CLEAN STREAMS PROGRAM

GAZOS CREEK WATERSHED

ANNUAL REPORT
JULY-DECEMBER 2003

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COASTAL WATERSHED COUNCIL

GAZOS CREEK WATERSHED
Annual Report
July-December 2003

EXECUTIVE SUMMARY

The Coastal Watershed Council established a volunteer monitoring program in Gazos Creek in May 2003 through funding from the State Water Resources Control Board (SWRCB).

The Coastal Watershed Council has maintained a volunteer monitoring program in Gazos Creek since September 1997. The intent of the program is to provide data that pertain to the water quality objectives set by the Regional Water Quality Control Board (1994) and to the anadromous fisheries present in Gazos Creek. In the past, CWC received funding from the Sempervirens Fund and the Packard Foundation.

Currently, the Gazos Creek Clean Streams monitoring project focuses on bimonthly water quality data.

Water quality parameters measured include:
- Air and water temperature
- Dissolved oxygen
- Turbidity
- Conductivity
- pH

A total of 8 data collection events were completed between August-December 2003. Water quality measurements were taken on each field visit. Results from the water quality sampling indicate excellent stream conditions. No sample results exceeded water quality standards for dissolved oxygen, water temperature, pH or turbidity.

Volunteer water quality monitoring provides reliable data that can be used by regulatory organizations and citizen groups. Monitoring also provides volunteers with first-hand knowledge about water quality in Gazos Creek and the surrounding watershed.

Recommendations for 2004-2005 are to continue monitoring of basic water quality parameters, including nitrate and bacteria sampling in the wet and dry season, as well as stream flow monitoring. Recruitment and training of additional volunteers will increase the number of field collection visits.

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I. COASTAL WATERSHED COUNCIL'S MONITORING PROGRAM

The Coastal Watershed Council (CWC) is a nonprofit organization committed to the preservation and protection of coastal watersheds through citizen-based conservation, education and community outreach. Serving as watershed advocates, CWC promotes the health of these ecosystems through stewardship, advocacy and proper management practices. Founded in 1994, the Coastal Watershed Council was formed in response to the declining health of the watersheds of the Monterey Bay region.

The mission of the Coastal Watershed Council is to restore the watersheds of the Monterey Bay region and teach area residents how to become stewards of their local creeks and streams. CWC's program areas focus on:

- Watershed stewardship, research and restoration
- Watershed education and outreach through citizen monitoring programs
- Organizational support and training for other grassroots watershed groups

Clean Streams

The Clean Streams Program is managed by the CWC and provides water quality monitoring in 4 watersheds on the Central Coast. The goals of the monitoring are:

- To provide baseline data where data are lacking or absent.
- To support and inform ongoing assessments and enhancement plan development and ultimately provide effective monitoring for projects resulting from the assessment and enhancement plans.
- To support and inform ongoing watershed restoration action strategies.
- To develop and support stakeholder involvement in watershed initiatives and foster long- term watershed stewardship.

The four Central Coast streams in the 2003-4 program include: Aptos, Branciforte, Corralitos and Gazos Creeks. The Clean Streams Citizen Monitoring Program included recruitment, all aspects of training, scheduling and supervision of volunteers, data entry, and draft and final data report completion. Watershed Coordinators work under the supervision and direction of the CWC's Watershed Program Managers.

Description of Gazos Creek Watershed Monitoring Program

The Gazos Creek watershed is an 11 square mile watershed encompassing about 16 miles of drainages located in southern San Mateo County just south of the town of Pescadero. It is one of the last viable coho salmon habitats south of San Francisco (Figure 1). A relatively small watershed, Gazos Creek provides habitat for several federally protected species including coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss*), California red-legged frog *(Rana aurora draytoni*), and marbled murrelet (*Brachyramphus marmoratus*). Initially, a watershed assessment was conducted to identify problems within the watershed (Coastal Watershed Council 1997).

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Figure 1. General area of Gazos Creek Watershed

Volunteer water quality monitoring by CWC began in September 1997 with a Clean Streams program grant by the Packard Foundation. The current Clean Streams Watershed Monitoring Program for Gazos Creek, funded by State Water Resource Control Board (SWRCB), started in June 2003. Volunteer outreach methods included flyers and posters, community outreach notices, press releases and public service announcements in both Santa Cruz and San Mateo County area. On 2 August 2003, an informational public meeting was held at the Beach House Restaurant to provide information about the Coastal Watershed Council and the Clean Streams program, its goals and the volunteer time commitment required. Following the meeting, a three-hour field training was conducted along Gazos Creek for volunteers.

The training provided creek side hands-on training by conducting field water quality tests and by paying particular attention to Standard Operating Procedures (SOP'S) and protocols for each parameter to be tested. Program Manager, Tamara Doan, and Watershed Coordinator, Bernadette Ramer, conducted the training. Field monitoring teams were created at the training session and a schedule formed based on volunteer availability. Team leaders were chosen based on performance during field training, leadership skills, and willingness to commit to the additional volunteer time required for the position. Team leaders were responsible for kit pickup and checkout before monitoring events and for communication between the Watershed Coordinator and members of the teams. Leaders ensured that team members were aware of the monitoring schedule and communicated any needs and irregularities to the Coordinator.

Four volunteers in two teams collected bi-monthly water quality data at four monitoring stations in the Gazos Creek Watershed. Monitoring was conducted between 10 August 2003 and 22 November 2003.

Figure 2 shows the monitoring stations on Gazos Creek:

- Diversions Station ID: 202-Gazos-14
- Old Women's Creek Station ID: 202-Gazos-15
- Bear Gulch Station ID: 202-Bearg-11
- Mainstem Station ID: 202-Gazos-16

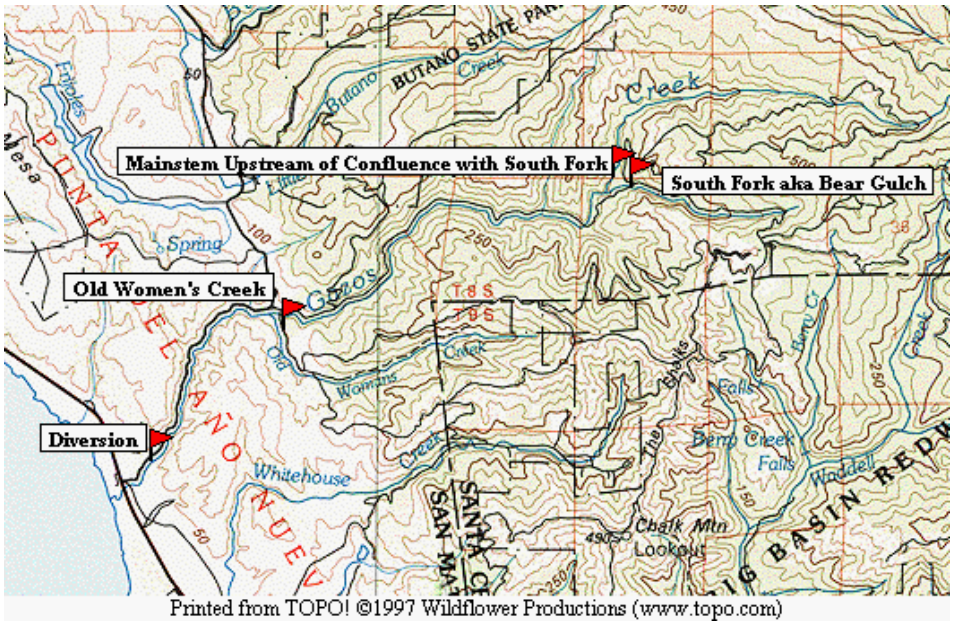

Figure 2. Monitoring locations of Gazos Creek Watershed stations.

Volunteer Participation

Hours spent by Gazo Creek volunteers in the field, at the community meeting and in-field training came to a total of 51 hours between 10 August –22 November 2003.

A volunteer recognition party was held at Petroglyphs in Santa Cruz on 3 December 2003 for volunteers from all current CWC programs. None of the Gazos volunteers were able to attend the celebration that evening.

Participating volunteers during the 2003 season included:

Gary Allen
Julianna Rhodes
Chantell Royer
Laura Verutti

II. DATA QUALITY, METHODS AND EQUIPMENT

Coordinator Training

Watershed Coordinators received two full days of classroom and in-field training. The training session was conducted by Program Managers Tamara Doan and Kaitilin Gaffney and assisted by Bridget Hoover (Monterey Bay Sanctuary Citizen Watershed Monitoring Network). Training topics covered: administration, quality assurance, the Monitoring Plan, parameters, volunteers, data and reporting.

Volunteer training

Volunteers received a full day of classroom and in-field training prior to monitoring. Program Manager, Tamara Doan, and Watershed Coordinator, Bernadette Ramer, conducted the training session. Training topics included: program purpose, safety, equipment orientation, in-field training, and quality assurance. The Coordinator continued to supervise each team during the monitoring season as necessary. Volunteer teams were provided with a program manual which included descriptions of parameters to be tested, parameter fact sheets, general watershed ecology, Standard Operating Procedures (SOP), data sheets, volunteer schedule, maps and directions to stations and a list of contact information for the Coordinator and program volunteers.

Volunteers conducted water quality monitoring two times per month at the selected monitoring stations within the watershed. The specific parameters sampled and the station locations for monitoring were those that had been used previously by CWC. The number of stations being sampled were chosen to represent the watershed and limited by the number of volunteers available for monitoring, At each station, volunteers were trained to collect water samples according to the appropriate protocol and to measure air/water temperature, pH, dissolved oxygen, conductivity and turbidity.

The Clean Streams water quality monitoring kit included the testing equipment, paper towels, water collection cups, trash bags, first aid kit, a clipboard with laminated protocol sheets for each parameter, as well as a water quality monitoring manual. The Coordinator maintained the kit.

Standard Operating Procedure

A Standard Operating Procedure (SOP) is an approved methodology for conductivity, dissolved oxygen, pH, turbidity and water temperature provided by State Water Resources Control Board (SWRCB) Clean Water Team (Table 1). Volunteer monitoring was conducted following the Standard SOP's.

Table 1. SWRCB Clean Water Team Compendium Standard Operating Procedures

Parameter	Equipment	SWRCB SOP
Water Temperature	Bulb Thermometer LaMotte Code 1066	3.1.2.1
pH	Non-bleeding pH strips Macherey-Nagel D-52348	3.1.4.2
Dissolved Oxygen	Winkler Model EDO Code:	3.1.1.2
Conductivity	7414ECTestr Oakton ISO 9001	3.1.3.1
Turbidity	Dual Cylinder turbidity kit Model TTM Code 7519	3.1.5.3

Data Quality Objectives (DQO)

This section identifies how sensitive and representative, precise, accurate, and complete measurements will be (Table 2). These Data Quality Objectives were derived by reviewing the QAPP and performance of other citizen

monitoring organizations, by considering the specifications of the instruments and methods planned for use, and by considering how the data will be used. These criteria are reflected in the Clean Streams QAPP. See Appendix A for all QA documentation forms.

Detection Limit and Sensitivity

The Method Detection Limit is the lowest possible concentration an instrument or equipment can detect. Sensitivity is the ability of the instrument to detect one concentration from the next.

Precision

The precision objectives apply to replicate samples taken as part of a QC session or as part of periodic in-field QC checks. Precision describes how well repeated measurements agree. The evaluation of precision described here relates to repeated measurements taken by either different volunteers on the same sample (at quality control sessions) or the same volunteer analyzing replicate samples in the field. Sampling variability will not be covered in this section.

Accuracy

Accuracy describes how close a measurement is to its true value. Using standard solutions, accuracy measurements compare the results of a sample of known value to its measured value. Accuracy checks are conducted twice per year on conductivity, pH, and temp erature

Completeness

Completeness is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. Volunteer data will not be used for legal or compliance uses. There are no statistical criteria that require a certain percentage of data. However, it is expected that 80% of all measurements would be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems.

Table 2. Data Quality Objectives for Conventional Water Quality Parameters

Parameter	Method/range	Units	Detection Limit	Sensitivity	Precision	Accuracy	Complete-ness
Temperature	Thermometer (-5 to 50)	^{o} C	-5	0.5 ^{o} C	± 0.5 ^{o} C	± 0.5 ^{o} C	80%
pH	Non-bleeding Strips (range 4.5-10.0)	pH units	4.5	0.5 unit	±0.5 units	± 0.5 units	80%
Dissolved oxygen	Micro-Winkler Titration	mg/L	0.2 mg/L	0.2 mg/L	± 10%	± 10%	80%
Conductivity	Conductivity Meter	µS/cm	10	10 µS/cm	± 10%	± 10%	80%
Turbidity	Dual Tube Optical	JTUs	5	5 JTUs	± 5 JTUs	NA	80%

NA: not applicable

- Note: Some test kits vary in sensitivity over the range of detection. The specific range of readings is noted in parentheses.
- DQO's are based on the manufacturer's enclosed accuracy information.

Quality Assurance

The following field measurement quality objectives were adopted to validate the quality of the data collected for the Clean Streams volunteering monitoring program:

1) Assure that each instrument had a unique identifying code (referred to as "Instrument ID") that was tracked with each measurement taken.
2) Assure that adjustable and non-adjustable-reading equipment provided was calibrated every 6 months using a certified state Standard to assess accuracy.

3) Assure accurate labeling of chemical reagents with expiration dates provided by LaMotte Chemical Company and that expired reagents were not used in the testing (dissolved oxygen and turbidity).
4) Assure that each instrument had at lease one "replicate" measurement on each field day for the purpose of calculating "precision".
5) Assure that in-field measurements were taken appropriately by providing adequate instruction and written procedures for volunteers.

Water Quality Objectives

A Water Quality Objective (WQO) is the acceptable range of values for a particular parameter, what constitutes *healthy* water quality. The Regional Water Quality Control Board (RWQCB) sets a Basin Plan to show how the quality of the surface and ground waters in the Central Coast Region should be managed to provide the highest water quality reasonably possible (Basin Plan).

The Central Coast RWQCB has established The Central Coast Ambient Monitoring Program (CCAMP), a regionally scaled water quality monitoring and assessment program, whose purpose is to provide scientific information to Regional Board staff and the public, to protect, restore, and enhance the quality of the waters of central California (CCAMP, 2004). CCAMP action levels for this area were adopted as Water Quality Objectives for dissolved oxygen, pH and water temperature. Exceedences occur when these action levels are above or below the acceptable ranges.

All of the parameters with WQO have a significant impact on water quality and habitat value for wildlife and fishes in coastal California, as well as indicate concerns for human health (Table 3).

Table 3. Water Quality Objectives

Parameter	Water Quality Objectives (WQO)	Source of Objective
Temperature (°C)	Not > 22 °C	CCAMP Action Level
pH	Not <7.0 or > 8.5	CCAMP Action Level
Dissolved Oxygen (mg/l)	Not lower than 7	CCAMP Action Level

III. DESCRIPTION OF PARAMETERS AND RELEVANCE TO WTER QUALITY AND HABITAT

Conductivity

Conductivity is a general measure of water's ability to conduct an electrical current. There are no water quality objectives for conductivity for water bodies in the Central Coast Region. Generally, potable water in the United States ranges between 30 to 1500 uS/cm and irrigation supply water ranges exceed 750 uS/cm (EPA 1994). Volunteers measure conductivity with a temperature-adjusted meter in the field.

Testing for conductivity provides ways to:

- identify different water sources (for example, rain water, agricultural runoff, municipal waste water)
- identify potential sources of pollution
- monitor seasonal changes in the water table
- monitor effects of salt water intrusion (salt water typically has higher conductivity than fresh water because of the presence of salts in the water)
- infer the local geology of the area (baseline conductivity varies depending upon which minerals are present as surface water flows over the local substrate)

Dissolved Oxygen

Dissolved oxygen (DO) refers to the amount of oxygen captured within the water column. Factors that affect the concentration of dissolved oxygen include temperature, DO sources (such as photosynthesis that adds oxygen to the water), DO sinks (such as respiration that consume oxygen), breakdown of organic material, sewage, yard waste, oil and grease, and salinity. Low dissolved oxygen levels usually result from water temperature increases, algal blooms, or the presence of human and animal waste.

Aquatic organisms, such as fish and amphibians, require adequate amounts of dissolved oxygen for their continued health and survival. Reduced dissolved oxygen levels in freshwater systems can cause problems with reproduction and incubation, egg or larval failure, retarded growth, and, in extreme cases, death in salmonids.

Anadromous fish require high DO levels (>9.0 mg/l) during their reproductive phases (San Francisco Estuary Institute 1997). During the juvenile growth period (in the summer and fall), DO levels must remain at 8.0 mg/l or higher to prevent impairment. If DO levels fall to 6.5-7.0 mg/l, sharp decreases in performance have been observed. Embryos and larvae require even higher DO levels (State Water Resources Control Board 1996). The Water Quality Objective minimum for DO for supporting coldwater fish has been set at not less than 7.0 mg/l (Basin Plan).

pH

pH is a measure of how acidic or basic (alkaline) the water is. On a scale of 0-14, a pH of 7 is said to be neutral, neutral, (neither acidic or basic). As the pH decreases, water becomes more acidic; as the pH increases, water becomes more basic. Changes in pH may also alter the concentrations of other substances in the water to a more toxic form. In freshwater systems, pH usually ranges between 6.5 and 8.5 (San Francisco Estuary Institute 1997). In fresh water, increasing temperature decreases pH. In the Central Coast Region for waters that are designated municipal and domestic water supply, water contact recreation, and non-contact water recreation, it is recommended that pH not fall below 6.5 or rise above 8.5 (Basin Plan).

Most fish species can tolerate pH values between 6.0 to 9.0. However, on the Central Coast, in streams that support salmon and steelhead, the pH values must fall between 7.0 and 8.5. Extreme pH values (<5 or >9) can be detrimental to fish survival and may cause physical damage to their gills, exoskeleton, and fins, and, in some cases, death (Basin Plan).

Temperature

Water temperature is one of the most important water quality parameters that has direct affects on water chemistry and the functions of aquatic organisms. Temperature influences the dissolved oxygen content of the water; conductivity and pH levels; the rate of photosynthesis by algae and other aquatic plants; the metabolic rates of organisms; the sensitivity of organisms to toxic wastes, parasites and diseases; and the timing of reproduction, migration and aestivation of aquatic organisms.

Factors that can affect water temperature include sunlight energy, seasonal and daily changes, shade, air temperature, streamflow, water depth, inflow of groundwater or surface water, and the color and turbidity (cloudiness) of the water. Other factors that can affect temperature include soil erosion, stormwater runoff, removal of riparian vegetation, water diversions, cooling water discharges from power plants, and alterations to stream morphology, substrate and flow. Water temperature is reported in degrees Celsius (°C).

Upstream migration of salmon and steelhead can occur when stream temperatures are between 3 °C and 20 °C; higher temperatures can inhibit migration, inducing salmonids to remain at sea until temperatures decrease (Reiser and Bjornn 1979). Water temperatures of 11.8-14.6 °C are optimal for coho salmon rearing; temperatures over 20 °C stop growth; and temperatures over 26 °C are lethal to coho salmon. Steelhead prefer lower temperatures of 7.3-14.6 °C for rearing; temperatures over 20 °C stops growth; and temperatures above 24 °C can result in mortality. Low water temperatures are imperative for successful salmonid reproduction and rearing.

Turbidity

Turbidity is a measure of the amount of suspended particles in the water. Watersheds have a natural turbidity level given the effects of natural erosion, organic decay and algae. There has been no determination of the natural turbidity level in most of the local watersheds within the Central California Coast. Turbidity can be an indicator of erosion, excessive nutrient loading and algal growth. Because of the number of suspended plants and animals (plankton) found within stream systems, turbid water can also be considered natural. The baseline level of turbidity will vary from stream to stream depending on the nutrient loading, geology and stream dynamics. Turbidity increases caused by discharge of sediment or nutrients should not exceed 10% of natural levels. In the absence of a numeric data quality objective, a turbidity level of >20 JTU (Jackson Turbidity Units) was adopted for this program.

Salmon and steelhead need clear-running streams with minimal sediment. High turbidity levels can indicate high sedimentation within the system. If a creek or river is heavily sedimented, spawning gravels and deep-water rearing habitat can become silted in. Also, highly turbid waters can increase the chance for redds (nests with egg sacks) to be washed away during storm events. Excessively turbid waters can also impair feeding. Coho salmon redds are highly susceptible to destruction caused by early storms (Smith 1998).

IV. DATA RESULTS

Four volunteers conducted eight water quality field data monitoring trips at four stations in Gazos Watershed from 10 August to 22 November 2003. The monitoring trips were conducted between 0930-1300 hours with two volunteers working together. The basic water quality measurements were taken: air and water temperature, dissolved oxygen, pH, turbidity and conductivity.

Raw data of the water quality data are presented in the Appendix B of this report.

Table 4 summarizes the water quality data by parameter for all the four stations sampled within the Gazos Creek watershed. It provide the Water Quality Objective, the total number of samples collected, and includes the number and percent exceedences, and the range and mean of each parameter. Tables 5 summarizes the same information for each of the four stations: Diversions, Old Woman's Creek, Bear Gulch and Mainstem.

Table 4. Gazos Creek Watershed

Parameter	WQO	Number of Samples	Number of Exceedences	Percent Exceedences	Minimum Result	Maximum Result	Mean Result
Air Temp (°C)	none	30			8.0	24.0	15.3
Conductivity (uS)	none	32	0	0	100	440.0	
DO (mg/l)	not <7	32	0	0	7.6	10.8	8.6
pH	not < 7.0 or > 8.5	32	0	0	7.0	7.5	7.1
Turbidity (JTU)	Not >20 JTU	32			5	5	
Water Temp (°C)	not > 22°C	28	0	0	8.0	17.0	13.1

Conductivity

Thirty-two water samples were tested for conductivity at four stations on eight field visits. The mean conductivity at all four stations was 400 uS with a range of 100 uS to 440 uS (Table 4). The low was recorded at Bear Gulch (Bearg-11) on 10 August, and the high was recorded at Mainstem (Gazos-16) on 22 November (Table 5). These conductivity values are within the acceptable range of potable water as determined by the US Environmental Protection Agency (San Francisco Estuary Institute 1997).

Dissolved Oxygen

Thirty-two samples were collected for dissolved oxygen at four stations on eight field visits. The mean dissolved oxygen (DO) at all four stations was 8.6 mg/l with a range of 7.6 mg/l at Diversions (Gazos-14) on 10 August to a high of 10.8 mg/l at Bear Gulch (Bearg-11) on 16 November (Tables 4 and Table 5).

All DO values for the four sites were within CCAMP water quality standards and are acceptable for both salmonid juvenile growth and reproductive-larval phases. The mean values for all four sites indicate that sufficient DO levels are present for rearing steelhead and coho salmon.

pH

Thirty-two water samples were tested for pH at 4 stations on eight field visits. The pH values were very consistent with a mean pH was 7.1 and the range was 7.0 to 7.5 (Table 4) The values are within the CCAMP water quality standards.

Temperature

Air temperature. Thirty samples of air temperature were taken at four stations on eight field visits. On one field visit, the air temperature thermometer was broken which resulted in no air temperature readings for 2 stations. The mean air temperature for all four stations was 15.3°C with a range between 8.0-24.0°C (Table4). The minimum temperature (8.0°C) was recorded at Bear Gulch (Bearg-11) on 22 November at 1235 hours, and the high temperature (24.0°C) was at Mainstem (Gazos-15) on 13 September at 1116 hours (Table5).

Water temperature. Twenty-eight samples of water temperature were taken at four stations on eight field visits. On one field visit, the water temperature thermometer was broken which resulted in no water temperature readings for all four stations on that day. The mean water temperature at all four stations was 13.1°C with a range of 8.0 to 17.0

°C (Table4). The minimum temperature was recorded at both Diversions (Gazos-14) and Mainstem (Gazos-16) stations on 22 November between 1135-1250 hours, and the high was at Diversion (Gazos-14) on 10 August at 0945 hours (Table 5). All 32 water temperature values were within CCAMP water quality standards..

Turbidity

Turbidity levels were within the acceptable range of not exceeding 20 JTU throughout the August through November 2003 monitoring period. Turbidity levels were 5 JTU or below on all thirty-two water samples tested (Table 4).

Table 5.

Diversions-Gazos-14

Parameter	WQO	Number of Samples	Number of Exceedences	Percent Exceedences	Minimum Result	Maximum Result	Mean Result
Air Temp (°C)	none	7			9.0	20.0	15.8
Conductivity (uS)	none	8	0	0	300	410	369
DO (mg/l)	not <7	8	0	0	7.6	9.4	8.5
pH	not < 7.0 or > 8.5	8	0	0	7.0	7.5	7.1
Turbidity (JTU)	Not >20 JTU	8	0	0	5	5	
Water Temp (°C)	not > 22°C	7	0	0	8.0	17.0	13.3

Old Woman's Creek-Gazos-15

Parameter	WQO	Number of Samples	Number of Exceedences	Percent of Exceedences	Minimum Result	Maximum Result	Mean Result
Air Temp (°C)	none	7			9.5	24.0	16.3
Conductivity (uS)	none	8	0	0	300	410	362
DO (mg/l)	not <7	8	0	0	8.0	9.2	8.6
pH	not < 7.0 or > 8.5	8	0	0	7	7.5	7.1
Turbidity (JTU)	Not >20 °C	8	0	0	5	5	
Water Temp (°C)	not > 22°C	7	0	0	9	16.5	13.4

Bear Gulch-Bearg-11

Parameter	WQO	Number of Samples	Number of Exceedences	Percent Exceedences	Minimum Result	Maximum Result	Mean Result
Air Temp (°C)	none	8			8.0	20.0	14.4
Conductivity (uS)	none	8	0	0	100	230	
DO (mg/l)	not <7	8	0	0	8.2	10.8	8.8
pH	not < 7.0 or > 8.5	8	0	0	7.0	7.0	7.0
Turbidity (JTU)	Not >20 °C	8	0	0	5	5	
Water Temp (°C)	not > 22°C	7	0	0	9	15.5	12.9

Mainstem-Gazos-16

Parameter	WQO	Number of Samples	Number of Exceedences	Percent Exceedences	Minimum Result	Maximum Result	Mean Result
Air Temp (°C)	none	8			10.0	21.0	14.9
Conductivity (uS)	none	8	0	0	300	440	400
DO (mg/l)	not <7	8	0	0	8.0	9.8	8.6
pH	not < 7.0 or > 8.5	8	0	0	7.0	7.5	7.1
Turbidity (JTU)	Not >20 °C	8	0	0	5	5	
Water Temp (°C)	not > 22°C	7	0	0	8.0	15.5	12.8

V. DISCUSSION

All (100%) of the data collected met water quality objectives set forth in this program for water temperature, dissolved oxygen, pH and turbidity during monitoring from August through November 2003.

Dissolved oxygen levels in the areas tested were suitable for salmon and steelhead. Continued monitoring of dissolved oxygen at all the stations will be important in determining the variability in DO throughout the year and in a variety of physical conditions.

Although there were only four volunteers doing water quality testing at Gazos Creek, the quality of the monitoring was very thorough, and field testing was done on all proposed test dates with the exception of a week delay in testing due to rain the previous week.

Air temperatures stayed above 15°C from August to the late October and then dropped to the lowest reading of 8°C on the last sampling day in November. Water temperature readings followed the air temperature again with water temperature being above 15°C up to mid October and down to 8.0°C in November.

Other Clean Streams Recommendations

Recommendations for 2004-2005 are to continue monitoring of basic water quality parameters, including nitrate and bacteria sampling in the wet and dry season, as well as stream flow monitoring. Recruitment and training of additional volunteers will increase the number of field collection visits as well as increase the educational value of the program

V. REFERENCES

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Quality Assurance Steps

See text provided from SSD to draw on for introducing this section.

There was some confusion on how to take a replicate sample due, in part, to the coordinator being unclear of the procedures. Future training should include written instructions on what a replicate is and how a replicate sample is taken for each parameter being tested.

Accuracy-

Percent Accuracy is calculated from the drift (the difference between the post-event reading and the value of the Standard), divided by the "true" value of the Standard, times 100. An acceptable value for percent accuracy is less than 10%.

The percent accuracy was calculated for the conductivity meters used in all but one of the sampling dates and found to be 0.07%; an acceptable values. The conductivity meter used on the first visit was calibrated with a different concentration standard in the pre and post event calibration check and accuracy could not be calculated.

The value of the pH strip at both the pre and post calibration event was identical.

Two of the temperature instruments used during monitoring were not calibrated before beginning monitoring but were calibrated on 20 November 2003. A third temperature instrument was broken on 10 August 2003 and a fourth separated on 6 October 2003.

Completeness

Twelve monitoring events (three trips to each station per month) were planned for the Branciforte Watershed. All of the planned trips were completed at each station. In addition, nutrient sampling was done at four stations on 5 November where water quality testing was also done. The coordinator conducted water quality sampling at Happy Valley School on 26 July and additional follow-up trips on 18 September at the Branciforte/San Lorenzo Confluence, 10 November at Happy Valley and 16 November at 434 Market St. Four sampling events were conducted at the Lower Branciforte Stations in October. From 14 to 15 monitoring events were conducted at each station. Water and air temperature was taken 87/87 (100%) of the time a trip was made, pH 86/87 (98%), dissolved oxygen and conductivity 85/87 (98%), and turbidity 84/87 (97%).

Precsion

The percent precision was calculated using the formula: |A-B|x100/Avg.(A+B); the absolute value of A minus B, divided by the average of A and B, times 100 where A equals the parameter result and B equals the replicate results. All water temperature, pH, conductivity and dissolved oxygen and turbidity fell within the acceptable range as set forth in the Data Quality Objectives for conventional water quality parameters. The range in accuracy measurements for conductivity (N=6) was 0-2.4%. Dissolved oxygen (N=6) precision calculations were between 0-9.1 %. For temperature, pH and turbidity, the difference between the parameter result and its replicate were compared to the precision objective for each parameter. All of the replicates for temperature, pH and turbidity were within the objective values for their respective parameters.

Volunteer Participation

The volunteers in the Branciforte Watershed were very committed and worked together to schedule field visits in which at least two volunteers in the group could be present to conduct the water testing. . One of the volunteers has been doing water quality testing in Gazos Creek with the CWC for many years and two other volunteers work in the science field and are familiar with scientific procedures.

Four volunteers contributed 26 field hours. Five people were attended a two-hour public meeting for a total of 10 volunteer hours and 5 people attended the three-hour field training for a total of 15 volunteer hours. The total volunteers hours for the public meeting, field training and fieldwork was 51 hours.

APPENDIX B-GAZOS CREEK RESULT TABLE

Description	Date	Group	Time	Air Temp. (°C)	H2O Temp (°C)	pH	DO (mg/l)	Conduct. (uS)	Turb. (JTU)
Diversions	08/10/03	A	9:45	20.0	17.0	7.0	7.6	300	5
Diversions	08/24/03	B	11:52		16.0	7.5	8.7	340	5
Diversions	09/13/03	A	11:43	20.0	15.0	7.5	8.0	370	5
Diversions	09/27/03	B	11:48	16.0	15.0	7.0	7.9	370	5
Diversions	10/12/03	A	12:07	18.0		7.0	8.4	380	5
Diversions	10/26/03	B	10:48	15.0	12.0	7.0	8.8	370	5
Diversions	11/16/03	B	11:53	9.0	10.0	7.0	9.4	410	5
Diversions	11/22/03	BAR	11:35	12.5	8.0	7.0	9.2	410	5
Old Woman's Ck.	08/10/03	A	10:25	21.0	16.5	7.0	8.1	300	5
Old Woman's Ck.	08/24/03	B	11:30		16.0	7.5	8.7	330	5
Old Woman's Ck.	09/13/03	A	11:16	24.0	15.0	7.0	8.0	360	5
Old Woman's Ck.	09/27/03	B	11:38	15.5	15.0	7.0	8.2	370	5
Old Woman's Ck.	10/12/03	A	10:30	18.0		7.0	9.0	370	5
Old Woman's Ck.	10/26/03	B	10:30	14.0	12.0	7.0	8.0	360	5
Old Woman's Ck.	11/16/03	B	11:37	9.5	10.0	7.0	9.2	400	5
Old Woman's Ck.	11/22/03	BAR	12:00	12.0	9.0	7.0	9.2	410	5
Bear Gulch	08/10/03	A	11:15	20.0	15.5	7.0	8.2	100	5
Bear Gulch	08/24/03	B	10:06	19.8	14.8	7.0	8.6	180	5
Bear Gulch	09/13/03	A	9:57	16.0	14.5	7.0	8.6	200	5
Bear Gulch	09/27/03	B	10:55	17.0	15.0	7.0	8.2	200	5
Bear Gulch	10/12/03	A	10:14	10.5		7.0	9.2	210	5
Bear Gulch	10/26/03	B	10:00	14.0	12.0	7.0	8.2	180	5
Bear Gulch	11/16/03	B	10:27	10.0	10.0	7.0	10.8	210	5
Bear Gulch	11/22/03	BAR	12:35	8.0	9.0	7.0	8.8	230	5
Mainstem	08/10/03	A	11:50	21.0	15.5	7.0	8.4	300	5
Mainstem	08/24/03	B	10:40	19.0	14.9	7.5	8.0	390	5
Mainstem	09/13/03	A	10:33	17.0	15.5	7.5	8.0	400	5
Mainstem	09/27/03	B	12:10	16.0	15.0	7.0	8.2	400	5
Mainstem	10/12/03	A	10:55	12.0		7.0	9.8	430	5
Mainstem	10/26/03	B	10:12	13.0	12.0	7.0	8.2	410	5
Mainstem	11/16/03	B	11:09	10.0	9.0	7.0	8.8	430	5
Mainstem	11/22/03	BAR	12:50	11.5	8.0	7.0	9.2	440	5

APPENDIX C-- PARTICIPATING AGENCIES, ORGANIZATION & DONOR

Beach House Restaurant
Monterey Bay National Marine Sanctuary
State Water Resources Control Board Clean Water Team
The Ocean Conservancy