SECTION 4: WATER QUALITY ASSESSMENT

4.1 Overview of Water Quality

4.1.1 Introduction to Water Quality

Water quality in Carpinteria Creek influences living things which depend on the creek, ranging from tiny insects to the endangered steelhead trout, and even humans. Creek water quality also affects the health of local beaches. Inputs that compromise water quality are trash and debris, sediments, nutrients, petroleum, heavy metals, pesticides, and pathogens, and altered environmental factors such as temperature, pH, and dissolved oxygen. Sources of water pollution can be natural or human induced, and are identified as either point sources or nonpoint sources. Point sources have a discrete discharge location such as a pipe or culvert, and include wastewater treatment plants, that discharge wastewater effluent. Nonpoint sources do not have discharges coming out of a defined point, but rather are difficult to identify and are typically conveyed as general runoff or groundwater seepage. Examples of nonpoint sources include surface runoff.

4.1.2 Components of Water Quality

Temperature:
Steelhead trout require clean, cool water for reproduction and growth. Temperature of a water body can vary due to seasonal and diurnal influences. Inflowing water, flow rate, wind speed, air temperature and riparian shade can all affect water temperature. Encouraging vegetative canopy coverage over the creek channel is a practical means of positively impacting water temperature.

Dissolved Oxygen:
All aquatic organisms need oxygen to live. Dissolved oxygen (DO) is the amount of oxygen dissolved in water and is measured in units of mg/L or percent saturation. It varies inversely with temperature, as colder water contains a higher concentration of oxygen. Fluctuations in dissolved oxygen occur throughout the day due to changes in temperature, photosynthesis and respiration of aquatic organisms. Generally dissolved oxygen is highest at noon, due to photosynthesis from algae, and lowest in the evening due to uptake of oxygen through respiration of all organisms in the stream.

Biochemical Oxygen Demand:
Biochemical oxygen demand (BOD) is the amount of oxygen that would be consumed if all the organics in one liter of water were oxidized by bacteria and protozoa. It is a common water quality parameter and is different than dissolved oxygen as it is measures biological demand and not physical concentration.

pH:
The pH measures acidity and alkalinity of water, with a pH below 7 indicating acidic conditions, and above 7 indicating alkaline conditions. Changes in pH could be due to

erosion of some types of geological features, such as serpentine outcroppings, acid mine drainage or effluent from wastewater treatment plants.

Nutrients:
Plants require both nitrogen and phosphorus for growth; however excess amounts of these nutrients that drain into surface water can stimulate the production of algae, which reduces the dissolved oxygen content in the water. Some algae can produce chemicals that are toxic to livestock and wildlife. Nitrogen and phosphorus are two of the most heavily applied nutrients in farming operations and the connection to water quality makes good management of fertilizer application crucial.

Bacteria:
Bacteria, such as Enterococcus, Eshcerichia coliform *(E. Coli)*, fecal coliform or total coliform are used as indicators of sanitary quality of water for drinking and recreational use like swimming or surfing. Total coliform is a collection of microorganisms that aid in the decomposition of organic material. Where total coliform is found in water, testing is also conducted for *E. Coli* and fecal coliform. *E. Coli* is a type of fecal coliform that is associated with human or animal waste and can originate from the presence of large congregations of birds, livestock, dogs, septic systems or non-treated human waste.

Turbidity:
Turbidity measures the clarity of water. When creek water is cloudy it is often due to the runoff of sediment containing small clay particles or other organic particles. Turbidity varies naturally with the soil type, for example a clayey soil is dominated by very small sized clays which remain suspended and cause the water to be turbid for several days.

Total Suspended Solids/Sediment:
Total suspended solids (TSS) refers to material suspended in water, and total suspended sediment refers to just the inorganic portion. Suspended sediment can adversely impact fish by damaging their gills, or covering up the gravel necessary for spawning. It can also smother eggs already laid. Pollutants such as bacteria and pesticides can attach to clay particles and re-suspend in the water column when disturbed by a storm event.

Chemical contaminants:
Chemical contaminants, like pesticides, herbicides and hydrocarbons, can be extremely toxic to aquatic organisms. Detection of such chemicals could indicate mis-application, leakage or spillage upstream of the monitoring point.

Metals:
Metals such as zinc, chromium lead etc. are natural elements used in industrial processes which can be toxic to aquatic life. Groundwater and wastewater treatment plants are required to monitor metals regularly to indicate possible contamination in the watershed.

4.1.3 Designated Beneficial Uses

The Basin Plan, developed by the Central Coast Regional Water Quality Control Board (RWQCB) for the Central Coast Basin, documents how quality of surface and ground waters in Carpinteria Creek should be managed to provide the highest water quality reasonably possible. The Basin Plan establishes beneficial uses available within each sub-basin of the Central Coast Region that are to be protected and maintained with water quality standards. The present and potential beneficial uses of waters within and associated with the Carpinteria Creek Watershed are shown in Table 4.1.

Table 4.1: Identified Beneficial Uses of Inland Surface Waters, for Carpinteria Creek Watershed adapted from the Central Coast Region Basin Plan (RWQCB, 1994).

Beneficial Use	Carpinteria Creek	Gobernador Creek	Steer Creek	Coastal Water
Agricultural water supply	X			
Preservation of biological habitats of special significance	X			
Cold fresh water habitat	X	X	X	
Ocean, commercial, and sport fishing	X	X	X	X
Estuarine habitat	X			
Freshwater replenishment of surface water	X			
Ground water recharge	X	X		
Industrial service water supply				X
Fish migration	X		X	
Municipal and domestic water supply	X	X	X	
Navigation				X
Preservation of rare and endangered species	X			X
Water contact recreation	X	X	X	X
Noncontact water recreation	X	X	X	X
Shellfish harvesting				X
Fish spawning	X	X	X	
Warm fresh water habitat	X	X	X	
Wildlife habitat	X	X	X	

Data source: http://www.swrcb.ca.gov/rwqcb3/BasinPlan/Index.html

4.1.4 Water Quality Criteria

Inland Surface Waters

Specific objectives for all inland surface waters are designed to uphold the specific beneficial uses, such as water contact recreation or coldwater fish habitat. Of particular significance for the Carpinteria Creek Watershed are the objectives for bacteria for water contact recreation beneficial uses, which apply to Carpinteria, Gobernador, and Steer Creeks, as well as ocean waters. Bacteria standards for ocean water (RWQCB, 1994) are listed in Table 4.2. When these standards are exceeded, the local Health Officer is required to post warning signs at the beach area where recreational water contact may occur. This requirement does not apply to inland fresh waters such as creeks or lakes.

Table 4.2: Relevant standards for fecal indicator bacteria in coastal ocean waters.

Fecal indicator bacteria	Standard	Source
Total Coliform	10,000 MPN	AB 411 and RWQCB's Basin Plan for Marine Water Contact Recreation
Fecal Coliform	400 MPN	AB 411 and RWQCB's Basin Plan for Water Body Contact Recreation
Enterococcus	104 MPN	AB 411

Notes:
MPN is Most Probable Number
AB 411 - California Health and Safety Code, Assembly Bill 411 http://www2.nrdc.org/water/oceans/ttw/sumcal.pdf

An amendment proposed to the Basin Plan based on recent studies, would combine fecal coliform and *E. Coli* to assess the quality of inland surface waters for contact recreation. Changes to the fecal coliform objective for non-contact recreation were not proposed (RWQCB, 2004).

Nutrient water quality indicators considered here include ammonia, nitrate, nitrite, total nitrogen, phosphate, and total phosphorus (Table 4.3). While groundwater and municipal water supply do reach the stream and can impact surface water quality of the creek, the focus of Section 4 is on inland surface waters only. For more information on the quality of groundwater and the municipal water supply, see Appendix B.

Table 4.3: Current Regional and State Nutrient Standards

Nutrient	Standard	Source
Ammonia as N, Total	2.4	California Ocean Plan Daily Maximum
Ammonia as N, Unionized	0.025	Basin Plan: General Objective
Nitrate as N	10	Basin Plan: Municipal & Domestic Supply
Nitrate as NO3	45	Basin Plan: Municipal & Domestic Supply
Nitrite as N	1	EPA Primary Maximum Contaminant Level
Total N	NA	NA
Phosphate, total as P	NA	NA
Phosphorus, total	NA	NA

Note: NA – Information not available

4.1.5 EPA's 303(d) List

The federal Clean Water Act, amended in November 2002, stipulates in Section 303(d) the requirement that states identify water bodies that do not meet water quality standards set forth in a respective basin plan. Once identified, the waters are placed on a priority list based on the urgency of the impairment, and a total maximum daily load (TMDL) report must be prepared. A TMDL sets a limit on the amount of a pollutant allowed to enter a body of water from all sources.

Carpinteria Creek is listed as impaired for pathogens (bacteria) in the lower reaches and development of a plan to reduce the pollution is scheduled to begin in 2006. The RWQCB is the state agency responsible for development of TMDL plans.

4.2 Pollutant Sources

Primary nonpoint sources of concern include urban and agricultural land uses, as well as septic system effluent and natural sources such as birds and oil seeps. The major point sources within the watershed include: wastewater treatment effluent and greenhouse drainage.

4.2.1 Point Sources

NPDES permitted discharges

The Clean Water Act prohibits the discharge of waste to surface waters without filing a federal National Pollutant Discharge Elimination System (NPDES) permit. The Regional Water Quality Control Board requires a permit to release runoff or wastewater into California's surface, coastal or groundwater bodies. Discharges, such as those impacting groundwater resources, require that a Report of Waste Discharge be filed. A discharge of storm water may require a Storm Water permit. These permits set concentration limits on the pollutants discharged from a facility based on the ability of the receiving water body to absorb and disperse those pollutants.

The Carpinteria Sanitary District (CSD), with its wastewater treatment plant located on the bank of Carpinteria Creek, holds a permit for discharging wastewater into the creek The plant's discharge point is actually located about 1000 feet offshore on the ocean floor in 27 feet of water at zero tide. CSD reported 31 spills between July 1997 and June 24 2002, with nearly half resulting from the 1998 El Nino storms overwhelming the capacity of the sewers and pump stations. In 2002 the federal EPA ordered the district to develop a spill prevention plan.

4.2.2 Non-Point Sources

The largest source of pollutants in the watershed is surface water runoff, and includes rain and irrigation water flowing over roofs, driveways, streets, lawns, and agricultural lands. These loads are typically highest during the flush of the first major storm of the water year following an extended dry period during which pollutants have accumulated. Land use has a big impact on the ability of the soil to filter pollutants naturally or to increase the availability of pollutants to creeks. Such is the case with paved streets or parking lots, which cover the soil and direct water directly into storm drains and the creek. Fertilizer, pesticides, and irrigation water are vital to farm operations, landscapes and lawns; however, inefficient applications cause leaching of pesticides and nutrients into groundwater and runoff into surface water. Agricultural runoff and runoff from activities such as watering lawns and landscaping, washing cars, and washing parking lots and driveways can also contribute pollutants to surface water (US EPA, March 2003). Septic system effluent is a concern outside the zone of the municipal sewer service. Approximately 200 parcels within the Carpinteria Creek Watershed utilize a septic system, all of which are located north of Highway 101 across the watershed. There is also a concern of human waste polluting the creek as a result of camping and littering in or near the creek channel.

4.3 Water Quality Data Sources

Water quality monitoring efforts have been carried out within the watershed by several organizations since 1979.

4.3.1 United States Geological Survey

In addition to recording flow measurements of Carpinteria Creek, the U.S. Geological Survey (USGS) has the earliest available water quality results, with a wide suite of organic and inorganic constituents that were analyzed sporadically between April 1979 and May of 1992. These water quality measurements have established baseline conditions for chemical and physical properties, nutrients, and radiochemical concentrations of Carpinteria Creek. The USGS monitoring station is the same as their flow gauging station located just upstream of Highway 192. Constituents measured include temperature, specific conductance, pH, dissolved oxygen, flow, ammonia, nitrite, nitrate, orthophosphate, various metals, and other inorganic water quality indicators.

4.3.2 County of Santa Barbara Environmental Health Services

The Environmental Health Service (EHS) samples Carpinteria City Beach and Carpinteria State Beach on a weekly basis throughout the year specifically for pathogens. In general, most samples are collected 25 yards north or south of the mouth of a storm drain or creek (EHS, 2004).

4.3.3 County of Santa Barbara, Project Clean Water

Project Clean Water (PCW), a program of the County's Water Agency, sampled monthly and during several storm events on Carpinteria Creek during water years 2000, 2001 and 2002. Staff-persons gathered samples at the beginning of storms, in an attempt to catch the "first flush" of water, which typically carries the most pollutants. Samples from Carpinteria Creek were collected where the creek flows under the 8^{th} Street footbridge, the 6th Street storm drain, the USGS site at Highway 192, and just below the Gobernador debris basin on Gobernador Creek (Figure 4.1).

4.3.4 Central Coast Ambient Monitoring Program

The Central Coast Ambient Monitoring Program (CCAMP) is a regionally scaled water quality monitoring and assessment program of the RWQCB. Monthly sampling occurred from 2001 to 2003 at several sites in the watershed, including the USGS Site and 8th Street; and is part of a regional sampling effort. Data is generalized to minimum, maximum, and means, and includes conventional water quality parameters, benthic invertebrate bio-assessment measures, data on stream channel and bank characteristics, and indexed scores for habitat quality, riparian health, and sediment impact. A description of the program and data gathered can be viewed at: http://www.ccamp.org/

4.3.5 UC Santa Barbara, Coastal Long Term Ecological Research Project

The UC Santa Barbara, Santa Barbara Coastal Long Term Ecological Research Project (LTER) through funding by the National Science Foundation began monitoring efforts in water year 2001, which continue to date. The LTER focus is on measuring nutrient loading to the ocean by monitoring flow and nutrient concentrations at the outlet of the watershed above tidal influences. LTER has been performing water quality sampling at one to four different locations within the Carpinteria Creek Watershed, where they take samples either by grab or auto-sampler. Water quality indicators analyzed include nitrate (NO_3), ammonium (NH_4), phosphate (PO_4), total dissolved nitrogen (TDN), total dissolved phosphorus (TDP), particulate carbon, particulate nitrogen, particulate phosphorus, total suspended solids (TSS), specific conductance, with occasional sampling of the major ions of oxygen and hydrogen isotopes, O^{18}, and H^3 (deuterium). They analyze for various species of nitrogen and phosphorus by taking samples weekly as well as every one to four hours during storm flow events to characterize nutrient loading to the Santa Barbara Channel.

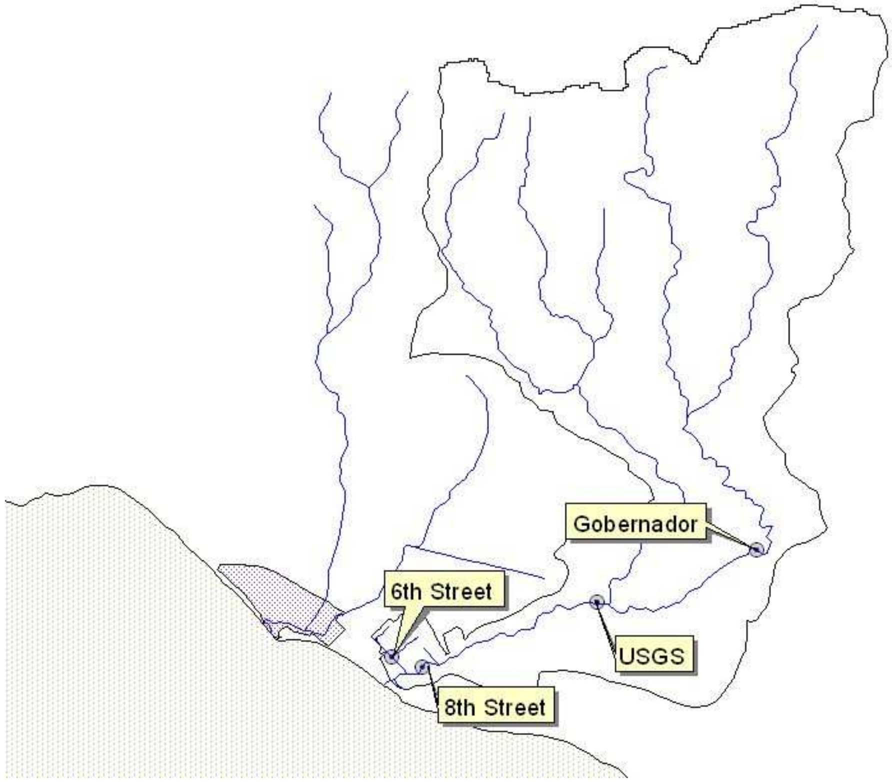

Figure 4.1: Project Clean Water Monitoring Sites Source: Project Clean Water, 2004
Notes: Gobernador is at the debris basin and is PCW Site GOB080,
USGS is at Casitas Pass Road and is PCW Site Carp0115,
8th Street is at the foot bridge and is PCW Site Carp013, and
6th Street is a storm drain north of the creek.

4.4 Water Quality Constituents Analysis

4.4.1 Temperature

Earlier records of water temperature recorded by USGS show morning temperature ranging from 48.2 to 67.1 degrees Fahrenheit (ºF), averaging 56.3ºF and afternoon temperatures 45.5 to 82.4ºF, with an average of 60.8ºF. Recent water temperature values have ranged from 46.6 to 67.3ºF at 8th Street with 31 measurements taken from January 2001 to March 2003 (CCAMP, 2004).

Incubation of steelhead eggs occurs in water temperature ranging from 32 to 75ºF. The time it takes for eggs to develop is reduced with a decrease in water temperature. Steelhead have difficulty in obtaining oxygen from the water when the temperature is greater than 70ºF (Stoecker et al., 2002). In general, DFG uses a daily average temperature of 68ºF in central and southern California as a standard to indicate reasonable conditions for healthy growth of rainbow trout. Rainbow trout/steelhead in southern California may have higher temperature tolerances. Fish that survive in warmer waters require more food and oxygen because their metabolism increases with temperature (Lower Santa Ynez River Fish Management Plan, 2000)

4.4.2 Dissolved Oxygen

Dissolved oxygen (DO) concentrations have ranged from 4.9 to 15.1 mg/L at 8th Street, as exemplified by Figure 4.2 below (CCAMP,2004). Note that these measurements were taken monthly and were likely taken during the day; therefore, the range of concentrations may actually differ significantly from what is depicted. For embryonic and alevin survival, a minimum dissolved oxygen level of 7.2 mg/L is needed (Stoecker et al., 2002).

PCW storm water sampling from November 1999 to February 2002 showed biochemical oxygen demand levels ranging from 0 to 50 mg/L, averaging 17.5 mg/L. The storm drain sampling station at 6th street showed higher levels of BOD coming from the commercial area of downtown Carpinteria, than from the 8th Street site.

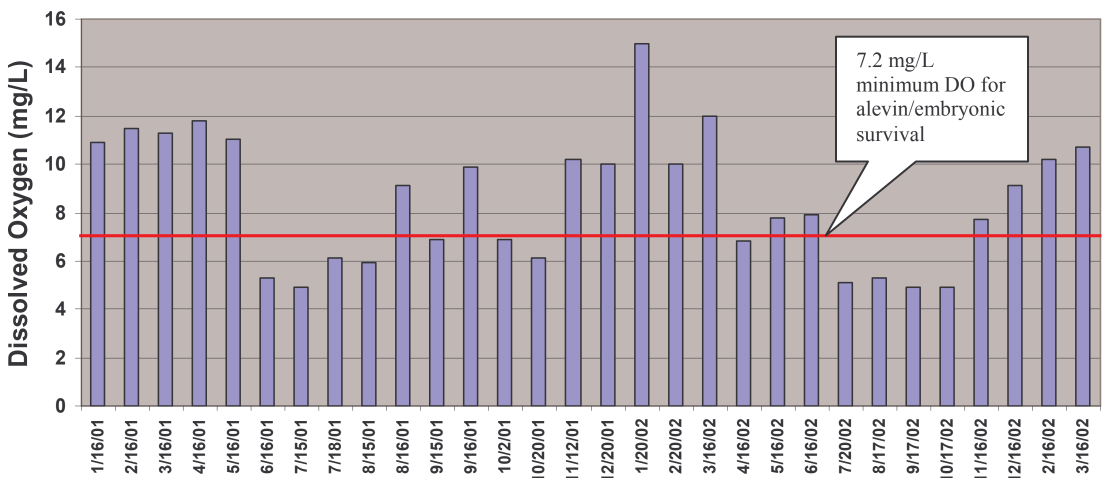

Figure 4.2: Dissolved Oxygen (DO) concentrations in Carpinteria Creek at 8th Street. Source: CCAMP, 2004.

4.4.3 pH

Earlier records by the USGS at their gauging station showed morning pH levels ranging from 7.5 to 8.7, averaging 8.3 and afternoon levels at 6.8 to 8.7, with most of the afternoon values at 8.5 or greater. From January 2001 to March 2003, 32 measurements were taken by CCAMP at 8th Street with values for pH ranging from a minimum of 7.15 to a maximum of 8.4. The Basin Plan objective for Cold Water Fish Habitat states that the pH value shall not be depressed below 7.0 or raised above 8.5.

4.4.4 Nutrients

Average annual nitrate and phosphate concentrations at the 8th Street Footbridge for water years 2001, 2002 and 2003 are presented in Figure 4.3. Nitrate concentrations were well below drinking water standards (EPA Standards are 45 mg/L for nitrate NO_3 and 10 mg/L for NO_3-N), where twice as much export occurred during stormflow events. Instantaneous measurements of nitrate, showed that concentrations regularly exceeded EPA Standards, specifically during baseflow conditions. Carpinteria received less than half the annual average rainfall in water year 2002 which resulted in higher nitrate concentrations from less dilution. Annual phosphate concentrations were generally low and similar year to year, with over 95% of the export associated with stormflow.

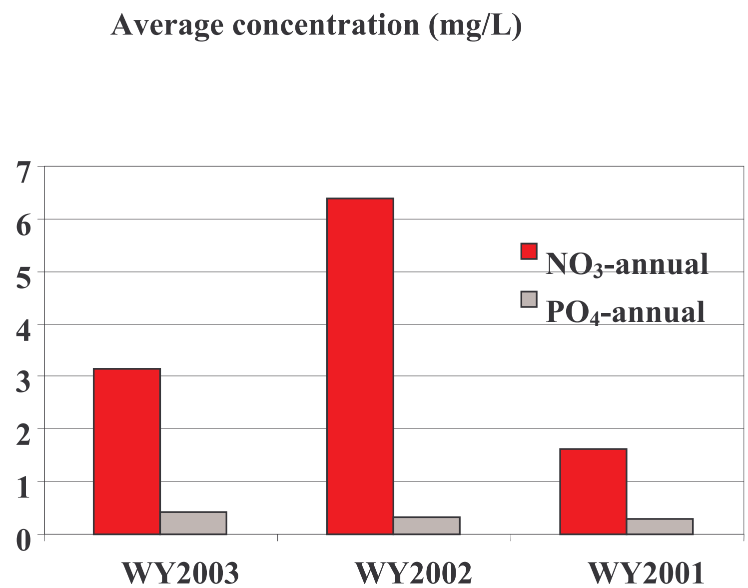

Figure 4.3: Annual Nitrate (NO_3) and Phosphate (PO_4) Concentrations Measured at the 8th Street Footbridge. Source SBC-LTER, 2003

Table 4.4 shows the total amount of nitrate (NO_3) and phosphate (PO_4) leaving the Carpinteria Creek watershed during water years 2002 and 2003. The Upper Gobernador site indicates the contribution from undisturbed land, while the 8th Street footbridge site indicates the contribution of these constituents from urban and agricultural development. Data showed that a majority of the exported nitrate and phosphate came from the agricultural and urban areas of the coastal plain (Robinson et al., 2003).

Table 4.4: Total Annual Nitrate (NO_3) and Phosphate (PO_4), Leaving Carpinteria Creek for Water Years 2002 and 2003. Source: Tim Robinson, UCSB

Gross Nutrient Export:

Sample Location	*Water Year*	NO_3 (m-ton*)	PO_4 (m-ton)	Runoff (1000 m^3)	Area (ha)	% Developed**
8th Street Footbridge	2002	6	0.2	828	3851	18
8th Street Footbridge	2003	10	0.8	2992	3851	18
Upper Gobernador	2002	< 0.1	< 0.1	418	1861	0.2
Upper Gobernador	2003	0.5	0.1	1151	1861	0.2

* metric tons - 1000 kgs.

** includes urban and agricultural lands.

Project Clean Water data, with respect to nutrients, showed similar results with higher concentrations at the downstream sites compared to the upper portions of the watershed (Figure 4.4). Their instantaneous sampling showed that the Basin plan standards (10 mg/L of NO_3-N) were exceeded 4 out of 8 sampling dates.

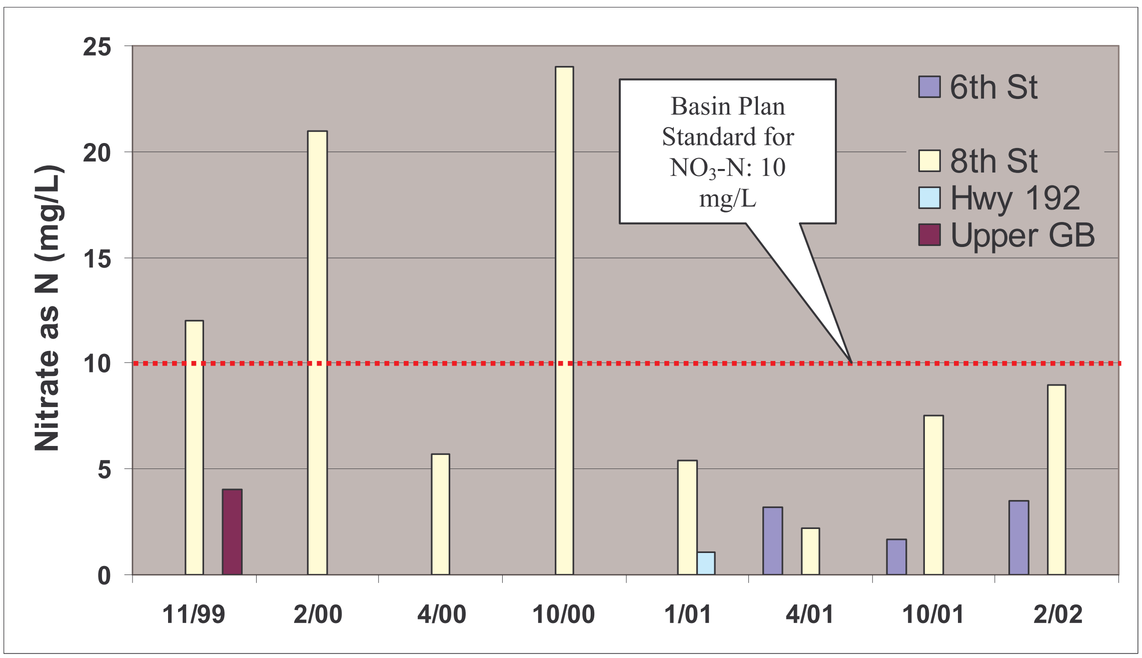

Figure 4.4: Nitrate as Nitrogen (NO_3-N) from Four Sampling Sites within the Carpinteria Creek Watershed.

Note: When values are not shown, either no sample was taken, or nitrate was not detected.
Source: Project Clean Water.

4.4.5 Turbidity/Suspended Sediment

CCAMP monitoring studies at 8th Street show TSS ranging from 1 to 590 mg/L, and turbidity (NTU) to range from 1 to 1,001 NTU; both were measured between 27 and 31 times respectively, between January 2001 and March, 2003. Storm water sampling by PCW at 8th Street showed turbidity levels ranging from 0 to 1000, with a mean of 156, measured 18 times between November 1999 and February 2002. TSS numbers recorded by PCW showed a high of 920, with an average of 131 mg/L. Measured Total Dissolved Solids (TDS) ranged from 37 to 1000, averaging 405 mg/L. Studies have shown that physiological damage can occur to steelhead when TSS is at 3,000 ppm or greater (Stoecker et al., 2002); three times the maximum levels recorded by CCAMP.

4.4.6 Bacteria and viruses

PCW data showed that average levels for E. Coli, Enterococcus, and Total Coliform during storms were well above Basin Plan water quality standards, averaging 195,000; 11,250 and 42,300 MPN; respectively (See Figure 4.5). Data showed that E. Coli numbers are higher at the 6th street site, while Total Coliform is higher at the 8th Street site. Interestingly, high levels of bacteria at the Gobernador site recorded by PCW were for Total Coliform, which suggests that the majority of the source is naturally occurring bacteria, such as from plant decomposition, rather than human or animal waste (Pers Comm Liddell, 2004).

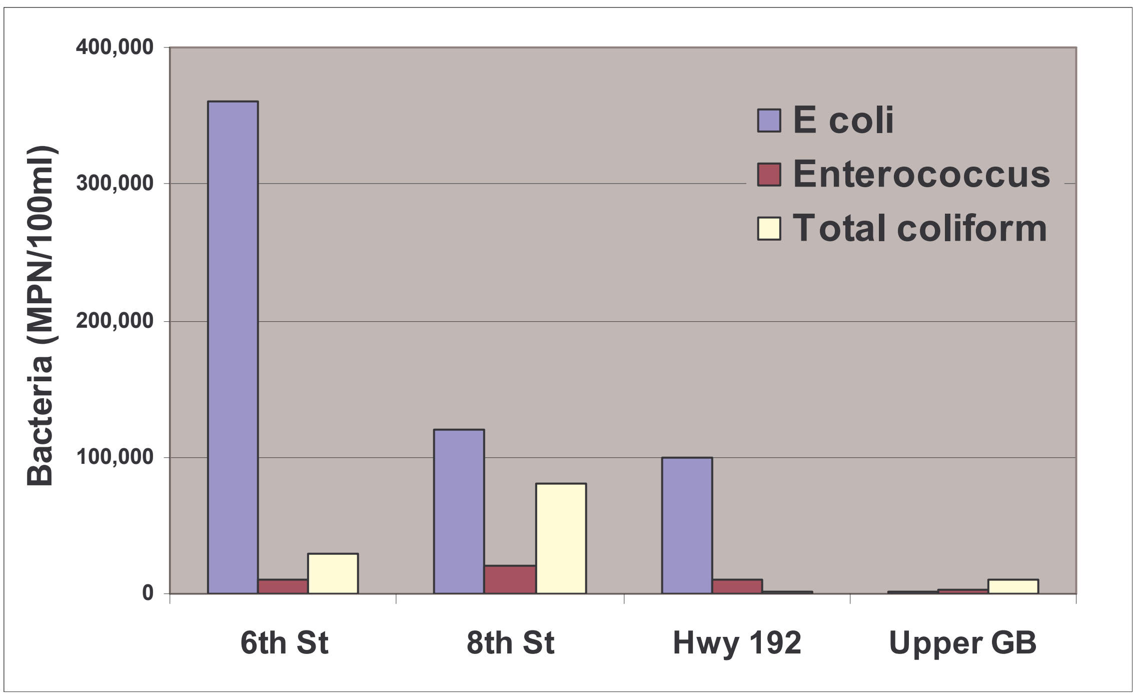

Figure 4.5: Bacteria Mean Levels.

Source Project Clean Water

Standards from Table 4.2 as MPN: E Coli = NA; Enterococcus = 104; Total Coliform = 10,000

County EHS sampling also indicated high levels of bacteria at Carpinteria State Beach on the same days sampled by PCW. Table 4.5 shows the percentage of times that sampling results exceeded the standards shown in Table 4.2 during six years of weekly sampling. Exceedences usually occurred during winter storm months of November through April, but 30 samples taken May to October 1998 (an El Niño year) showed that Total coliform, E. Coli and Enterococcus standards were exceeded by 87%, 43% and 43% respectively. Upper Gobernador again had high levels of total coliform, possibly due to plant decomposition products being flushed down and creating high levels of total coliform.

Table 4.5: Samples which have exceeded one or more of state fecal indicator bacteria standards, shown as a percentage of the total samples taken.

Beach	Percent exceedences					
	1998	1999	2000	2001	2002	2003
Carpinteria City Beach	7%	10%	4%	13%	9%	4%
Carpinteria State Beach	36%	37%	13%	31%	9%	6%

Notes:Adapted from SBC EHS, 2004

Standards are from AB 411 - California Health and Safety Code, Assembly Bill 411, and are shown in Table 4.2, above.

CCAMP monitoring studies at 8th Street have also demonstrated that fecal indicator bacteria standards have been exceeded on several occasions. Figure 4.6 illustrates that total coliform has ranged from 130 to 30,000 MPN, with 5 points exceeding standards. Fecal coliform sampling have ranged from 20 to 8,000, both measured 23 times between January 2001 and September, 2002 (Figure 4.7).

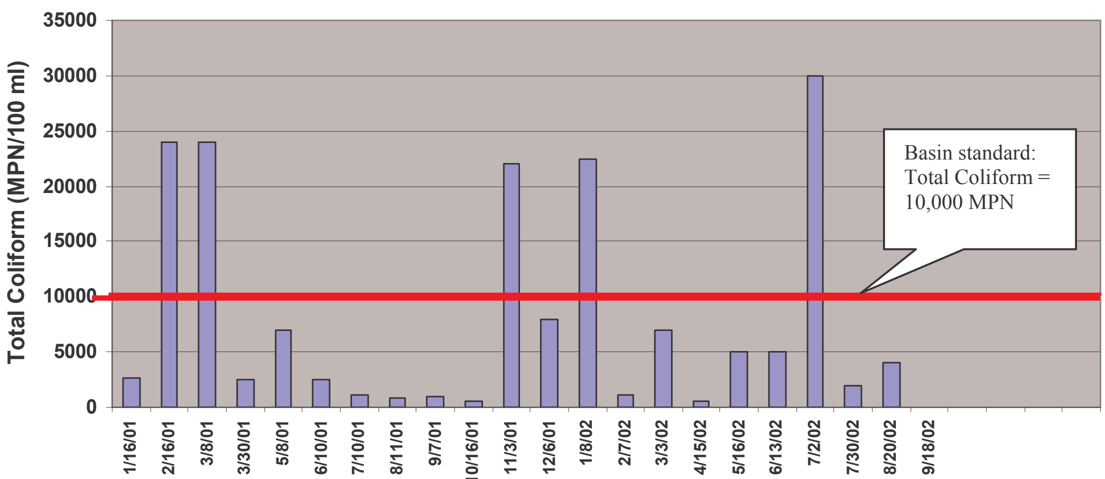

Figure 4.6: Total Coliform Counts at the 8th Street Monitoring Station on Carpinteria Creek. *Source: CCAMP, 2004*

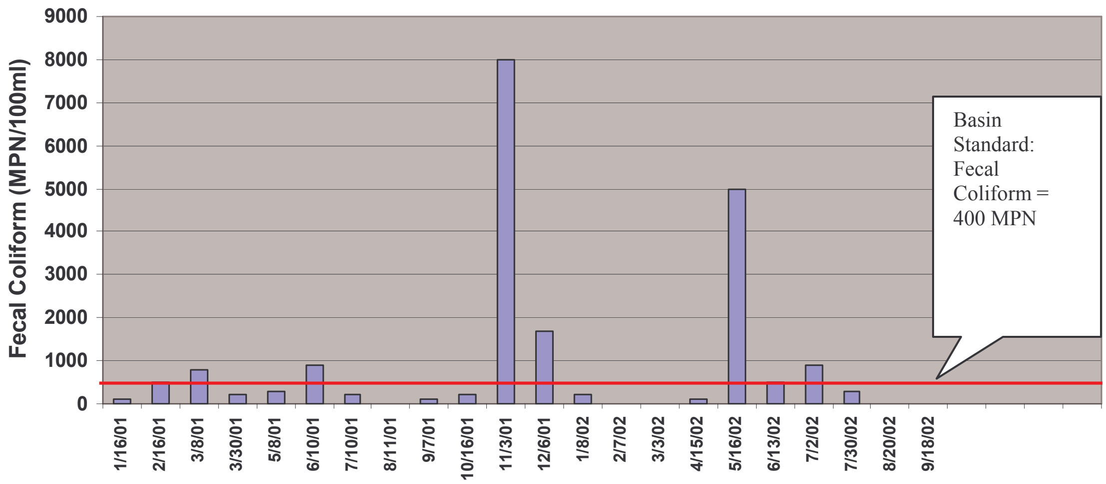

Figure 4.7: Fecal Coliform Counts at the 8th Street Monitoring Station on Carpinteria Creek. ***Source****: CCAMP, 2004*

4.4.7 Pesticides

Project Clean Water monitored for a wide suite of pesticides in the Carpinteria Creek Watershed. Table 4.6 below is a summary of PCW results for four common pesticides detected at the monitoring station located downstream of Carpinteria Avenue.

Table 4.6: Common Pesticides Sampled by Project Clean Water Downstream of Carpinteria Avenue.

	Pesticide Concentration [mg/L]			
	Chlorpyrifos	Diazinon	Glyphosate	Malathion
MCL	NA	NA	0.7	NA
Date				
8-Nov-99	NA	NA	0.57	NA
17-Jan-00	ND	0.018	0.081	ND
10-Feb-00	ND	0.00063	0.094	ND
17-Apr-00	ND	0.00036	0.18	ND
26-Oct-00	ND	0.0049	0.018	ND
8-Jan-01	0.00024	0.00007	0.12	0.00017
24-Jan-01	0.00041	0.00028	0.12	0.0001
6-Apr-01	0.00015	ND	0.019	ND
30-Oct-01	ND	0.00015	0.022	0.0002
24-Nov-01	ND	0.00009	ND	ND
17-Feb-02	ND	0.0003	0.048	ND

Notes:
MCL – Maximum contaminant levels – EPA National Primary Drinking Water Regulations
NA – Results not available
ND – Levels not detected above the method detection limit.

Chemoreception allows a fish to respond to its environment and its olfactory system is the predominant chemical sense. Fish use its olfactory system for predator avoidance, reproduction and in dominance behaviors. Researchers have found that many pesticides can disrupt electrical transmission within the olfactory system of salmon, reducing the ability of the males to reproduce. Juvenile Chinook salmon were exposed to Diazinon for 2 hours at concentrations of 1 and 10 μg/l, and this eliminated their response to their "alarm substance", which allows a fish to respond properly to the threat of predation. The ability of these chemicals to increase the susceptibility of contaminated fish to its predators also allows the chemical to be passed up the food chain (Scott and Sloman, 2004).

4.4.8 Metals

Project Clean Water data indicates that Carpinteria Creek downstream of Carpinteria Avenue has exceeded Maximum Contaminant Levels (MCL) for drinking water for chromium in 1 out of 7 samples and for lead 2 out of 7 samples (Table 4.7). The sampling site above Highway 192 exceeded the MCL for lead and mercury in 1 out of 2 sampling events. Trace metals can come from natural sources in the upper watershed (Ackerman & Schiff, 2003). Lead and mercury have disrupted nest building, spawning or courtship behaviors of fish. These pollutants can alter the timing of reproductive behavior and as well as the actual reproductive performance of the males. Spawning site selection can also be affected by exposure to metals. Rainbow trout exposed to copper eliminated its preference for its home rearing waters, although ten weeks after exposure, normal preferences returned (Scott and Sloman, 2004).

Table 4.7: Project Clean Water results for common metals in Carpinteria Creek.

Metals	Total Chromium	Total Lead	Total Mercury
MCL	0.1	0.015	0.002
Date Sampled	mg/L		
Sampled below Carpinteria Avenue			
8-Nov-99	0.08	0.019	ND
17-Jan-00	0.06	0.005	ND
10-Feb-00	0.15	0.014	ND
17-April-00	ND	0.016	ND
8-Jan-01	ND	0.012	ND
24-Jan-01	ND	0.01	0.0003
6-April-01	ND	ND	ND
Sampled above Casitas Pass Road			
24-Jan-01	0.04	0.016	0.002
6-April-01	ND	ND	NS

Notes: ND indicates sampled but not detected
NS indicates not sampled

4.5 Water Quality Condition Summary

Although sometimes a creek can appear clean, the water may be polluted from natural and anthropogenic sources such as excessive fertilizer runoff, pesticides, sediment, oil grease, bacteria, and others. Most of these pollutants come from urban, rural, and agricultural land use practices. Most sampling has occurred in the lower, urbanized areas of the watershed, while data is limited for the upper portion of the watershed.

The lower reaches of the creek are sensitive to storm water runoff, as indicated by high levels of naturally occurring bacteria, total suspended solids/sediment, dissolved oxygen content, nutrients and pesticides. While total suspended sediment levels recorded in the creek do not reach the point that impacts physiological responses of steelhead, suspended sediment can still pose a problem by covering up the gravels females like to lay eggs or clogging gills of fish. Pesticides and metals can negatively affect the physiological response of steelhead/rainbow trout. This can impact reproduction, incubation, number of eggs produced, and migration.

In 1997, researchers from the Southern California Coastal Waters Research Project (SCCWRP) completed a study estimating mass emissions from various sources to the Southern California Bight region, including Santa Barbara County watersheds. SCCWRP is a joint powers agency composed of several government agencies that focus on marine environmental research. Modeling conducted showed that most of the storm water pollutant loads to the Santa Barbara Channel from Santa Barbara County were from commercial and industrial sources. Agriculture contributed the greatest flux of total suspended solids, total DDT from old applications and Chlorpyrifos. Residential sources contributed the greatest flux of Diazinon (Ackerman & Schiff, 2003).

Benthic macroinvertebrate (BMI) surveying is increasingly used to provide an indication of the health of a creek. BMI's cycle energy and matter in a creek ecosystem and provide food for steelhead and other aquatic organisms. Ecology Consultants in 2003 and 2004 found that BMI community composition is a reliable indicator of ecological integrity in Carpinteria Creek. The lower reach of the creek was found to be low in BMI diversity, reflecting poor water quality and habitat conditions. Consistent with water quality sampling results in the upper reaches of the watershed which show low levels of pollutants, high BMI diversity was found in Gobernador Creek.

The RWQCB lists lower reaches of Carpinteria Creek as being impaired by pathogens. Sampling has shown that coliform bacteria are present in even the upper watershed. Algae masses have been observed in the lower reaches of Carpinteria Creek indicating that excessive levels of nutrients are also entering the creek. Metals and herbicides have both been detected in the creek, though at very low levels. Recommendations for continued sampling measures are given in Section 8.