at 4:40 pm on the 9<sup>th</sup> of November.

Storm drain outfalls were monitored for conductivity, water temperature, pH, transparency, and field samples were collected for analysis of nitrate, orthophosphates, zinc, copper, lead, total coliform, *E. coli.*, total dissolved solids, and total suspended solids. A separate report will be written for the 2005 First Flush monitoring event which will be available to the public and sent to local area governments and agencies. 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>

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<sup>13</sup> Kentucky "Water Watch": [WWW.KYWATER.ORG](http://WWW.KYWATER.ORG); <http://www.state.ky.us/nrepc/water/wcetp.htm>

## DISCUSSION

The following section summarizes the results from monitoring discharge waters during the monitoring station visits, and breaks the program results into the two main qualitative groups for review; 'by parameter', and 'by station.' Please refer to the Appendix Tables 1-5 for a detailed presentation of the program data.

### *Discharge at Monitoring Stations*

Of the six stations visited during the 2005 Urban Watch monitoring period, all six exhibited enough flow to measure water quality conditions during at least some portion of the program. Flows were detected at the Glen Canyon, Disc Drive, Carbonero #2, and Granite Creek stations during most every station visit, possibly indicating that these four stations either expressed perennial 'stream' flows or received consistent discharges from some unknown source

The Seagate station was visited 38 times and flows were detected 14 times overall, however only once after August 10<sup>th</sup>, 10/28/05: during 23 continuous visits between 8/16-10/25/05 the outfall was dry, possibly indicating a change in an 'urban' run-off source, or as no detections were made during the program, perhaps a 'seasonal' stream discharging at this outfall had gone dry during the mid-late summer months.

The Carbonero #1 station also had a low frequency of detected discharges, with discharging water being present on only 14 days out of 38 station visits (37%), however these 'dry' days were spread throughout the program period, possibly indicating an urban run-off source.

### *Parameter Detections*

- **Detergent** surfactants were detected in 14% of all samples tested, and ranged between 0.2 and 0.4 ppm. All stations had detergent detections except for Granite Creek. The Seagate station had the highest frequency of detections with 6 of 14 samples testing positive (43%). The highest recorded detection was 0.4 ppm at Disc Drive on August 31, 2005.
- **Nitrate nitrogen** (NO<sub>3</sub>-N) was added to the field program in August 2005 and was detected in 42% of all samples tested, and ranged between 1.10 and 17.6 mg/L. All stations except Seagate had at least one detection of nitrate nitrogen. Measured values exceeded the WQO (2.25 mg/L) only at the Disc Drive station, where 89% of the 19 samples tested detected nitrate nitrogen over the WQO. The highest value for nitrate nitrogen detected was 17.6 mg/L at Disc Drive (August 31, 2005),

As well, monthly samples of stormdrain discharge waters were collected and delivered to the laboratory for analysis of **nitrate nitrogen** (NO<sub>3</sub>-N). These samples were predominantly collected by staff on a separate trip from the volunteer monitoring, therefore there is not field analysis along side the lab analysis results. Lab analysis of nitrate nitrogen averaged 0.65 mg/L (n=19, range 0.01-2.8, 0.53 median). The detection results for these visits were that only 1 sample in 19 (5%) had a detection of nitrate nitrogen in exceedence of the WQO; Disc Drive on 7/27/05, 2.83 mg/L- NO<sub>3</sub>-N.

- **Ammonia nitrogen** (NH<sub>3</sub>-N) was added to the field program in August 2005 and was detected in 20% of all samples tested. Measure values were converted to NH<sub>3</sub> which then ranged between 1.10-17.6 mg/L. All stations had at least one value, and all converted values exceeded the NH<sub>3</sub> WQO (>0.025 mg/L). The Disc Drive station had the highest frequency of detections with 7 of 26 samples testing above the WQO (27%). The highest detection was 0.56 mg/L, was found at least once at all stations except Granite Creek (on 9/29/05 and 10/25/05).

Monthly samples of stormdrain discharge waters were collected and delivered to the laboratory for analysis of **ammonia** (NH<sub>3</sub>). These samples were predominantly collected by staff on a separate trip from the volunteer monitoring, therefore there is not field analysis along side the lab analysis results. Lab analysis of ammonia averaged 0.23 mg/L (n=9, range 0.02-0.71, 0.11 median). The results for these visits were that 9 samples in 14 (64%) were identified at a detectable level of ammonia, and 6 of the 9 were in exceedence of the WQO (67%): Glen Canyon on 9/29/05 (0.41 mg/L); Disc Drive on 7/27/05 (0.71 mg/L) and 9/29/05 (0.37 mg/L); Carbonero #2 on 7/27/05 (0.11 mg/L); Seagate on 7/27/05 (0.34 mg/L); and granite Creek on 7/27/05 (0.46 mg/L).

- Monthly samples of stormdrain discharge waters were collected and delivered to the laboratory for analysis of **orthophosphate** (PO<sub>4</sub>). These samples were predominantly collected by staff on a separate trip from the volunteer monitoring and there was no field analysis for orthophosphate used in this program. All stations except Glen canyon had at least one value which exceeded the PO<sub>4</sub> WQO (>0.37 mg/L). All samples at Disc Drive, Carbonero #1, and Carbonero #2 exceeded the WQO. In total 12 of 19 samples testing above the WQO (75%). The highest detection was 0.94 mg/L, was found at Disc Drive (on 9/29/05).

Lab analysis of orthophosphate averaged 0.35 mg/L (n=16, range 0.05-0.94, 0.32 median). The results for these visits were that 16 sample in 19 (84%) were identified at a detectable level of ammonia, and 8 were in exceedence of the WQO: Disc Drive on 7/27/05 (0.47 mg/L), and on 8/29, 9/29 and 10/25/05 (0.47 mg/L); Carbonero #1 on 9/29/05 (0.67 mg/L); and at Carbonero #2 7/27/05 (0.60 mg/L), 9/29 (0.43 mg/L) and 10/25/05 (0.30 mg/L).

- **Copper** was detected only once at all six stations during the monitoring season, at Carbonero #2 on July 27, 2005 (11:29 am). The discharging water was observed to be a ‘dark brown’ by the Volunteer Coordinator who was present, and detergent surfactants were the only other detection on that visit, at 0.3 ppm.
- There were no detections of **chlorine** or **phenols** above the detection range of the equipment used (0.2 ppm for chlorine and 0.5 ppm for Phenols) in the samples collected from all stations, and the ‘visual’ observation of **turbidity** (Hi/Med/Low) was consistently ‘Low’ for all measurable stations during the 2005 program.
- From the **qualitative observations**, no distinct odor or intense color was detected in all 230 station visits. One distinct odor was observed at Carbonero #1 and was referred to as a “musty smell”. Volunteers reported 14 findings of the presence of oil sheen (9%) and surface scum (6%), however most were associated with areas of high algae: volunteers were instructed to look for the characteristics of naturally occurring ‘sheen’ and ‘scum’, and those used in this report were the instances where this was not indicated on the datasheet. Trash was observed at a moderately high frequency at all monitoring stations, in 26% of station visits, and consisted mostly of food wrappers, paper and plastic packaging, drink containers, and cigarette butts.
- Monthly samples of stormdrain discharge waters were collected and delivered to the laboratory for analysis of the **total coliform** bacteria. These samples were predominantly collected by staff on a separate trip from the volunteer monitoring, and there is no field analysis which can be done for this parameter. Lab analysis of total coliform ranged between 637 MPN to >24,192 MPN (the upper limit of detection in this method of analysis).

The results for this analysis was that 8 samples of 19 (42%) were identified in exceedence of the WQO (<10,000 MPN in any one sample): Glen Canyon on 7/27/05 (14,136 MPN), 8/29/05 (12,997 MPN), 10/25/05 (>24,192 MPN); Disc Drive on both 9/29 and 10/25/05 (>24,192 MPN); Carbonero #1 on 10/25/05 (19,863 MPN); Carbonero #2 on 10/25/05 (14,136 MPN); and Seagate on 7/27/05 (>24,192 MPN); no total coliform exceedences were identified in the four samples analyzed from the Granite Creek station.

- Monthly samples of stormdrain discharge waters were collected and delivered to the laboratory for analysis of the **E.coli** bacteria. These samples were predominantly collected by staff on a separate trip from the volunteer monitoring, and there is no field analysis which can be done for this parameter. Lab analysis of *E.coli* ranged between 10 MPN to 2,613 MPN.

The results for this analysis was that 5 samples of 19 (26%) were identified in exceedence of the *E.coli* WQO (<400 MPN in any one sample): Glen Canyon on 8/29/05 (2,481 MPN), 10/25/05 (537 MPN); Carbonero #1 on 10/25/05 (631 MPN); Carbonero #2 on 7/27/05 (432 MPN); and Seagate on 7/27/05 (2,613 MPN); no *E.coli* exceedences were identified in the 8 samples analyzed from the Disc Drive or Granite Creek stations identified in the.

On four occasions the total and *E.coli* and total coliform bacteria were both in exceedence of their WQO: Glen Canyon on 8/29 and 10/25/05; Carbonero #1 on 10/25/05, and at Seagate on 7/25/05.

#### *Station Detections*

- The **Glen Canyon** station was visited by program staff and volunteers 40 times. Detections outside acceptable ranges were limited to ammonia. Flowing water from the outfall was detected continuously at this station throughout the program period (98% of station visits).

Discharging water temperatures at Glen Canyon averaged 19.1°C (n=40, range 15.5 to 21.5, 20.0 median). The average conductivity for each station is used to aid in the determination of the “First Flush” event, where a drop in conductivity below the average indicates that there has been an introduction of ‘fresh’ water into the system was; at Glen Canyon the average conductivity was 646 µS (n=37, range 520-780, 650 median). pH values at Glen Canyon averaged 7.0, (n=39, range 6.5-8.0, 7.0 median). However, it is notable that 10 values were 6.5 which is the bottom threshold of the pH WQO (>6.5) and one value was at the upper limit of the WQO (<8.0).

As mentioned above, all detectable measurements of ammonia in the program were above the United States Environmental Protection Agency’s (US EPA) water quality objective of <0.025 mg/L-NH<sub>3</sub>; there is no other regional objective. Ammonia was measured at Glen Canyon 24 times, and six values were found to be above the detection limit of the kit (0.0 mg/L), these averaged 0.21 mg/L (n=6, range 0.06-0.56, 0.11 median).

Nutrient and bacteria analysis performed at the lab reflected no detections of nitrate or orthophosphate at this station, and one instance on high ammonia (two samples were non-detects, and two were not analyzed for his parameter). Both total coliform and *E.coli* bacteria were detected in every sample taken to the laboratory: total coliform bacteria were detected at levels above the WQO in 3 of 4 samples, and one of these exceeded the test capacity of 24,192 MPN/100mL (10/25/05). *E.coli* was detected on two of four samples analyzed beyond the applied WQO, and on both 8/29 and 10/25/05 both total coliform and *E.coli* exceeded their respective WQO.

- The **Disc Drive** station was visited by program staff and volunteers 38 times. Detections outside acceptable ranges were of detergent surfactants, nitrate nitrogen, and ammonia. Flowing water from the outfall was detected continuously at this station throughout the program period (100% of station visits).

Discharging water temperatures at Disc Drive averaged 16.9°C (n=38, range 13 to 23.5, 17.5 median). The average conductivity at Glen Canyon was 825 µS (n=38, range 520-1030, 825 median). pH values at Disc Drive averaged 7.0, (n=37, range 6.5-7.0, 7.0 median).

Detergent surfactants were detected in 6 of the 36 Disc Drive samples analyzed. Detectable values ranged from 0.2-0.4 ppm. Although there is not an official WQO for surfactants, this is a compound not found in natural waters which are common in household cleaners as well as of widespread importance in industrial applications, such as in emulsification, lubrication, catalysis, tertiary oil recovery, and in drug delivery<sup>2</sup>, and are therefore a strong indicator of run-off waters in the outfall discharges.

Nitrate nitrogen was detected in 17 of the 19 samples analyzed, and in 6 instances values exceeded the WQO (2.25 mg/L-NH<sub>3</sub>). Nitrate nitrogen averaged 4.01 mg/L (n=17, range 1.10-17.60, 0.50 median) and the one significant detection of 17.60 mg/L NH<sub>3</sub> (4.0 mg/L NO<sub>3</sub>-N) was measured on 8/31/05 (11:55 am). This was the single highest value in the program, and it was identified with the following other detections and measurements: detergent surfactants of 0.4 ppm, water temperature of 17.0 °C, and pH of 6.5. The water was noted as very ‘turbid’ below the outfall, and the conductivity was higher than average, at 950 µS. [Note: without the single 17.6 mg/L detection, the nitrate nitrogen detections averaged 2.4 mg/L (n=16, range 1.10-8.8, 2.2 median)].

Ammonia was measured at Disc Drive 26 times, and 7 measurements were found to be above the WQO. Ammonia values averaged 0.31 mg/L (n=7, range 0.06-0.56, 0.28 median).

Nutrient and bacteria analysis performed at the lab reflected 4 detections of nitrate nitrogen at this station, one of which exceeded the WQO (7/25/05, 2.83 mg/L). All four samples analyzed for orthophosphate exceeded the WQO. As well, of the three samples tested for ammonia one was a non-detect, and the other two exceeded the WQO (the fourth sample was not analyzed for this parameter). Both total coliform and *E.coli* bacteria were detected in every sample taken to the laboratory: total coliform bacteria were detected at levels above the WQO in 3 of 4 samples, and two of these exceeded the test capacity of 24,192 MPN. *E.coli* was detected on all four samples analyzed at levels below the applied WQO. On 7/27/05 nitrate, orthophosphate, and ammonia all exceeded their WQO, and on 9/29/05 orthophosphate, ammonia, and total coliform all exceeded their WQO.

- The **Carbonero #1** station was visited by program staff and volunteers 38 times. Detections outside acceptable ranges were limited to detergent surfactants and ammonia. Flowing water from the outfall was detected periodically at this station throughout the program period (37% of station visits).

Discharging water temperatures at Carbonero #1 averaged 15.6°C (n=14, range 13.5 to 19.5, 15.5 median). The average conductivity at Carbonero #1 was 889 µS (n=14, range 810-1050, 870 median). pH averaged 7.4 (n=14, range 6.5-8.0, 7.5 median). Three pH values of 14 measured were at the boundary of the WQO; two measurements of 8.0, and one at 6.5.

Detergent surfactants were detected in 6 of the 13 Carbonero #1 samples analyzed. Detectable values averaged 0.23 ppm (n=6, range 0.2-0.3, 0.2 median).

Ammonia was measured at Carbonero #1 12 times, and two measurements were above the WQO (<0.025 mg/L-NH<sub>3</sub>). Ammonia values averaged 0.42 mg/L (n=2, range 0.28-0.56, 0.42 median).

Nutrient and bacteria analysis performed at the lab reflected 2 detections of nitrate at this station, neither of which exceeded the WQO. One of the samples analyzed for orthophosphate exceeded the WQO. As well, of the one sample tested for ammonia one was a non-detect, and the other did not exceed the WQO. Both total coliform and *E.coli* bacteria were detected in every sample taken to the laboratory: total coliform bacteria were detected at levels above the WQO in 1 of 2 samples. *E.coli* was detected in both samples analyzed and one of these exceeded the test WQO. On 10/25/05 orthophosphate, *E.coli* and total coliform all exceeded their WQO.

- The **Carbonero #2** station was visited by program staff and volunteers 38 times. Detections outside acceptable ranges were limited to detergent surfactants, ammonia and pH. Flowing water from the outfall was detected continuously at this station throughout the program period (100% of station visits).

Discharging water temperatures Carbonero #2 averaged 17.7°C (n=37, range 14.5 to 20.0, 18.0 median). The average conductivity at Carbonero #2 was 625 µS (n=38, range 430-810, 630 median). pH averaged 7.0 (n=38, range 6.0-8.0, 7.0 median).

Detergent surfactants were detected in 3 of the 35 Carbonero #2 samples analyzed. Detectable values averaged 0.23 ppm (n=3, range 0.2-0.3, 0.2 median).

Ammonia was measured at Carbonero #2 25 times, and 4 measurements were above the WQO (<0.025 mg/L-NH<sub>3</sub>). Ammonia values averaged 0.24 mg/L (n=4, range 0.06-0.56, 0.17 median).

Four pH values of 38 measured were at the boundary of the WQO; 3 measurements of 6.5, and one at 8.0. However, two measurements of 6.0 were below the WQO (7/1 and 7/7/2005; both samples also measured low conductivity 460 and 560 µS respectively, and there was 0.2 ppm detergent surfactant detected on 7/7/05).

Nutrient and bacteria analysis performed at the lab reflected 4 detections of nitrate at this station, none of which exceeded the WQO. Three of the 4 samples analyzed for orthophosphate exceeded the WQO. As well, of the two sample tested for ammonia one did not exceeded the WQO. Both total coliform and *E.coli* bacteria were detected in every sample taken to the laboratory: total coliform bacteria were detected at levels above the WQO in 1 of 4 samples. *E.coli* was detected in all samples analyzed and one of these exceeded the WQO. On 7/27/05 orthophosphate, ammonia, and *E.coli* all exceeded their WQO.

- The **Seagate** station was visited by program staff and volunteers 38 times. Detections outside acceptable ranges were limited to detergent surfactants, and ammonia. Flowing water from the outfall was detected continuously at this station between 6/29-8/3/05 (12 visits), once again on 8/10/05, and then flow was not observed until the last station visit of the program, on 10/28/05 (37% of station visits).

Discharging water temperatures at Seagate averaged 19.6°C (n=14, range 15.0 to 22.0, 19.8 median). The average conductivity at Seagate was 606 µS (n=14, range 400-830, 605 median). pH averaged 7.1 (n=14, range 6.5-7.5, 7.0 median) and 1 pH value of 14 measured was 6.5, at the boundary of the WQO.

Detergent surfactants were detected in 6 of the 14 Seagate samples analyzed. Detectable values averaged 0.22 ppm (n=6, range 0.2-0.3, 0.20 median).

Ammonia was measured at Seagate two times, and in one sample the detected measurement was above the WQO (<0.025 mg/L-NH<sub>3</sub>) at 0.28 mg/L.

Nutrient and bacteria analysis performed at the lab on the one sample collected at this station. Nitrate nitrogen was detected, but did not exceed the WQO. Orthophosphate was not detected, and the ammonia exceeded the WQO. Both total coliform and *E.coli* bacteria were detected: both *E.coli* and total coliform bacteria were detected at levels above the WQO (total coliform above the >24,192 MPN). On 7/27/05, ammonia, *E.coli*, and total coliform all exceeded their WQO.

- The **Granite Creek** station was visited by program staff and volunteers 38 times. Detections outside acceptable ranges was limited to pH. Flowing water from the outfall was detected continuously at this station throughout the program (100% of station visits).

Discharging water temperatures at Granite Creek averaged 16.3°C (n=38, range 12.0 to 20.0, 16.3 median). The average conductivity at Seagate was 412 µS (n=38, range 360-670, 400 median). pH averaged 7.2 (n=38, range 6.0-7.5, 7.0 median) and 1 pH value of the 38 measured was 6.0, below the boundary of the WQO.

Nutrient and bacteria analysis performed at the lab on the four samples collected at this station. Nitrate nitrogen was detected, but did not exceed the WQO. Orthophosphate was detected in three of the four samples, and no values exceeded the WQO. Ammonia analysis was performed on three of four samples, one was a non-detect, and one exceeded the WQO. Both total coliform and *E.coli* bacteria were detected in all samples, however no levels exceeded the WQO. On no single sample collection day did multiple parameters exceed their WQO.

## **CONCLUSIONS AND RECOMMENDATIONS**

The 2005 Urban Watch program in the City of Scotts Valley conducted 38 individual monitoring days at six stations over the five months June to October, resulting in 230 individual station visits. Results from the data collected showed are detailed in this report, and indicate that detergent, ammonia, orthophosphate, bacteria, and trash are the most common contaminant in and around the storm drains and entering Carbonera Creek within the study area. Nitrate nitrogen was detected just one time during the in field monitoring and nitrate nitrogen was only detected once in the laboratory analyses. As well, copper was only detected once, but at a very high level in turbid, or ‘dirty,’ water, along with detergent surfactants. No detectable amounts of chlorine or phenols were found in any of the samples collected. Additionally, there was a low frequency of sewage odors, surface scum and oil sheen during the monitoring events.

Station conditions were generally found to be good, however detergent surfactants, nutrients and bacteria conditions in exceedence of the stated WQO were found at every station:

Overall water quality conditions from the **Glen Canyon** station were observed to be good. Flows were consistent throughout the program and the storm drain was never dry, indicative of a perennial flow which receives surface run off. A few detections of detergent surfactants, ammonia and variable pH were the only measurements of note from the volunteer monitoring, however, the persistent detection of elevated bacteria should be investigated further.

Water quality conditions measured in the volunteer program at the **Disc Drive** station reflected detections of detergent surfactants, ammonia, nitrate nitrogen and variable pH as well. Flows were consistent throughout the program and the storm drain was never dry, indicative of a perennial flow which receives surface run off. The Disc Drive station had the most frequent detections of values out of the acceptable range from the lab analysis with the exception of *E.coli*, where 47% of all test results from the four samples exceeded the appropriate WQO.

Water quality conditions from the **Carbonero #1** station were generally very good. Flows were infrequent and indicative of urban run-off conditions. There were a few detections of detergent surfactants, and ammonia, as well as variable pH. Orthophosphate and bacteria were both detected above the WQO in the two sets of lab results.

Water quality conditions from the **Carbonero #2** station were generally very good. Flows were consistent throughout the program and the storm drain was never dry, indicative of a perennial flow which receives surface run off. There were also a few detections of detergent surfactants, ammonia and two pH results were below the WQO. Orthophosphate and ammonia were both detected above the WQO in the two sets of lab results, and both bacteria were detected once each above their WQO.

Water quality conditions from the **Seagate** station were generally good. Flows were consistent throughout the first half of the program and the storm drain went dry between August and October, possibly indicative of an intermittent stream flow which receives surface run off. There were a higher percentage of detections of detergent surfactants, but only one nutrient test was run due to the timing of the addition of this equipment to the kit, and the reduced flows at the station. From the single sample taken from this station, ammonia, and both bacteria were detected above their WQO.

Water Quality conditions at the **Granite Creek** station were found to be very good. Two instances of high ammonia, and one low pH exceeded their WQO in the volunteer monitoring program. From the lab results, orthophosphate and ammonia were both detected at levels in exceedence of their WQO, however this is the only station to not have a single exceedence of either bacteria WQO.

Detergents were also detected at all stations except Granite Canyon—the most rural and residential drainage area. Although not detected in extremely high levels (max detection 0.4 ppm) these detections show that these stormdrains all received “run-off” containing some form of cleaning solutions or mild industrial effluents.

Bacteria in the discharging waters proved to be a persistent parameter detected above its water quality

objective at all stations except Granite Canyon as well. Both the total coliform counts and the more specific *E.coli* bacteria were found in high numbers at the Glen Canyon and Disc Drive (high total) stations on a number of occasions; both Carbonero Way station had at least one detection above the criteria of for both classes bacteria; only one sample was processed at the Seagate station due to reduced flows but it exceeded the criteria for both classes of bacteria. This condition should be investigated further and may warrant ‘up-pipe’ investigation into possible sources above the outlet.

Ammonia nitrogen was measured in this program and converted to Ammonia to compare to the criteria. These calculated values of ‘Ammonia’ proved to be the most prevalent parameter detected above the stated water quality objective (*US EPA; Ammonia >0.025 mg/L-NH<sub>3</sub>*). An investigation into native water conditions in the area should be performed and compared to other sources of nutrient data from the area to determine if this is a naturally occurring condition of elevated ammonia levels and therefore not a problem, or if there is a local discharge source affecting all the storm drains on the “Carbonera Creek” system.

As well, we found the pH of the water analyzed to be consistently of a lower pH than we have found in any other Urban Watch’s program during our monitoring. Although there were only three measurements which were outside the applied objective (6.5-8.0), we feel that the same kind of data review from other water quality monitoring sources, or further investigation including comparison to conditions within the stream water column, might be warranted. Perhaps this is a natural condition of the local geology and perhaps there are sources of discharge which are increasing the acidity of the discharges.

Trash also proved to be a consistent pollutant along the stream banks of Carbonera Creek, in the stormdrains themselves, and moving in the storm water discharges; found in 26% of all visits to all sites. It is important to note that trash was also observed along the Carbonera Creek riparian corridor, away from the individual storm drains (which was not recorded because it was not in immediate proximity of the storm drain being monitored—per the volunteer’s protocol). The trash observed was not in high densities, and was composed entirely of ‘small’ paper and plastic ‘bits’, food wrappers and drink containers, small amounts of packaging materials—predominantly Styrofoam, and cigarette butts.

The Carbonera Creek corridor would be a nice resting place for employees of the streamside businesses to lunch or take breaks; and this may be the primary source of trash in this program. As well, the discharges on the west side of the stream, Disc Drive and Carbonero #2, both receive runoff from the stormdrains receiving run-off from Scotts Valley Drive, and those on the east side, Carbonero #1, and Seagate, receive run-off from Highway 17, where discarded trash on the roadways is more prevalent. Both Glen canyon and Granite Creek are near major road ways as well.

An ‘outreach’ program encouraging periodic community ‘Stream Clean-Up’ days, outreach to streamside businesses, or targeted notices posted to point out the problem could be beneficial in trash abatement. As well, it is true in most urban environments that the presence or absence of trash receptacles directly affects the amount of trash pollution in a given area. Locating trashcans in the areas where the community use is obvious, as well as making sure they are maintained, is an important component in reducing trash as a pollutant in our local waterways. Other ideas may include working with local newspapers to publish weekly monitoring results from the Urban Watch program, and working with the Chamber of Commerce or other business associations to promote clean water practices. Development of a Public Service Announcement for the local newspapers or cable television channels detailing information about storm water and urban runoff pollution is another possible avenue for outreach to a wider audience.

The 2005 City of Scotts Valley Urban Watch Monitoring Program joined the ongoing efforts of the cities of Pacific Grove, Monterey, Capitola and the Santa Cruz County area of Live Oak, in looking at non-point source pollutants entering the waterways of the Monterey Bay. The LaMotte Urban Watch kit, which was used by volunteers to monitor dry-weather storm drain flow, is easy to use and provides consistent data for cities and interested parties. It provides a vehicle for community involvement in data collection, which contributes critical data not otherwise collected by other programs in the City of Scotts Valley.

The First Flush event proved a useful event for data collection and showed a great need to do further monitoring in the systems now looked at with the Urban Watch monitoring. This program also is a great tool for volunteers to see what the storm drain system is meant to do.

Although these discharge conditions were found to be relatively good, there were persistent detections throughout the program, and it is advised to recognize that these were the conditions during only 40 days between June and October in 2005. Although these conditions show no 'significant' detections or identify major sources of pollution, this is an evaluative process which requires multiple years of observation to identify trends.

The data results presented here show the need for continued public outreach and education regarding sources of non-point source pollution, including storm system connection to the local stream systems, urban runoff control within the city limits as well as in the surrounding neighborhoods which feed these drains. The continuation of this program in 2006 would add to the data set presented in this report and provide further information regarding the state of water health in Carbonera Creek.

Recommendation for a 2006 Urban Watch-First Flush program would include: 1) assess upstream sources of illicit discharges and pollutant sources; 2) support the investigation of additional parameters for study; 3) reevaluation of the stations monitored and the possible inclusion of new locations; and 4) 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.

In conclusion, the County of Santa Cruz and the cooperating City of Scotts Valley, as well as the supporting agency, the Regional Water Quality Control Board, are commended for supporting first year of the Monterey Bay Regional Urban Watch-First Flush program in the Scotts Valley area and they are urged to find the means to continue this valuable citizen monitoring program into the future to augment the data presented here.

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