California Regional Water Quality Control Board
Central Coast Region

Total Maximum Daily Loads for Pathogens in San Lorenzo River Watershed Waters (Including San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek and Lompico Creek), Santa Cruz County, California

Final Project Report
For the May 8, 2009 Water Board Meeting

Item No. 17 Attachment No. 2
May 8, 2009 Meeting
TMDLs for Pathogens –
San Lorenzo River Watershed

Adopted by the
California Regional Water Quality Control Board
Central Coast Region
on _____, 200x

Approved by the
State Water Resources Control Board
on _____, 200x
and the
Office of Administrative Law
on _____,200x
and the
United States Environmental Protection Agency
on _____. 200x

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PROJECT DEFINITION

1.1. Introduction

The Clean Water Act requires the State to establish Total Maximum Daily Loads (TMDLs) for the San Lorenzo River Watershed surface waters. TMDLs are required because these waters were identified as impaired for pathogen indicators and have been placed on the Clean Water Act 303(d) list. Waters of the 303(d) list include the San Lorenzo River Estuary (referred to on the 303(d) list as the "San Lorenzo River Lagoon"), San Lorenzo River, Carbonera Creek, and Lompico Creek.

This report proposes TMDLs and load allocations for the above-listed waters and two unlisted waters, Branciforte and Camp Evers Creeks. These waters flow into San Lorenzo River Estuary and Carbonera Creek, respectively, and are impaired due to fecal coliform concentration exceeding water quality objectives.

The California Regional Water Quality Control Board, Central Coast Region (Water Board) staff is proposing to remove the shellfish harvesting beneficial use in the San Lorenzo River Estuary as part of this project. The supporting documentation is included in the Use Attainability Analysis contained in Appendix D.

Staff is also proposing to modify a prohibition currently in the *Water Quality Control Plan, Central Coast Region* (Basin Plan) for the San Lorenzo River Watershed. The purpose of the prohibition is to provide consistency with State Water Resource Control Board's nonpoint source policy. This report contains justification for this modification.

Clean Water Act Section 303(d) requires the State to establish TMDLs at levels that attain water quality objectives. The State must also incorporate seasonal variations and a margin of safety into TMDLs that takes any lack of knowledge into account concerning the relationship between load limits and water quality.

1.1.1 San Lorenzo River

San Lorenzo River was placed on the 303(d) list for not attaining pathogen indicator water quality objectives. Based on historic data and recent data, concentrations exceeded the water quality objectives for fecal coliform and federal water quality recommendations for *Escherichia coli* (*E. coli).* These organisms are pathogen indicators. The purpose of these water quality objectives and recommended criteria are to protect the beneficial uses for water

contact recreation. Exceedances occurred at most stations sampled during both wet and dry seasons.

Natural sources[1] and non-natural sources contribute to water quality objective violations. The natural sources are birds, rodents and wildlife. Examples of non-natural controllable pathogen sources are onsite wastewater disposal system discharges, storm drain discharges, homeless person/encampment discharges, and domestic animals and livestock. Some of the natural sources are partially controllable.

1.1.2. San Lorenzo River Estuary

San Lorenzo River Estuary (also known as San Lorenzo River Lagoon) was placed on the 303(d) list for not attaining pathogen indicator water quality objectives. Based on historical and recent data, concentrations exceeded the water quality objectives for fecal coliform and federal water quality criteria for *E. coli*. The purpose of the objectives and recommended criteria is to protect beneficial uses for water contact recreation and shellfish harvesting.[2] Exceedances occurred during both wet and dry seasons.

Natural sources and non-natural sources contributed to water quality objective violations. Natural sources included birds, rodents, and wildlife. Non-natural causes of impairment included sanitary sewer collection system spills and leaks, storm drain discharges (including illegal recreational vehicle discharges and other illegal human waste discharges), homeless person/encampment discharges, occasional onsite wastewater disposal system failures, and domestic animals and livestock discharges. Some of the natural sources are partially controllable.

1.1.3. Carbonera Creek

Carbonera Creek was placed on the 303(d) list for not attaining pathogen indicator water quality objectives. Fecal coliform concentrations exceeded water quality objectives and *E. coli* concentrations exceeded recommended federal water quality criteria for water contact recreational beneficial use.

Natural sources and non-natural sources contributed to water quality objective violations. Natural sources included birds, rodents, and wildlife. Non-natural sources of impairment included sanitary sewer collection system spill/leaks, storm drain discharges, homeless person/encampment discharges, occasional

[1] See section 6 for a discussion on natural sources.
[2] Staff is proposing to remove the shellfish harvesting beneficial use in the San Lorenzo River Estuary.

onsite wastewater disposal system failures, and domestic animals and livestock. Some of the natural sources were partially controllable.

1.1.4. Lompico Creek

Lompico Creek was placed on the 303(d) list for not attaining pathogen indicator water quality objectives. Based on historic data, and to a lesser extent recent data, concentrations exceeded the water quality objective for fecal coliform that protects the beneficial uses for water contact recreation. Exceedances occurred during both wet and dry seasons.

Natural sources and non-natural sources contributed to water quality objective violations. Non-natural causes of impairment sources included onsite wastewater disposal system discharges, storm drain discharges, and domestic animals and livestock.

1.1.5. Branciforte Creek

Branciforte Creek was never listed on the 303(d) list but staff determined it was impaired based on data review. Therefore, staff proposes TMDLs and allocations for this creek as well. Natural sources and non-natural sources contributed to water quality objective violations. Non-natural causes of impairment sources included storm drain discharges, pet waste, sanitary sewer collection leaks, homeless persons, onsite wastewater disposal system discharges and domestic animals and livestock.

1.1.6. Camp Evers Creek

Camp Evers Creek was never listed on the 303(d) list but staff determined it was impaired based on data review. Therefore, staff proposes TMDLs and allocations for this creek as well. Natural sources and non-natural sources contributed to water quality objective violations. Non-natural causes of impairment sources included storm drain discharges, pet waste, homeless persons, onsite wastewater disposal system discharges and domestic animals and livestock.

1.2. Listing Basis

According to the United States Environmental Protection Agency (USEPA) *Protocol for Developing Pathogen TMDLs*, “the numbers of pathogenic organisms present in polluted waters generally are few and difficult to isolate

and identify, as well as highly varied in their characteristic and type. Therefore, scientists and public health officials typically choose to (1) monitor nonpathogenic pathogen indicator organisms that are usually associated with pathogens transmitted by fecal contamination but (2) are more easily sampled and measured. These associated bacteria are called indicator organisms." Indicator organisms indicate the potential presence of human and animal pathogenic organisms. When large fecal coliform populations are present in the water, it is assumed that there is a greater likelihood that pathogens are present. The Basin Plan uses fecal coliform concentrations as a water quality objective to indicate the presence of pathogenic organisms.

Staff uses the phrase "fecal indicator bacteria" to represent fecal coliform, enterococcus, *E. coli*, or any other indicator organisms that are used to indicate the potential presence of fecal material and/or pathogens in a waterbody. Indicator organisms are used because 1) pathogens themselves may be difficult and/or costly to test for and 2) the Basin Plan does not have pathogen-specific water quality objectives. The word "pathogens" is also used in this document because the 303(d) listed waterbodies are listed as impaired by pathogens.

The following section details when and why waters within the San Lorenzo River Watershed were placed on the 303(d) list.

1.2.1. San Lorenzo River

San Lorenzo River was listed for pathogens in 1994 based on water quality sampling performed by the County of Santa Cruz. San Lorenzo River water samples analyzed by the County of Santa Cruz from 1985 to 1994 showed exceedances of the Basin Plan's fecal coliform water quality objective for contact recreation at several sampling sites within the San Lorenzo River Watershed (Santa Cruz County, 1989).

The County's recent data are discussed in Chapter 3.

1.2.2. San Lorenzo River Estuary

San Lorenzo River Estuary (listed as "San Lorenzo River Lagoon") was listed for pathogens in 1994 based on several reports that indicated high fecal coliform concentrations. This includes the Evaluation of Water Quality 1989 report. In that report, the sampling location "Rivermouth @ Trestle" was reported to exceed the water contact recreation beneficial use fecal coliform objective from October 1985-September 1988. Another report titled *San Lorenzo River Watershed Management Plan Update, Evaluation of Water Urban Quality, Task 4 Report* (August 2001, Environmental Health Service, Health Services Agency, County of Santa Cruz) indicates the sampling location "Rivermouth @ Trestle" also exceeded the water contact recreation beneficial use fecal coliform objective

from October 1990-September 1991 and from October 1992-September 1993.

The County's recent data is discussed in Section 3.

1.2.3. Carbonera Creek

Carbonera Creek was listed for pathogens in 1994 based in several reports indicating high fecal coliform concentrations. These reports included the Evaluation of Water Quality 1989 report which indicated "Carbonera Creek below Scotts Valley" exceeded the water contact recreation beneficial use fecal coliform objective from October 1985 – September 1987.

1.2.4 Lompico Creek

Lompico Creek was listed for pathogens in 1994. Water samples analyzed by the County of Santa Cruz from 1985 to 1994 showed exceedances of the Basin Plan's bacterial water quality objective for contact recreation from their sampling site on Lompico Creek (Evaluation of Water Quality Report 1989).

The County's recent data are discussed in Chapter Three.

1.3. Beneficial Uses

The Basin Plan contains beneficial uses for San Lorenzo River Estuary, San Lorenzo River, Carbonera Creek, Lompico Creek, and Branciforte Creek. Camp Evers Creek is a tributary to Carbonera Creek and is not listed separately in the Basin Plan. As such, beneficial uses for Carbonera Creek must be protected in Camp Evers Creek. The beneficial uses are shown in Table 1.

Table 1. Beneficial Uses for San Lorenzo River Watershed

Beneficial Use	Waterbody Name[1]				
	San Lorenzo River Estuary	San Lorenzo River	Branciforte Creek	Carbonera Creek	Lompico Creek
Municipal and domestic supply		X	X	X	X
Agricultural supply		X	X	X	X
Industrial		X		X	
Groundwater recharge		X	X	X	X
Water contact recreation	X	X	X	X	X
Non-contact water recreation	X	X	X	X	X
Wildlife habitat	X	X	X	X	X
Cold fresh water habitat	X	X	X	X	X
Migration of aquatic organisms	X	X	X	X	X
Spawning, reproduction, and/or early development	X	X	X	X	X
Preservation of biological habitats of special significance	X	X			
Rare, threatened, or endangered species	X	X			
Estuarine habitat	X				
Freshwater Replenishment		X			
Commercial and sport fishing	X	X	X	X	X
Shellfish harvesting[2]	X				

(1) The Basin Plan does not designate Beneficial Uses for Camp Evers Creek. However, the Basin Plan states that surface waters that do not have beneficial uses designated for them are assigned the following designations (a) municipal and domestic water supply and (b) protection of both recreation and aquatic life.
(2) Staff is proposing to remove the shellfish harvesting beneficial use in the San Lorenzo River Estuary.

1.3.1. Shellfish Harvesting

Staff is proposing to remove the shellfish harvesting beneficial use in San Lorenzo River Estuary. This is primarily based on the fact that staff found no evidence of the shellfish harvesting beneficial use in the San Lorenzo River Estuary. Hydraulic modifications, seasonal lagoon closure to tidal circulation, and evidence that historical (since 1975) or current shellfish harvesting has not occurred led Central Coast Water Board staff to propose removing the shellfish harvesting beneficial use in San Lorenzo River Estuary.

Appendix D to this report, "Use Attainability Analysis for San Lorenzo River Estuary," provides the basis for staff's proposal.

1.4. Water Quality Objectives

The following Water Quality Objectives apply to all the impaired waterbodies that are part of this project.

The Basin Plan states "*controllable* water quality shall conform to the water quality objectives contained herein. When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality" (emphasis added). This requirement applies to all waters of the State.

The Basin Plan contains specific water quality objectives that apply to fecal coliform (Basin Plan, pg. III-10). Also, the USEPA has recommended water quality criteria for *E. coli* and enterococci. These objectives/criteria are in place to protect specific beneficial uses and include the following. All of the impaired waterbodies in this project are designated with these beneficial uses (See Table 1, Section 1.3).

1.4.1. Water Contact Recreation

The Basin Plan defines water contact recreation as "uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs."

The Basin Plan contains the following objective to protect the water contact recreation beneficial use. The fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN -per 100 mL, nor shall more than 10% of samples collected during any 30-day period exceed 400 MPN per 100 mL.[1]

E. coli is another pathogen indicator organism. The Basin Plan does not include water quality objectives for *E. coli*. However, the USEPA recommends *E. coli* not exceed a geometric mean of 126 CFU per 100 mL, generally based on not less than five samples spaced over a 30-day period (United States Environmental

[1] Throughout this document, fecal coliform units are expressed as colony forming unit (CFU), organisms, count (#/100mL or CFU/100 mL) and most probable number (MPN/100mL). All unit expressions are considered equivalent fecal coliform bacteria concentration measures (Reference: Protocol for Developing Pathogen TMDLs).

Protection Agency, *Ambient Water Quality Criteria for Bacteria-1986*, January 1986).

Enterococci are also pathogen indicator organisms. The Basin Plan does not include water quality objectives for enterococci. However, the USEPA recommends enterococci not exceed a geometric mean of 33 CFU per 100 mL in freshwater and 35 CFU per 100 mL for marine waters, generally based on not less than five samples spaced over a 30-day period.

1.4.2. Non-Contact Water Recreation

The Basin Plan defines non-contact water recreation as "uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities."

The Basin Plan contains the following objective to protect the non-water contact recreation beneficial use. The fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 2000 MPN per 100 mL, nor shall more than 10% of samples collected during any 30-day period exceed 4000 MPN per 100 mL.

1.4.3 Shellfish Harvesting

The Basin Plan states that at all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70 per 100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230 per 100 ml for a five tube decimal dilution test or 330 per 100 ml when a three-tube decimal dilution test its used. The above water quality objective applies where the shellfish harvesting beneficial use is designated. However, the Central Coast Water Board is proposing to remove the shellfish harvesting beneficial use from the San Lorenzo River Estuary (Lagoon). Therefore, the shellfish water quality objectives will not apply.

1.4.4 Other Applicable Beneficial Uses

The Basin Plan does not include explicit numeric pathogen indicator organism objectives for the other surface water beneficial uses.

1.5. Waste Discharge Prohibition

In 2004, the State Water Resources Control Board (State Board) adopted the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program,* May 20, 2004 (Nonpoint Source Implementation Policy). The Nonpoint Source Implementation Policy requires the Central Coast Water Board to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Water Quality Control Act. Administrative permitting authorities include waste discharge requirements (WDRs), waivers of WDRs, and Basin Plan prohibitions. Responsible parties are to participate in the development and implementation of NPS Pollution Control Implementation Programs designed around their type of nonpoint source discharge.

Staff is proposing to address specific types of nonpoint sources of pollution in the San Lorenzo River Watershed by adding the watershed as a named area subject to two proposed nonpoint source pollution prohibitions: (1) the Human Fecal Material Discharge Prohibition and (2) the Domestic Animal Waste Discharge Prohibition. These two prohibitions were adopted as amendments to the Basin Plan with the TMDLs for the Pajaro River Watershed at the March 20, 2009 Board Meeting (see Resolution No. R3-2009-0008).

2. WATERSHED DESCRIPTION

2.1. Location, Climate, and Hydrology

Figure 1 below shows the location of the waters discussed within this report. (Camp Evers Creek is not shown, but it drains into upper Carbonera Creek.) Santa Cruz County staff provided the estuary boundary. The inland estuary boundary is the Soquel Avenue Bridge, except when a sand bar closes the Estuary outlet to the Ocean. During this time, estuary water levels can rise back to Water Street. (See map in Figure 7 for estuary boundary locations.)

The San Lorenzo River flows from the Santa Cruz Mountains southerly toward the City of Santa Cruz. The estuary is located within the City of Santa Cruz. The San Lorenzo River and Estuary receives water from approximately 87,827 acres and drains into northern Monterey Bay.

The San Lorenzo River, and Branciforte, Camp Evers, Carbonera, and Lompico Creeks drain into the Estuary. Camp Evers Creek drains into Carbonera Creek. Carbonera Creek flows from the City of Scotts Valley through the County of Santa Cruz. Carbonera Creek ends at the confluence with Branciforte Creek in the City of Santa Cruz. Lompico Creek flows to Zayante Creek and Zayante Creek flows into the San Lorenzo River. The City of Santa Cruz is approximately six miles downstream of the City of Scotts Valley. (Figure 3 shows the location

of the City of Scotts Valley, Santa County, and City of Santa Cruz.)

According to the U.S. Census Bureau, the City of Santa Cruz population was approximately 54,600 in the year 2000. According to the Scotts Valley Chamber of Commerce, the City's population in 2000 was approximately 11,400 persons. San Lorenzo River Valley is the location of communities such as Felton, Ben Lomond, Brookdale, and Boulder Creek. The combined population of these communities was approximately 8,500 persons in the year 2000. The actual Valley population was larger because people also reside outside these communities.

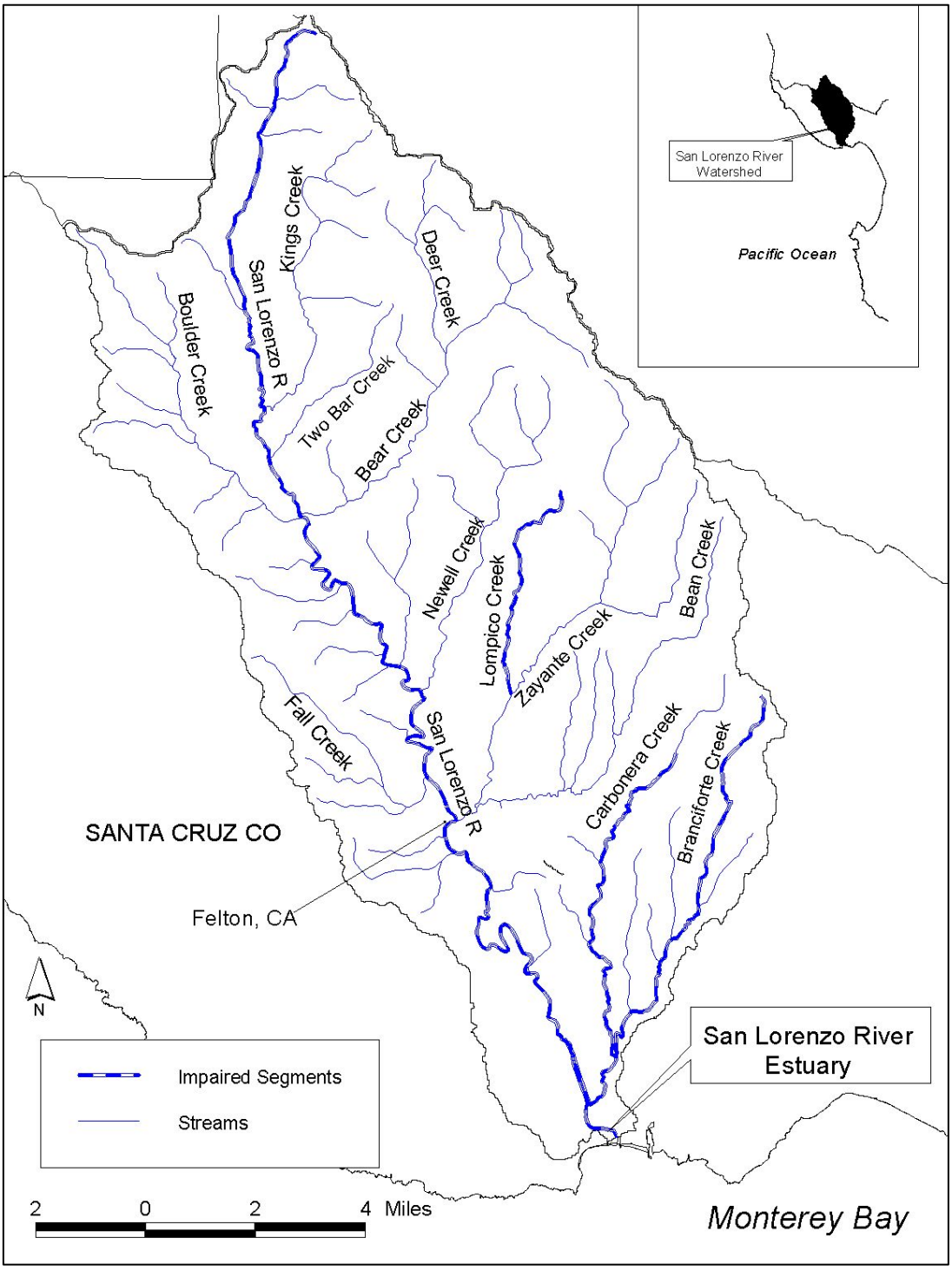


Figure 1. San Lorenzo Watershed Boundary with San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Lompico, and Carbonera Creek (Camp Evers Creek is Shown in Figure 8)

The Watershed's Mediterranean climate is moderated by its close proximity to the Pacific Ocean. Summers are warm and dry, cooled at times by morning fog at lower elevations. The winters are cool and wet. Average annual rainfall is about 47 inches, ranging from about 30 inches in Santa Cruz to 60 inches above Boulder Creek.

The average annual precipitation from 1948 to 2005 for the City of Santa Cruz was 30.6 inches. Figure 2 shows average monthly precipitation totals from during this timeframe.

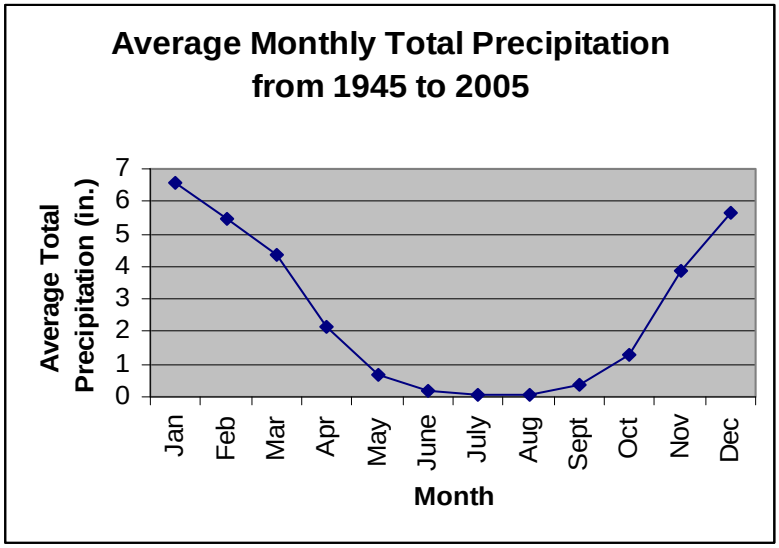


Figure 2. City of Santa Cruz Average Monthly Precipitation (Averages taken from 1948 through 2005)

The *San Lorenzo River Watershed Management Plan*, December 1979 stated that normal (median monthly) flows of the main river drop from a high of 170 cubic feet per second (cfs) in February to a low of 17 cfs in September at the Big Trees Station near Felton, California.

2.2. Land Use

Staff used land use information as one line of evidence to determine sources of pathogen indicator organisms. (Staff determined sources and relative contributions in Section 4.2 of this report.)

The San Lorenzo River Watershed is affected by activities that occur within predominately three governmental jurisdictions. These jurisdictions are the City of Santa Cruz, the County of Santa Cruz, and the City of Scotts Valley. The California State Parks system also has jurisdiction of lands in this Watershed. Figure 3 below shows the boundaries for the City of Santa Cruz and the City of Scotts Valley. Figure 3 also shows the Henry Cowell Redwoods State Park. Carbonera Creek is affected by activities that occur within the City of Scotts

Valley and the County of Santa Cruz. San Lorenzo River is affected by activities that occur within the City and County of Santa Cruz and activities that occur within State Parks. Lompico Creek is affected by activities that occur within the County of Santa Cruz.

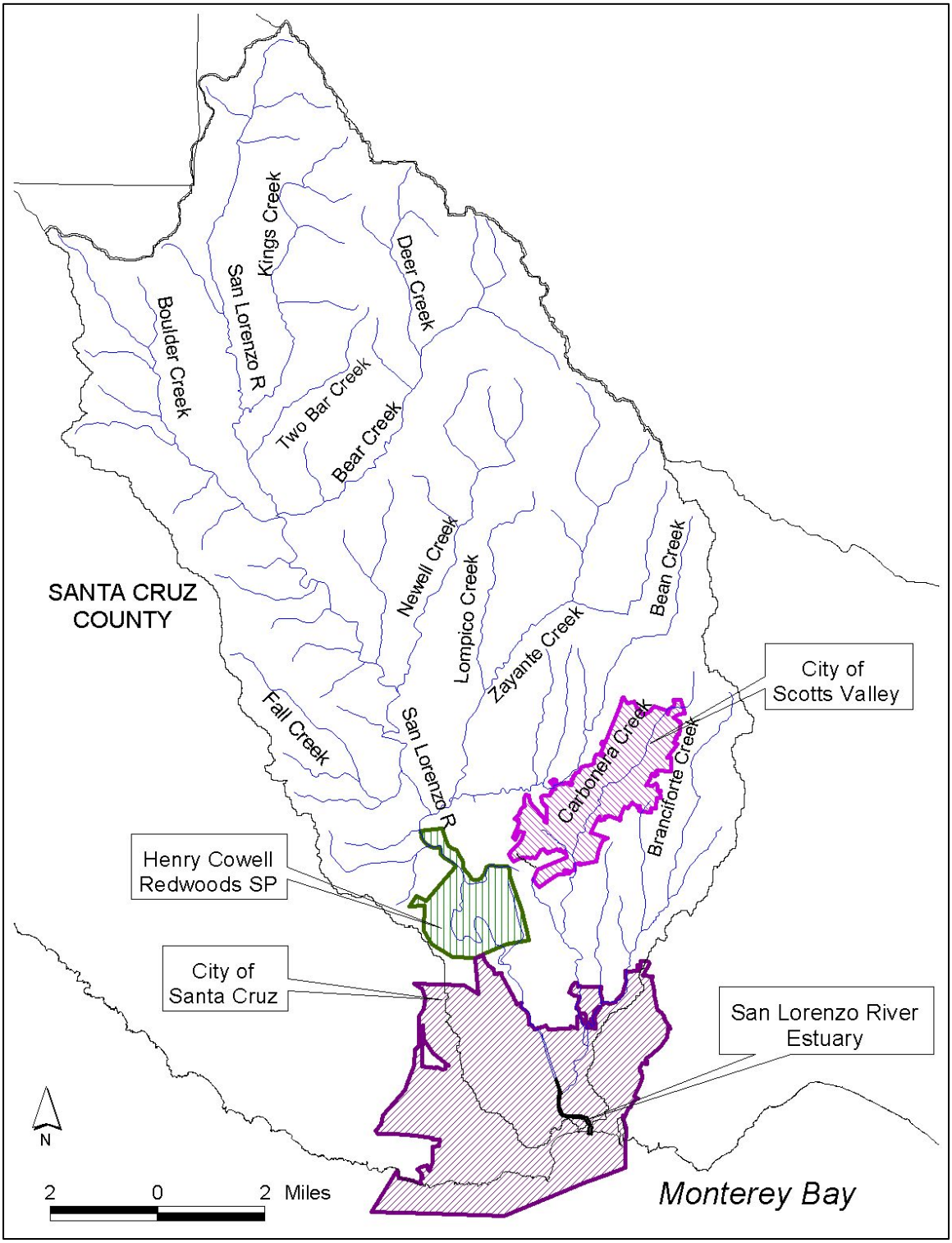


Figure 3. City of Santa Cruz, City of Scotts Valley, and Henry Cowell Redwoods State Park Boundaries Within Santa Cruz County

Figure 4 below shows percent land use acreage for the San Lorenzo River Watershed.

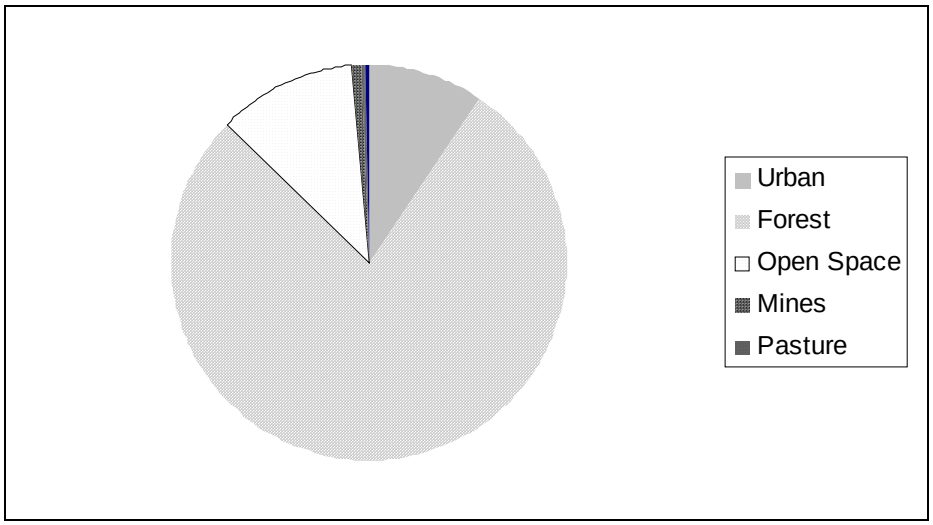


Figure 4. Percent Land Use in the San Lorenzo River Watershed[3]

The San Lorenzo River Watershed is approximately 137 square miles in size. The largest land use in this Watershed is forest land (78%). Although the largest land use if forest land, much of this land is used for suburban/rural residential development. The second and third largest land uses are open space (11%) and urban lands (10%), respectively. Mines comprise approximately one percent of the Watershed. (The mines are sand and gravel mines.) Pasture occupies only about 0.1% of the Watershed area. Staff estimates the Lompico Creek subwatershed has similar land use characteristics (pers. comm. John Ricker October 15, 2007). Staff used data which represents land uses from 1988 to 1994. Land uses have not changed significantly since 1994.

Natural fecal coliform and *E. coli*/enterococci discharges from wild animals and birds occur in forest lands, open space, and urban lands. Onsite wastewater disposal system discharges can occur from forest lands because most rural residential properties that utilize onsite wastewater disposal systems are located on forested properties that support trees such as redwood, bay, and oak trees. Pathogen contributions commonly occur from urban land use, but pathogen contributions can occur in forestlands and open space from homeless encampments as well. Sewage spills/leaks and storm drain discharges can occur from urban lands. Domestic animals and livestock discharges can occur on rural residential properties that contain forest lands and open space.

[3] Acreage determined using Geographic Information Systems (GIS) analysis using Multi-Resolution Land Characterization (MRLC) data

Figure 5 below shows percent land use acreage for the Carbonera Creek Watershed.

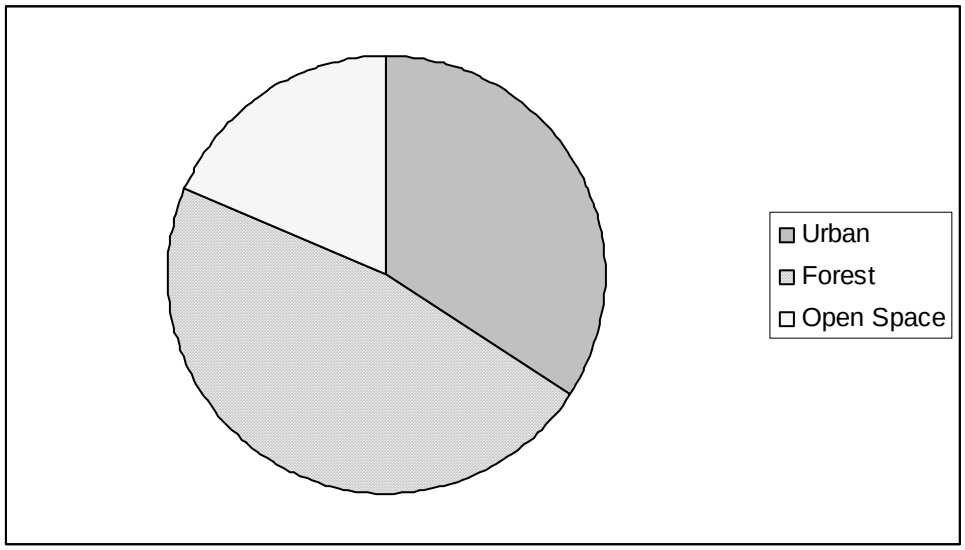


Figure 5. Percent Land Use for Carbonera Creek Watershed[4]

Figure 5 shows that the largest land use within the approximately seven square mile Carbonera Creek Watershed is forestland (47%). The second and third largest land uses are urban uses (34%) and open space (19%), respectively. Pathogen contributions commonly occur from urban land use, but pathogen contributions can occur in forestlands and open space from homeless encampments as well. Sewage spills/leaks and storm drain discharges can occur from urban lands. Domestic animals and livestock discharges can occur on rural residential properties that contain forest lands and open space.

Branciforte Creek subwatershed has similar land use characteristics to the Carbonera Creek Watershed while the Camp Evers Creek subwatershed is predominantly urban.

[4] Acreage determined using Geographic Information Systems (GIS) analysis using Multi-Resolution Land Characterization (MRLC) data

3. DATA ANALYSIS

3.1. Water Quality Data

Staff analyzed water quality data to determine impairment areas. Staff also used water quality data as one line of evidence to determine sources of pathogen indicator organisms. (Staff determined sources and relative contributions in Section 4.2 of this report.)

Staff analyzed samples taken by the City of Santa Cruz, City of Scotts Valley, and County of Santa Cruz Environmental Health Services (County of Santa Cruz). The maps that follow illustrate sampling site locations. A description of each site is provided in Section 3.1.1.

The Coastal Watershed Council and Santa Cruz Surfrider Association also took samples in the Watershed; however staff did not develop any conclusions from these data due to the small number of samples taken.

Some of the sampling stations shown are along the San Lorenzo River Estuary. A more detailed map illustrating sampling stations near the San Lorenzo River Estuary is provided in Figure 7.

Likewise, there are many sampling stations in the City of Scotts Valley. A more detailed map illustrating sampling stations within the City of Scotts Valley is provided in Figure 8.

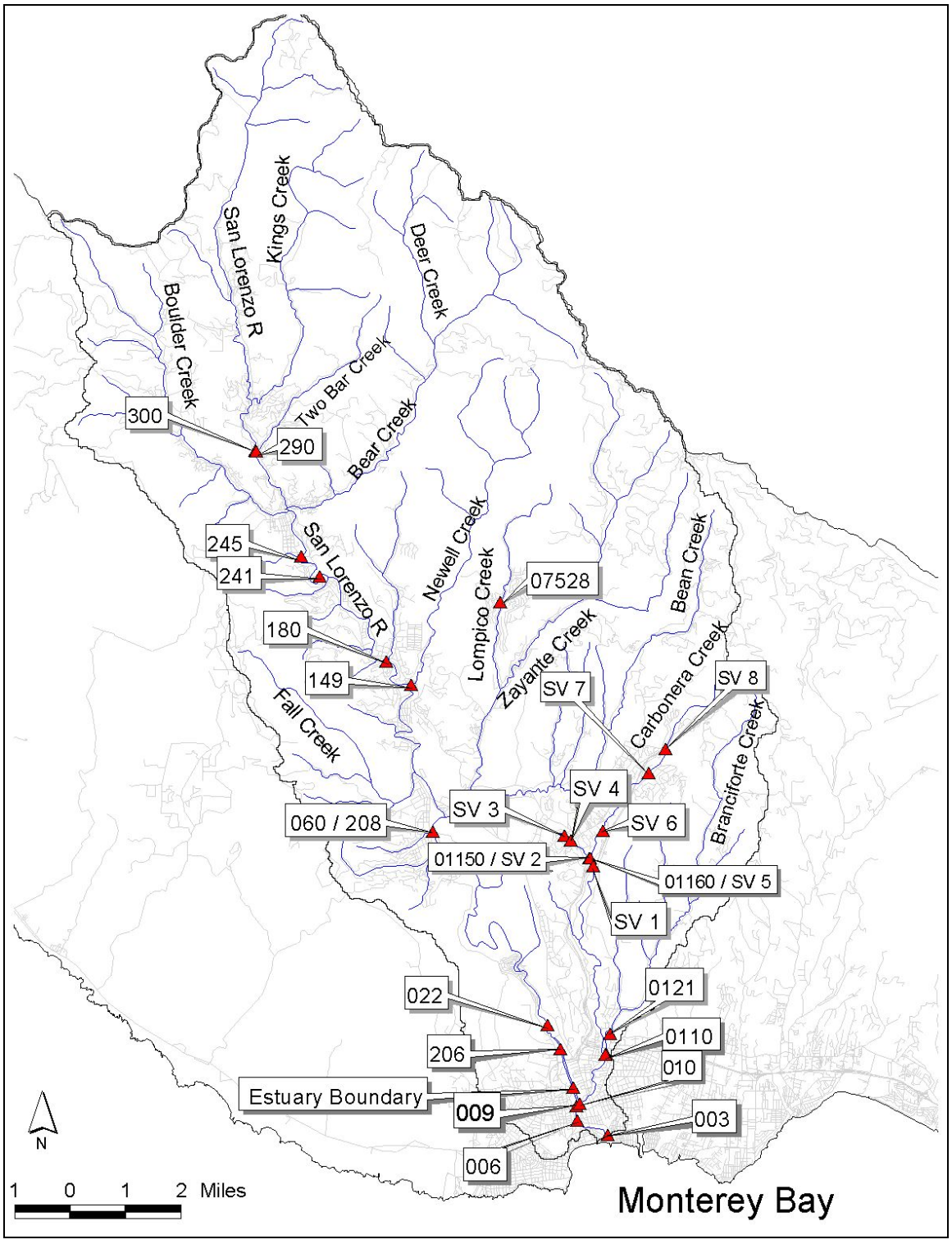


Figure 6 . Water Quality Sampling Stations in the San Lorenzo River Watershed

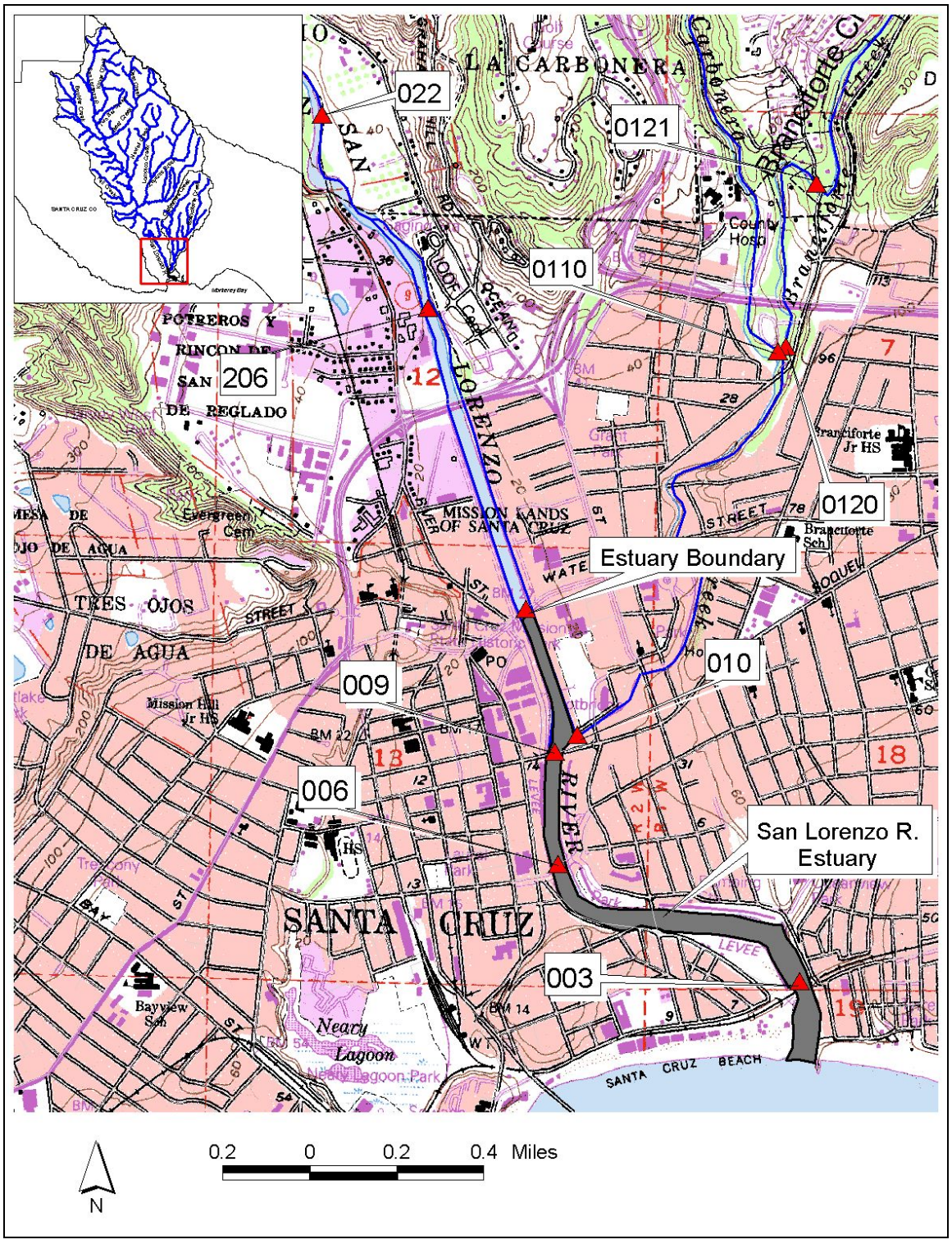


Figure 7. San Lorenzo River Estuary and Vicinity Sampling Stations

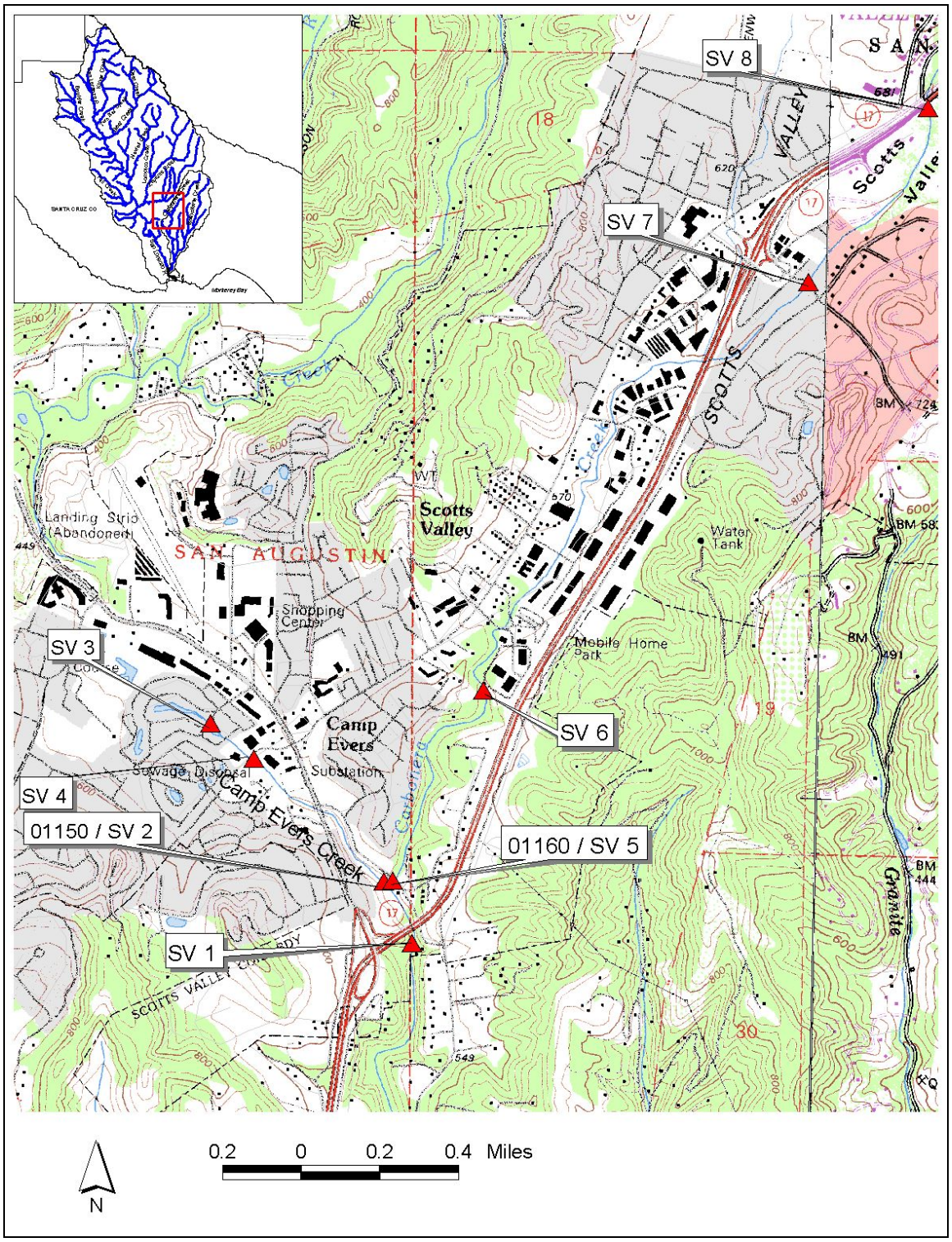


Figure 8 . Carbonera Creek and Scotts Valley Vicinity Sampling Stations

3.1.1. San Lorenzo River Watershed (Excluding Carbonera Creek)

Fecal coliform data used in this report were obtained from sampling efforts of the County of Santa Cruz. Fecal coliform sampling activities for the San Lorenzo River Estuary and San Lorenzo River are shown in Table 2 below.

Table 2. Santa Cruz County Environmental Health Services Fecal Coliform Data Utilized for this Report

Station #	Water Body	Station	Number of Fecal Coliform Samples	Frequency of Fecal Coliform Samples	Period of Record for Fecal Coliform
003	San Lorenzo River Estuary	San Lorenzo River Lagoon @ Trestle	351	Weekly	01/04/2000 – 06/27/2006
006	San Lorenzo River Estuary	San Lorenzo River Lagoon @ Broadway/Laurel Bridge	326	Weekly	01/04/2000 – 06/27/2006
009	San Lorenzo River Estuary	San Lorenzo River @ Soquel Avenue Bridge	36	Irregular	11/24/1986 – 02/19/1997
010	Branciforte Creek	Branciforte Creek @ San Lorenzo River	33	Irregular	04/11/1995 – 06/15/2006
0120	Branciforte Creek	Branciforte Creek @ Carbonera Creek	7	Irregular	09/20/1995 – 01/24/2002
0121	Branciforte Creek	Branciforte Creek @ Isbel Drive	59	Monthly	02/09/2000 – 06/15/2006
0110	Carbonera Creek	Carbonera Creek @ Branciforte Creek	11	Irregular	10/19/2000 – 06/15/2006
022	San Lorenzo River	San Lorenzo River @ Sycamore Grove	375	Weekly	01/04/2000 – 01/25/2006
060	San Lorenzo River	San Lorenzo River @ Big Trees	322	Weekly	01/04/2000 – 01/23/2006
07528	Lompico Creek	Lompico Creek @ Carrol Avenue	69	Approximatel y Weekly	02/02/2000 – 01/12/2006
149	San Lorenzo River	San Lorenzo River @ Highlands Park	111	Monthly between June and September	02/15/2000 – 09/06/2005
180	San Lorenzo River	San Lorenzo River Above Love Cr	319	Weekly	01/04/2000 – 01/23/2006

Station #	Water Body	Station	Number of Fecal Coliform Samples	Frequency of Fecal Coliform Samples	Period of Record for Fecal Coliform
241	San Lorenzo River	San Lorenzo River @ Pacific Ave., Brookdale	101	Weekly between May and September	07/11/2000 – 09/06/2005
245	San Lorenzo River	San Lorenzo River @ River St	325	Weekly	01/04/2000 – 01/23/2006
290	Two Bar Creek	Two Bar Cr @ San Lorenzo River	54	Monthly	11/29/2001 – 01/12/2006
300	San Lorenzo River	SLR @ Two Bar Cr. (this site is above the confluence of SLR with Two Bar Creek)	58	Monthly	11/06/2000 – 01/12/2006

E. coli data used in this report were obtained from sampling efforts of the City of Santa Cruz and the County of Santa Cruz. Recent *E. coli* sampling activities for the San Lorenzo River and Estuary are shown in Table 3 below. (Staff did not include the County's *E. coli* water quality sampling for the San Lorenzo River (non-estuarine portion) because the data were either older and/or did not include many sampling events.)

Table 3. Santa Cruz City and County *E. coli* Data Utilized for this Report

Station #	Agency Responsible for Sample Collection	Waterbody	Station	Number of *E. coli* Samples	Frequency of *E. coli* Samples	Period of Record for *E. coli*
003	County	San Lorenzo River Estuary	San Lorenzo River Lagoon @ Trestle	11	Irregular	02/05/2001-02/28/2005
006	County	San Lorenzo River Estuary	San Lorenzo River Lagoon @ Broadway/Laurel Bridge	3	Irregular	02/20/2002-07/30/2004
009	County	San Lorenzo River Estuary	San Lorenzo River @ Soquel Avenue Bridge	15	Irregular	05/29/1996-02/19/1997

206	City	San Lorenzo River	San Lorenzo River @ Tait Street	149	Approx. monthly, sometimes more frequent	01/11/2000– 05/23/2006
208	City	San Lorenzo River	San Lorenzo River @ Henry Cowell. Park Bridge	149	Approx. monthly, sometimes more frequent	01/11/2000 – 05/23/2006

The County collected *E. coli* samples at three San Lorenzo River Watershed stations irregularly. The City of Santa Cruz provided *E. coli* samples for two San Lorenzo River stations upstream of the Estuary.

Staff also reviewed data collected by the Coastal Watershed Council. The Coastal Watershed Council collected fecal coliform samples at two San Lorenzo River Estuary stations. One station had three samples and another station had two samples. The Coastal Watershed Council also took fecal coliform samples at four stations on Branciforte Creek. The sample numbers ranged from three samples to eight samples per station. The Coastal Watershed Council also took fecal coliform samples on Carbonera Creek. Staff did not develop conclusions based on this data due to the small number of samples taken.

The Santa Cruz Surfrider Association took one fecal coliform sample on the San Lorenzo River at the High School. Staff did not develop any conclusions from this datum due to the single sample taken.

All Coastal Watershed Council and Surfrider Association data are shown in Appendix A of this document.

3.1.2. Carbonera Creek

Fecal coliform and *E. coli* data used to develop this report were obtained from sampling efforts of the City of Scotts Valley and Santa Cruz County Environmental Health Services. Table 4 below shows the sampling activities used to analyze Carbonera Creek water quality.

Table 4. City of Scotts Valley and Santa Cruz County Pathogen Indicator Organism Data Utilized for this Report

Station #	Station	Pathogen Indicator Sampled	Number of Samples	Frequency	Period of Record
0110	Carbonera Creek @ Branciforte Creek (County of Santa Cruz Station)	Fecal Coliform	11	Irregular	10/19/2000-06/15/2006
SV #1	Carbonera Cr @ Hwy 17 (City of Scotts Valley Station)	*E. coli*	38	Weekly	01/06/2005-02/17/2005 and 02/07/06-08/30/06
SV #2	Camp Evers Cr @ Carbonera Cr (City of Scotts Valley Station	*E. coli*	38	Weekly	01/06/2005-02/17/2005 and 02/07/06-08/30/06
01150	Spring Lakes Creek (A.K.A. Camp Evers Cr) at Carbonera Cr (County of Santa Cruz Station)	Fecal coliform	6	Monthly for five months in the year 2000	02/02/2000-08/31/2001
SV #3	Camp Evers Cr @ Cold Stream Way (City of Scotts Valley Station)	*E. coli*	6	Weekly	01/06/2005-02/172005
SV #4	Camp Evers Cr @ Whispering Pines (City of Scotts Valley Station	*E. coli*	6	Weekly	01/06/2005-02/17/2005
SV #5	Carbonera Cr above Camp Evers (City of Scotts Valley Station)	*E. coli*	38	Weekly	01/06/2005-02/17/2005 and 02/07/06-08/30/06
01160	Carbonera Creek above Spring Lakes Creek (A.K.A. Camp Evers Creek) (County of Santa Cruz Station)	Fecal coliform	62	Monthly	02/02/2000-06/15/2006
SV#6	Carbonera Cr @ Disc Drive (City of Scotts Valley Station	*E. coli*	38	Weekly	01/06/2005-02/17/2005 and 02/07/06-08/30/06
SV#7	Carbonera Cr @ Granite Creek Road (City of Scotts Valley Station	*E. coli*	32	Weekly	2/07/2006-08/30/2006
SV#8	Carbonera Creek @ Bethany Road (City of Scotts Valley Station	*E. coli*	32	Weekly	02/07/2006-08/30/2006

Table 4 shows that the City of Scotts Valley sampled six stations on Carbonera Creek/Camp Evers Creek on a weekly basis for one and one-half months during the winter 2005. The table also shows the City of Scotts Valley sampled six stations on Carbonera Creek/Camp Evers Creek on a weekly basis during 2006.

Table 4 also shows the County of Santa Cruz sampled three stations on Carbonera Creek/Camp Evers Creek. The County has sampled Carbonera Creek above Camp Evers Creek monthly since the year 2000.

3.2. Water Quality Objective Exceedance Analysis

Staff analyzed fecal coliform using a program titled "Fecal Coliform Investigation and Analysis Spreadsheet" (FECIA). FECIA is a fully automated spreadsheet designed to assist in determining pathogen indicator objectives or criteria exceedances. Observed data are compared against specified values equal to water quality objectives to determine the magnitude of exceedances (FECIA; Riverson, 2003). (The reader may view the results of this analysis in Appendix B to this report.) Staff analyzed the *E. coli* using the standard Microsoft Excel Program.

3.2.1. San Lorenzo River Watershed (Excluding Carbonera Creek)

This section summarizes data analysis results for the San Lorenzo River Watershed. (Carbonera Creek is discussed in the next section.) For each station, the percent violation of the geometric mean and maximum fecal coliform water quality objective is provided as well as the number of sample sets used to calculate the percent violation.

The results for San Lorenzo River Watershed (excluding Carbonera Creek) fecal coliform are shown in Table 5 below. The table shows the frequency of exceedances of the geometric mean water quality objective (when five or more samples were available in a 30-day period). In addition, the table shows the frequency of exceedance of the single sample maximum water quality objective (400 MPN/100 mL).

Table 5. San Lorenzo River, Branciforte Creek, and Lompico Creek Fecal Coliform Percent Violations of Water Quality Objectives[5]

Station	Water Body Segment Represented	Station Number	Geometric Mean Water Quality Objective (200 MPN/100 mL)		Maximum Water Quality Objective (400 MPN/100mL)	
			% Exceedances	Number of Sample Sets	% Exceedances	Number of Samples
San Lorenzo River Lagoon @ Trestle	San Lorenzo River Estuary	003	50%	325	29%	351
San Lorenzo River @ Broadway/Laurel Bridge	San Lorenzo River Estuary	006	63%	283	35%	326
San Lorenzo River @ Soquel Avenue Bridge	San Lorenzo River Estuary	009	(1)	(1)	47%	36
Branciforte Creek @ San Lorenzo River	Branciforte Creek (San Lorenzo River to Carbonera Creek Reach)	010	(1)	(1)	52%	33
Branciforte Creek @ Carbonera Creek	Branciforte Creek (Carbonera Creek to Headwaters Reach)	0120	(1)	(1)	0%	7
Branciforte Creek @ Isbel Drive	Branciforte Creek (Carbonera Creek to Headwaters Reach	0121	(1)	(1)	14%	59
San Lorenzo River @ Sycamore Grove	Branciforte Creek Upstream to Henry Cowell State Park Reach)	022	4%	370	5%	375
San Lorenzo River @ Big Trees	Branciforte Creek Upstream to Henry Cowell State Park Reach)	060	24%	294	10%	322

[5] See Table 2 for the dates of this sampling.

Station	Water Body Segment Represented	Station Number	Geometric Mean Water Quality Objective (200 MPN/100 mL)		Maximum Water Quality Objective (400 MPN/100mL)	
			% Exceedances	Number of Sample Sets	% Exceedances	Number of Samples
Lompico Creek @ Carrol Avenue	Lompico Creek	07528	(1)	(1)	16%	69
San Lorenzo River @ Highlands Park	San Lorenzo River Upstream of Henry Cowell State Park	149	11%	84	5%	111
San Lorenzo River above Love Cr	San Lorenzo River Upstream of Henry Cowell State Park	180	11%	295	8%	319
San Lorenzo River @ Pacific Ave., Brookdale	San Lorenzo River Upstream of Henry Cowell State Park	241	18%	68	1%	101
San Lorenzo River @ River St	San Lorenzo River Upstream of Henry Cowell State Park	245	22%	294	8%	325
Two Bar Creek @ San Lorenzo River	Two Bar Creek just before the confluence with San Lorenzo	290	(1)	(1)	30%	54
San Lorenzo River above Two Bar Cr.	San Lorenzo River Upstream of Henry Cowell State Park	300	(1)	(1)	14%	58

(1) Insufficient data to calculate geometric mean

The results for San Lorenzo River Watershed *E. coli* are shown in Table 6 below. The table displays violations of USEPA's recommended water quality criteria.

Table 6. San Lorenzo River and Estuary *E. coli* Geometric Means Since 2000[6]

Station	Water Body Segment Represented	Station Number	Year	USEPA's Geometric Mean Water Quality Criteria (126 MPN)			
				Number of Samples	Geometric Mean During November-March Recreation Season	Number of Samples	Geometric Mean During April-October Recreation Season
San Lorenzo River Lagoon @ Trestle	San Lorenzo River Estuary	003	2004	(1)	(1)	6	1205
San Lorenzo River @ Soquel Avenue Bridge	San Lorenzo River Estuary	009	1996 - 1997(2)	6	208	6	429
San Lorenzo River @ Tait Street	San Lorenzo River (Branciforte Creek Upstream to Henry Cowell State Park Reach	206	1999-2000	9	96		
			2000			14	90
			2000-2001	8	61		
			2001			14	156
			2001-2002	6	97		
			2002			14	86
			2002-2003	5	140		
			2003			14	100
			2003-2004	7	129		
			2004			13	79

[6] See Table 3 for dates of sampling.

Station	Water Body Segment Represented	Station Number	Year	USEPA's Geometric Mean Water Quality Criteria (126 MPN)			
				Number of Samples	Geometric Mean During November-March Recreation Season	Number of Samples	Geometric Mean During April-October Recreation Season
			2004-2005	7	490		
			2005			14	94
San Lorenzo River @ Henry Cowell Park Bridge	San Lorenzo River (Branciforte Creek Upstream to Henry Cowell State Park Reach	208	1999-2000	9	307		
			2000			14	189
			2000-2001	8	125		
			2001			14	392
			2001-2002	6	181		
			2002			14	166
			2002-2003	5	101		
			2003			13	222
			2003-2004	7	380		
			2004			13	255
			2004-2005	8	362		
			2005			14	192

(1) Insufficient data to calculate geometric mean
(2) No sampling of this station has occurred more recently than the year 2000

3.2.2. Carbonera Creek

The results for Carbonera Creek Watershed fecal coliform are shown in Table 7 below.

Table 7. Carbonera Creek Percent Exceedances of Fecal Coliform Water Quality Objective Since January 1, 2000[7]

Station	Station Number	Geometric Mean Water Quality Objective (200 MPN)		Maximum Water Quality Objective (400 MPN)	
		% Exceedances	Number of Sample Sets	% Exceedances	Number of Samples
Carbonera Creek @ Branciforte Creek	0110[2]	(1)	(1)	9%	11
Carbonera Creek @ Hwy 17	SV #1	(1)	(1)	42%	12
Spring Lakes Creek (same as Camp Evers Creek) above Carbonera Creek	1150	(1)	(1)	17%	6
Carbonera Creek above Spring Lakes Creek (same as Camp Evers Creek)	01160[2]	(1)	(1)	24%	62
Carbonera Creek @ Bethany Road	SV #8	(1)	(1)	0%	12

(1) Insufficient data to calculate geometric mean
(2) Staff used Santa Cruz County station number

The results for the Carbonera Creek subwatershed *E. coli* are shown in Table 8 below. The table displays violations of the USEPA's recommended water quality criteria.

[7] See Table 4 for dates of sampling.

Table 8. Carbonera Creek *E. coli* Geometric Means Since January 1, 2000[8]

Station	Water Body Segment Represented	Station Number	Year	USEPA's Geometric Mean Water Quality Criteria (126 MPN)			
				Number of Samples	Geometric Mean During November- March Recreation Season[1]	Number of Samples	Geometric Mean During April - October Recreation Season[2]
Carbonera Creek @ Hwy 17	Carbonera Creek	SV #1	2005	6	170		
			2006	7	186	25	301
Camp Evers Creek above Carbonera Creek	Camp Evers Creek	SV#2	2005	6	189		
			2006	7	361	25	330
Camp Evers Cr @ Cold Stream Way	Camp Evers Creek	SV # 3	2005	6	148		
Camp Evers Cr @ Whispering Pines	Camp Evers Creek	SV # 4	2005	6	675		
Carbonera Creek above Camp Evers Creek	Carbonera Creek	SV # 5	2005	6	145		
			2006	7	147	25	287
Carbonera Ck @ Disc Drive	Carbonera Creek	SV #6	2005	6	163		
			2006	7	170	25	290
Carbonera Cr @ Granite Ck Rd	Carbonera Creek	SV # 7	2006	7	180	25	518
Carbonera Cr @ Bethany Ro	Carbonera Cr	SV #8	2006	7	96	25	39

1 - The City of Scotts Valley took samples January - February in 2005 and February - March in 2006

2 – The City of Scotts Valley took samples April – August in 2006.

Staff also analyzed additional sample results collected by the Coastal Watershed Council. The data and data analysis results are shown in Appendix A. The data presented above are consistent with the Coastal Watershed Council data.

[8] See Table 4 for dates of sampling.

3.3 Detailed Data Analysis

A complete data analysis of fecal coliform data is presented in Appendix B of this report. Staff analyzed water quality sampling results using FECIA as mentioned in Section 3.2.

FECIA generated figures for each sampling station for data represented in Section 3.1. The figures display water quality objectives, concentration ranges, the range of concentrations within the 25th - 75th percentile range, the mean concentration, and the median concentration are shown.

FECIA also generated tables that show data results monthly basis. These tables show results of monthly data combined for all years analyzed. These tables shows the mean, median, minimum, maximum, the 25th percent deviation, the 75th percent deviation, the number of water quality objective exceedances, the sample count, and the percent sample exceedance.

3.4. Data Analysis Summary and Identification of Project Reach

This section identifies impacted areas. Staff identified all named reaches of the San Lorenzo River Watershed (including San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek and Lompico Creek), with the exception of Carbonera Creek upstream of Bethany Road within the City of Scotts Valley (see section 3.4.6.), as impaired[9] based on the results presented in Section 3.2.

3.4.1. San Lorenzo River Estuary Reach

Fecal coliform and *E. coli* impaired the San Lorenzo River Estuary. Fecal coliform concentrations at the San Lorenzo River Lagoon @ Broadway/Laurel Bridge (006) exhibited the highest exceedance. This station violated the fecal coliform geometric mean objective (200 MPN per 100 mL) by 63%. The other two stations, San Lorenzo River Lagoon @ Trestle (003) and San Lorenzo River @ Soquel Avenue Bridge (009), also exhibited impairment. The percent exceedance of the maximum water quality objective for these stations was 29 percent and 49 percent, respectively. The station "San Lorenzo River @ Soquel Avenue Bridge (009)" has not been sampled since 1997.

E. coli exceeded the USEPA's recommended water quality criteria at both the San Lorenzo River Estuary stations (stations 003 and 009). *E. coli* data for the San Lorenzo River @ Trestle station were available in the year 2004. There

[9] "Impairment" is defined as exceeding water quality objectives and can range from exceeding objectives only a couple of times, to exceeding a majority of the time.

were no "winter" samples taken. The most recent *E. coli* data for the San Lorenzo River @ Soquel Avenue Bridge station were taken in 1996.

Staff considered this entire reach impaired.

3.4.2. Branciforte Creek (San Lorenzo River to Carbonera Creek Reach)

Branciforte Creek was also impaired by fecal coliform. The Branciforte Creek at San Lorenzo River station (010) exceeded the fecal coliform maximum objective 52% of the time. The data indicated that Branciforte Creek at Carbonera Creek (0120) never exceeded objectives. However, only seven samples were taken at this station. The sampling data at this station are insufficient in number. Staff needs more data to determine impairment conditions at this station.

The Coastal Watershed Council sampled Branciforte Creek just upstream of the San Lorenzo River confluence on six occasions between May 2003 and May 2005 for *E. coli*. These samples exceeded the USEPA's recommended water quality criteria 100 percent of the time. *E. coli* concentrations varied from 590-25,000 cfu/100ml. (The sample results are shown in Appendix A of this document.)

Staff considered this entire reach impaired.

3.4.3. Branciforte Creek (Carbonera Creek to Headwaters Reach)

Branciforte Creek appears to have lower fecal coliform concentrations upstream of Carbonera Creek as shown at the Branciforte Creek @ Isabel Drive station (0121) than at station 010 (right above the confluence with the San Lorenzo River). However, even though the fecal coliform concentrations are fairly low, they still exceed the maximum water quality objective of 400 MPN/100 mL about 14% of the time.

Therefore, staff considered this entire reach impaired.

3.4.4. San Lorenzo River (from the confluence with Branciforte Creek Upstream to Henry Cowell State Park Reach)

The City of Santa Cruz collected *E. coli* data for San Lorenzo River at Tait Street (206) and San Lorenzo River at Henry Cowell State Park (208). Station 206 exceeded the USEPA's recommended water quality criteria during the dry[10]

[10] Staff used water quality data from April-October to represent the dry season.

season of 2001 and the wet[11] seasons of 2002-2003, 2003-2004 and 2004-2005. Station 208 exceeded the USEPA's recommended water quality criteria during the dry seasons of 2000-2005. Station 208 exceeded the USEPA's recommended water quality criteria during the wet seasons of 1999-2000, 2001-2002, 2003-2004, and 2004-2005.

Although the City of Santa Cruz's data show exceedances of the USEPA's recommended water quality criteria, the geometric means were not that elevated. Geometric mean exceedances ranged from barely exceeding the criteria at 129 MPN/100 mL to 490 MPN/100 mL at the highest exceedance during the wet season.

Santa Cruz County took fecal coliform samples at two locations in this reach, San Lorenzo River at Sycamore Grove (022) and San Lorenzo River at Big Trees (060). Station 060 is the same as the City's site 208 and station 022 is just upstream of the City's station 206. While station 022 exceeded the water quality objective, the geometric mean was only exceeded 4% of the time over a six year period. Additionally, while station 060 exceeded the water quality objective about 24% of the time when averaged over a six year period, the mean values for those six years only exceeded the geometric mean of 200 MPN in November and December.

Staff considered this entire reach impaired, although, the severity with which it exceeds USEPA's water quality criteria and the Basin Plan objective is very low.

3.4.5. San Lorenzo River Upstream of Henry Cowell State Park and Lompico Creek

The San Lorenzo River Station San Lorenzo River @ Highlands Park (149) and San Lorenzo River above Love Creek (180) barely exceeded water quality objectives with both stations exceeding the geometric mean just 11% of the time. Upstream of these two stations, the San Lorenzo River Station at Pacific Street (241) exceeded the geometric mean water quality objective 18% of the time and the San Lorenzo River Station at River Street (245), just upstream of 241 exhibited the greatest impairment by fecal coliform (22% of the geometric mean water quality objective) in this segment. The two remaining stations in this segment, Two Bar Creek at San Lorenzo River (290) and San Lorenzo River above Two Bar Creek (300) both exhibited exceedances of the maximum fecal coliform objective by 30 and 14%. Lompico Creek at Carrol Avenue exhibited 16% exceedance of the maximum water quality objective.

[11] Staff used water quality data form November-March to represent the wet season.

Although some stations exhibited minimal exceedances, staff considered this entire reach impaired.

3.4.6. Carbonera Creek/Camp Evers Creek

The City of Scotts Valley began comprehensive pathogen indicator organism sampling actions in 2005. This data indicates Carbonera Creek and Camp Evers Creek are impaired.

Table 7 indicates Carbonera Creek is impaired by fecal coliform at Highway 17 (SV #1). This station indicated 42% of 12 sample sets exceeded the fecal coliform maximum water quality objective. (Carbonera Creek @ Branciforte Creek (0110) has been sampled irregularly since the year 2000. Staff needs more sampling data to determine impairment.)

E. coli exceeded the USEPA's recommended water quality criteria for both the wet and dry seasons at all stations except the most upper station, Carbonera Creek @ Bethany Road. Staff considered this reach impaired upstream to water quality station Carbonera Creek @ Bethany Road (SV #8)

Load and wasteload allocations presented in Table 16. Allocations and Responsible Parties apply to the entire reach of Carbonera Creek.

3.5. Microbial Source Analysis Results

Genetic ribotyping is a microbiological source tracking method that differentiates animal *Escherichia coli (E. coli)* from other sources of animal *E. coli*. Mansour Samadpour of the University of Washington Public Health Department developed a library of over 100,000 *E. coli* samples and has developed genetic fingerprints that are specific to certain *E. coli* sources of animal origin. This method compares Ribonucleic Acid band patterns extracted from contaminated stream sites and known sources of *E. coli*. Numerous entities in California have successfully used this method, including California Polytechnic State University's (San Luis Obispo) study of Morro Bay, California.

Although this report presents various sources in "percent contribution" values, staff considered ribotyping results only as an estimate of possible sources and of relative source contributions among all of the various sources. Ribotyping represents one of the "lines of evidence" in determining source contribution.

Santa Cruz County personnel collected *E. coli* samples from the San Lorenzo River Estuary mouth (003), upstream of the Estuary at Sycamore Grove (022), San Lorenzo River at River Street (245) and San Lorenzo River at Big Trees (060). Figure 9 shows ribotyping collection sites. (This figure also shows storm drain sampling stations displayed later in Table 13.)

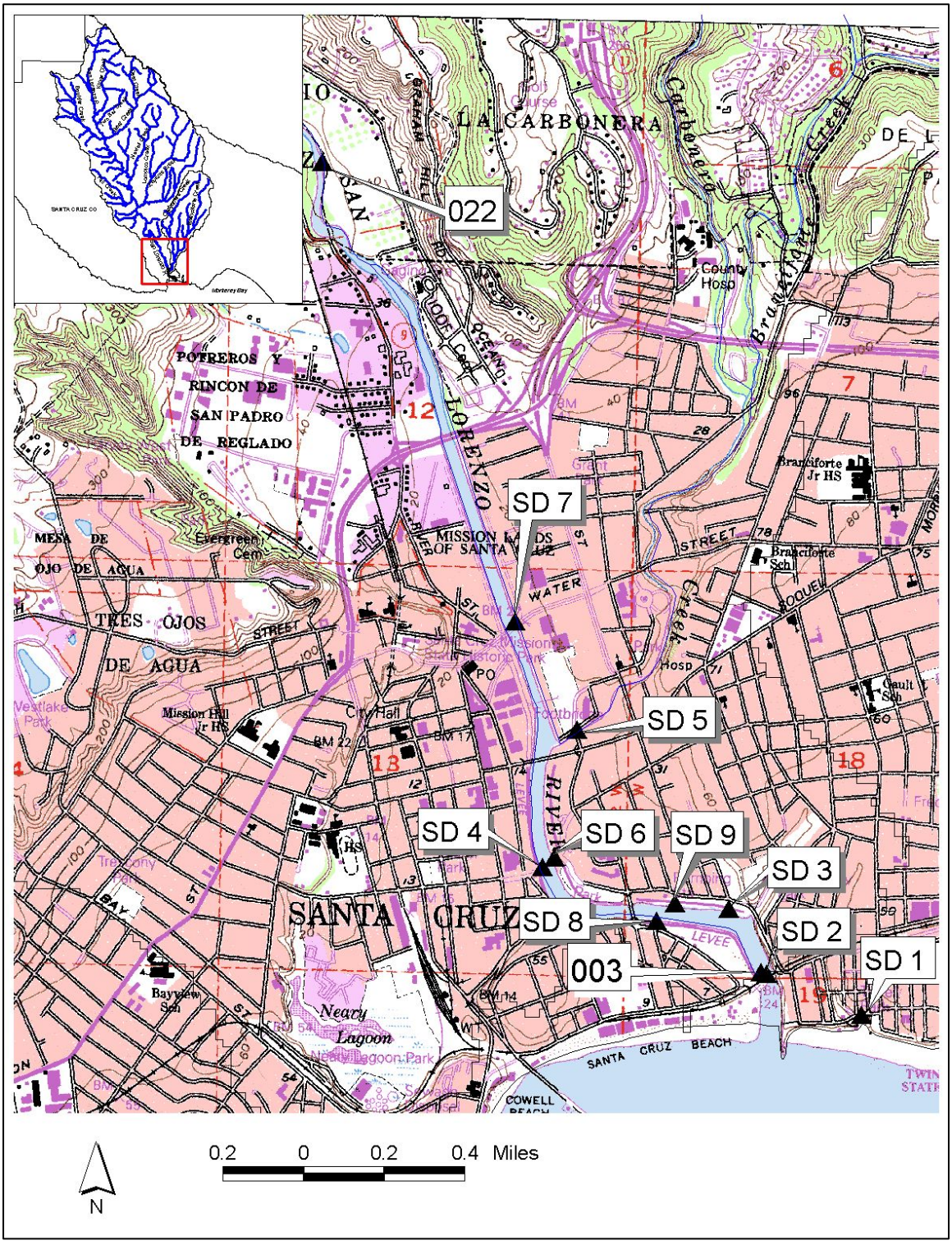


Figure 9. San Lorenzo River Estuary Ribotyping Data Stations and Storm Drains (Sites 003 and 022 were ribotyping data stations.)

Santa Cruz County collected ribotyping samples between January 28, 2002 and September 21, 2004. The ribotyping analysis results are shown in Table 9.

Table 9. Percent Source Contributions from Two Sites from January 2002-September 2004 (Combined Wet and Dry Season)

	Percent Source Contribution of *E. coli*			
Sites	**San Lorenzo River Estuary at Trestle (003)[1]**	**San Lorenzo River at Sycamore Grove (022)[2]**	**San Lorenzo River at River Street (245)[3]**	**San Lorenzo River at Big Trees (060)[4]**
Dates	**1/28/2002 - 9/21/2004**	**1/28/2002 - 8/4/2004**	**1/28/2002 - 8/4/2004**	**1/28/2002 - 8/4/2004**
Source				
Bird	45 %	36 %	38%	30%
Human	20 %	17 %	23%	17%
Rodent	7 %	10 %	8%	8%
Dog	6 %	6 %	8%	12%
Wildlife	6 %	10 %	11%	13%
Cow	1 %	4 %	0%	1%
Horse	1 %	1 %	1%	8%
Cat	0 %	1 %	1%	1%
Marine Mammal	0 %	0 %	0%	0%
Unknown	14 %	14 %	9%	9%
Total Water Samples	71	41	39	42
Total Isolate Samples	282	156	184	193

[1] This station location is shown in Figure 9.
[2] This station location is shown in Figure 9.
[3] This station location is shown in Figure 6.
[4] This station location is shown in Figure 6.

Table 9 shows that birds and humans were the two largest sources at all four sites. Bird contribution ranged from 30% at the Big Trees Station (060) to 45% of *E. coli* at the Trestle Station (003). Staff considers birds to be largely natural and uncontrollable sources. Human contributions ranged between 17% at the Sycamore Grove (022) and Big Trees Stations (060) to 23% of *E. coli* at the River Street Station (245). Rodent contributions, considered partially controllable, ranged from 7 % of *E. coli* at the Trestle Station (003) to 10 % at the Sycamore Grove station (022). Pets and domestic animals and livestock (considered controllable) contributed 8% of *E. coli* at the Trestle (003) and up to 22% of *E. coli* at Big Tree (060). Big Trees (060) had the highest contribution of both horse (8%) and dog (12%) of any of the four stations. Wildlife, considered partially controllable, ranged from 6-13%. The unknown component ranged between 9 and 14% at all four stations.

Table 10 below divides pathogen indicator organism contributions into wet and dry seasons.

Table 10. Variation of *E. coli* Sources During Wet and Dry Seasons (January 2002 - September 2004)

	San Lorenzo River at Mouth (003) [1]		San Lorenzo River at Sycamore Grove (022) [2]		San Lorenzo River at River Street (245) [3]		San Lorenzo River at Big Trees (060) [4]	
Source/Percent Occurrence	**Wet[5]**	**Dry[6]**	**Wet[5]**	**Dry[6]**	**Wet[5]**	**Dry[6]**	**Wet[5]**	**Dry[6]**
Bird	37%	52%	25%	49%	31%	47%	24%	39%
Cat	0%	0%	1%	1%	1%	1%	1%	0%
Cow	1%	2%	5%	4%	0%	0%	1%	1%
Dog	6%	7%	6%	7%	7%	9%	11%	14%
Horse	1%	1%	0%	3%	1%	1%	12%	1%
Human	25%	15%	20%	14%	28%	16%	16%	18%
Rodent	6%	7%	11%	9%	4%	14%	9%	8%
Unknown	18%	10%	20%	7%	12%	5%	12%	5%
Wildlife	6%	5%	16%	4%	16%	5%	15%	12%
No. of Isolates[7]	127	155	87	69	108	76	117	76
No. of Sample Dates	8	15	7	8	7	7	7	8
No. of Water Samples	26	45	22	19	20	19	23	19

[1] This station location is shown in Figure 9.
[2] This station location is shown in Figure 9.
[3] This station location is shown in Figure 6.
[4] This station location is shown in Figure 6.
[5] Wet =Samples taken during a time when rain occurred within the previous 72 hours
[6] Dry =Samples taken during a time more than 72 hours occurred without rain
[7] The number of isolates taken per water sample ranged from one isolate per water sample to 11 isolates per water sample with a median value of 3 isolates per water sample.

Table 10 indicates that birds contributed more during dry periods and humans contributed more during wet periods. Birds congregating at pooled areas may cause pathogen indicator organism growth within the stream system. Birds may also increase their contribution as a result of people feeding them during fair weather conditions. (Stormwater can provide a transport mechanism for pathogen indicator organisms. For example, leaking sewers may mix with surface and subsurface stormwater flow and migrate to the river.)

Both of the above tables show a significant portion of *E. coli* comes from unknown sources. The University of Washington Public Health Department does not have a genetic fingerprint match that is specific to some *E. coli* sources.

4. SOURCE ANALYSIS

For the San Lorenzo River Watershed, staff based the information contained within this section on investigations performed by staff and also on a report prepared by the County of Santa Cruz, Environmental Health Service Water Resources Program. The report is titled *Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches* prepared in March 2006 (Proposition 13 Report). Staff used water quality data, ribotyping results, discharger data and reports, land use data, field reconnaissance work, and conversations with staff from other agencies to complete the source analysis. Therefore, staff did not determine sources solely on ribotyping results, but staff investigated the potential sources identified by ribotyping.

For Carbonera Creek, the sources are based on existing water quality data, discharger data and reports, discussions with City of Scotts Valley staff, Central Coast Water Board staff assumptions based on the Proposition 13 Report, and microbial source analysis results for other water bodies within the Central Coast Region.

Pathogen indicator organism sources include natural sources; sanitary sewer collection system leaks and spills (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems); storm drain discharges to municipally owned and operated separate storm sewer systems (MS4s) required to be covered by an NPDES permit; onsite wastewater disposal system discharges; pet waste in areas that do not drain to MS4s homeless person/encampment discharges in areas that do not drain to MS4s; and domestic animals and livestock discharges.[12]

Each source staff identified is discussed below.

4.1. Sources of Pathogen Indicator Organisms Investigated

Staff determined the following sources contributed pathogen indicator organisms. These sources are discussed below. The implementation plan section (section 10) provides actions staff concluded are necessary to attain water quality objectives.

[12] Staff concluded garden shops and nurseries are not a source because their acreage is not significant. Also, possible pathogenic materials, such as steer manure, are placed in plastic bags.

4.1.1. WASTE DISCHARGES SUBJECT TO REGULATION BY THE CENTRAL COAST WATER BOARD

This section discusses potential pathogen sources subject to regulation by the Central Coast Water Board. This section identifies various sources that may contribute pathogen indicator bacteria to San Lorenzo River Watershed surface waters.

Local agencies, landowners, and other dischargers have already implemented many corrective actions that result in improved water quality. This report provides some additional measures local agencies, land owners, and other dischargers can take to continue the water quality improvement efforts already begun.

4.1.1.a. Sanitary Sewer Collection System Spills and Leaks

Sewage can reach surface waters from sewer line overflows or leaks. Sewage spills can occur when roots, grease buildup, or other causes block sewer lines. Leaks can also occur from cracked lines or lines with poor connections. When sewer lines are blocked or leaking, sewage may run onto the street, into gutters, and into storm drains. Sewer leaks can occur in small volumes above or below the ground surface. These types of leaks often continue unnoticed.

The Central Coast Water Board issued National Pollutant Discharge Elimination System (NPDES) permits and Waste Discharge Requirements to the City of Santa Cruz (NPDES Permit No. CA 0048194 and WDR R3-2005-003, respectively) and the City of Scotts Valley (NPDES Permit No. CA 0048828 and WDR R3-2002-0016, respectively). The Cities of Santa Cruz and Scotts Valley NPDES permit and Waste Discharge requirements addresses the collection system, wastewater treatment plant (WWTP), and disposal system discharges. The wastewater treatment plant discharges treated wastewater to the Pacific Ocean. Collection system spills and leaks may discharge to Carbonera Creek and the San Lorenzo River Estuary.

The Santa Cruz County Sanitation District Waste Discharge Requirements (WDR No. R3-2005-0043) addresses the County's WWTP collection system. Wastes generated within the Sanitation District that serve the communities east of the City of Santa Cruz are collected and treated at the City of Santa Cruz wastewater treatment plant. The Sanitation District sewer main line lies below the San Lorenzo River bed. It is located at the Laurel/Broadway Street Bridge.

The State Water Resources Control Board adopted Statewide General Order (WQ Order No 2003-0005-DWQ) and Statewide General Waste Discharge

Requirements for Sanitary Sewer Systems (Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans. The goal of the sewer system management plan is to provide a plan and schedule to properly manage, operate, and maintain all parts of the sanitary sewer system. This will help reduce and prevent sanitary sewer overflows and releases, as well as mitigate any sanitary sewer overflows and releases that do occur.

The State Board General Waste Discharge Requirements for Sanitary Sewer Systems do not impose additional requirements beyond those requirements already adopted by the Central Coast Water Board.

4.1.1.a.1. City of Santa Cruz Sanitary Sewer Collection System Spills and Leaks

The City of Santa Cruz (City) has discovered cracks, breaks, and misalignments in sewer lines. The City also found and corrected some cross-connections between sewers and storm drains. During the wet season, these situations can contribute to sewer system overflows by rainfall and groundwater infiltration. Conversely, a sewage exfiltration potential exists in dry seasons. (Exfiltration occurs when sewage leaks underground).

The Proposition 13 Report states “there have been substantial direct discharges of sewage from overflows or breaks in lines adjacent to lagoons or creeks, the most common mechanism for sewage to reach the creeks or beach, particularly during dry periods, is through the storm drain system as a result of surface spills, subsurface leaks, or cross-connections.

The causes of the surface spills are: 1) sewer main/lift station overflows; 2) sewer line blockages; 3) rainfall inundation resulting in sewage overflows; and 4) human mistakes (e.g. contractor errors during repairs or maintenance).

Table 11 below shows spill volumes that have occurred within the City of Santa Cruz. The graph shows three spill categories represented in the legend from January 1, 2000, through November 4, 2005.

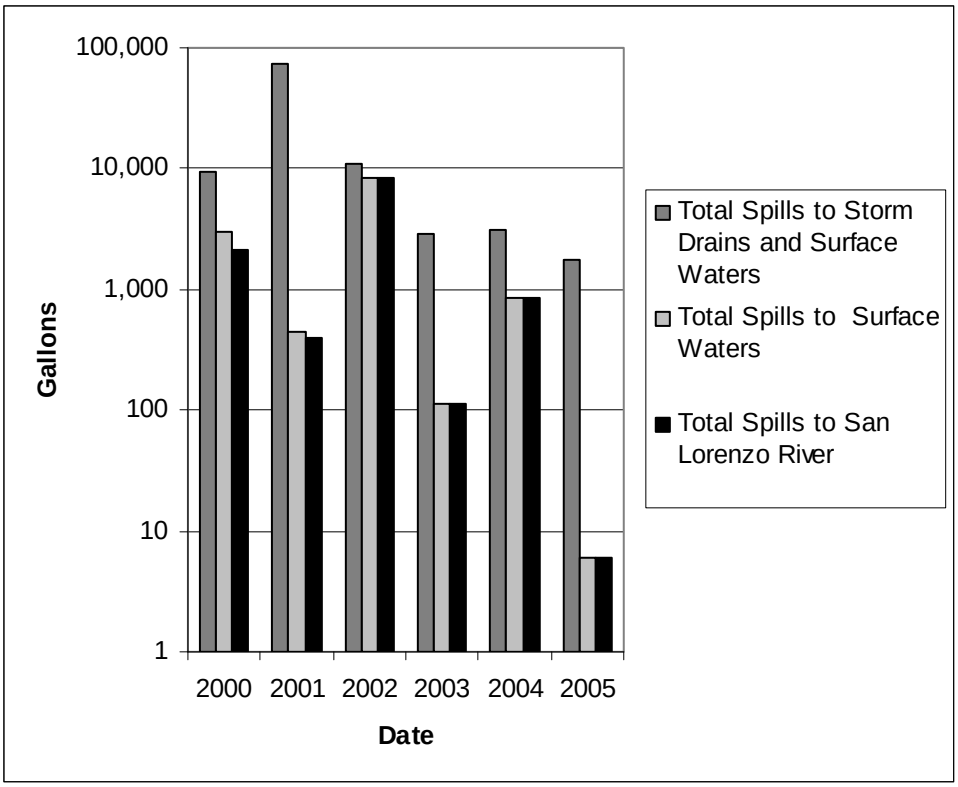


Figure 10. Spill Volumes within the City of Santa Cruz

The largest category of spills in Figure 10 is total spills to storm drains and surface waters. The second largest category of spills in Figure 10 is total spills to surface waters. However, some of these spills did not flow to San Lorenzo River. Some flows reached other surface waters such as Neary's Lagoon and Monterey Bay. The smallest category of spills is "total spills to San Lorenzo River."

Figure 10 shows the City implemented activities that dramatically reduced spill volumes since the year 2000. Repairs in the beach flats areas have shown diminished bacteria levels in pump station at the Trestle (Santa Cruz County, Oct. 2007).

Table 11 below shows the total annual spill volumes and the number of spills that occurred from January 1, 2000 through November 4, 2005.

Table 11. Annual Spill Volume and Number of Spills within the City of Santa Cruz

		Total Spills to Storm Drains and Surface Waters	Total Spills to Surface Waters	Total Spills to San Lorenzo River
2000	Gallons	9,265	3,025	2,125
	Number of Spills	57	6	5
2001	Gallons	72,463	450	400
	Number of Spills	37	3	2
2002	Gallons	11,000	8,300	8,300
	Number of Spills	23	3	3
2003	Gallons	2,866	115	115
	Number of Spills	20	3	3
2004	Gallons	3,145	850	850
	Number of Spills	21	2	2
2005	Gallons	1,746	6	6
	Number of Spills	24	2	2

Table 11 shows for the years 2001 through 2005 (excluding the year 2000), two or three spills reached the San Lorenzo River.

The City of Santa Cruz implements a spill management program to minimize the effects of spills upon surface waters. When spills occur, the City determines if the spills have entered storm drains. If the spill enters the storm drain, the City determines where the spill has migrated and "traps" the spill. The City extracts the spills from the storm drains and hauls the sewage to the wastewater treatment plant. Starting in 2003, and as demonstrated by Table 11, the City implemented improved spill management activities that dramatically reduced sewage spill volumes.

Since 1997, the City has replaced or rehabilitated most of the sewer lines in the vicinity of Market Street, River Street, Water Street, Lower Ocean Street, and Beach Flats areas. Additional rehabilitation is scheduled for the lower east side area and Water Street.

Based upon the information above, Central Coast Water Board staff concluded that collection system spills and leaks were a problem. Staff also concluded a portion of the human waste at the river mouth (shown by ribotyping to contribute 20% of the *E. coli*) may originate from these leaks and spills.

4.1.1.a.2. City of Scotts Valley

The City of Scotts Valley operates a secondary wastewater treatment system located in Scotts Valley. Treated wastewater flows to the effluent pipeline and is discharged to the Pacific Ocean through the City of Santa Cruz's outfall. The City also operates and maintains the municipal collection system.

4.1.1.a.2.1. City of Scotts Valley Wastewater Treatment Plant and Effluent Pipeline

Spills have occurred at the treatment plant in the past. However, most of these spills were treated effluent. In the last five years, only two spills of secondarily treated wastewater drained to surface waters. One spill that occurred on May 17, 2001, to Camp Evers Creek was approximately 50 gallons. This spill occurred due to operator error. The second spill occurred on February 25, 2002, and resulted in an approximately 312,000 gallons flowing to Camp Evers Creek. This spill occurred due to a pump malfunction at the treatment plant.

To prevent these problems from reoccurring, the City of Scotts Valley has improved management of the plant. The City installed an improved pager system to ensure operators are notified of a pump failure immediately.

These spills do not represent a chronic problem requiring additional regulation. Rather, they were anomalous events and the discharger took steps to minimize the likelihood of future occurrences. No such spills have occurred since 2002. Staff concluded this is not a source to Carbonera Creek.

4.1.1.a.2.2. City of Scotts Valley Sanitary Sewer Collection System Spills and Leaks

The City of Scotts Valley has a relatively new collection system. The sewer collection system was completely rebuilt after the Loma Prieta earthquake in 1989.

The City of Scotts Valley performed a video analysis of the entire collection system in 1999. The City repaired every separated collection system joint, sagged pipe, or damaged pipe (personal communication, Scott Hamby, City of Scotts Valley Wastewater and Environmental Program Manager, Jan 30, 2006).

Figure 11 below shows spill volumes that have occurred within the City of Scotts Valley. The graph shows three spill categories from January 1, 2000, through August 2, 2005. The figure provides information regarding two types of spills. The figure displays the total spills to (1) storm drains and surface waters and (2) spills to Carbonera Creek. The causes of the total known spill volume are: 1) sewer main/lift station overflows; 2) sewer line blockages; and 3) a broken

sewer line.

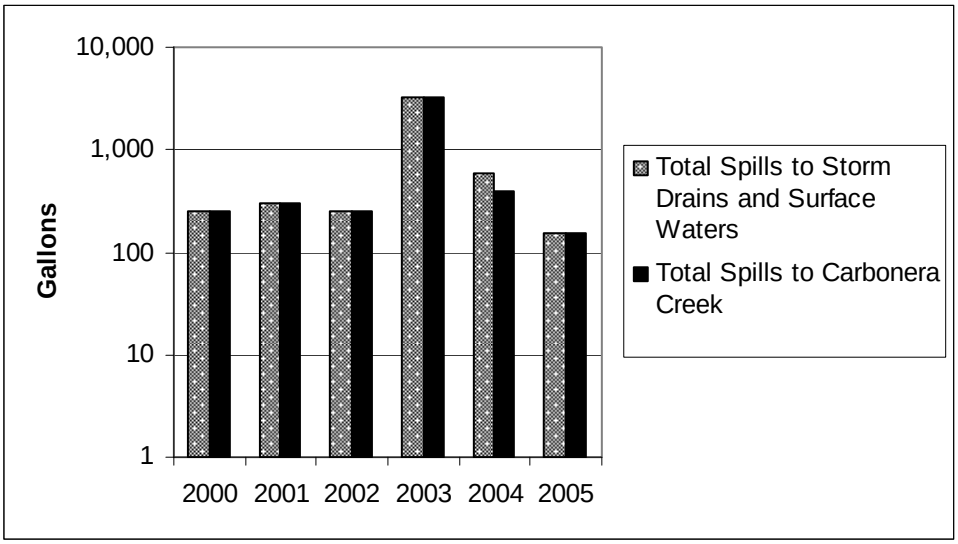


Figure 11. Spill Volumes within the City of Scotts Valley

Figure 11 shows the volume of spills has generally been consistent since the year 2000 within the City of Scotts Valley.

Table 12 shows the total annual spill volumes and the number of spills that occurred from January 1, 2000 through August 2, 2005 within the City of Scotts Valley.

Table 12. Annual Spill Volume and Number of Spills within the City of Scotts Valley

		Total Spills to Storm Drains and Surface Waters	Total Spills to Carbonera Creek
2000	Gallons	250	250
	Number of Spills	2	2
2001	Gallons	300	300
	Number of Spills	2	2
2002	Gallons	250	250
	Number of Spills	3	3
2003	Gallons	3300	3300
	Number of Spills	1	1
2004	Gallons	600	400
	Number of Spills	4	3
2005	Gallons	150	150

	Number of Spills	1	1

Table 12 shows between one and three spills reached Carbonera Creek.

In the year 2003, a 3,300-gallon spill occurred. This spill was attributed to pump failure at a lift station within the City's jurisdiction. An alarm failed to notify City of Scotts Valley staff of the pump failure. Since then, the City of Scotts Valley implements a daily "manual activation program" to ensure alarms work. City of Scotts Valley staff physically check each alarm within the entire system to ensure the alarms work. Central Coast Water Board staff concluded the alarm inspections are a very effective means to ensure alarms work. The City of Scotts Valley also now inspects pumps at lift stations on a more frequent basis. Therefore, staff concludes that spills from the Scotts Valley sewer collection system are not a source of impairment from fecal indicator bacteria in project area surface waters.

To determine if leaks occur from the collection system, the City of Scotts Valley analyzed wastewater flows coming into the wastewater treatment plant after rainfall events. Wastewater flow increased by approximately 20% after rains occurred. However, wastewater flows quickly returned to the normal flow rates. City staff determined the increase in flow was attributed to rainfall entering manholes because flows quickly returned to normal pre-rain flows. This demonstrates subsurface infiltration (and consequently leaks and cracks) of the collection occurs in small volumes and not large volumes (Water Board staff communication with Scott Hamby, City of Scotts Valley Wastewater and Environmental Program Manager, December 21, 2006). Therefore, Water Board staff concludes that leaks from the sewer collection system of Scotts Valley are not a source of impairment from fecal indicator bacteria in project area surface waters.

4.1.1.a.3. Santa Cruz County Sanitation District Sanitary Sewer Collection System Main

The Santa Cruz County Sanitation District implements a maintenance and inspection program for its sewer main. The program includes a procedure to remove obstacles within the line. The program also includes inspection of the sewer main line to determine if corrosion is occurring. In 2005, Santa Cruz County Sanitation District staff inspected the main line and observed no corrosion (personal communication: Rachel Lather, Senior Civil Engineer, Santa Cruz County Sanitation District February 16, 2006). Central Coast Water Board staff concluded this is not a pathogen source.

4.1.1.a.4. Other Domestic Wastewater Facilities

The Central Coast Water Board regulates several publicly operated discharges to land by Waste Discharge Requirements. These facilities are California Department of Forestry, Ben Lomond Youth Conservation Camp, San Lorenzo Valley Unified School District, Redwood Elementary School and San Lorenzo Valley High School, San Lorenzo Valley Water District, Bear Creek Estates[13], Santa Cruz CSA # 7, Boulder Creek County Club, Santa Cruz CSA # 10, Rolling Woods Subdivision, Scotts Valley Water District (as a reclaimed water recipient), and Scotts Valley Wastewater Treatment Plant (as a reclaimed water provider).

Staff determined these discharges do not impact water quality. The reasons are (1) disposal sites and collection systems comply with Basin Plan onsite sewage disposal system requirements; (2) where spills have occurred, the discharger has corrected the problem; or (3) the discharge was disinfected prior to disposal.

The Central Coast Water Board also regulates some privately operated discharges to land. These facilities include Big Basin Woods, Brookdale Lodge[14], Mount Hermon Conference Center and historically Casa de Montgomery[15]. Staff determined these discharges are not impacting San Lorenzo Watershed surface waters because (1) disposal sites and collection systems comply with Basin Plan onsite sewage system requirements and/or (2) where spills have occurred, the discharger has corrected the problem.

4.1.1.a.5. Private Laterals/Pump Station Spills and Leaks

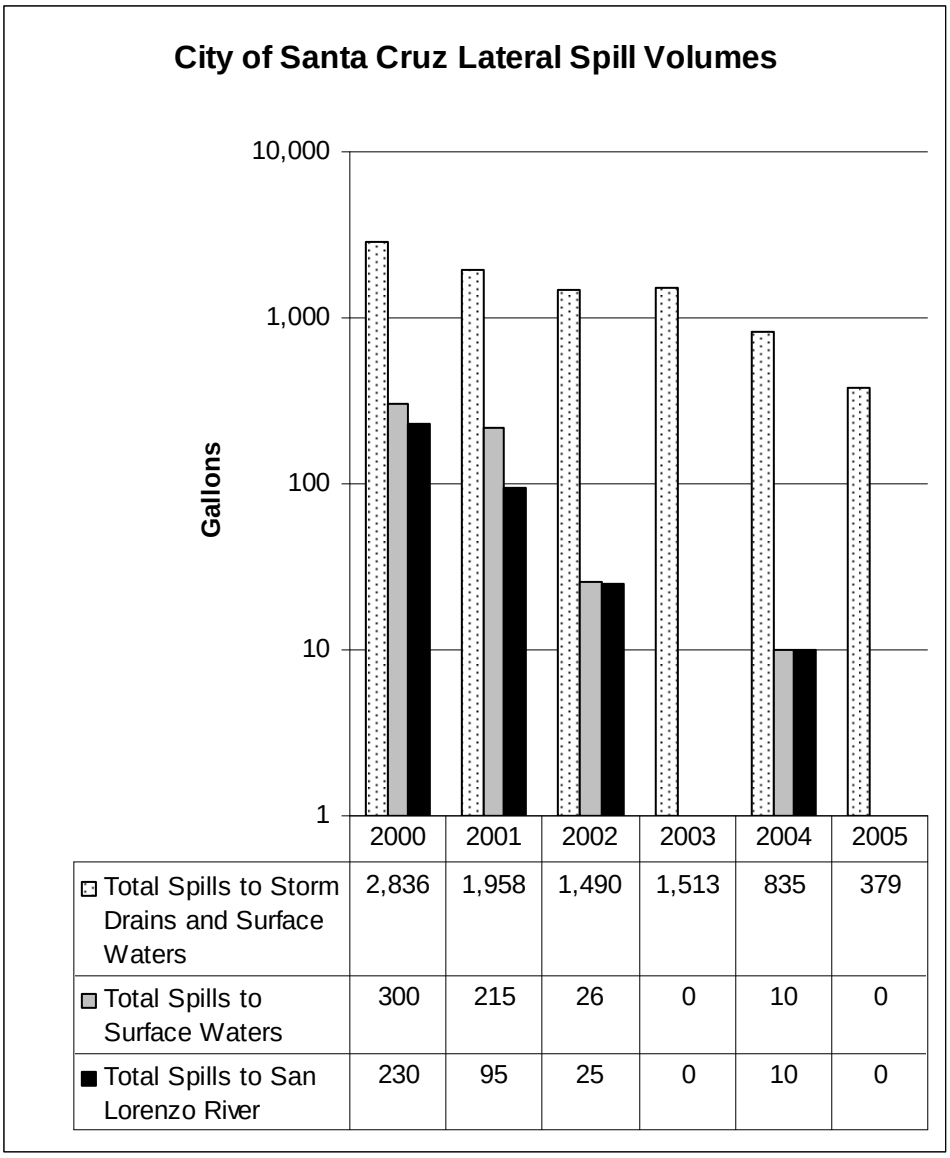
Staff found conflicting information regarding the significance of problems from private laterals within the City of Santa Cruz. On one hand, staff concluded that spills from private laterals are not a problem. Staff reviewed lateral spill volume data collected by the City of Santa Cruz and determined lateral spills are not a problem. But on the other hand, staff concluded leaks are a problem based on two reports.

The evidence that indicates private laterals are not a problem in the City of Santa Cruz are spill data collected by the City of Santa Cruz and presented in Figure 12 (shown below). Figure 12 shows spill volumes from private laterals within the City of Santa Cruz for the year 2000 through November 04, 2005. These spill volumes represent known spill volumes.

[13] Bear Creek Estates is currently in violation of its permit with regard to nitrogen removal. The violation does not affect bacterial water quality. However, steps are being taken the correct the situation

[14] Brookdale Lodge is currently in violation of its permit with regard to nitrogen removal. The violation does not affect bacterial water quality. However, steps are being taken the correct the situation

[15] Casa de Montgomery's Waste Discharge Requirements were rescinded on August 23, 2007. The facility is not operating as of the writing of this report. The County of Santa Cruz is enforcing. The County posted the site as uninhabitable. No one is allowed to live in this area until they get a County permit or Waste Discharge Requirements. The Water Board will have to decide which one.



	2000	2001	2002	2003	2004	2005
Total Spills to Storm Drains and Surface Waters	2,836	1,958	1,490	1,513	835	379
Total Spills to Surface Waters	300	215	26	0	10	0
Total Spills to San Lorenzo River	230	95	25	0	10	0

Figure 12. Spill Volumes within the City of Santa Cruz from Private Laterals

Figure 12 indicates the known spills from laterals were approximately 2,836-gallons in the year 2000. Lateral spill volumes were significantly reduced since the year 2000. The lateral spill volume in 2005 was 379-gallons. Lateral spill volumes reaching surface waters was 300-gallons in the year 2000; no lateral spills reached any surface waters in the year 2005.

The City of Santa Cruz recently implemented spill management practices to prevent lateral spills from flowing to surface waters. The City also recently replaced 72 private laterals with Clean Beach Initiative funds.

However, leaks appear to be a problem. Central Coast Water Board staff reviewed two reports that indicate private laterals within the City of Santa Cruz

are leaking. These reports are the Proposition 13 Report and the City of Santa Cruz proposed Storm Water Management Program (SWMP). The Proposition 13 report indicated that approximately 75% - 80% of spills were generated by overflows and private laterals. (The report did not estimate overflow from solely private laterals.) The report indicated the City of Santa Cruz is considering a program to require private lateral inspection and upgrade at the time of sale of a property. The proposed SWMP report indicates leaking private sanitary sewer laterals contribute to infiltration problems and may cause discharges to the storm drain system.

Based upon above information, staff determined leaks from private laterals are a source of fecal indicator bacteria in the City of Santa Cruz stormwater.

The City of Scotts Valley has had only one known private lateral spill since the year 2000. The City of Scotts Valley adopted an ordinance regarding private laterals. The City requires all new laterals to be video taped after installation to assure the line is not sagging. (Sagging laterals can result in blocked lines or spills.) Staff concludes that private laterals in the City of Scotts Valley are not a source of surface water impairment due to fecal indicator bacteria.

4.1.1.b. Storm Drain Discharges to Municipally Owned and Operated Separate Storm Sewer Systems (MS4s) Required to be Covered by an NPDES Permit

Storm drains can be a conduit for pathogen indicator organisms travel to surface waters. During storms, rainwater can come in contact with human or animal waste and carry pathogen indicator organisms to a storm drain.

Staff reviewed *E. coli* data collected in storm drains by Santa Cruz County Environmental Health Officials. Table 13 shows sampling results. Figure 9 shows locations of storm drain sampling stations. Storm drain sampling has not occurred at drains to Carbonera Creek.

Table 13. Pathogen Indicator Organism Sampling Results at Estuary Storm Drains (October 22, 2003-March 02, 2005)

Station Label	Location	Number of Samples	Minimum *E. coli* (MPN/100 mL)	Geomean *E. coli* (MPN/100 mL)	Maximum *E. coli* (MPN/100 mL)
SD 1	Mott Street Storm Drain	2	759	1405	2,602
SD 2	Gravity Storm Drain at Trestle	13	5	294	11,199
SD 3	Jessie Street Storm Drain	13	20	308	12,997
SD 4	Laurel Street Exit at San Lorenzo River Estuary Storm Drain	12	31	327	11,199
SD 5	Storm Drain at Riverside West	12	5	126	11,199
SD 6	Broadway Pump Station Storm Drain	13	31	815	15,531
SD 7	West Water Street Storm Drain	12	5	223	25,000
SD 8	Raymond Street at San Lorenzo River	5	2247	3,978	12,033
SD 9	Northeast Pump Bixby at San Lorenzo Blvd	13	209	1156	17,329

Table 13 shows excessive *E. coli* discharges to the San Lorenzo River Estuary. Staff expects similar *E. coli* concentrations throughout the watershed. Possible *E. coli* sources are discussed below.

4.1.1.b.1 Controllable Bird Waste Transport Mechanisms

Microbial source tracking results indicated birds were the largest contributor to the Watershed. Table 10 shows the bird contributed the most *E. coli* at each of the four sites analyzed. Controllable sources of bird waste may be dumpsters, trashcans, and trash litter. Birds may frequent these locations as feeding sites. Bird waste may leach to storm drains or surface waters when storms occur.

See Section 4.1.2 for a discussion on bird waste that is not deemed controllable (natural bird waste).

4.1.1.b.2. Pet Waste Transport Mechanisms

Microbial source tracking results indicated dog waste was a source at each of the four sites analyzed. According to the Proposition 13 report, one storm drain discharge contained a sizeable percent contribution from dogs. Pet wastes can reach surface waters via storm drain discharges during wet seasons. Also pet

wastes can reach storm drains during dry seasons if wash water[16] comes into contact with pet droppings.

4.1.1.b.3. Controllable Rodent and Wildlife Waste Transport Mechanisms

Microbial source tracking results indicated rodents and wildlife waste was a source at each of the four sites analyzed. Controllable rodent and wildlife waste can reach surface waters the same way that bird waste can reach surface waters.

4.1.1.b.4. Dumpster Leachate

When it rains, rainwater can enter dumpsters and discharge leachate. This occurs when dumpsters are uncovered and containers leak. Dumpsters are often repositories for pet waste and human waste (diapers). Recent microbial source tracking indicated pet and human waste existed at each of the four sites. Staff estimates a small portion of pet and human waste detected from microbial source tracking analysis is placed in dumpsters.

During dry seasons, bird waste may reach surface waters when trash-holding areas are washed down. Wash down waters may reach storm water drains and surface waters.

4.1.1.b.5. Illegal Human Waste Discharges in Non-Riparian Areas

Illegal human waste discharges can reach surface waters via storm drains. For example human discharges can occur when homeless people do not have access to restroom facilities. According to an Applied Survey Research report titled *Santa Cruz County Homeless 2000 Census and Needs Assessment* (Applied Survey Research report), the population of homeless in the City of Santa Cruz was 1,273 individuals. This report indicated the population under estimates the actual population. (Central Coast Water Board staff has read numerous Santa Cruz newspaper articles that indicate the City's population is approximately 2,000 persons.) The Applied Survey Research Report indicated the population living out of doors is 17.1%. Therefore, staff estimated the homeless population living outdoors was approximately 350 people in the year 2000. Since these people lived outdoors and were not living in shelters, and since toilet facilities were not always readily available, staff concluded a portion of such human wastes eventually discharged to the San Lorenzo River and Estuary from within the City of Santa Cruz.

The Applied Survey Research report indicated the population of homeless in Santa Cruz County unincorporated areas is 1,020 persons. (Again, the Applied

[16] "Wash water" means any water used for the purposes of washing (for example, a car, sidewalk, restaurant mats, pets, tools, etc.) that runs off and enters the storm drain or waterbody directly.

Survey Research Report under estimates the actual population.) Staff estimated the population of homeless with the San Lorenzo River Watershed was approximately 400 persons and approximately 70 of those individuals lived outdoors in the year 2000. Since these people lived outdoors and were not living in shelters and since toilet facilities were not always readily available, staff concluded a portion of the wastes are eventually discharged to San Lorenzo River Watershed surface waters.

Staff concluded the homeless population is currently not as significant a problem within the City of Scotts Valley based upon the Applied Survey report. This report indicated the homeless population within the City of Scotts Valley in the year 2000 was 174 persons. Staff estimated the number of homeless people living outdoors was approximately 15 persons in the year 2000. Staff estimates a portion of wastes from people living outdoors reaches Carbonera Creek.

Staff concluded, in (4.1.1.a.5. Private Laterals/Pump Station Spills and Leaks), that leaks from private laterals are a source of fecal indicator bacteria in stormwater.

Staff concluded a portion of the human waste (20% at the Estuary) originated from illegal human waste discharges to storm drains within the City of Santa Cruz. Owners/operators of land that include homeless persons/encampments may include (but are not limited to) private landowners, the County of Santa Cruz, the City of Santa Cruz, the City of Scotts Valley, California Department of Transportation (Caltrans), and the railroads.

4.1.1.b.6. Illegal Recreational Vehicle Discharges

Illegal recreational vehicle discharges can reach storm drains and eventually surface waters. The Applied Survey report also estimated 7.8% of homeless people live in vehicles. Spill Reports have reported discharges from recreational vehicles within the City of Santa Cruz. Many recreational vehicles contain wastewater storage tanks. Some recreational vehicle owners may have released wastewater to streets or parking areas if 1) disposal facilities were not available, 2) owners did not want to lose a parking space, or if 3) owners didn't want to pay a disposal fee.

(Staff concluded recreational vehicles are not a problem in the Scotts Valley area based on the Applied Survey Research report, spill reports, and discussions with City staff. There were no reported spills from recreational vehicles in Scotts Valley.)

Staff estimates a portion of the human waste (20% at the Estuary and 23% at River Street) originates from illegal recreational vehicle discharges within the City of Santa Cruz. Staff also concluded a portion of the human waste at Stations 022 and 060 originated from illegal recreational vehicle discharges within the

County of Santa Cruz.

4.1.1.c. Pet Waste in Areas that do not Drain to MS4s

Staff concluded that pet waste in areas that do not drain to MS4s likely contributed pathogens to surface waters in the Aptos Creek watershed. Staff discussed pet waste in Section 4.1.1.b.2. *Pet Waste Transport Mechanisms*. As mentioned, microbial source tracking results indicated dog waste was a source at each of the four sites analyzed. Additionally, County staff observed pet waste in riparian areas (personal communication, John Ricker, County of Santa Cruz Environmental Health Services, September 18, 2007). Pet waste that is directly deposited to surface waters from riparian areas is not regulated by MS4s. Furthermore, staff observed other watersheds in which owners and operators of dogs did not pick up their waste in riparian areas. Staff concluded similar activities occur in this watershed.

Staff concluded that pet waste in areas that do not drain to MS4s, was a source of pathogens that can be controlled and is proposing additional actions in Section 10 *Implementation Plan*.

4.1.1.d. Onsite Wastewater Disposal System Discharges

Onsite wastewater disposal system discharges occur throughout the San Lorenzo River Watershed within the County of Santa Cruz's jurisdiction. There are also some onsite wastewater disposal systems within the City of Scotts Valley.

Onsite wastewater disposal systems in the San Lorenzo River Watershed (but not the City of Scotts Valley) are managed by the Santa Cruz County Environmental Health Service. County Environmental Health Service winter inspections indicated that one to three percent of the San Lorenzo River Watershed's 13,000 onsite wastewater disposal systems fail (even during a wet winter) (*Draft San Lorenzo River Watershed Management Plan Update,* October 2001*).* When failures occur during wet periods, partially treated sewage may flow to ditches, roadways, creeks, and the River, especially if the failure originated in close proximity to a water body. During dry periods, sewage from failing onsite wastewater disposal systems probably will not reach a waterway unless a failure occurs close to a creek or the River.

The County's Wastewater Management Plan requires inspection and evaluation of existing systems, upgrade of malfunctioning systems, ongoing inspection and maintenance, program administration, and financing.

The Central Coast Water Board adopted a Basin Plan amendment in 1995

(Resolution 95-04) adding the following language in Chapter Four, Section VIII.D.3.i., Individual, Alternative, and Community Systems Prohibitions. (This amendment does not apply to Scotts Valley onsite wastewater disposal systems.)

> **"In order to achieve water quality objectives, protect present and future beneficial water uses, protect public health, and prevent nuisance, discharges are prohibited in the following areas:**
>
> …2. Discharges from individual sewage disposal systems within the San Lorenzo River Watershed shall be managed as follows:
>
> a. Discharges shall be allowed, providing the County of Santa Cruz, as lead agency, implements the "Wastewater Management Plan for the San Lorenzo River Watershed, County of Santa Cruz, Health Services Agency, Environmental Health Service", February 1995 and "San Lorenzo Nitrate Management Plan, Phase II Final Report", February 1995, County of Santa Cruz, Health Services Agency, Environmental Health Service (Wastewater Management Plan) and assures the Central Coast Water Board that areas of the San Lorenzo River Watershed are serviced by wastewater disposal systems to protect and enhance water quality, to protect and restore beneficial uses of water, and to abate and prevent nuisance, pollution, and contamination."

There are also onsite wastewater disposal systems within the City of Scotts Valley. The Wastewater Management Plan does not apply to onsite wastewater disposal systems within the City of Scotts Valley. However, the County of Santa Cruz is currently considering incorporating the onsite wastewater disposal systems in the City of Scotts Valley into the County's Wastewater Management Plan. According to Ken Anderson, City of Scotts Valley Public Works director, there are approximately 25-40 onsite wastewater disposal systems within the City of Scotts Valley (personal communication February 8, 2007). Many of these systems are located east of Carbonera Creek and are within six hundred feet of Carbonera Creek. According to Ken Anderson, many of these systems are already twenty years old and these systems have a high failure rate (personal communication February 8, 2007). However, there is currently no direct evidence that failed systems have discharged to the impaired surface waters.

The City is requiring all failed systems to connect to the existing wastewater collection system. Therefore, Water Board staff is recommending the continuance of the current practice of connecting failed systems until all identified problem onsite wastewater disposal systems are rectified or are connected to

the collection system within the City of Scotts Valley.

Therefore, staff recommends that onsite wastewater disposal systems located in the City of Scotts Valley not be identified as a source causing exceedance of fecal coliform water quality objectives in area surface waters. However, staff will continue to monitor efforts by the City of Scotts Valley to identify and address problem onsite wastewater disposal systems. To this end, staff will monitor these efforts through mechanisms used to regulate other onsite wastewater disposal systems, e.g. through an anticipated Central Coast Region Implementation Program (e.g. as a conditional waiver of waste discharge requirements for onsite wastewater disposal systems).

4.1.1.e. Domestic Animals and Livestock

Microbial source tracking results indicated cows and horses each contributed an estimated one percent of the *E. coli* bacteria to the Estuary. Cows contributed 4% and horses contributed 1% at the Sycamore Grove station. At the Big Trees station, cows contributed 1% and horses contributed 8%.

Staff observed horses and other domestic animals while performing field reconnaissance. According to the County's Proposition 13 Report (March 2006), it is estimated there may be 400-600 head of livestock kept in the San Lorenzo watershed, primarily horses in commercial stables and small homeowner operations. Of those that have horses on their property, there are likely many that compost or age their manure on site while some use it in its raw form[17] (Ecology Action 2006). The Proposition 13 Report also states that except where animals are allowed into creeks, stables are not a significant source of microbiologic contamination during non-storm periods. However, during storm periods and in situations where animals are allowed into the creek, fecal input may reach the creek and contribute to elevated levels of pathogen indicator organisms.

Runoff during storms from areas occupied by cows, horses, and manure stockpiles may contribute pathogens. Animals allowed in the creeks during dry periods can also contribute pathogens.

Staff concluded domestic animals and livestock are sources of pathogens that can be controlled.

[17] While Central Coast Water Board staff is citing this study for Santa Cruz County, the study also included Santa Clara and San Benito Counties. Because there were three counties as part of this study, we are not citing a percentage associated with each type of manure management practice.

4.1.1.f. Homeless Person/Encampment Discharges in Areas That do not Drain to MS4s

This report discussed homeless people in Section 4.1.1.b.5, Illegal Human Waste Discharges in Non-Riparian Areas. Homeless encampments are present in the San Lorenzo River Watershed riparian areas and may be a significant human pathogen source. However, homeless people that discharge directly to surface waters from riparian areas are not regulated by the SWMP program.

Staff estimated the homeless population within the San Lorenzo River Watershed was approximately 400 persons in the year 2000 based upon data presented within the Applied Survey Research report. According to the Applied Survey Research report, 17.1% of the people live outdoors. Therefore staff estimated the population of homeless people living outdoors in the Watershed to be approximately 70 persons.

Staff concluded homeless encampment discharges must be addressed. Staff based this conclusion upon the estimated homeless encampment population. Another basis for including homeless encampment wastes from riparian areas as a source originated from discussions at technical advisory committee meetings established while the County developed the Proposition 13 Report. The homeless encampment issue often came up in discussions among members.

The October 22, 2005 issue of the local newspaper, the Santa Cruz Sentinel, reported a homeless community on Carbonera Creek. Human waste was observed ten feet from the Creek. The newspaper indicated that there are numerous other encampments throughout the county. The newspaper also stated that there is a lack of shelters and this forced people to camp. The article also stated if law enforcement officials cleared sites, campers merely moved to a different site. Also, at the June 26, 2006 public meeting, staff received a comment that a common homeless encampment site occurs adjacent to Carbonera Creek at Hwy 17 (Tamara Doan, personal communication).

Homeless encampment locations are dynamic due to the general mobility of this population. Locations change depending upon dispersal performed by law enforcement officials. For these reasons, staff did not prepare maps showing homeless encampment locations.

In addition to human waste, homeless encampments may also generate wastes from other sources such as rodent waste, pet waste, and bird waste.

Central Coast Water Board staff concluded homeless encampments are a pathogen indicator organism source and is proposing additional actions in the Implementation Plan in Section Ten.

4.1.2. NATURAL SOURCES

According to microbial source tracking results, birds and other wildlife (e.g. squirrels, deer, and raccoons) are *E. coli* sources. Bird wastes enter surface waters from roosting areas in close proximity to surface waters. Wildlife droppings in close proximity to surface waters also contribute *E. coli*.

Staff distinguished natural sources from "controllable" wildlife sources. Controllable sources were those caused or influenced by human activity, such as littering or leaving trash receptacles accessible to wildlife. Another controllable source was the entrance of wildlife fecal matter into storm drains through wash water. Staff discussed controllable wildlife sources in the preceding sections and included measures to minimize their contribution to pathogen loading in the Implementation Plan of this report.

4.2. Source Analysis Conclusions

This section provides staff's conclusions regarding the relative order of pathogen indicator organism sources. Staff provides the relative order for San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek and Carbonera and Camp Evers Creek.

Staff estimated the relative order beginning with the largest source first. (The relative order is a staff estimate only. The reader should be aware there are uncertainties associated with determining such estimates. For example, staff can not be certain of the magnitude and location of private lateral leaks.)

4.2.1 San Lorenzo River Estuary

Staff concluded that natural sources of fecal indicator bacteria were significant contributors to the San Lorenzo River Estuary. Staff based this estimate upon ribotyping analysis that indicated a significant contribution of pathogen indicator organisms (58%) originated from natural sources such as birds, rodents, and wildlife. Additionally, staff observed many birds during reconnaissance visits to the Estuary. Staff estimated most of the bird, rodent, and wildlife waste is natural or not controllable.

Staff estimated the relative order of controllable sources as follows: 1) City of Santa Cruz sanitary sewer collection system leaks (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems); 2) storm drain discharges; 3) pet waste in areas that do not drain to MS4s 4) homeless person/encampment discharges; 5) onsite wastewater disposal system

discharges, and 6) domestic animals and livestock discharges. The order was based on the information in Sections 2, 3, and 4 of this report.

Staff concluded that all sources must be addressed concurrently regardless of staff's estimate of relative order.

Staff explains the rationale for ordering the sources below.

1. City of Santa Cruz Sanitary Sewer Collection System Spills and Leaks

Human waste was the largest controllable source to the Estuary. Ribotyping results indicated humans contributed 20% of the pathogen indicator organisms. The Estuary is surrounded by urban land use interlaced with leaking sewage collection systems. Therefore, staff concluded human waste originated primarily from urban sources. Staff concluded one of the largest human sources is the City of Santa Cruz collection system. The City of Santa Cruz has done an excellent job in repairing collection system problems in the downtown area. However, the City needs to continue this effort throughout the City limits.

2. Storm Drain Discharges

Of the five remaining sources (storm water discharges, homeless encampment discharges, on-site sewage discharges, and domestic animals and livestock), staff expects storm drain discharges to contribute the second largest pathogen indicator organism source.

Storm drain discharges can contain human waste from illegal human discharges, private lateral leaks, and illegal recreational vehicle discharges. Storm drains can also contain pet waste and dumpster leachate.

(Staff estimated storm drain discharges were a greater source than onsite wastewater disposal systems or homeless encampments. There are very few onsite wastewater disposal system discharges in close proximity to the Estuary.)

3. Pet waste in areas that do not drain to MS4s.

Staff estimated that pet waste in areas that do not drain to MS4s was the third largest pathogen indicator organism contributor. Dogs were one of the most prevalent sources in the ribotyping analysis. Additionally, the sand along the Estuary is an attractive dog walking areas. Staff concluded that dog waste was a large source of pathogen indicator organisms to the Estuary.

4. Homeless Person/Encampment Discharges

Staff estimated homeless encampment discharges were the third largest pathogen indicator organism contributor because they are typically located in

close proximity to surface waters. Staff estimated a portion of the 70 homeless people that live in the San Lorenzo River Watershed directly discharge to the Estuary. Staff assumed many of the 70 homeless people live in close proximity to the City of Santa Cruz because City services are available.

5. On-site Sewage Disposal System Discharges

There are over 13,000 onsite wastewater disposal systems in the San Lorenzo River Watershed. Although the *San Lorenzo Wastewater Management Plan Program Status Report*, 1999-2001 estimates only one to five percent of onsite wastewater disposal systems fail, this means that 130-650 systems are failing. Staff does not expect all of the failed onsite wastewater disposal systems to discharge partially treated wastewater to surface waters. Most onsite wastewater disposal systems are located upstream in areas that are more likely to impact the San Lorenzo River.

6. Domestic Animals and Livestock

Staff concluded domestic animals and livestock are the smallest controllable pathogen indicator organism source to the Estuary. Ribotyping results indicated cows and horses contributed 2% of the *E. coli* to the Estuary. Cows and horses exist at low-intensity residential development and pasture lands. These lands are further upstream from the Estuary.

4.2.2. San Lorenzo River and Lompico Creek

This section discusses the pathogen indicator organism relative order for the San Lorenzo River and Lompico Creek.

Staff concluded significant contributors of the pathogen indicator organisms were natural sources. Staff based this estimate upon ribotyping analysis that indicates a majority of pathogen indicator organisms originated from natural sources such as birds, rodents, and wildlife. Additionally, staff observed many birds during reconnaissance visits to the River. Staff estimated most of the bird, rodent, and wildlife waste is natural or not controllable.

Staff estimated the relative order of controllable sources that contributed pathogen indicator organisms to San Lorenzo River and Lompico Creek. Staff estimated relative order as follows 1) onsite wastewater disposal system discharges, 2) storm drain discharges, 3) City of Santa Cruz sanitary sewer collection system leaks (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems) within the City of Santa Cruz [does not include Lompico Creek] 4) pet waste in areas that do not drain to MS4s 5) homeless encampment discharges, and 6) domestic animals and livestock discharges.

The order was based on the information in Sections 2, 3, and 4 of this report. As stated previously, staff used water quality data, discharger data and reports, flow estimates, land use data, ribotyping results, field reconnaissance work, and conversations with Santa Cruz County staff to complete the source analysis conclusions.

Staff concluded that all sources must be addressed concurrently regardless of staff's estimate of relative order.

Staff explains the rationale for ordering the sources below.

1. Onsite Wastewater Disposal System Discharges

There are over 13,000 onsite wastewater disposal systems in the San Lorenzo River Watershed. Although the *San Lorenzo Wastewater Management Plan Program Status Report*, 1999-2001 estimates only one-five percent of onsite wastewater disposal systems fail, this means that 130-650 systems are failing. Some of the failing systems are located in close proximity to surface waters. Staff estimates this is the greatest source to the River.

2. Storm Drain Discharges

San Lorenzo River Watershed receives more than five inches of rainfall a month during the winter season. Staff concludes that storm drain discharges from urban runoff, private lateral leaks, illegal recreational vehicle discharges, dumpster leachate, and pet waste will commingle with storm flows and flow into the River. Staff estimated this source would be less than that from onsite wastewater disposal system discharges.

3. Santa Cruz City Sanitary Sewer Collection System Spills and Leaks

Staff concluded that collection systems spills and leaks (including private laterals) contributed to elevated fecal coliform levels <u>within the City limits of Santa Cruz</u> in the San Lorenzo River Watershed.

4. Pet waste in areas that do not drain to MS4s.

Staff estimated that pet waste in areas that do not drain to MS4s was the second largest pathogen indicator organism contributor. Dogs were one of the most prevalent sources in the ribotyping analysis. Also, according to Santa Cruz County staff, pet waste was observed in the River Bed during dry periods. Because riparian areas were attractive dog walking areas, dog waste was observed there, and the riparian areas were directly connected to the River, staff concluded that dog waste was a large source of pathogen indicator organisms to this watershed.

5. Homeless Person/Encampment Discharges

As mentioned earlier, staff estimated approximately 70 persons live outdoors. Based upon discussions at a public meeting on June 26, 2005, staff concluded most of these individuals live in close proximity to creeks. Human waste and pet waste is commonly found at these sites. Staff estimated the waste from homeless encampments was less than from storm drain discharges.

6. Domestic Animals and Livestock

Staff concluded domestic animals and livestock are the smallest controllable pathogen indicator organism source. Ribotyping results indicated cows and horses contributed 1% and 8% *E. coli,* respectively, at Big Trees. (See Section 4.1.1.e. Domestic Animals and Livestock for more information.)

4.2.3. Branciforte Creek

Staff concluded significant contributors of the pathogen indicator organisms to Branciforte Creek were natural sources. Staff based this estimate upon ribotyping analysis of San Lorenzo River Estuary and San Lorenzo River. Staff estimated most pathogen indicator organisms originated from natural sources such as birds, rodents, and wildlife. Additionally, staff observed many birds during reconnaissance visits to the Creek. Staff estimated most of the bird, rodent, and wildlife waste is natural or not controllable.

Staff estimated relative order of controllable sources as follows: 1) Storm drain discharges to MS4s required to be covered by an NPDES permit, 2) pet waste in areas that do not drain to MS4s, 3) City of Santa Cruz sanitary sewer collection system leaks (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems) within the City limits of Santa Cruz.4) homeless person/encampment discharges in areas that do not drain to MS4s, 5) onsite wastewater disposal system discharges, and 6) domestic animals and livestock discharges. The order was based on the information in Sections 2, 3, and 4 of this report.

Staff concludes that all sources must be addressed concurrently regardless of staff's estimate of relative order.

Staff explains the rationale for ordering the sources below.

1. Storm Drain Discharges

As with other areas in the San Lorenzo River Watershed where ribotyping analysis was performed, staff expects human waste is the largest controllable pathogen. San Lorenzo River Watershed receives more than five inches of

rainfall a month during the winter season. Staff expects storm drains are a larger contributor than collection system leaks or spills because the collection system is relatively young. The collection system was installed in the 1970s and later.

Storm drain discharges can contain human waste by private lateral leaks and human waste (such as from diapers) in dumpster leachate.

2. Pet waste in areas that do not drain to MS4s.

Staff estimated that pet waste in areas that do not drain to MS4s was the second largest pathogen indicator organism contributor. Dogs were one of the most prevalent sources in the ribotyping analysis. Also, according to Santa Cruz County staff, pet waste was observed in the River Bed during dry periods. Because riparian areas were attractive dog walking areas, dog waste was observed there, and the riparian areas were directly connected to the River, staff concluded that dog waste was a large source of pathogen indicator organisms to this watershed.

3. Homeless Person/Encampment Discharges

As mentioned earlier, staff estimated approximately 70 persons live outdoors. Based upon discussions at a public meeting on June 26, 2005, staff concluded most of these individuals live in close proximity to creeks. Human waste and pet waste is commonly found at these sites. Staff estimated the waste from homeless encampments was less than from storm drain discharges.

4. Onsite Wastewater Disposal System Discharges

There are over 13,000 onsite wastewater disposal systems in the San Lorenzo River Watershed. Although the *San Lorenzo Wastewater Management Plan Program Status Report*, 1999-2001 estimates only one-five percent of onsite wastewater disposal systems fail, this means that 130-650 systems are failing. Some of the failing systems are located in close proximity to surface waters. Staff estimates these systems are a source of pathogen indicator organisms to this watershed.

5. Domestic Animals and Livestock

Staff concluded domestic animals and livestock are a small controllable pathogen indicator organism source. Staff concluded this information based upon land use and reconnaissance of the area. (See Section 4.1.1.e. Domestic Animals and Livestock for more information.)

6. Santa Cruz City Sanitary Sewer Collection System Spills and Leaks

Staff concluded that collection systems spills and leaks (including private

laterals) contributed to elevated fecal coliform levels within the City limits of Santa Cruz in Branciforte Creek.

4.2.4. Carbonera Creek and Camp Evers Subwatershed

Staff concluded significant contributors of the pathogen indicator organisms to Carbonera Creek and Camp Evers Creek were natural sources. Staff based this estimate upon ribotyping analysis of San Lorenzo River Estuary and San Lorenzo River. Staff estimated most pathogen indicator organisms originated from natural sources such as birds, rodents, and wildlife. Additionally, staff observed many birds during reconnaissance visits to the Creeks. Staff estimated most of the bird, rodent, and wildlife waste is natural or not controllable.

Staff estimated relative order of controllable sources as follows: 1) storm drain discharges, 2) pet waste in areas that do not drain to MS4s, 3) homeless encampment discharges, 4) onsite wastewater disposal system discharges, 5) domestic animals and livestock discharges, and 6) City of Santa Cruz sanitary sewer collection system leaks (including private laterals connected to municipal sanitary sewer collection systems) (only for only for Carbonera Creek). The order was based on the information in Sections 2, 3, and 4 of this report.

Staff concludes that all sources must be addressed concurrently regardless of staff's estimate of relative order. All sources must be reduced to comply with the proposed Basin Plan prohibition within the San Lorenzo River Watershed.

Staff explains the rationale for ordering the sources below.

1. Storm Drain Discharges

As with other areas in the San Lorenzo River Watershed where ribotyping analysis was performed, staff expects human waste is the largest controllable pathogen. San Lorenzo River Watershed receives more than five inches of rainfall a month during the winter season. Staff expects storm drains are a larger contributor than collection system leaks or spills because the collection system is relatively young. The collection system was installed in the 1970s and later.

Storm drain discharges can contain human waste by private lateral leaks and human waste (such as from diapers) in dumpster leachate.

2. Pet waste in areas that do not drain to MS4s.

Staff estimated that pet waste in areas that do not drain to MS4s was the second largest pathogen indicator organism contributor. Dogs were one of the most prevalent sources in the ribotyping analysis. Also, according to Santa Cruz County staff, pet waste was observed in the River Bed during dry periods.

Because riparian areas were attractive dog walking areas, dog waste was observed there, and the riparian areas were directly connected to the River, staff concluded that dog waste was a large source of pathogen indicator organisms to this watershed.

3. Homeless Person/Encampment Discharges

Staff concluded the commonly occurring homeless encampment located by Carbonera Creek at Highway 17 is a source, but cannot be covered under "storm drain discharges" mentioned in no. 1 above because homeless encampment discharges are not regulated by the SWMP program. However, staff assumed homeless encampment discharges can impair water quality.

4. Onsite Wastewater Disposal System Discharges

Some homes on the east side of Highway 17 utilize onsite wastewater disposal systems for waste discharge. Carbonera Creek is impaired downstream of the onsite wastewater disposal systems. As of the date of this report, there are only approximately 25-40 onsite wastewater disposal systems that remain unconnected to the existing wastewater collection system. As these systems fail[18], the City of Scotts Valley requires these systems to connect to the wastewater collection system.

5. Domestic Animals and Livestock

Staff concluded domestic animals and livestock are a small controllable pathogen indicator organism source. Staff concluded this information based upon land use and reconnaissance of the area. (See Section 4.1.1.e. Domestic Animals and Livestock for more information.)

4.2.4 Responsible Parties

Please see Table 16 for a summary of responsible parties. Actions the responsible parties need to take are presented in Section 10 of this report.

4.3. Comparison with Sources in Other Pathogen Impaired Waters

[18] The City code states that onsite disposal systems cannot be fixed. In other words, when a system warrants repair, the homeowner must connect to the sewer. Therefore, "failure" does not *necessarily* indicate discharge from a homeowner but rather any substandard functionality of the system.

The purpose of this section is to describe how sources from the San Lorenzo River Watershed compared with sources identified in other TMDL Project Reports. Staff compared sources with similar sources identified in the Morro Bay pathogen and Watsonville Slough TMDL project reports.

Sanitary Sewer Collection System Spills and Leaks: The Watsonville Slough TMDL identified the municipal collection system as a source in Harkins Slough, Watsonville Slough, and Struve Slough. The responsible party is the Santa Cruz County Freedom Sanitation District and the City of Watsonville. This finding is similar for San Lorenzo River waters in close proximity to urban areas.

Storm Drain Discharges: The Morro Bay and Watsonville Slough Pathogen TMDL Project Reports indicated stormwater contributed a relatively large portion of pathogens to surface waters. This is consistent with results for the San Lorenzo River Watershed.

Onsite Wastewater Disposal System Discharges: The Morro Bay pathogen TMDL project report identified failing onsite wastewater disposal systems in Los Osos and other parts of the watershed as possible sources. There are many onsite wastewater disposal systems in both the Morro Bay Watershed and the San Lorenzo River Watershed.

The Watsonville Slough project report did not indicate onsite wastewater disposal systems were a problem. This is expected because onsite wastewater disposal system density is less than San Lorenzo Watershed and surface waters are generally dry during late spring through early fall. In contrast, there is always flow in the San Lorenzo River.

Homeless Person/Encampment Discharges: Both the Morro Bay and the Watsonville Slough Pathogen TMDL project reports identified homeless discharges as pathogen sources. This is consistent with the conclusions of this report.

Domestic Animals and Livestock: Both the Morro Bay and the Watsonville Slough Pathogen TMDL project reports identified livestock discharges as pathogen sources. This is consistent with the conclusions of this report.

5. CRITICAL CONDITIONS AND SEASONAL VARIATION

This section discusses factors affecting impairment, critical conditions, uncertainties, and seasonal pathogen indicator organism variations.

5.1. Critical Conditions and Uncertainties

The critical conditions of impairment occur when fecal coliform levels approach, but do not exceed water quality objectives. These levels are considered critical because of the uncertainty surrounding actual fecal coliform levels, and effectiveness of implementation measures.

Staff concluded that there are no critical conditions.

There are several uncertainties with pathogens. Stream flows may serve to either increase or dilute pathogen indicator organism concentrations. Stagnant pools may be areas where pathogen indicator organism concentrations increased due to evaporation or increasing numbers of cells, i.e., through naturalized bacteria. Conversely, increased stream flows may dilute fecal coliform concentrations.

There is uncertainty regarding the relative contributions of identified sources. Staff concluded that both "controllable" and "non-controllable" sources are contributing fecal input into the waterbodies. However, there is uncertainty surrounding the relative load that each of these sources is contributing.

Staff has addressed the uncertainties through the use of conservative approaches in the TMDL development and implementation program. For example, setting the TMDL equal to the water quality objective assures that critical conditions, if any, and uncertainties are addressed.

5.2. Seasonal Variations

Staff analyzed San Lorenzo River Watershed surface water fecal coliform and *E. coli* data on a seasonal basis. Table 14 shows that seasonal variation is not a critical factor (based on monthly pathogen data). However, the proportion of human contribution to fecal coliform is significantly higher during wet periods (see Table 10).

Staff analyzed water quality objective exceedance on a monthly basis. Table 14 and Table 15 show seasonal trend conclusions for each San Lorenzo River monitoring station. Table 14 and Table 15 provide data for the evaluation of possible seasonal variations for fecal coliform and *E. coli* respectively. Based on available data, these tables show there are no seasonal variations.

Table 14. San Lorenzo River Watershed Seasonal Analysis for Fecal Coliform

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
San Lorenzo River Lagoon @ Trestle	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean=288 MPN/100 mL	Mar, Apr, June-Dec	No Seasonal Trend
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=555 MPN/100 mL	Feb, Mar, May-Dec	
San Lorenzo River Lagoon at Broadway/Laurel Bridge	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean=330 MPN/100 mL	Jan-Apr and June-Dec	No Seasonal Trend
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=514 MPN/100 mL	Feb, Mar, Jul-Dec	
San Lorenzo River @ Soquel Avenue Bridge	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	No Seasonal Trend
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=1815 MPN/100 mL	Jan, Apr, May, Aug, Oct-Dec	
Branciforte Creek @ San Lorenzo River	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient Samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=1066 MPN/100 mL	Jan, Feb, May, June, Aug-Dec	
Branciforte Creek @ Carbonera Creek	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations or impairment
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=127 MPN/100 mL	None (no samples Apr-July and Oct-Nov)	
Branciforte Creek @ Isbel Drive	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	No Seasonal Trend

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=293 MPN/100 mL	Apr and Oct	
Carbonera Creek @ Branciforte Creek	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=261 MPN/100 mL	Aug	
Carbonera Creek @ Hwy 17	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=422 MPN/100 mL	Mar, June, July (no samples in Jan, Feb, Sept-Dec)	
Camp Evers Creek @ Carbonera Creek	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 201 MPN/100 mL	May (no samples Jan, June, Sept-Dec)	
Carbonera Creek @ Camp Evers Creek	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 356 MPN/100 mL	Apr, May, Sept	
San Lorenzo River at Sycamore Grove	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 80 MPN/100 mL	None	Mean concentrations attain objectives
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 139 MPN/100 mL	None	
SLR @ Big Trees	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 155 MPN/100 mL	Nov and Dec	Mean concentrations attain objectives

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 207 MPN/100 mL	None	
Lompico Creek @ Carrol Avenue	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 276 MPN/100 mL	Jun and Aug	Mean concentrations attain objectives
SLR @ Highlands Park	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 135 MPN/100 mL	None	Mean concentrations attain objectives
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 153 MPN/100 mL	None	
SLR Above Love Cr	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 113 MPN/100 mL	None	Mean concentrations attain objectives
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 164 MPN/100 mL	None	
SLR @ Pacific Ave., Brookdale	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 121 MPN/100 mL	None	Mean concentrations attain objectives
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 149 MPN/100 mL	None	
SLR @ River St	Fecal Coliform Geometric Mean=200 MPN/100 mL	Mean= 153 MPN/100 mL	Dec	Mean attains objectives (except for Dec)
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 205 MPN/100 mL	None	Mean and median concentrations attain objectives
Two Bar Cr. @ SLR	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=303 MPN/100 mL	Sep, Oct, Nov	Higher concentrations during first rains
SLR @ Two Bar Cr. (this site is above the confluence of SLR with Two Bar Creek)	Fecal Coliform Geometric Mean=200 MPN/100 mL	Not Applicable	Not enough samples to compute geometric means	Insufficient samples to determine seasonal variations
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 225 MPN/100 mL	Jul, Nov	None

Table 14 shows that the most of the stations (with the exception of Two Bar Creek @ San Lorenzo River) either showed no seasonal trend or there were insufficient samples to determine seasonal variation. This analysis was done using calendar months to indicated wet periods and dry period (dry being April – October and wet being November – March). Staff acknowledges that some of the samples taken during the "wet" season, may not have been rainfall influenced.

The seasonal variation for *E. coli* is presented below.

Table 15. San Lorenzo River Watershed Seasonal Analysis for *E. coli*

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
San Lorenzo River Lagoon @ Trestle	*E. coli* Geometric Mean=126 MPN/100 mL	Mean= 1535 MPN/100 mL	July (no sample sets Jan-June or Aug-Dec)	Insufficient samples to determine seasonal variations
	E. coli not to Exceed=235 MPN/100 mL	Mean= 2256 MPN/100 mL	July (no samples Apr-June or Aug-Nov)	
San Lorenzo River Lagoon at Broadway/Laurel Bridge	*E. coli* not to Exceed=235 MPN/100 mL	Mean= 1318 MPN/100 mL	July (no samples Man, Mar-June, Aug-Dec)	Insufficient samples to determine seasonal variations
San Lorenzo River @ Soquel Avenue Bridge	*E. coli* not to Exceed=235 MPN/100 mL	Mean=1293 MPN/100 mL	Feb, June, Aug, Sept, Oct, and Dec	No Seasonal Trend
San Lorenzo River @ Tait Street	*E. coli* Geometric Mean=126 MPN/100 mL	Mean=98 MPN/100 mL	None (no sample sets Jan, Feb, July-Sept, Dec)	Insufficient samples to determine seasonal variations
	E. coli not to Exceed=235 MPN/100 mL	Mean=293 MPN/100 mL	Jan, Feb, May, Oct, Nov, Dec	No Seasonal Trend
San Lorenzo River @ Henry Cowell Park Bridge	*E. coli* Geometric Mean=126 MPN/100 mL	Mean=223 MPN/100 mL	Mar, Apr, May, Jun, Oct, Nov (no sample sets Jan, Feb, July-Sept, Dec)	Insufficient samples to determine seasonal variations
	E. coli not to Exceed=235 MPN/100 mL	Mean=887 MPN/100 mL	Jan, Feb, Mar, May, Jul, Aug, Oct, Nov, Dec	No Seasonal Trend
Carbonera Creek @ Hwy 17	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean=289 MPN/100 mL	Apr-Aug (no samples Jan, Feb, Sept, and October)	Insufficient Samples to determine seasonal variations
Camp Evers Creek @ Carbonera Creek	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean=287 MPN/100 mL	Jan	Insufficient Samples to determine seasonal variations

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
Camp Evers Creek @ Cold Stream Way	*E. coli n*ot to Exceed=235	Mean=1015MPN/100 mL	Jan and Feb (no samples Mar-Dec)	Insufficient Samples to determine seasonal variations
Camp Evers Creek @ Whispering Pines	*E. coli n*ot to Exceed=235	Mean=898 MPN/100 mL	Feb (no samples Mar-Dec)	Insufficient Samples to determine seasonal variations
Carbonera Creek @ Camp Evers Creek	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean=320 MPN/100 mL	Mar-July (No samples Sept-Dec)	Insufficient Samples to determine seasonal variations
Carbonera Creek @ Disc Drive	*E. coli* Geometric Mean=126 MPN/100mL	Mean=308 MPN/100 mL	Mar-Aug (no sample sets Jan, Feb, Sept-Dec)	Insufficient Samples to determine seasonal variations
	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean=320 MPN/100 mL	Mar-May, July, and August (no samples Sept-Dec)	Insufficient Samples to determine seasonal variations
Carbonera Creek @ Granite Road	*E. coli* Geometric Mean=126 MPN/100mL	Mean=552 MPN/100 mL	Mar (no samples Jan, Feb, Sept-Dec)	Insufficient Samples to determine seasonal variations
	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean= 552 MPN/100 mL	Mar, May-Aug (no samples Jan, Sept-Dec)	Insufficient Samples to determine seasonal variations
Carbonera Creek @ Bethany Road	*E. coli* Geometric Mean=126 MPN/100mL	Mean=48 MPN/100 mL	None (no sample sets Jan, Feb, Sept-Dec)	Insufficient Samples to determine seasonal variations
	*E. coli n*ot to Exceed=235 MPN/100 mL	Mean= 84 MPN/100 mL	Mar (no samples Jan, Sept-Oct)	Insufficient Samples to determine seasonal variations

Again, Table 15 shows that the stations either showed no seasonal trend or there were insufficient samples to determine seasonal variation. This analysis was done using calendar months to indicate wet periods and dry period (dry being April – October and wet being November – March). Staff acknowledges that

some of the samples taken during the wet season may not have been rainfall influenced. Most stations on Carbonera Creek have not been sampled for a full year. However, most Carbonera Creek stations indicated impairment during the spring and summer.

Further analysis could be performed in order to determine the extent rainfall versus dry conditions influence the bacterial concentration of the sample. However, staff determined that in order to best protect public health, allocations should be in place during wet and dry weather. Therefore, no further analysis was performed at this time.

5.3. Conclusion

Although San Lorenzo River Watershed waters are impaired, staff concluded there are no critical condition considerations. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions.

Although ribotyping data indicated the human contribution was significantly higher during wet periods (see Table 10), staff analysis of fecal coliform and *E. coli* did not show seasonal variations. Therefore, staff did not adjust load allocations and numeric targets for seasonal variation. The numeric targets provided in Section 6 apply to both wet and dry weather.

6. NUMERIC TARGETS

The Basin Plan contains fecal coliform water quality objectives. These water quality objectives are in place to protect the water contact recreation beneficial use.

The numeric target used to develop the TMDL is:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.[19]

Staff proposes removal of the shellfish beneficial use for San Lorenzo River Estuary from the Basin Plan. (See the Use Attainability Analysis in Appendix D.) Therefore, staff is not proposing numeric targets related to shellfish harvesting.

[19] Throughout this report, fecal coliform units are expressed as colony forming unit (CFU), organisms, count (#/100ml or CFU/100 ml) and most probable number (MPN). All unit expressions are considered equivalent fecal coliform bacteria concentration measures (Reference: Protocol for Developing Pathogen TMDLs).

Natural non-controllable sources are contributors of fecal indicator bacteria (FIB) in the San Lorenzo River Watershed. The question exists whether the non-controllable fraction of FIB alone could cause receiving water concentration of FIB to exceed the numeric target. However, there is evidence that non-controllable sources alone may not cause receiving water concentration to exceed the numeric target, i.e., that the numeric target can be achieved by managing controllable sources of FIB. For example, Waddell[20] and Scott's Creeks[21] are coastal streams with lagoons. Both Waddell and Scott's Creeks, as well as their lagoons, carry FIB concentrations that achieve the geometric mean value of the numeric target. Single samples from these water bodies have exceeded the numeric target, but again, the monthly geometric mean achieves the numeric target. Staff, therefore, concludes that the potential exists to achieve the numeric targets by managing the controllable fraction of FIB in San Lorenzo River Watershed. Staff acknowledges that the San Lorenzo River Estuary is a waterbody heavily influenced by urban sources of FIB, whereas Waddell and Scott's Creek are much less developed with less human presence in their watersheds. Therefore, staff offers the above example as more of an indirect comparison, showing concentrations of FIB that more natural waterbodies may exhibit in this area, and not to show a direct comparison to other urban waterbodies that are achieving numeric targets.

In the event that the numeric target cannot be achieved through management of controllable sources, staff will consider other regulatory options; please see the discussion in the TMDL and Allocations section.

7. LINKAGE ANALYSIS

The goal of the linkage analysis is to establish a link between pollutant loads and water quality. This, in turn, supports that the loading capacity specified in these TMDLs will result in attaining the numeric targets. For these TMDLs, this link is established because the numeric target concentrations are the same as the TMDLs and water quality objectives, expressed as a concentration. Sources of pathogen indicator organisms have been identified that cause the elevated concentrations of pathogen indicator organisms in the receiving water body. Therefore, reductions in pathogen indicator organism loading from these sources should cause a reduction in the pathogen indicator organism concentrations measured. The numeric targets are protective of the recreational beneficial use. Hence, the TMDLs define appropriate water quality.

[20] Waddell Creek is located in the Redwood Belt of the Santa Cruz Mountains. The California Big Basin State Park occupies approximately 85% of the Waddell Creek watershed. The lower watershed is comprised of developed open space with a ranger/nature station at the bottom.

[21] Scott's Creek is also located in the Santa Cruz Mountains. The watershed is very rural with a small number of humans in residence. Low intensity timber harvesting, row-crop farming, and cattle ranching are practiced in a sustainable fashion.

8. TMDL CALCULATION AND ALLOCATIONS

A TMDL is the pollutant loading capacity that a water body can accept while protecting beneficial uses. TMDLs can be expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of pathogens, it is more logical for the TMDL to be expressed as a concentration. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures [40 CFR §130.2(I)]. A concentration TMDL makes more sense in this situation because the public health risks associated with recreating in contaminated waters correlates with organism concentration, and pathogens are not readily controlled on a mass basis. Therefore, we are establishing the TMDL as a concentration for pathogen indicators in the San Lorenzo River Watershed.

TMDLs are established for the following reaches in the following water bodies:

1. San Lorenzo River Estuary: all reaches of the San Lorenzo River Estuary.
2. San Lorenzo River: all reaches of the San Lorenzo River.
3. Branciforte Creek: all reaches of Branciforte Creek.
4. Camp Evers Creek: all reaches of Camp Evers Creek
5. Carbonera Creek: from the mouth of Carbonera Creek upstream to its intersection with Bethany Road.
6. Lompico Creek: all reaches of Lompico Creek.

The TMDLs for the San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek and Lompico Creek are:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.

8.1. Proposed Wasteload and Load Allocations

The wasteload and load allocations are receiving water concentrations. Responsible parties can not cause pathogen indicator organism (e.g. fecal coliform) concentration to exceed the allocations in the receiving water body.

The wasteload and load allocations are applicable to all responsible parties. For all sources not containing human fecal material the wasteload and load allocation is:

Fecal coliform concentration, based on a minimum of not less than five samples

for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.

For all sources containing human fecal material the wasteload and load allocation is

Fecal coliform concentration shall not exceed zero MPN per 100mL.

All responsible parties for sources of pathogens to the San Lorenzo River Watershed will be accountable to attain these allocations. The parties responsible for the allocations to non-natural (controllable) sources are not responsible for the allocation to natural (uncontrollable) sources. See Table 16 for allocations and responsible parties.

Table 16. Allocations and Responsible Parties

WASTE LOAD ALLOCATIONS		
Waterbody Assigned Allocation[1]	**Responsible Party (Source) NPDES/Order number**	**Receiving Water Fecal Coliform (MPN/100mL)**
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, and Carbonera Creek	City of Santa Cruz (Storm drain discharges to MS4s required to be covered by an NPDES permit) NPDES No. CAS000004	Allocation-1[a]
Camp Evers Creek and Carbonera Creek	City of Scotts Valley (Storm drain discharges to MS4s required to be covered by an NPDES permit) NPDES No. CAS000004	Allocation-1[a]
San Lorenzo River, Branciforte Creek, Lompico Creek, and Carbonera Creek	Santa Cruz County (Storm drain discharges to MS4s required to be covered by an NPDES permit) NPDES No. CAS000004	Allocation-1[a]
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, and Carbonera Creek	City of Santa Cruz (Sanitary sewer collection system spills and leaks) NPDES No. CA 0048194, WDR Order R3-2005-003	Allocation-2[b]
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek , Camp Evers Creek and Lompico Creek	Owners of onsite wastewater disposal systems residing in the County of Santa Cruz (Onsite wastewater disposal system discharges)	Allocation-2[b]
LOAD ALLOCATIONS		
Waterbody	**Responsible Party (Source)**	**Receiving Water Fecal Coliform (MPN/100mL)**
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek , Camp Evers Creek and Lompico Creek	Owners of onsite wastewater disposal systems residing in the County of Santa Cruz (Onsite wastewater disposal system discharges)	Allocation-2[b]
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek , and Lompico Creek	Owners/operators of land used for/containing pets (Pet waste not draining to MS4s)	Allocation-1[a]
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek, Camp Evers Creek, and Lompico Creek	Owners/operators of land used for/containing farm animals and livestock (Farm Animals and Livestock discharges)	Allocation-1[a]

San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Lompico Creek, Camp Evers Creek, and Carbonera Creek	Owners and/or operators of land that include homeless persons/encampments (Discharges from homeless persons/encampments not regulated by WQ Order No. 2003-0005-DWQ [storm water general permit])	Allocation-2[b]
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Lompico Creek, Camp Evers Creek, and Carbonera Creek	No responsible party (Natural sources)	Allocation-1[a]

[1] All reaches of the following water bodies are assigned allocations, excepting Carbonera Creek, where the allocations are assigned from the mouth to the intersection with Bethany Road.

[a] Allocation-1 = Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN/100mL, nor shall more than ten percent of total samples during any 30-day period exceed 400 MPN/100 mL.

[b] Allocation-2= Allocation of zero; no loading allowed from this source.

Should all control measures be in place, pathogen indicator organism concentrations remain high, and a TMDL not be met, investigations (e.g., genetic studies to isolate sources or other appropriate monitoring) may take place to determine if the high level of indicator organism is due to uncontrollable sources. Responsible parties may demonstrate that controllable sources of pathogen indicator organisms are not contributing to exceedance of water quality objectives in receiving waters. If this is the case, staff may consider re-evaluating the targets and allocations. For example, staff may propose a site-specific objective to be approved by the Central Coast Water Board. The site-specific objective may be based on evidence that natural, or "background" sources alone were the cause of exceedances of a TMDL.

Central Coast Water Board staff acknowledges that there is uncertainty as to whether or not the waterbodies can attain the numeric targets set forth in these TMDLs due to these natural sources. Staff finds there is a strong probability that controlling the controllable portion of fecal input in the watershed will lead to attaining the numeric targets.

8.2. Margin of Safety

A TMDL requires a margin of safety component that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water (CWA 303(d)(1)(C)). For pathogens in San Lorenzo River Watershed, a margin of safety has been established implicitly through the use of protective numeric targets, which are in this case the water quality objectives/criteria for the beneficial uses.

The pathogen TMDLs for San Lorenzo River Watershed are the Basin Plan water quality objective for fecal coliform. The Central Coast Region Water Quality

Control Plan states that, “controllable water quality shall conform to the water quality objectives...” When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality” (Basin Plan, p. III-2). Because the allocation for controllable sources is set at the water quality target, if achieved, these allocations will by definition contribute as much as possible to achieving the water quality objectives in the receiving water. Thus, in these TMDLs there is no uncertainty that controlling the load from controlled sources will positively affect water quality by reducing the pathogen indicator organism contribution.

However, in certain locations there is a possibility that non-controllable, or, natural sources will themselves occur at levels exceeding water quality objectives. And while it is controllable water quality conditions (“actions or circumstances resulting from man’s activities” (Basin Plan, p. III-2)) that must conform to water quality objectives, receiving water quality will contain discharge from both controllable and natural sources.

The ability to differentiate the controlled from the natural sources is an uncertainty in these TMDLs. The ribotyping method used for this report is one of the best methods available, but it is not 100 percent accurate. This ribotyping method results in greater variability of false positive rates among genotypic library-based methods, with incorrect classification ranging from 25-75% (John F. Griffith, Stephen B. Weisberg, Charles D. McGee 2003).

Additionally, these data, which confirmed the presence of natural sources, do not estimate loads; they only provide the relative percent of samples that indicated the type of source. Reporting and monitoring will indicate whether the allocations from controllable sources are met, thereby minimizing any uncertainty about the impacts of loads on the water quality.

9. PUBLIC PARTICIPATION

Public participation began when the County developed a report required by Proposition 13 Grant Funds. The grant required a Technical Advisory Committee to meet periodically.

Central Coast Water Board staff presented TMDL project report results at two meetings. Central Coast Water Board staff solicited comments at both these meetings. One meeting was held during the early phase of Central Coast Water Board TMDL project development on November 16, 2005. At the second meeting, on June 26, 2006, Central Coast Water Board staff presented preliminary project report findings. Central Coast Water Board staff incorporated public comments into this document where appropriate. Staff also scoped issues pursuant to the California Environmental Quality Act at this meeting. Staff prepared environmental documents indicating any potential environmental impacts (CEQA checklist, Attachment 3) and considered alternative implementation strategies prior to soliciting formal public comments on these TMDLs and implementation plan.

Central Coast Water Board staff solicited public comments before the Central Coast Water Board public hearing to consider adoption of a San Lorenzo River TMDLs. Staff received comments from:
1. Teri Caddell, A-1 Septic Service, Inc. in a letter dated December 6, 2007,
2. G. Scott McGowen, Chief Environmental Engineer, California Department of Transportation, in a letter dated January 18, 2008,
3. John Ricker, Water Resources Division Director, Santa Cruz County Environmental Health Services, in an email dated January 23, 2008.

Comments from the abovementioned individual/agencies are included as Attachment 7 to the staff report. Some comments resulted in changes to the Project Report and are noted in Attachment 7.

On March 21, 2008 in Salinas, California, the Central Coast Water Board held a public hearing and heard and considered all public comments and evidence in the record regarding these TMDLs and Implementation plan. The TMDLs and implementation plan were amendments included in resolution no. R3-2008-0001. The Central Coast Water Board also adopted resolution no. R3-2008-0001 on March 21, 2008.

On November 6, 2008, the Central Coast Water Board's Executive Officer withdrew resolution no. R3-2008-0001 from consideration for adoption by the State Water Resources Control Board. The Executive Officer withdrew the resolution for consideration due to State Board staff's request to clarify language regarding the amendments before submittal to the State Water Resources Control Board for approval. The clarifications included changing the allocations

to human sources to zero, clarifying and simplifying the prohibition language and changing some of the nonpoint sources to point sources.

On May 8, 2009 in San Luis Obispo, California, the Central Coast Water Board held a public hearing and heard and considered all public comments and evidence in the record.

10. IMPLEMENTATION PLAN

The purpose of the Implementation Plan is to describe the steps necessary to reduce pathogen loads to achieve these TMDLs. The Implementation Plan identifies the following: 1) actions expected to reduce pathogen loading; 2) parties responsible for taking these actions; 3) regulatory mechanisms by which the Central Coast Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; 5) and a timeline for completion of implementation actions. The Implementation Plan also addresses economic considerations to achieve compliance.

Recall from Section 1.5 Waste Discharge Prohibition that staff is proposing to address specific types of nonpoint sources of pollution in the San Lorenzo River Watershed by adding the Watershed as a named area subject to two proposed nonpoint source pollution prohibitions: (1) the Human Fecal Material Discharge Prohibition and (2) the Domestic Animal Waste Discharge Prohibition. Also, recall that these two prohibitions will be proposed as amendments to the Basin Plan with the TMDLs for the Pajaro River Watershed at the March 20, 2009 Board Meeting (see Resolution No. RB3-2009-0008). Some of the required implementation actions described in the following subsections are actions required to demonstrate compliance with the Human Fecal Material Discharge Prohibition and the Domestic Animal Waste Discharge Prohibition.

Staff differentiated existing requirements versus proposed requirements below.

10.1. Implementation Actions

This section presents the proposed actions necessary to reduce pathogens, attain water quality objectives, and attain the existing and proposed prohibition in this section. The actions are presented by the mode in which pathogen indicator organisms reach San Lorenzo River Watershed waters.

10.1.1. Sanitary Sewer Collection System Spills and Leaks

Entities with jurisdiction over sewer collection systems in the San Lorenzo River Watershed can demonstrate compliance with these TMDL load allocations through Waste Discharge Requirements and/or NPDES permits.

The City of Santa Cruz is required to prevent spills and leaks from their Sanitary Sewer Collection System pursuant to NPDES Permit No. CA 0048194 and WDR Order R3-2005-0003. The City of Santa Cruz must comply with this permit by

improving maintenance of their sewage collection system. Improved maintenance includes identification, correction, and prevention of sewage leaks in portions of the collection systems that intersect, or could impact the water quality, of the San Lorenzo River Estuary or San Lorenzo River. The NPDES permit requires an annual technical report that describes how and when the City of Santa Cruz will conduct improved system maintenance in portions of the system most likely to affect the San Lorenzo Estuary and San Lorenzo River. Within one year following adoption of these TMDLs by the Office of Administrative Law, the Executive Officer will evaluate the results of the annual technical report submitted by the City of Santa Cruz to determine compliance with the requirement to prevent spills and leaks and corresponding compliance with the Human Fecal Material Discharge Prohibition. The Executive Officer and/or the Central Coast Water Board will determine whether modifications to the City of Santa Cruz NPDES Permit No. CA 0048194 and/or WDR Order R3-2005-003 are necessary to address sewer collection system spills and leaks.

To comply with the Human Fecal Material Discharge Prohibition, the City of Scotts Valley Sanitary Sewer Collection System is required to prevent spills and leaks pursuant to NPDES Permit No. CA 0048828 (current number) and WDR R3-2002-0016 (current number). The City of Scotts Valley is currently in compliance with their existing NPDES permit and WDR and the Water Board is not requiring additional implementation measures for this TMDL. However, during the Central Coast Water Board's three-year implementation evaluations, should the Executive Officer determine additional maintenance needs to be performed, the Executive Officer and/or the Central Coast Water Board will determine whether modifications to the City of Scotts Valley NPDES Permit No. CA 0048828 and/or WDR Order R3-2002-0016 are necessary to address sewer collection system spills and leaks.

The Executive Officer or the Central Coast Water Board will amend the Monitoring and Reporting Program of the Cities of Santa Cruz and Scotts Valley NPDES permits to incorporate monitoring for fecal coliform and reporting results.

10.1.1.c. Requirements for the Santa Cruz County Sanitation District

The County of Santa Cruz is required by WDR R3-2005-0043 to comply with the approved Collection System Management Plan (CSMP). Staff concluded that the District is satisfactorily implementing the CSMP within the San Lorenzo River Watershed. No additional requirements are necessary.

10.1.2. Private Laterals to the Sanitary Sewer Collection Systems

Individual owners and operators of private laterals to sanitary sewer collection systems are ultimately responsible for maintenance of their private laterals and are, therefore, responsible for complying with the Human Fecal Material

Discharge Prohibition; compliance with the Human Fecal Material Discharge Prohibition implies compliance with their load allocation for these TMDLs.

The Central Coast Water Board requires immediate cessation of leaks from private laterals.

The Central Coast Water Board has identified leaks from private laterals located in the City of Santa Cruz as a source of fecal indicator bacteria in municipal separate storm sewer systems (MS4s). Therefore, enrollees for the City of Santa Cruz' General Permit for the Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems will address fecal indicator bacteria from private lateral leaks in the Wasteload Allocation Attainment Program (as described in the following section).

10.1.3. Storm Drain Discharges to Municipally Owned and Operated Separate Storm Sewer Systems (MS4s) Required to be Covered by an NPDES Permit

The Central Coast Water Board will address fecal indicator bacteria (FIB), e.g. fecal coliform and/or other indicators of pathogens, discharged from the County of Santa Cruz and the Cities of Santa Cruz and Scotts Valley municipal separate storm sewer systems (MS4 entities) by regulating the MS4 entities under the provisions of the State Water Resource Control Board's General Permit for the Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit) (NPDES No. CAS000004). As enrollees under the General Permit, the MS4 entities must develop and implement Storm Water Management Plans (SWMPs) that control urban runoff discharges into and from their MS4s. To address the MS4 entities' TMDL wasteload allocations, the Central Coast Water Board will require the MS4 entities to specifically target FIB in urban runoff through incorporation of Wasteload Allocation Attainment Program in their SWMPs.

The Central Coast Water Board will require the Wasteload Allocation Attainment Program to include descriptions of the actions that will be taken by the MS4 entities to attain the TMDL wasteload allocations, and specifically address:

1. Development of an implementation and assessment strategy;
2. Source identification and prioritization (including leaks to storm sewers from private laterals);
3. Best management practice identification, prioritization, implementation schedule, analysis, and effectiveness assessment;
4. Monitoring program development and implementation;
5. Reporting; including evaluation whether current best management practices are progressing towards achieving the wasteload allocations within thirteen years of the date that the TMDLs are approved by the Office of Administrative Law;
6. Coordination with stakeholders; and

7. Other pertinent factors.

The Wasteload Allocation Attainment Program will be required by the Central Coast Water Board to address each of these TMDLs that occur within the MS4 entities' jurisdictions.

The Central Coast Water Board will require the Wasteload Allocation Attainment Program to be submitted at one of the following milestones, whichever occurs first:

1. Within one year of approval of the TMDLs by the Office of Administrative Law;
2. When required by any other Water Board-issued storm water requirements (e.g., when the Phase II Municipal Storm Water Permit is renewed).

For those MS4 entities that are enrolled under the General Permit at the time of Wasteload Allocation Attainment Program submittal, the Wasteload Allocation Attainment Program must be incorporated into the SWMPs when they are submitted. For those MS4 entities that are not enrolled under the General Permit at the time of Wasteload Allocation Attainment Program submittal, the Wasteload Allocation Attainment Program must be incorporated into the SWMPs when the SWMPs are approved by the Central Coast Water Board.

The Executive Officer or the Central Coast Water Board will require information that demonstrates implementation of the actions described above, pursuant to applicable sections of the California Water Code and/or pursuant to authorities provided in the General Permit for storm water discharges.

City of Santa Cruz Dry Weather Improvement Implemented

The City of Santa Cruz recently received funds to install a dry weather diversion system. The City has implemented three dry weather diversions at pump stations within the City and has the funding to implement two more. Dry weather storm water will not discharge to the Estuary; instead, the storm water will be diverted to the City's wastewater treatment system and discharged to the City's outfall. These are reducing bacteria loading (report in preparation). Water Board staff expects the dry weather diversion to greatly improve the Estuary's water quality during the summer.

10.1.4. Pet Wastes and Domestic Animal and Livestock Discharges Not Regulated By WQ Order No. 2003-0005-DWQ [Storm Water General Permit]

Owners and/or operators of lands containing domestic animals (including pets, farm animals, and livestock) in the San Lorenzo River Watershed must comply with the Domestic Animal Waste Discharge Prohibition; compliance with the

Domestic Animal Waste Discharge Prohibition implies compliance with the load allocation for these TMDLs.

Within three years of approval of these TMDLs by the Office of Administrative Law, the Executive Officer will notify owners and/or operators of lands used for/containing domestic animals of the requirement to comply with the Domestic Animal Waste Discharge Prohibition. In his notification, the Executive Officer will also describe the owner's/operator's of lands containing domestic animals options for demonstrating compliance with the Domestic Animal Waste Discharge Prohibition; pursuant to California Water Code section 13267 and within six months of the notification by the Executive Officer, owners/operators of lands containing domestic animals will be required to submit the following for approval by the Executive Officer or the Water Board:

1) Clear evidence that the owner/operator of lands containing domestic animals is and will continue to be in compliance with the Domestic Animal Waste Discharge Prohibition; clear evidence could be documentation submitted by the owner/operator to the Executive Officer validating current and continued compliance with the Prohibition, or
2) A plan for compliance with the Domestic Animal Waste Discharge Prohibition. Such a plan must include a list of specific management practices that will be implemented to control discharges containing fecal material from domestic animals. The plan must also describe how implementing the identified management practices are likely to progressively achieve the load allocations to domestic animals, with the ultimate goal achieving the load allocations no later than thirteen years after Office of Administrative Law approval of the TMDL. The plan must include monitoring and reporting to the Central Coast Water Board, demonstrating the progressive progress towards achieving load allocations for discharges from domestic animals, and a self-assessment of this progress. The plan may be developed by an individual discharger or by or for a coalition of dischargers in cooperation with a third-party representative, organization, or government agency acting as the agents of owners/operators of lands containing domestic animals, or
3) Submittal of a Report of Waste Discharge pursuant to California Water Code Section 13260 (as an application for waste discharge requirements; WDRs or National Pollutant Discharge Elimination System (NPDES permit).

10.1.5. Onsite Wastewater Disposal System Discharges

For onsite wastewater disposal systems within the San Lorenzo River Subbasin, the Central Coast Water Board addressed onsite wastewater disposal system failures by adopting a Basin Plan prohibition in 1995 (Resolution 95-04). The prohibition required the County of Santa Cruz to implement the "Wastewater Management Plan for the San Lorenzo River Watershed" dated February 1995.

The Plan includes the following elements:

1. inspection and evaluation of existing onsite wastewater disposal systems;
2. disposal system improvements for malfunctioning systems;
3. on-going system inspection and maintenance;
4. community disposal systems development;
5. wastewater disposal management from new development;
6. water quality monitoring; and
7. implementation schedule.

For onsite wastewater disposal systems within the City of Scotts Valley, Water Board staff concluded: 1) onsite wastewater disposal systems are not a source of exceedance of fecal coliform water quality objectives in area surface waters, and 2) the City is already taking appropriate actions to control discharges to surface waters, if any, from onsite wastewater disposal systems.

Mr. Ken Anderson with the City of Scotts Valley Public Works Department provided Water Board staff the following information through personal communication on February 8, 2007.

The City only has approximately 25-40 onsite wastewater disposal systems. The City implements a policy[22] that requires failed onsite wastewater disposal systems to connect to the wastewater collection system. A wastewater collection system already exists in the area where onsite wastewater disposal systems are located.[23] Historically, the rate of onsite wastewater disposal system failure within the City has been approximately three failures per year. Mr. Anderson expects this failure rate to accelerate soon because these systems are already at the end of there expected useful life. The systems are approximately 20 years old. Additionally, there are some residents who have connected to the sewer before their systems failed.

Although the County is implementing the "Wastewater Management Plan for the San Lorenzo River Watershed," and the City of Scotts Valley is taking action to connect onsite wastewater disposal systems to the sewer, individual homeowners are ultimately the responsible parties for their onsite wastewater disposal systems.

Owners of onsite wastewater disposal systems in the San Lorenzo River Watershed must comply with the Human Fecal Material Discharge Prohibition.

[22] The City code states that onsite disposal systems cannot be fixed. In other words, when a system warrants repair, the homeowner must connect to the sewer. Therefore, "failure" does not *necessarily* indicate discharge from a homeowner but rather any substandard functionality of the system.

[23] There is one area within the Hacienda Road area that has approximately five onsite wastewater treatment systems that are not easily served by a collection system. However, Water Board staff concluded these systems are not a source because they are greater than ½ mile from Carbonera Creek and because there are only a few systems.

Owners of onsite wastewater disposal systems must demonstrate to the satisfaction of the Executive Officer or the Water Board that they are in compliance with the Human Fecal Material Discharge Prohibition; compliance with the Human Fecal Material Discharge Prohibition implies compliance with the load allocation for these TMDLs.

Within three years of approval of these TMDLs by the Office of Administrative Law, the Executive Officer will either 1) determine that the County of Santa Cruz, or similar, is making adequate progress towards implementing an approved Wastewater Management Plan (or another Implementation Program to address onsite wastewater disposal systems) as it pertains to controlling the waste loads from onsite wastewater disposal systems in the San Lorenzo River Watershed, or 2) notify owners of onsite wastewater disposal systems (owners) in the area described above of the requirement to comply with the Human Fecal Material Discharge Prohibition. In his notification, the Executive Officer will also describe owner's options for demonstrating compliance with the Human Fecal Material Discharge Prohibition; pursuant to California Water Code 13267 and within six months of the notification by the Executive Officer, owners will be required to submit the following for approval by the Executive Officer or the Water Board:

1) Clear evidence that the owner is and will continue to be in compliance with the Human Fecal Material Discharge Prohibition; clear evidence could be verification by the County of Santa Cruz, or similar, that the owners onsite wastewater disposal system is in compliance with the Human Fecal Material Discharge Prohibition, or
2) A schedule for compliance with the Human Fecal Material Discharge Prohibition. The compliance schedule must include a monitoring and reporting program and milestone dates demonstrating progress towards compliance with the Human Fecal Material Discharge Prohibition, with the ultimate milestone being compliance with the Human Fecal Material Discharge Prohibition no later than three years from the date of the Executive Officer's notification to the owner requiring compliance, or
3) Submittal of a Report of Waste Discharge pursuant to California Water Code Section 13260 (as an application for waste discharge requirements; WDRs), or
4) Clear evidence of current or scheduled compliance with the Human Fecal Material Discharge Prohibition (as described in number-1 and number-2 above, respectively) through the submittal of the required information by County of Santa Cruz, acting as the voluntary agents of owners of onsite wastewater disposal systems. Note that an owner of an onsite wastewater disposal system cannot demonstrate compliance with the Human Fecal Material Discharge Prohibition through this option if: 1) the County of Santa Cruz is not their voluntary agent, or 2) if the owner of the onsite wastewater disposal system does not choose the County of Santa Cruz as their agent, or, 3) the Executive Officer or Water Board does not approve the evidence submitted by the County of Santa Cruz on behalf of

the owners of onsite wastewater disposal systems.

10.1.6. Homeless Persons/Encampment Discharges Not Regulated By WQ Order No. 2003-0005-DWQ [Storm Water General Permit]

Owners of land that contain homeless persons and/or homeless encampments in the San Lorenzo River Watershed must comply with the Human Fecal Material Discharge Prohibition.

Owners of land with homeless persons must demonstrate to the satisfaction of the Executive Officer or the Water Board that they are in compliance with the Human Fecal Material Discharge Prohibition; compliance with the Human Fecal Material Discharge Prohibition implies compliance with the load allocation for these TMDLs.

Within three years of approval of these TMDLs by the Office of Administrative Law, the Executive Officer will notify owners of land containing homeless persons of the requirement to comply with the Human Fecal Material Discharge Prohibition. In his notification, the Executive Officer will also describe owner's options for demonstrating compliance with the Human Fecal Material Discharge Prohibition; pursuant to California Water Code 13267 and within six months of the notification by the Executive Officer, owners will be required to submit the following for approval by the Executive Officer or the Water Board:

1) Clear evidence that the owner is and will continue to be in compliance with the Human Fecal Material Discharge Prohibition; clear evidence could be documentation submitted by the owner to the Executive Officer validating current and continued compliance with the Prohibition, or
2) A plan for compliance with the Human Fecal Material Discharge Prohibition. Such a plan must include a list of specific management practices that will be implemented to control discharges containing fecal material from homeless persons. The Plan must also describe how implementing the identified management practices are likely to progressively achieve the load allocation for homeless persons, with the ultimate goal achieving the load allocation no later than three years from the date of the Executive Officer's notification to the owner requiring compliance. The plan must include monitoring and reporting to the Central Coast Water Board, demonstrating the progressive progress towards achieving load allocations for discharges from homeless persons, and self-assessment of this progress, or
3) Submittal of a Report of Waste Discharge pursuant to California Water Code Section 13260 (as an application for waste discharge requirements; WDRs).

10.2. Evaluation of Implementation Progress

Every three years, beginning three years after TMDLs are approved by the Office of Administrative Law, the Central Coast Water Board will perform a review of implementation actions, monitoring results, and evaluations submitted by responsible parties of their progress towards achieving their allocations. The Central Coast Water Board will use annual reports, nonpoint source pollution control implementation programs, evaluations submitted by responsible parties, and other available information to determine progress toward implementing required actions and achieving the allocations and the numeric target.

Responsible parties will continue monitoring and reporting according to this plan for at least three years, at which time the Central Coast Water Board will determine the need for continuing or otherwise modifying the monitoring requirements. Responsible parties may also demonstrate that although water quality objectives are not being achieved in receiving waters, controllable sources of pathogens are not contributing to the exceedance. If this is the case, the Central Coast Water Board may re-evaluate the numeric target and allocations. For example, the Central Coast Water Board may pursue and approve a site-specific objective. The site-specific objective would be based on evidence that natural, or background sources alone were the cause of exceedances of the Basin Plan water quality objective for fecal indicator bacteria.

Three-year reviews will continue until the water quality objectives are achieved. The compliance schedule for achieving the TMDL numeric target is 13 years after the date of approval by the Office of Administrative Law.

10.3. Timeline and Milestones

Staff anticipates that the allocations, and therefore the TMDL, will be achieved 13 years from the date of the TMDL becomes effective (which is upon approval by the California Office Administrative Law) under state law. The Central Coast Water Board staff estimation is based on the cost and difficulty inherent in identifying fecal pathogen indicator organism sources from all sources. Some of the nonpoint source dischargers have never been educated regarding pollution sources from their properties or operations, nor have ever been regulated for their pollution loading or waste discharges before (e.g., owners of properties with homeless encampments). The Central Coast Water Board staff estimation is also based on the uncertainty of the time required for water quality improvements resulting from best management practices to be realized. Small Storm Water Management Program permits outline a five year schedule for full implementation of best management practices (BMPs) and activities. In general, storm water BMPs are designed to achieve compliance with water quality standards to the maximum extent practicable through an iterative process.

10.4. Economic Considerations

Overview

Porter-Cologne requires that the Central Coast Water Board take "economic considerations", into account when requiring pollution control requirements (Public Resources Code, Section 21159 (a)(3)(c)). The Central Coast Water Board must analyze what methods are available to achieve compliance and the costs of those methods."

Staff identified a variety of costs associated with implementation of these TMDLs. Costs fall into four broad categories: 1) planning or program development actions (e.g., establishing nonpoint source implementation programs, conducting assessments, etc.); 2) implementation of management practices for permanent to semi-permanent features; and 3) TMDL inspections/monitoring; and 4) reporting costs.

Anticipating costs with any accuracy is challenging for several reasons. Many of the actions, such as review and revision of policies and ordinances by a governmental agency, could incur no significant costs beyond the program budgets of those agencies. However, other actions, such as establishing nonpoint source implementation programs and establishing assessment workplans carry discrete costs. Cost estimates are further complicated by the fact that some implementation actions are necessitated by other regulatory requirements (e.g., Phase II Storm water) or are actions anticipated regardless of TMDL adoption. Therefore assigning all of these costs to TMDL implementation would be inaccurate.

Cost Estimates

Sanitary Sewer Collection System Spills and Leaks

Implementation: All sanitary sewer activities specified in the Basin Plan amendment are currently required under the existing Water Board permits and requirements. No new costs are anticipated as a result of this TMDL.

Inspections/Monitoring: These costs are currently required by Central Coast Water Board permits.

Reporting: These costs are currently required by Central Coast Water Board permits.

Storm Drain Discharges

The State Water Resources Control Board adopted an NPDES General Permit for storm water discharge. The General Permit requires smaller State municipal

dischargers, such as the City/County of Santa Cruz and the City of Scotts Valley, to develop and implement a Storm Water Management Program (SWMP). As of the date of writing this report, the City and County of Santa Cruz and the City of Scotts Valley have submitted a SWMP for the Water Board's approval. The Water Board has not approved Storm Water Management Programs for the above agencies.

Staff notes the County and Cities have a difficult time collecting costs for the SWMP from individual property owners, and could require a proposition 218 vote. This may impose a financial hardship upon the County and Cities.

Planning or Program Development Actions: Water Board staff estimate no significant costs beyond the local agency program budget.

Stormwater Plan Implementation: To implement the requirements of the TMDL, the Central Coast Water Board may ask local agencies to develop additional management measures for pathogen reduction; identify measurable goals and time schedules for implementation; develop a monitoring program; and assign responsibility for each task. The specifics of the storm water program efforts will not be known until Central Coast Water Board adoption of the SWMP occurs. An estimate of the storm water program efforts and their associated costs are provided below.

The University of Southern California conducted a survey of NPDES Phase I Stormwater Costs in 2005 (Center for Sustainable Cities, University of Southern California, 2005). They determined the annual cost per California household ranged from $18 to $46. However, these costs were just to keep the existing plan running and did not include start-up costs which may increase the total cost per household. According to Central Coast Water Board Stormwater Unit staff, recently approved Phase II SWMPs in Region 3 ranged from $21 to $130 per household. Stormwater Unit staff reported that the wide range of costs in both cases was based on many factors including the amount of revenue generated by the municipality, the size of the area covered by the SWMP, and because some municipalities did not include the cost of programs such as street sweeping that are already accounted for in other program budgets, while other municipalities did include this cost.

It was difficult for staff to estimate the cost of a SWMP for the above reasons. To get a rough idea of how much a SWMP program would cost in the San Lorenzo River Watershed, staff calculated an average annual cost from the range of costs for recently approved Phase II SWMPs in Region 3 ($21 in Seaside to $130 in the City of Monterey). Staff calculated an average annual cost of $77 per household. Staff used this cost per household to estimate the cost per year of SWMP implementation in the Cities of Santa Cruz and Scotts Valley as well as the unincorporated portion the San Lorenzo River Watershed:

City of Santa Cruz: 54,593 (population) (http://www.hellosantacruz.com/Census.Cfm, December 19, 2004) (÷ 2.44 persons per household http://quickfacts.census.gov/qfd/states/06/0669112.html))(x $77 cost per household per year) = $1,722,812 per year.

City of Scotts Valley: 11,154 (population) (http://www.citytowninfo.com/places/california/scotts-valley, January 22, 2007) (÷2.5 persons per household (http://realestate.scottsvalleychamber.com) (x $77 cost per household per year) = $343,543 per year.

San Lorenzo River Unincorporated area: 26,620 (population) (http://santacruzrealestate.biz/cities/san_lorenzo_valley/index.htm, January 22, 2007) (÷ 2.71 persons per household[24] (http://quickfacts.census.gov/qfd/states/06/06087.html) (x $77 cost per household per year)) = $756,362 per year.

The agencies mentioned above are required to develop and implement a storm water program for this Watershed independently of the Basin Plan amendment. Since this is an existing requirement under Phase II of the storm water program, no additional cost is estimated for implementing the existing storm water management program. Some additional implementation measures or management programs may be needed for pathogen reductions. The specific measures are not known at this time. However, the California Regional Water Quality Control Board, San Francisco Bay Region's *Pathogens in the Napa River Watershed Total Maximum Daily Load* , June 14, 2006, Marin County estimated additional pathogen-specific measures would result in a 2 to 15 percent increase to their annual program budget. Therefore staff estimates the total cost between the following minimum and maximum ranges:

City of Santa Cruz: $1,722,812 per year x 1.02 % minimum increase=$1,757,268 minimum increase
$1,722,812 per year x 1.15 % maximum increase= $1,981,234 maximum increase

City of Scotts Valley: $343,543 per year x 1.02 % minimum increase=$350,414 minimum increase
$343,543 per year x 1.15 % maximum increase= $395,074 maximum increase

San Lorenzo River Unincorporated Area: $756,362 per year per year x 1.02 % minimum increase = $771,489 minimum increase
$756,362 per year 1.15 % maximum increase= $869,816 maximum increase

[24] Average Santa Cruz County occupancy

Inspections/Monitoring: Water Board staff is proposing the above Agencies monitor storm drains. The purpose of the monitoring is to determine the effectiveness of management measures.

Water Board staff estimated monitoring will cost local agencies approximately $24,000 per year ($8000 per each Agency). According to the County of Santa Cruz, the cost of performing fecal coliform sampling is $60 per sample ($40 for sample collection and field analysis and $20 for each bacteria analysis). The Project Report estimates each Agency sample each storm drain 10 times per year. Water Board staff estimated 10 samples stations will be analyzed per year. Therefore, the total lab cost per year for each Agency is $6000 ($60/sample x 10 samples/sampling event x 10 sampling events per year). Water Board staff assumes staff resources will be $200 per sampling day. Therefore annual sampling costs are $2,000 ($200/sampling day x 10 sampling day/year) for staff resources with a total cost of $8,000 including lab and resources.

Reporting: The City of Santa Cruz and Scotts Valley/County of Santa Cruz are required to report independent of the TMDL under Phase II of the municipal storm water program. Therefore, no costs have been estimated for reporting.

Private Lateral Upgrades

Implementation: According to the Proposition 13 Report, the cost to repair a leaking private lateral is estimated to be $5,000.

Inspections/Monitoring: According to the Proposition 13 Report, the cost to test for leaking private laterals is approximately $1,000.

Reporting: Responsible parties shall submit a report documenting that their private sewer lateral was inspected and/or repaired or replaced and is effectively minimizing pathogen discharges. Water Board staff estimated this report will require approximately six hours or less of land owner time.

Onsite Wastewater Disposal System Discharges:

Onsite Wastewater Disposal System Plan Implementation: As of the date of writing this report, staff concluded existing actions appear to adequately address correcting failing system discharges. However, better coordination is necessary between the Central Coast Water Board and the City of Scotts Valley/County of Santa Cruz to assure the best controls are implemented.

Inspections/Monitoring: Water Board staff is not proposing any additional inspections or monitoring.

Reporting: Water Board staff is recommending the City of Scotts Valley triennially report to the Water Board progress made toward connecting onsite

wastewater sewage disposal systems to the community collection system. Water Board staff concludes the cost associated with this reporting is minimal.

Domestic Animals and Livestock

Planning or Program Development Actions: The cost to develop pathogen control measures at these facilities will vary from site to site depending upon constraints present at each site. Water Board staff estimate approximately eight hours is necessary for planning control actions.

Domestic Animals/Livestock Plan Implementation: There are a variety of methods owners of domestic animals and livestock could use to help control wastes. Some methods include installing livestock exclusion barriers, stables for horses, corrals, and manure bunkers at locations that prevent runoff from entering surface waters.

1. Livestock Exclusion Barriers: According to USEPA, the cost of permanently excluding livestock from areas where animal waste can impact surface waters ranges from $2,474/mi to $4,015/mi (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 840-B-92-002,* United States Environmental Protection Agency, January 1993).

2. Horse Stables: Horses can be boarded at stables. According to the American Miniature Horse Association, miniature horses can be board in a professional stable for $50 to $150 per month per horse and full size horses can be boarded for $200 to $550 per month per horse. The cost depends on the facilities, pasture, and riding opportunities (http://www.amha.com/MarketTools/Profitibility.html).

3. Corral Cost: According to a Progressive Farmer website, a corral (excluding the head gate) can cost less than $7,000. Gates cost the most-between $3,000 and $4,000 (http://www.progressivefarmer.com/farmer/animals/article/0,24672,1113452,00.html).

4. Manure Bunker Costs: Ecology Action has worked with landowners to install manure bunkers. Manure bunkers help prevent storm waters from infiltrating the manure thereby causing runoff of pollutants from the manure. According to Ecology Action, the average cost for constructing a manure bunker on properties in the San Lorenzo watershed was approximately $4000. (Each bunker was constructed on an existing cement slab, or a new one was poured and employed some type of cover - either a permanent roof or a tarp.) The cost of bunker construction varies greatly depending on the size and materials choice. When looking at bunkers for the entire program, costs ranged from $3000 to $15,000 (Reference: E-mail dated 5-1-2007 from Jennifer Harrison of Ecology Action).

Inspections/Monitoring: The landowner cost for inspections/monitoring will vary depending upon the elements of the Nonpoint Source Implementation Program. The cost could be low if daily property walks occur to assess and repair discharges. Costs are higher if a landowner performs water quality monitoring.

Reporting: Water Board staff estimate it would take approximately eight hours of land owner time to prepare a report to the Water Board. This report is required every three years.

Homeless Person/Encampment Discharges*:*

Planning or Program Development Actions: The approaches used to control homeless encampment waste can range from a land owner 1) installing barriers to 2) participating with local agencies to develop a comprehensive Watershed-wide solution. Water Board staff estimate the planning cost for an approach such as installing barriers may require approximately eight hours of land owner time. Landowners may devote more time to comprehensive Watershed-wide approaches.

Homeless Person/Encampment Waste Plan Implementation: The Water Board will identify possible properties with homeless encampments. The methods used to control these wastes will be developed by landowners as part of their Nonpoint Source Management Plan. However, a few possibilities include hiring security to patrol areas used by homeless, utilizing portable toilets, and fencing. The web site http://www.security-ess.com/DesignDetail.html indicates the cost of security guards range from $25 - $40 per hour. This service provides guards for a six hour minimum per guard per day. Staff contacted a service that provides portable toilets. This service provides a portable toilet for $95 per month (personal communication with Ace Portable Services, Santa Cruz, CA, January 23, 2007). Staff also contacted a service that provides security fences. The cost of a six foot chain link fence with 3 strands of barbed wire on the top is $1,800 per 100 feet or $15,000 per 1000 feet (personal communication with Affordable Fence Company, Santa Cruz, CA, January 23, 2007.)

Inspections/Monitoring: Land owners could utilize various approaches to inspect lands for homeless encampments. Again, the approach is dependant upon whether the land owner uses an approach in which the land owner is responsible for inspecting the property or local agencies are able to provide inspection services. The cost for security guards, mentioned above, is one means to estimate this cost.

Reporting: The Water Board will identify possible properties with homeless encampments. All land owners are required to submit triennial reports to the Water Board. All land owners shall submit a report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from homeless encampments. Water Board staff

estimate this report will require approximately eight hours of land owner time.

Cost Summary

These costs are reasonable relative to the water quality benefits to be derived from the adopting these TMDLs.

Table 17 below shows a tabular cost estimate.

Table 17: Tabular Cost Estimates

	RESPONSIBLE PARTIES				
SOURCES	City of Santa Cruz	City of Scotts Valley	County of Santa Cruz	Private individual	Unit of measurement
Sanitary Sewer Collection System Spills and Leaks					
No additional projected costs	$ -	$ -	$ -		
Stormwater					
Stormwater Plan Implementation	$ 1,722,812	$ 343,543	$ 756,362		per year
Stormwater Plan Implementation including specific pathogen reducing mechanisms					
Minimum	$ 1,757,268	$ 350,414	$ 771,489		per year
Maximum	$ 1,981,234	$ 395,074	$ 869,816		per year
Inspections/monitoring	$ 8,000	$ 8,000	$ 8,000		per year
Private laterals					
Inspections/monitoring				$ 1,000	cost to test for
Private lateral upgrade implementation				$ 5,000	cost to repair
Onsite systems					
No additional projected costs		minimal	minimal	minimal	
Farm animals/livestock					
Planning or Program Development Actions					8 hours
Farm animals/livestock plan implementation					
livestock exclusion barriers					
Minimum				$ 2,474	per mile
Maximum				$ 4,015	per mile
horse stables					
Minimum				$ 200	per month
Maximum				$ 550	per month
Corral					
Minimum				$ 10,000	per structure
Maximum				$ 11,000	per structure
Manure Bunker costs					
Minimum				$ 3,000	
Maximum				$ 15,000	
Inspections/monitoring					no cost given. Varies
Reporting					8 hours every 3 years
Homeless Person discharges					
Planning or Program Development Actions					8 hours
Plan Implementation					
Security guard					
Minimum	$ 25	$ 25	$ 25	$ 25	per hour
Maximum	$ 40	$ 40	$ 40	$ 40	per hour
Portable toilet	$ 95	$ 95	$ 95	$ 95	per month
Security fences					
Minimum	$ 1,500	$ 1,500	$ 1,500	$ 1,500	for 100 feet of fencing
Maximum	$ 1,800	$ 1,800	$ 1,800	$ 1,800	for 100 feet of fencing (if you purchase 1000 feet)
Inspections/monitoring					varies
Reporting					8 hours

11. MONITORING PLAN

11.1. Introduction

Water quality monitoring is needed to gauge progress towards achieving the TMDL/allocations. Monitoring will be required pursuant to existing or anticipated regulatory mechanisms, e.g. NPDES permits, Waste Discharge Requirements, prohibitions, waivers, and other orders granted by the Executive Officer of the Regional Board under the Porter-Cologne Water Quality Control Act. The details of monitoring, e.g. location, frequency, and analysis will be articulated in the regulatory mechanisms requiring the monitoring.

This section presents the proposed monitoring sites, frequency of monitoring, and parties responsible for monitoring. The monitoring proposed below for TMDL compliance and evaluation is the minimum staff concludes is necessary. However, if a change in these requirements is warranted after the TMDL is approved; the Executive Officer and/or the Central Coast Water Board will require such changes. Although Water Board staff does not require responsible parties collect daily samples, the samples required shall be sufficient to represent a daily load.

11.2. Monitoring Sites, Frequency, and Responsible Parties

The following monitoring plan proposes specific monitoring sites, frequency, and indicators to be monitored. Staff will work with parties responsible for monitoring when the implementation and monitoring phase of the project commences, and will make revisions, if appropriate, to the monitoring plan outlined below.

Central Coast Water Board will require the City and County of Santa Cruz perform fecal coliform monitoring in receiving waters shown in Table 18. While Table 18 indicates responsible parties shall sample for fecal coliform, the Water Board will also accept *E. coli* samples as a surrogate for fecal coliform. Additionally, although not required, the Water Board would welcome enterococci data where available.

The Central Coast Water Board staff will determine monitoring sites the California Department of Transportation (Caltrans) and the City of Scotts Valley will sample at a later date.

Staff also proposes fecal coliform monitoring for storm water. The City of Santa Cruz and Scotts Valley will develop the monitoring sites and the Executive

Officer of the Central Coast Water Board will approve the sites. The purpose of storm drain sampling is to assess the effectiveness of management measures. Storm drain samples will not be used to determine if the TMDL is attained. The Central Coast Water Board will use receiving water samples to determine compliance.

Monitoring will become effective six months following adoption of the TMDL by the Central Coast Water Board. The responsible party must provide the data to the Central Coast Water Board in subsequent annual reports required by the Small MS4 Permit or submit them in a separate technical report.

Table 18. Monitoring Required

Responsible Party	Monitoring Site	Sampling Period	Number of Samples[1]	Constituent(#/100 mL)
RECEIVING WATER MONITORING				
City of Santa Cruz	San Lorenzo @ Tait Street (206)	Monthly[4] Wet Season[2 6] Dry Season[3 6]	12 5 5	Fecal coliform
City of Santa Cruz	San Lorenzo @ Henry Cowell Park Bridge (208)	Monthly[4] Wet Season[2 6] Dry Season[3 6]	12 5 5	Fecal coliform
County of Santa Cruz	Branciforte Creek @ San Lorenzo River (010)	Monthly[4] Wet Season[2 6] Dry Season[36]	12 5 5	Fecal coliform
County of Santa Cruz	Branciforte Creek @ Isbel Drive (0121)	Monthly[4] Wet Season[2 6] Dry Season[3 6]	12 5 5	Fecal coliform
County of Santa Cruz	San Lorenzo River @ Trestle (003)	Weekly	48	Fecal coliform
County of Santa Cruz	San Lorenzo River @ Broadway/Laurel St. Bridge (006)	Weekly	48	Fecal coliform
County of Santa Cruz	San Lorenzo River @ Sycamore Grove (022)	Weekly	48	Fecal coliform
County of Santa Cruz	San Lorenzo River @ Big Trees (060)	Weekly	48	Fecal coliform
County of Santa Cruz	San Lorenzo River Above Love Creek (180)	Weekly	48	Fecal coliform
County of Santa Cruz	San Lorenzo River @ River Street (245)	Weekly	48	Fecal coliform
County of Santa Cruz	Lompico Creek @ Carrol Avenue (07528)	Monthly[4] Wet Season[2 6] Dry Season[3 6]	12 5 5	Fecal coliform
Caltrans at Highway One	To be determined[5]	Wet Season[2]	5	Fecal coliform

Responsible Party	Monitoring Site	Sampling Period	Number of Samples[1]	Constituent(#/100 mL)
City of Scotts Valley	To be determined[5]	Wet Season[2]	5	Fecal coliform
STORM WATER MONITORING				
City of Santa Cruz	To be determined[5]	Wet Season[2] Dry Season[3]	5	Fecal coliform
City of Scotts Valley	To be determined[5]	Wet Season[2] Dry Season[3]	5	Fecal coliform
County of Santa Cruz	To be determined[5]	Wet Season[2] Dry Season[3]	5	Fecal coliform

[1] Grab Sample
[2] Wet season is November through March
[3] Dry season is April through October
[4] At least one sample must be drawn in a 30-day period within the sampling period
[5] Sampling sites will be determined by the City and approved by the Executive Officer of the Central Coast Water Board
[6] Although the number of samples listed under "number of samples" says "five" for both wet and dry season sampling, four grab samples in a 30-day period will suffice during the first phase of monitoring. Water Board staff will notify responsible parties when five samples during a wet or dry period become necessary.

Where landowners need to demonstrate their activity is not passing fecal material into waters, landowner monitoring for pathogen indicator organisms may provide evidence of complying with load allocations. Landowners have the option of performing individual monitoring or participating in a cooperative monitoring program. Individual landowner monitoring can comprise either water quality monitoring or other forms of monitoring (such as a report documenting visual site inspections supported by site photos). Central Coast Water Board staff will review data every three years to determine compliance with the TMDL. If the Executive Officer determines additional monitoring is needed, he shall request it pursuant to Section 13267 of the California Water Code.

11.3. Reporting

The Executive Officer or Central Coast Water Board will require monitoring and reporting through authorities granted in California Water Code and/or NPDES or Waste Discharge Requirements.

The parties responsible for implementation and monitoring will incorporate the results of monitoring efforts in reports filed pursuant to the NPDES permit, Small MS4 Stormwater Permit, Nonpoint Source Implementation Program, or other correspondence as requested by the Central Coast Water Board pursuant to applicable sections of the California Water Code.

If reporting changes become necessary based on staff's assessment of the TMDL implementation progress, the Executive Officer or the Central Coast Water Board will require such changes. At a minimum, the Central Coast Water Board will evaluate monitoring reporting data and implementation reporting information

every three years.

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Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
San Lorenzo River @ Tait St	24-Aug-99	62
San Lorenzo River @ Tait St	21-Sep-99	62
San Lorenzo River @ Tait St	05-Oct-99	23
San Lorenzo River @ Tait St	18-Oct-99	23
San Lorenzo River @ Tait St	02-Nov-99	62
San Lorenzo River @ Tait St	16-Nov-99	240
San Lorenzo River @ Tait St	30-Nov-99	130
San Lorenzo River @ Tait St	14-Dec-99	6
San Lorenzo River @ Tait St	11-Jan-00	23
San Lorenzo River @ Tait St	25-Jan-00	700
San Lorenzo River @ Tait St	08-Feb-00	240
San Lorenzo River @ Tait St	07-Mar-00	240
San Lorenzo River @ Tait St	21-Mar-00	62
San Lorenzo River @ Tait St	04-Apr-00	62
San Lorenzo River @ Tait St	18-Apr-00	240
San Lorenzo River @ Tait St	02-May-00	240
San Lorenzo River @ Tait St	16-May-00	1300
San Lorenzo River @ Tait St	13-Jun-00	23
San Lorenzo River @ Tait St	27-Jun-00	62
San Lorenzo River @ Tait St	11-Jul-00	62
San Lorenzo River @ Tait St	25-Jul-00	62
San Lorenzo River @ Tait St	08-Aug-00	62
San Lorenzo River @ Tait St	22-Aug-00	130
San Lorenzo River @ Tait St	19-Sep-00	13
San Lorenzo River @ Tait St	03-Oct-00	23
San Lorenzo River @ Tait St	17-Oct-00	700
San Lorenzo River @ Tait St	31-Oct-00	50
San Lorenzo River @ Tait St	14-Nov-00	500
San Lorenzo River @ Tait St	28-Nov-00	<4.5
San Lorenzo River @ Tait St	12-Dec-00	62
San Lorenzo River @ Tait St	09-Jan-01	1300
San Lorenzo River @ Tait St	23-Jan-01	62
San Lorenzo River @ Tait St	06-Feb-01	23
San Lorenzo River @ Tait St	06-Mar-01	62
San Lorenzo River @ Tait St	20-Mar-01	23
San Lorenzo River @ Tait St	03-Apr-01	240
San Lorenzo River @ Tait St	17-Apr-01	62
San Lorenzo River @ Tait St	01-May-01	240
San Lorenzo River @ Tait St	15-May-01	240
San Lorenzo River @ Tait St	12-Jun-01	240
San Lorenzo River @ Tait St	26-Jun-01	700
San Lorenzo River @ Tait St	12-Jul-01	240
San Lorenzo River @ Tait St	24-Jul-01	62
San Lorenzo River @ Tait St	06-Aug-01	23
San Lorenzo River @ Tait St	21-Aug-01	130
San Lorenzo River @ Tait St	18-Sep-01	23
San Lorenzo River @ Tait St	02-Oct-01	62
San Lorenzo River @ Tait St	16-Oct-01	240

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
San Lorenzo River @ Tait St	30-Oct-01	2400
San Lorenzo River @ Tait St	27-Nov-01	2400
San Lorenzo River @ Tait St	10-Dec-01	62
San Lorenzo River @ Tait St	08-Jan-02	62
San Lorenzo River @ Tait St	05-Feb-02	23
San Lorenzo River @ Tait St	05-Mar-02	62
San Lorenzo River @ Tait St	19-Mar-02	62
San Lorenzo River @ Tait St	01-Apr-02	240
San Lorenzo River @ Tait St	16-Apr-02	62
San Lorenzo River @ Tait St	29-Apr-02	62
San Lorenzo River @ Tait St	29-Apr-02	62
San Lorenzo River @ Tait St	13-May-02	240
San Lorenzo River @ Tait St	11-Jun-02	23
San Lorenzo River @ Tait St	25-Jun-02	700
San Lorenzo River @ Tait St	09-Jul-02	240
San Lorenzo River @ Tait St	23-Jul-02	23
San Lorenzo River @ Tait St	06-Aug-02	62
San Lorenzo River @ Tait St	20-Aug-02	62
San Lorenzo River @ Tait St	17-Sep-02	50
San Lorenzo River @ Tait St	01-Oct-02	240
San Lorenzo River @ Tait St	15-Oct-02	62
San Lorenzo River @ Tait St	29-Oct-02	23
San Lorenzo River @ Tait St	10-Dec-02	62
San Lorenzo River @ Tait St	07-Jan-03	240
San Lorenzo River @ Tait St	04-Feb-03	240
San Lorenzo River @ Tait St	04-Mar-03	62
San Lorenzo River @ Tait St	18-Mar-03	240
San Lorenzo River @ Tait St	01-Apr-03	62
San Lorenzo River @ Tait St	15-Apr-03	240
San Lorenzo River @ Tait St	29-Apr-03	240
San Lorenzo River @ Tait St	13-May-03	50
San Lorenzo River @ Tait St	10-Jun-03	62
San Lorenzo River @ Tait St	24-Jun-03	23
San Lorenzo River @ Tait St	08-Jul-03	62
San Lorenzo River @ Tait St	22-Jul-03	240
San Lorenzo River @ Tait St	05-Aug-03	62
San Lorenzo River @ Tait St	21-Aug-03	240
San Lorenzo River @ Tait St	16-Sep-03	240
San Lorenzo River @ Tait St	30-Sep-03	240
San Lorenzo River @ Tait St	15-Oct-03	13
San Lorenzo River @ Tait St	15-Oct-03	13
San Lorenzo River @ Tait St	28-Oct-03	240
San Lorenzo River @ Tait St	28-Oct-03	240
San Lorenzo River @ Tait St	11-Nov-03	240
San Lorenzo River @ Tait St	11-Nov-03	240
San Lorenzo River @ Tait St	08-Dec-03	62
San Lorenzo River @ Tait St	09-Dec-03	62
San Lorenzo River @ Tait St	05-Jan-04	62

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
San Lorenzo River @ Tait St	06-Jan-04	62
San Lorenzo River @ Tait St	02-Feb-04	700
San Lorenzo River @ Tait St	03-Feb-04	700
San Lorenzo River @ Tait St	01-Mar-04	62
San Lorenzo River @ Tait St	02-Mar-04	62
San Lorenzo River @ Tait St	16-Mar-04	62
San Lorenzo River @ Tait St	16-Mar-04	62
San Lorenzo River @ Tait St	30-Mar-04	240
San Lorenzo River @ Tait St	30-Mar-04	240
San Lorenzo River @ Tait St	13-Apr-04	62
San Lorenzo River @ Tait St	13-Apr-04	62
San Lorenzo River @ Tait St	27-Apr-04	240
San Lorenzo River @ Tait St	27-Apr-04	240
San Lorenzo River @ Tait St	12-May-04	62
San Lorenzo River @ Tait St	12-May-04	62
San Lorenzo River @ Tait St	25-May-04	23
San Lorenzo River @ Tait St	25-May-04	23
San Lorenzo River @ Tait St	08-Jun-04	62
San Lorenzo River @ Tait St	22-Jun-04	23
San Lorenzo River @ Tait St	20-Jul-04	130
San Lorenzo River @ Tait St	03-Aug-04	62
San Lorenzo River @ Tait St	17-Aug-04	23
San Lorenzo River @ Tait St	31-Aug-04	230
San Lorenzo River @ Tait St	14-Sep-04	23
San Lorenzo River @ Tait St	28-Sep-04	P
San Lorenzo River @ Tait St	12-Oct-04	62
San Lorenzo River @ Tait St	26-Oct-04	2400
San Lorenzo River @ Tait St	07-Dec-04	7,000
San Lorenzo River @ Tait St	03-Jan-05	620
San Lorenzo River @ Tait St	01-Feb-05	62
San Lorenzo River @ Tait St	15-Feb-05	2400
San Lorenzo River @ Tait St	01-Mar-05	130
San Lorenzo River @ Tait St	15-Mar-05	130
San Lorenzo River @ Tait St	29-Mar-05	620
San Lorenzo River @ Tait St	12-Apr-05	230
San Lorenzo River @ Tait St	26-Apr-05	62
San Lorenzo River @ Tait St	10-May-05	230
San Lorenzo River @ Tait St	24-May-05	130
San Lorenzo River @ Tait St	07-Jun-05	130
San Lorenzo River @ Tait St	21-Jun-05	62
San Lorenzo River @ Tait St	19-Jul-05	62
San Lorenzo River @ Tait St	02-Aug-05	62
San Lorenzo River @ Tait St	16-Aug-05	230
San Lorenzo River @ Tait St	30-Aug-05	240
San Lorenzo River @ Tait St	13-Sep-05	62
San Lorenzo River @ Tait St	27-Sep-05	62
San Lorenzo River @ Tait St	11-Oct-05	23
San Lorenzo River @ Tait St	25-Oct-05	62

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
Intake @ SLR/Adjacent to Meter Shop	08-Nov-05	20
Intake @ SLR/Adjacent to Meter Shop	21-Nov-05	6
Intake @ SLR/Adjacent to Meter Shop	06-Dec-05	62
Intake @ SLR/Adjacent to Meter Shop	20-Dec-05	230
Intake @ SLR/Adjacent to Meter Shop	03-Jan-06	230
Intake @ SLR/Adjacent to Meter Shop	31-Jan-06	620
Intake @ SLR/Adjacent to Meter Shop	14-Feb-06	23
Intake @ SLR/Adjacent to Meter Shop	28-Feb-06	2400
Intake @ SLR/Adjacent to Meter Shop	15-Mar-06	230
Intake @ SLR/Adjacent to Meter Shop	28-Mar-06	62
Intake @ SLR/Adjacent to Meter Shop	10-Apr-06	240
Intake @ SLR/Adjacent to Meter Shop	25-Apr-06	62
Intake @ SLR/Adjacent to Meter Shop	09-May-06	230
Intake @ SLR/Adjacent to Meter Shop	23-May-06	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	24-Aug-99	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	21-Sep-99	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	05-Oct-99	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	18-Oct-99	620
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-Nov-99	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Nov-99	210
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Nov-99	620
Sn Lrnzo Rivr @ H.C. Prk Brdg	14-Dec-99	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Jan-00	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-Jan-00	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	08-Feb-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	07-Mar-00	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	21-Mar-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	04-Apr-00	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	18-Apr-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-May-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-May-00	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-Jun-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	27-Jun-00	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Jul-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-Jul-00	20
Sn Lrnzo Rivr @ H.C. Prk Brdg	08-Aug-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	22-Aug-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	19-Sep-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	03-Oct-00	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	17-Oct-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	31-Oct-00	500
Sn Lrnzo Rivr @ H.C. Prk Brdg	14-Nov-00	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	28-Nov-00	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-Dec-00	1300
Sn Lrnzo Rivr @ H.C. Prk Brdg	09-Jan-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	23-Jan-01	50
Sn Lrnzo Rivr @ H.C. Prk Brdg	06-Feb-01	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	06-Mar-01	62

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
Sn Lrnzo Rivr @ H.C. Prk Brdg	20-Mar-01	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	03-Apr-01	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	17-Apr-01	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-May-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-May-01	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-Jun-01	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	26-Jun-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-Jul-01	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	24-Jul-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	06-Aug-01	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	21-Aug-01	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	18-Sep-01	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-Oct-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Oct-01	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Oct-01	>24000
Sn Lrnzo Rivr @ H.C. Prk Brdg	27-Nov-01	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	10-Dec-01	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	08-Jan-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	05-Feb-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	05-Mar-02	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	19-Mar-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Apr-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Apr-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	29-Apr-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	29-Apr-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-May-02	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Jun-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-Jun-02	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	09-Jul-02	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	23-Jul-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	06-Aug-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	20-Aug-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	17-Sep-02	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Oct-02	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Oct-02	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	29-Oct-02	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	10-Dec-02	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	07-Jan-03	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	04-Feb-03	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	04-Mar-03	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	18-Mar-03	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Apr-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Apr-03	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	29-Apr-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-May-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	10-Jun-03	21
Sn Lrnzo Rivr @ H.C. Prk Brdg	24-Jun-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	22-Jul-03	2400

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
Sn Lrnzo Rivr @ H.C. Prk Brdg	05-Aug-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	21-Aug-03	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Sep-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Sep-03	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Oct-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Oct-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	28-Oct-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	28-Oct-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Nov-03	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Nov-03	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	08-Dec-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	09-Dec-03	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	05-Jan-04	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	06-Jan-04	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-Feb-04	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	03-Feb-04	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Mar-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-Apr-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-Apr-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	27-Apr-04	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	27-Apr-04	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-May-04	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-May-04	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-May-04	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-May-04	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	08-Jun-04	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	22-Jun-04	50
Sn Lrnzo Rivr @ H.C. Prk Brdg	20-Jul-04	700
Sn Lrnzo Rivr @ H.C. Prk Brdg	03-Aug-04	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	17-Aug-04	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	31-Aug-04	620
Sn Lrnzo Rivr @ H.C. Prk Brdg	14-Sep-04	230
Sn Lrnzo Rivr @ H.C. Prk Brdg	28-Sep-04	P
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-Oct-04	230
Sn Lrnzo Rivr @ H.C. Prk Brdg	26-Oct-04	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	09-Nov-04	1
Sn Lrnzo Rivr @ H.C. Prk Brdg	07-Dec-04	>24,000
Sn Lrnzo Rivr @ H.C. Prk Brdg	03-Jan-05	620
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Feb-05	23
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Feb-05	>24,000
Sn Lrnzo Rivr @ H.C. Prk Brdg	01-Mar-05	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	15-Mar-05	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	29-Mar-05	2400

Santa Cruz City

San Lorenzo River Data

Station	Date	E.Coli Concentration (MPN/100ml)
Sn Lrnzo Rivr @ H.C. Prk Brdg	12-Apr-05	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	26-Apr-05	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	10-May-05	230
Sn Lrnzo Rivr @ H.C. Prk Brdg	24-May-05	2400
Sn Lrnzo Rivr @ H.C. Prk Brdg	07-Jun-05	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	21-Jun-05	620
Sn Lrnzo Rivr @ H.C. Prk Brdg	19-Jul-05	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	02-Aug-05	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	16-Aug-05	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	30-Aug-05	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	13-Sep-05	62
Sn Lrnzo Rivr @ H.C. Prk Brdg	27-Sep-05	240
Sn Lrnzo Rivr @ H.C. Prk Brdg	11-Oct-05	130
Sn Lrnzo Rivr @ H.C. Prk Brdg	25-Oct-05	620
Felton Diversion/Below Cowell Bridge	08-Nov-05	230
Felton Diversion/Below Cowell Bridge	21-Nov-05	62
Felton Diversion/Below Cowell Bridge	06-Dec-05	130
Felton Diversion/Below Cowell Bridge	20-Dec-05	620
Felton Diversion/Below Cowell Bridge	03-Jan-06	620
Felton Diversion/Below Cowell Bridge	31-Jan-06	620
Felton Diversion/Below Cowell Bridge	14-Feb-06	23
Felton Diversion/Below Cowell Bridge	28-Feb-06	1300
Felton Diversion/Below Cowell Bridge	15-Mar-06	230
Felton Diversion/Below Cowell Bridge	28-Mar-06	130
Felton Diversion/Below Cowell Bridge	10-Apr-06	620
Felton Diversion/Below Cowell Bridge	25-Apr-06	62
Felton Diversion/Below Cowell Bridge	09-May-06	620
Felton Diversion/Below Cowell Bridge	23-May-06	29

APPENDIX B. FECAL COLIFORM DATA ANALYSIS

Staff analyzed water quality data using a program developed by Tetra Tech, the United States Environmental Protection Agencies' contractor. The program is titled "Fecal Coliform Investigation and Analysis Spreadsheet (FECIA)." FECIA is a fully automated spreadsheet designed to assist in characterization and quantification of fecal coliform instream water quality objective[1] exceedances. Data are compared against water quality objectives or criteria to determine magnitude and frequency of exceedances. The FECIA program generated the data analysis figures and tables within this section.

All figures in Appendix B show the REC-1 geometric mean water quality objective or criteria, concentration ranges, range of concentrations within the 25th -75th percentile range, mean concentration, and median concentration.

All tables in Appendix B provide summary statistics of the figures. The table displays statistical data on a monthly basis. The table shows the mean, the median, the minimum, the maximum, the 25th percent deviation, the 75th percent deviation, the number of exceedances of the water contact recreation water quality objective or criteria versus the sample count (XS:Count), and the percent sample exceedance (XS%) of the water quality objective or criteria. Note that when the table analyzed geometric means, the column entitled "mean" is actually the "mean of the geometric mean." The mean value for the maximum water quality objective or criterion is the actual mean value of the samples collected.

San Lorenzo River Estuary at Trestle (003)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

Figure 1 shows monthly fecal coliform concentrations for the San Lorenzo River Estuary at the Trestle from 1/4/2000 to 6/27/2006. Fecal coliform mean values are below the water quality objective in January, February and May. All other months of the year the mean concentrations exceed the water quality objective.

[1] Or *E.coli* water quality criteria

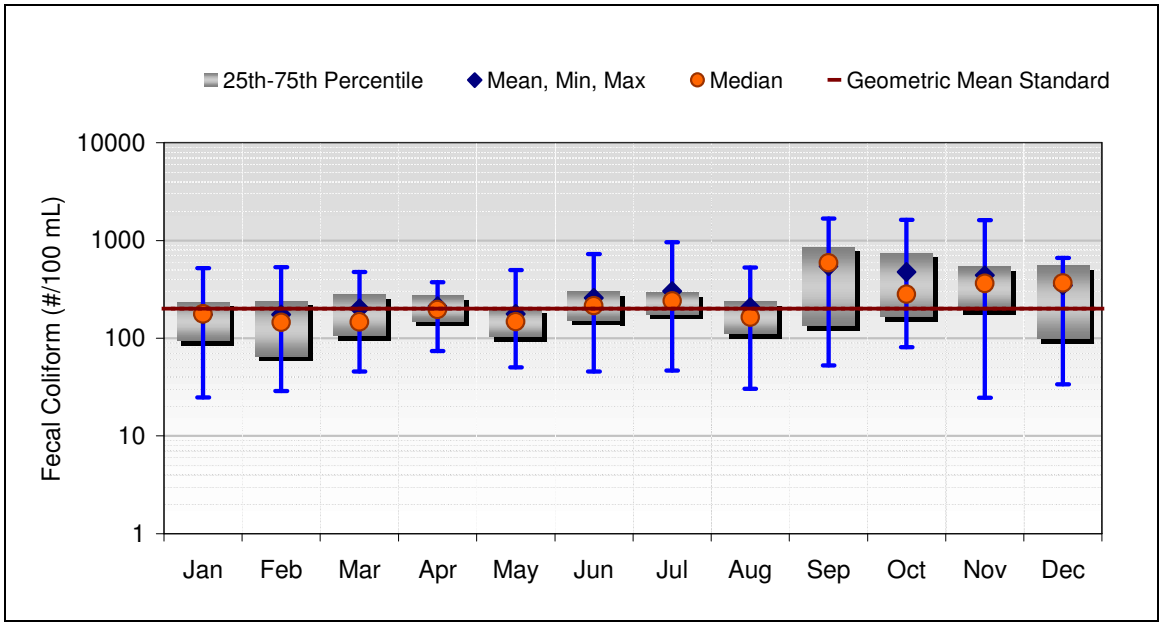

Figure 1. San Lorenzo River Estuary Fecal Coliform at Trestle (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 – June 27, 2006)

Table 1 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 50% of the time. The least violations occur in May and the greatest numbers of violations occur in October. There is no seasonal water quality trend.

Table 1. San Lorenzo River Estuary Fecal Coliform at Trestle Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Geometric Mean Water Quality Objective

Summary Statistics (Data: 1/4/2000 to 6/27/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	175	178	25	522	92	235	10:25	40%
Feb	175	144	29	532	65	239	9:26	35%
Mar	202	147	45	474	106	282	13:33	39%
Apr	214	196	74	374	150	271	15:32	47%
May	177	148	50	498	103	203	7:25	28%
Jun	257	215	46	728	152	301	14:27	52%
Jul	303	241	47	955	177	290	17:26	65%
Aug	208	165	30	529	110	238	10:27	37%
Sep	545	590	52	1669	134	865	13:23	57%
Oct	475	280	81	1620	164	753	18:25	72%
Nov	441	363	25	1609	194	538	20:28	71%
Dec	347	367	34	662	97	557	18:28	64%
All Data	**288**	**207**	**25**	**1669**	**127**	**357**	**164:325**	**50%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 2 below shows monthly fecal coliform concentrations for San Lorenzo River Estuary at the Trestle from 1/4/2000 to 6/27/2006. Mean concentrations exceed the water quality objective in all months except January and April.

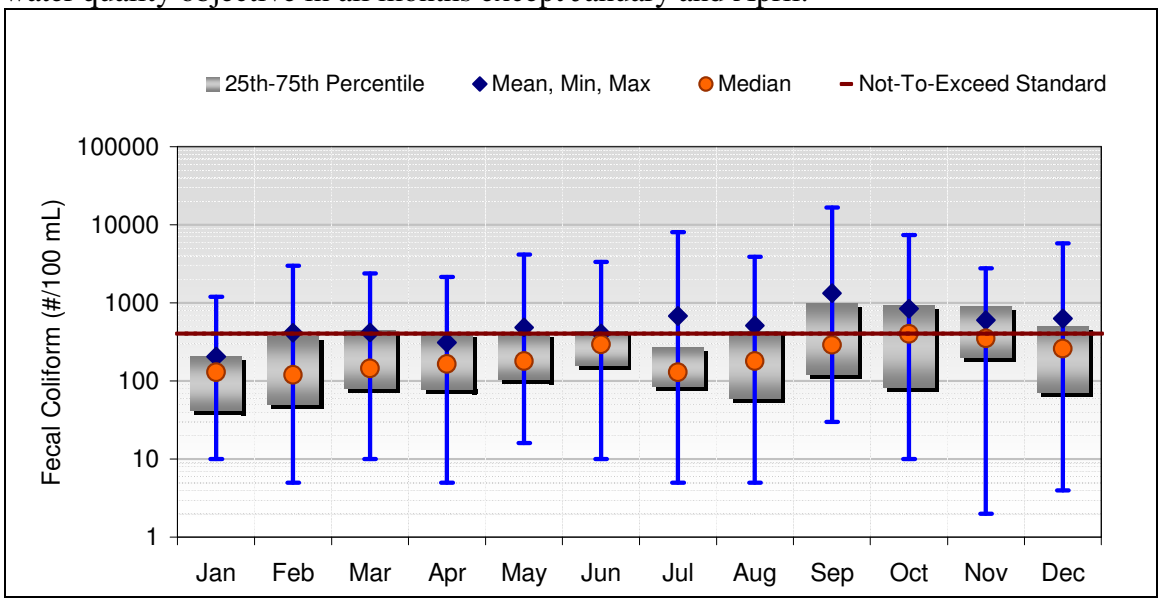

Figure 2. San Lorenzo River Estuary Fecal Coliform at Trestle (#/100 mL) and Water Contact Maximum Water Quality Objective (January 4, 2000 through June 27, 2006)

Table 2 below provides summary statistics of the above figure. Overall, the quality objective was exceeded 29% of the time with no seasonal trend.

Table 2. San Lorenzo River Estuary Fecal Coliform at Trestle Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 1/4/2000 to 6/27/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	205	130	10	1200	42	210	3:31	10%
Feb	414	120	5	2976	50	378	8:31	26%
Mar	419	145	10	2380	80	453	9:32	28%
Apr	311	165	5	2150	78	415	8:32	25%
May	484	180	16	4170	105	415	7:26	27%
Jun	405	295	10	3350	160	438	9:32	28%
Jul	679	130	5	8040	85	275	4:27	15%
Aug	513	180	5	3910	60	440	8:29	28%
Sep	1331	290	30	16632	123	1006	11:26	42%
Oct	844	400	10	7420	84	950	14:29	48%
Nov	601	350	2	2780	200	910	10:27	37%
Dec	631	260	4	5760	72	510	12:29	41%
All Data	**555**	**200**	**2**	**16632**	**80**	**490**	**103:351**	**29%**

San Lorenzo River Estuary at Broadway/Laurel Street Bridge (006)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

Figure 3 below shows monthly fecal coliform concentrations for San Lorenzo River Estuary at the Broadway/Laurel Street from 1/4/2000 to 6/27/2006. Mean concentrations exceed the water quality objective in all months except for May.

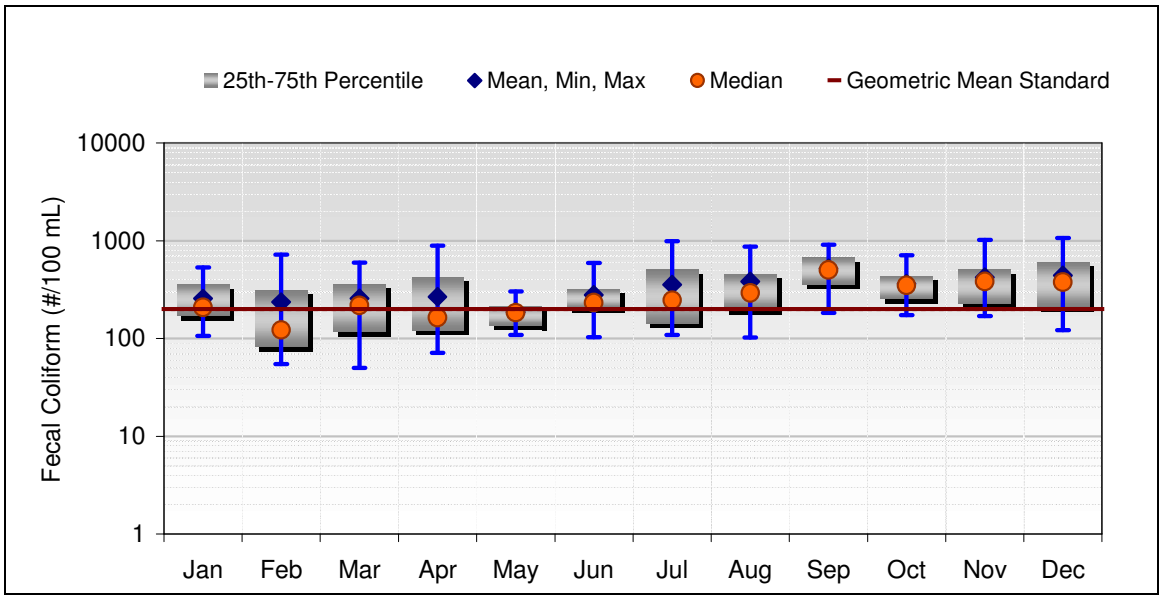

Figure 3. San Lorenzo River Estuary Fecal Coliform at Broadway/Laurel Bridge (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 through June 27, 2006)

Table 3 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 63% of the time with no apparent seasonal trend.

Table 3. San Lorenzo River Estuary Fecal Coliform at Broadway/Laurel Street Bridge Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Geometric Mean Water Quality Objective

Summary Statistics (Data: 1/4/2000 to 6/27/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	257	209	106	534	172	362	11:21	52%
Feb	235	123	55	724	82	314	9:23	39%
Mar	258	218	50	598	116	365	15:28	54%
Apr	268	164	72	895	122	427	11:29	38%
May	186	185	108	305	137	214	9:21	43%
Jun	281	233	104	593	204	321	17:23	74%
Jul	357	247	109	994	143	506	13:23	57%
Aug	383	293	103	870	198	460	16:22	73%
Sep	523	504	183	917	359	673	19:20	95%
Oct	363	350	174	711	254	435	19:22	86%
Nov	423	384	171	1016	225	507	19:24	79%
Dec	442	379	121	1068	209	607	21:27	78%
All Data	**330**	**256**	**50**	**1068**	**171**	**438**	**179:283**	**63%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 4 below shows monthly fecal coliform concentrations for San Lorenzo River Estuary at the Broadway/Laurel Street Bridge from 1/4/2000 to 6/27/2006. Mean concentrations exceed the water quality objective in all months except January, April, May and June.

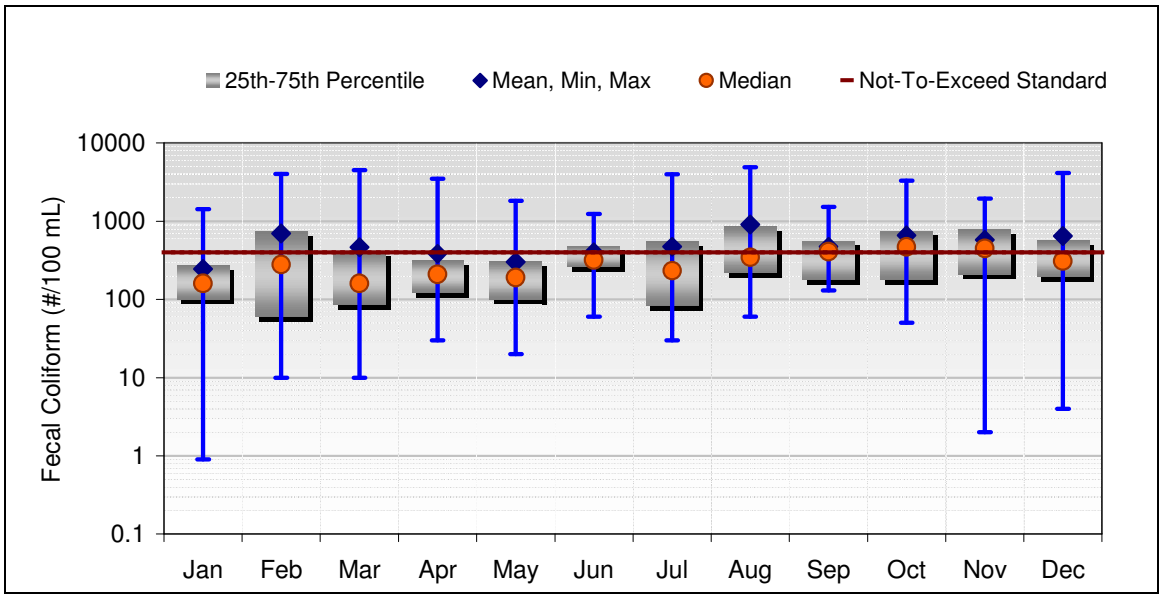

Figure 4. San Lorenzo River Estuary Fecal Coliform at Broadway/Laurel Street Bridge (#/100 mL) and Water Contact Maximum Water quality Objective (January 4, 2000 through June 27, 2006)

Table 4 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 35% of the time. There is no seasonal trend.

Table 4. San Lorenzo River Estuary Fecal Coliform at Broadway/Laurel Street Bridge Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 1/4/2000 to 6/27/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	246	160	1	1430	100	268	6:30	20%
Feb	700	280	10	4000	60	730	9:27	33%
Mar	465	160	10	4498	85	405	8:31	26%
Apr	384	210	30	3490	123	315	6:30	20%
May	303	190	20	1820	100	310	5:25	20%
Jun	399	320	60	1250	260	480	10:29	34%
Jul	471	232	30	3970	83	553	8:26	31%
Aug	907	345	60	4900	222	855	12:26	46%
Sep	472	410	130	1530	177	558	12:24	50%
Oct	659	470	50	3300	180	760	14:25	56%
Nov	583	450	2	1940	210	780	15:26	58%
Dec	647	310	4	4150	195	575	10:27	37%
All Data	**514**	**267**	**1**	**4900**	**130**	**538**	**115:326**	**35%**

San Lorenzo River Fecal Coliform at Soquel Avenue Bridge (009)

Geometric Mean Objective (200 MPN/100 mL)

There are not enough water quality data at the Soquel Avenue Bridge station to calculate the geometric mean (No months have the minimum of five samples needed to calculate the geometric mean). The most recent data available is from 11/24/86 to 02/19/97.

Maximum Objective (400 MPN/100 mL)

Figure 5 shows monthly fecal coliform concentrations for San Lorenzo River Estuary at the Soquel Avenue Bridge from 11/24/1986 to 02/19/1997. The mean concentrations exceed the water quality objective in January, April-May, August, and October through December.

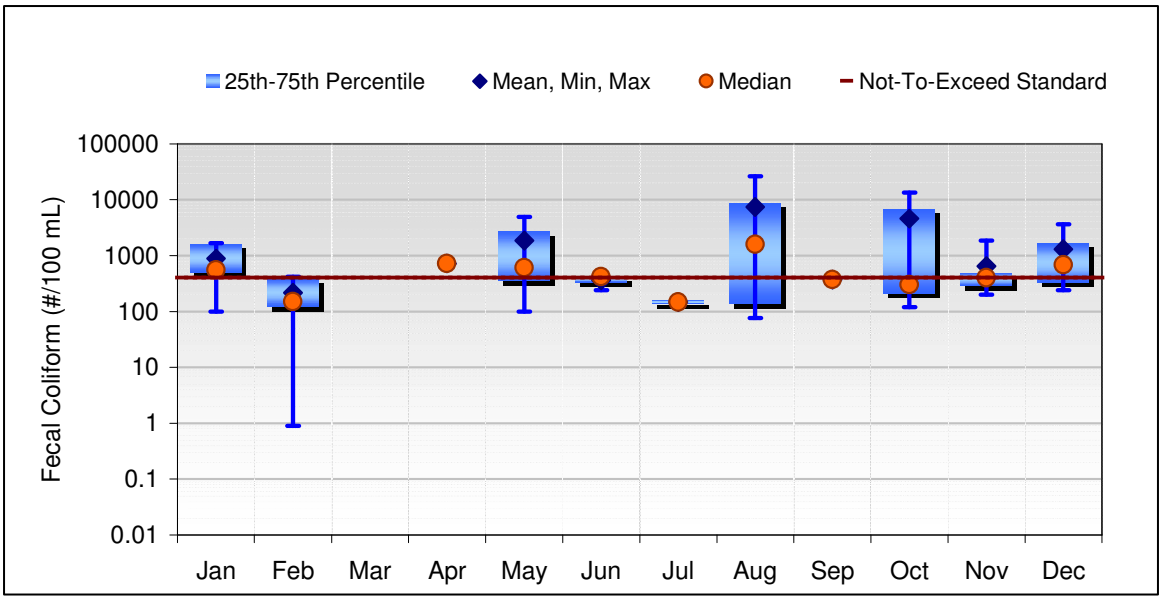

Figure 5. San Lorenzo River Estuary Fecal Coliform at Soquel Avenue Bridge Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective (11/24/1986 to 2/19/1997)

Table 5 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 47% of the time. There is no seasonal trend.

Table 5. San Lorenzo River Estuary Fecal Coliform at Soquel Avenue Bridge Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 11/24/1986 to 2/19/1997)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	882	550	100	1660	500	1600	4:5	80%
Feb	217	150	1	420	120	392	1:5	20%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	720	720	720	720	720	720	1:1	100%
May	1868	604	100	4900	352	2752	2:3	67%
Jun	360	420	240	420	330	420	2:3	67%
Jul	147	147	125	168	136	157	0:2	0%
Aug	7416	1593	76	26400	136	8873	2:4	50%
Sep	370	370	370	370	370	370	0:1	0%
Oct	4573	300	120	13300	210	6800	1:3	33%
Nov	646	400	200	1850	290	490	2:5	40%
Dec	1308	685	240	3620	330	1663	2:4	50%
All Data	**1817**	**396**	**1**	**26400**	**165**	**793**	**17:36**	**47%**

Branciforte Creek at San Lorenzo River (010)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There are not enough water quality data at the Branciforte Creek station upstream of the San Lorenzo River to calculate geometric means. The most recent data available is from 04/11/95 to 6/15/2006. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 6 below shows monthly fecal coliform concentrations for Branciforte Creek at the San Lorenzo River confluence from 04/11/1995 to 6/15/2006. Mean concentrations exceed the water quality objective almost every month except for March, April and July (March and July only had one sample).

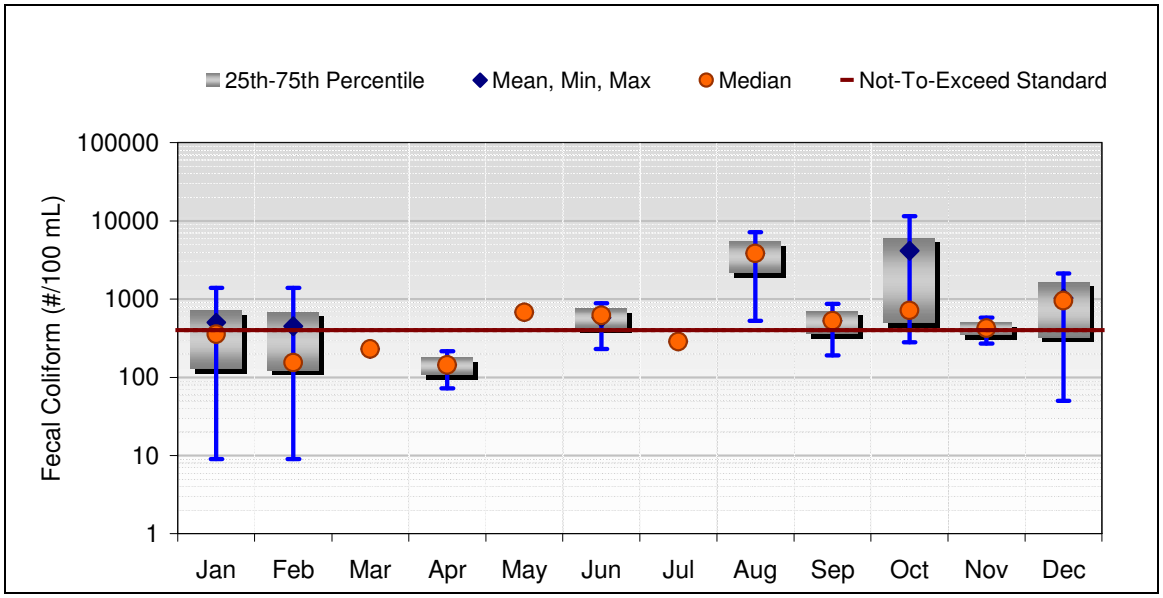

Figure 6. Branciforte Creek at San Lorenzo River Fecal Coliform (#/100 mL) and Water Contact Recreation Maximum Water Quality Objective (April 11, 1995 – June 15, 2006)

Table 6 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 52% of the time. There is no seasonal trend.

Table 6. Branciforte Creek Fecal Coliform at San Lorenzo River Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 4/11/1995 to 6/15/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	502	355	9	1390	130	723	3:6	50%
Feb	450	155	9	1400	123	690	2:6	33%
Mar	230	230	230	230	230	230	0:1	0%
Apr	144	144	72	216	108	180	0:2	0%
May	680	680	680	680	680	680	1:1	100%
Jun	580	620	230	890	425	755	2:3	67%
Jul	288	288	288	288	288	288	0:1	0%
Aug	3849	3849	528	7170	2189	5510	2:2	100%
Sep	530	530	190	870	360	700	1:2	50%
Oct	4173	720	280	11520	500	6120	2:3	67%
Nov	425	425	270	580	348	503	1:2	50%
Dec	1025	955	50	2140	328	1653	3:4	75%
All Data	**1066**	**420**	**9**	**11520**	**190**	**860**	**17:33**	**52%**

Branciforte Creek at Carbonera (0120)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There are not enough water quality data at the Branciforte Creek station upstream of the confluence with Carbonera Creek to calculate the geometric mean. The most recent data available is from 9/20/1995 to 1/24/2002. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 7 below shows monthly fecal coliform concentrations for Branciforte Creek at the Carbonera Creek confluence from 9/20/1995 to 1/24/2002. (This is the most recent data available.) The means did not exceed the water quality objective. However, as show in the figure below, there are not enough data to determine impairment conditions, because there are only seven samples for this timeframe.

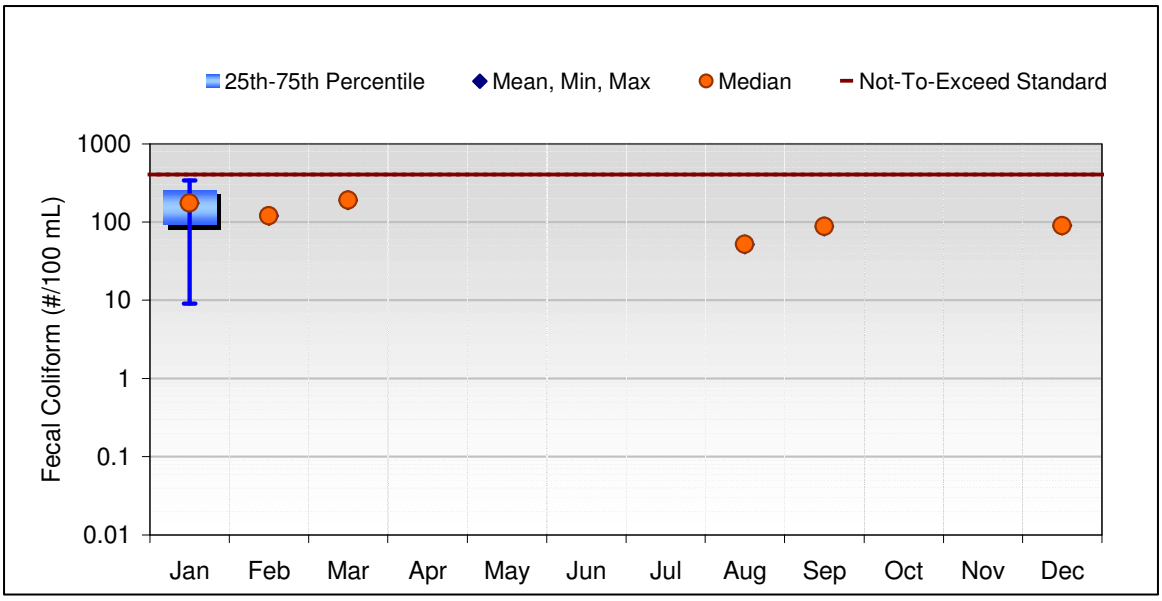

Figure 7. Branciforte Creek Fecal Coliform at San Lorenzo River Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective (September 20, 1995 – January 24, 2002)

Table 7 provides summary statistics of the above figure. This station never exceeded water quality objectives.

Table 7. Branciforte Creek Fecal Coliform at Carbonera Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 9/20/1995 to 1/24/2002)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	175	175	9	340	92	257	0:2	0%
Feb	120	120	120	120	120	120	0:1	0%
Mar	190	190	190	190	190	190	0:1	0%
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	52	52	52	52	52	52	0:1	0%
Sep	88	88	88	88	88	88	0:1	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	90	90	90	90	90	90	0:1	0%
All Data	**127**	**90**	**9**	**340**	**70**	**155**	**0:7**	**0%**

Branciforte Creek at Isbel Drive (0121)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There are not enough water quality data at the Isbel Drive station to calculate the geometric mean. The most recent data available is from 2/9/2000 to 6/15/2006. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 8 below shows monthly fecal coliform concentrations for Branciforte Creek at Isbel Drive from 2/9/2000 to 6/15/2006. The mean concentration exceeded the objective in April and October.

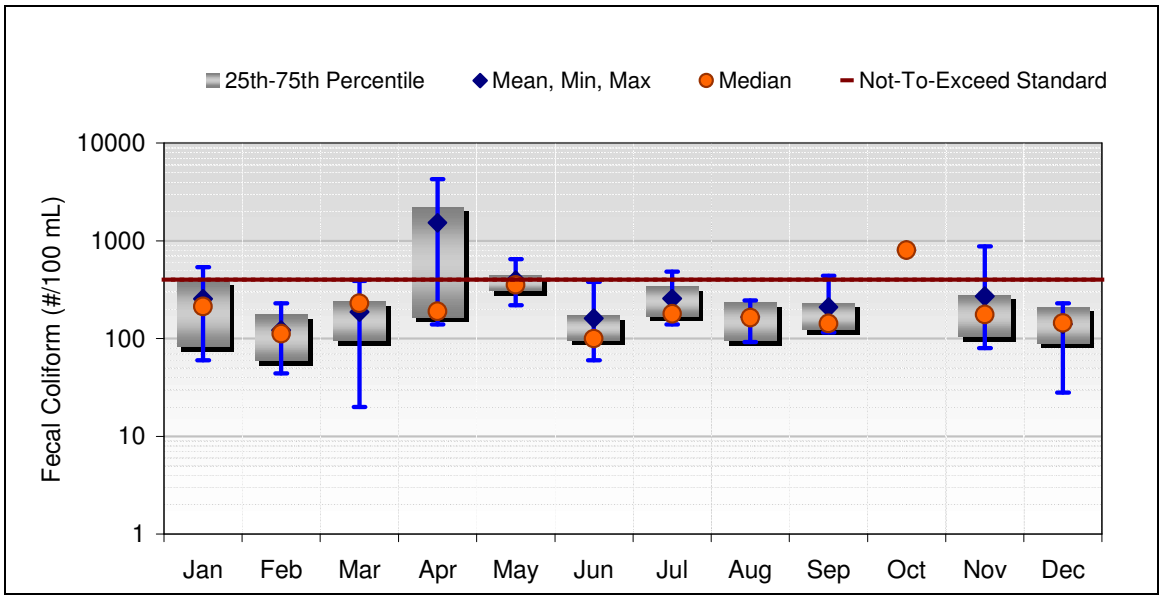

Figure 8. Branciforte Creek at Isbel Drive Fecal Coliform (#/100 mL) and Water Contact Recreation Maximum Water Quality Objective (February 9, 2000 – June 15, 2006)

Table 8 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 14% of the time. There is no seasonal trend.

Table 8. Branciforte Creek Fecal Coliform at Isbel Drive Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 2/9/2000 to 6/15/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	254	213	60	540	83	399	2:6	33%
Feb	122	112	44	230	59	175	0:7	0%
Mar	187	230	20	390	95	240	0:7	0%
Apr	1535	190	140	4275	165	2233	1:3	33%
May	395	355	220	650	310	440	1:4	25%
Jun	162	100	60	380	96	172	0:5	0%
Jul	257	179	140	485	170	340	1:6	17%
Aug	166	164	92	245	95	235	0:4	0%
Sep	210	143	116	440	123	230	1:4	25%
Oct	805	805	805	805	805	805	1:1	100%
Nov	272	176	80	880	105	280	1:7	14%
Dec	141	145	28	230	90	210	0:5	0%
All Data	**291**	**172**	**20**	**4275**	**96**	**293**	**8:59**	**14%**

San Lorenzo River at Sycamore Grove (022)

Geometric Mean Objective (200 MPN/100 mL)

Figure 9 below shows monthly fecal coliform concentrations for San Lorenzo River at the Sycamore Grove station from 1/4/2000 to 1/25/2006. The mean concentrations do not exceed the water quality objective.

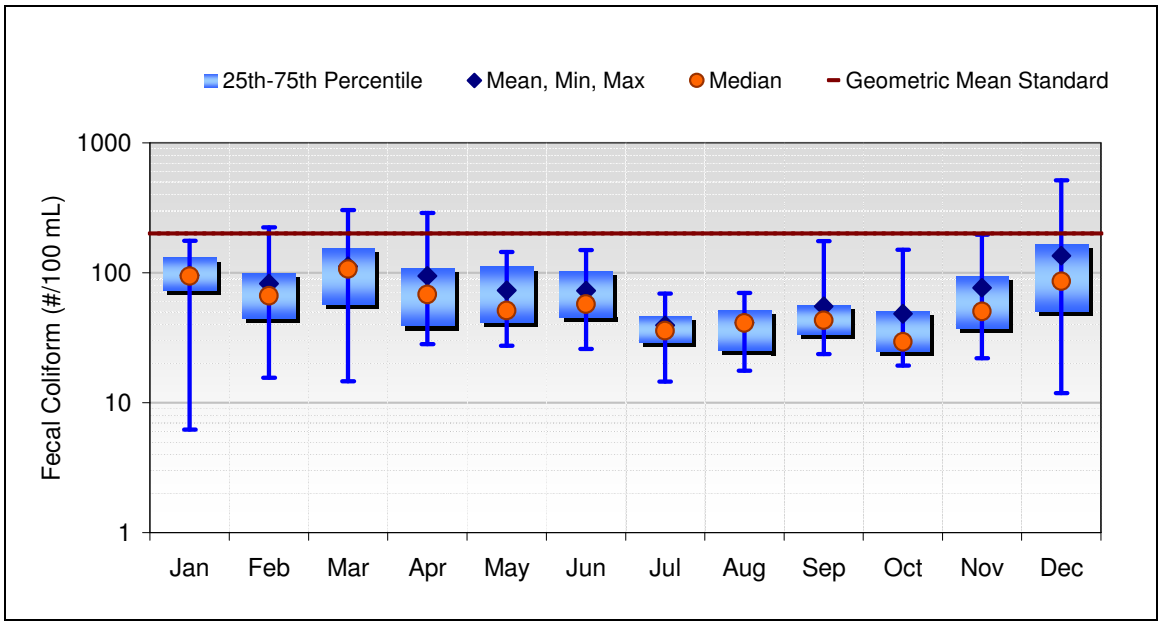

Figure 9. San Lorenzo River Fecal Coliform at Sycamore Grove (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 – January 25, 2006)

Table 9 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded only 4% of the time.

Table 9. San Lorenzo River Fecal Coliform at Sycamore Grove Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 1/4/2000 to 1/25/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	96	94	6	176	74	131	0:30	0%
Feb	83	67	16	224	45	100	1:33	3%
Mar	112	107	15	303	58	156	2:31	6%
Apr	95	68	28	290	39	109	5:31	16%
May	73	51	27	145	42	112	0:27	0%
Jun	73	57	26	150	46	103	0:32	0%
Jul	39	36	15	69	29	47	0:32	0%
Aug	41	41	18	70	25	52	0:32	0%
Sep	55	43	24	175	34	56	0:31	0%
Oct	48	29	19	150	25	51	0:30	0%
Nov	77	51	22	197	37	94	0:30	0%
Dec	136	86	12	516	50	167	6:31	19%
All Data	**77**	**54**	**6**	**516**	**35**	**101**	**14:370**	**4%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 10 shows monthly fecal coliform concentrations for San Lorenzo River at Sycamore Grove station from 1/4/2000 to 1/25/2006. Mean concentrations do not exceed the water quality objective.

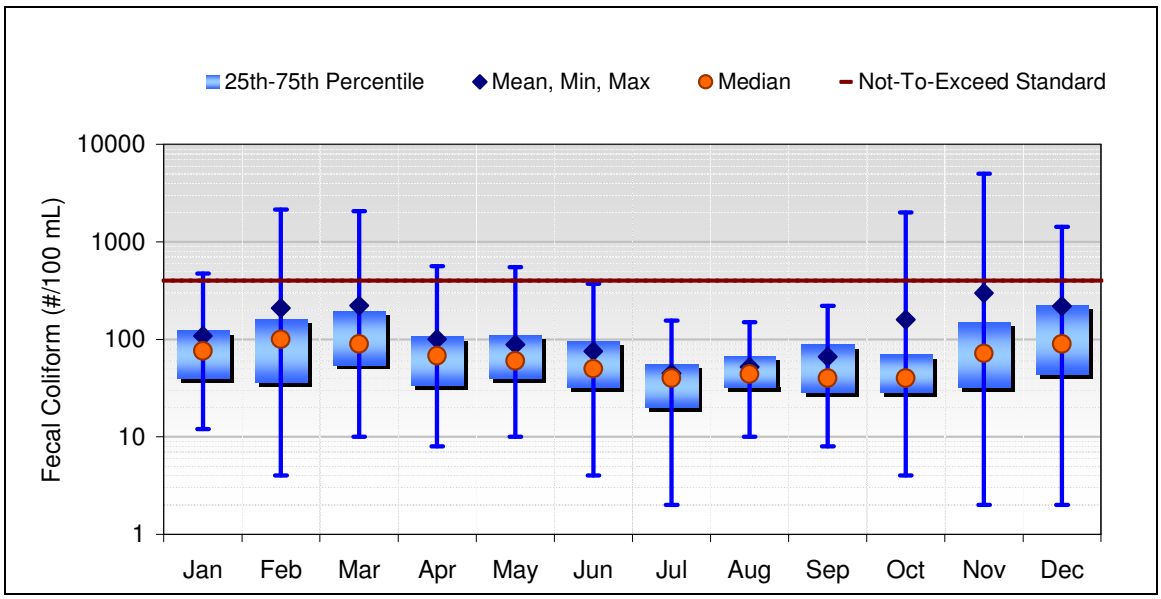

Figure 10. San Lorenzo River Fecal Coliform at Sycamore Grove (#/100 mL) and Water Contact Maximum Water Quality Objective (January 4, 2000 – January 25, 2006)

Table 10 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded only 5% of the time.

Table 10. San Lorenzo River Fecal Coliform at Sycamore Grove Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 1/4/2000 to 1/25/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	108	76	12	472	40	123	2:39	5%
Feb	209	100	4	2140	36	160	3:29	10%
Mar	222	90	10	2070	55	195	2:31	6%
Apr	101	68	8	560	34	108	2:30	7%
May	89	60	10	550	40	110	1:29	3%
Jun	76	50	4	370	32	96	0:32	0%
Jul	44	40	2	156	20	56	0:33	0%
Aug	52	44	10	150	32	67	0:31	0%
Sep	66	40	8	220	29	88	0:30	0%
Oct	159	40	4	2000	29	70	2:31	6%
Nov	298	72	2	5000	32	150	3:29	10%
Dec	219	90	2	1430	44	225	4:31	13%
All Data	**135**	**60**	**2**	**5000**	**32**	**110**	**19:375**	**5%**

San Lorenzo River at Big Trees (060)

Geometric Mean Objective (200 MPN/100 mL)

Figure 11 below shows monthly fecal coliform concentrations for San Lorenzo River at the Big Trees station from 1/4/2000 to 1/23/2006. The mean concentrations exceed the water quality objective in November and December.

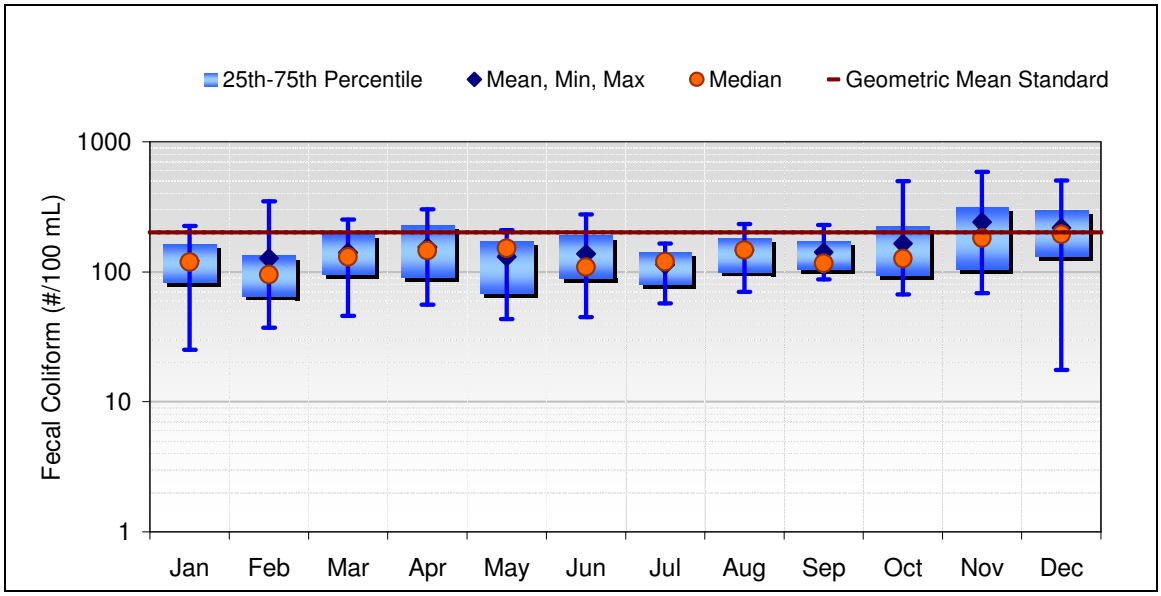

Figure 11. San Lorenzo River Fecal Coliform at Big Trees (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 – January 23, 2006)

Table 11 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 24% of the time.

Table 11. San Lorenzo River Fecal Coliform at Big Trees Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	122	119	25	226	83	164	3:26	12%
Feb	127	95	37	349	66	134	5:20	25%
Mar	141	130	46	253	95	197	6:25	24%
Apr	155	146	56	302	91	227	10:28	36%
May	131	152	43	209	69	173	2:24	8%
Jun	137	109	45	275	90	191	5:25	20%
Jul	114	120	57	165	80	142	0:25	0%
Aug	147	147	70	234	100	183	6:27	22%
Sep	141	116	88	229	106	173	3:17	18%
Oct	165	127	67	498	95	226	7:22	32%
Nov	241	182	68	589	105	314	13:28	46%
Dec	219	195	18	504	133	298	12:27	44%
All Data	**155**	**133**	**18**	**589**	**92**	**198**	**72:294**	**24%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 12 shows monthly fecal coliform concentrations for San Lorenzo River at Big Trees station from 1/4/2000 to 1/23/2006. Mean concentrations do not exceed the water quality objective.

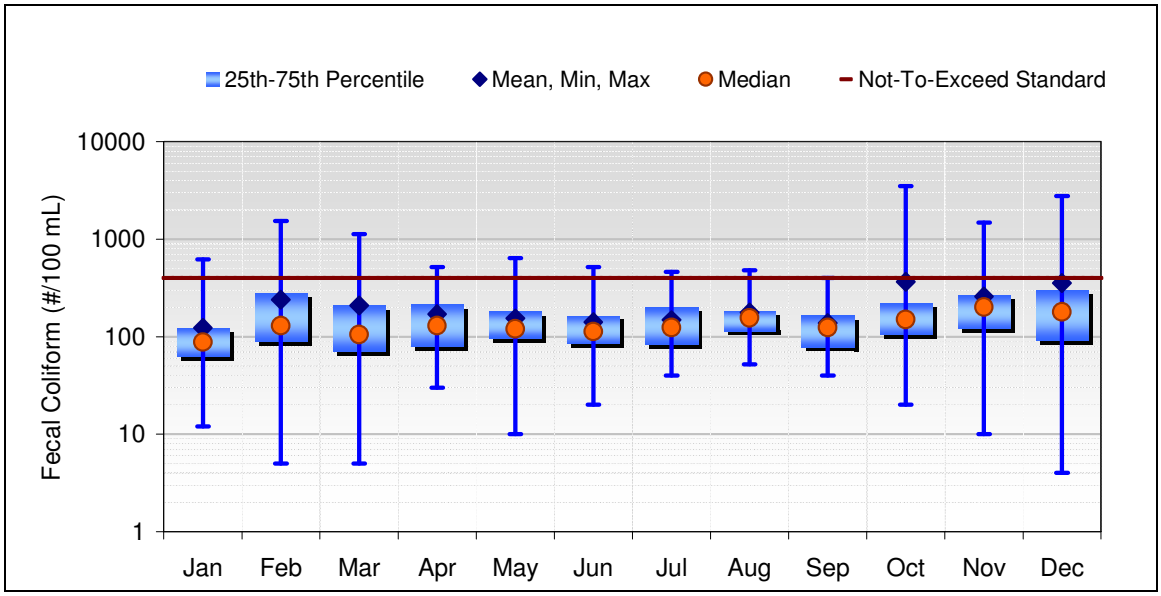

Figure 12. San Lorenzo River Fecal Coliform at Big Trees (#/100 mL) and Water Contact Maximum Water Quality Objective (January 4, 2000 – January 23, 2006)

Table 12 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 10% of the time.

Table 12. San Lorenzo River Fecal Coliform at Big Trees Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	124	88	12	620	63	122	1:32	3%
Feb	240	130	5	1530	90	280	4:23	17%
Mar	209	105	5	1130	72	210	3:28	11%
Apr	170	130	30	520	80	215	2:27	7%
May	154	120	10	640	98	181	1:24	4%
Jun	141	113	20	520	86	164	2:26	8%
Jul	148	124	40	464	84	200	1:29	3%
Aug	177	156	52	480	115	182	2:27	7%
Sep	138	124	40	400	79	165	0:24	0%
Oct	366	150	20	3492	106	219	6:28	21%
Nov	257	201	10	1480	122	265	4:26	15%
Dec	355	180	4	2770	92	300	5:28	18%
All Data	**207**	**128**	**4**	**3492**	**84**	**200**	**31:322**	**10%**

Lompico Creek at Carrol Avenue (07528)

Geometric Mean Objective (200 MPN/100 mL)

There are not enough water quality data at the Lompico Creek station at Carrol Avenue to calculate the geometric mean. The most recent data available is from 2/2/2000 – 1/12/006. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 13 shows monthly fecal coliform concentrations for Lompico Creek at Carrol Avenue station from 2/2/2000 – 1/12/2006. Mean concentrations exceed the water quality objective in June and August.

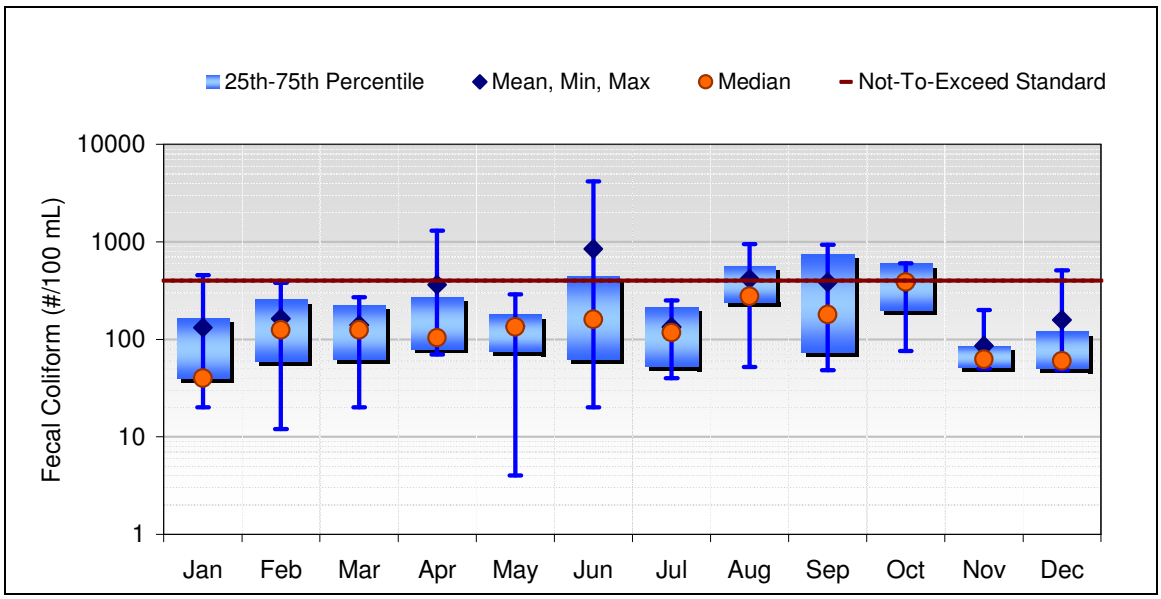

Figure 13. Lompico Creek Fecal Coliform at Carrol Avenue (#/100 mL) and Water Contact Maximum Water Quality Objective (February 2, 2000 – January 12, 2006)

Table 13 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 16% of the time.

Table 13. Lompico Creek Fecal Coliform at Carrol Avenue Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 2/2/2000 to 1/12/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	132	40	20	455	40	165	1:7	14%
Feb	163	125	12	380	60	256	0:6	0%
Mar	140	125	20	270	63	225	0:6	0%
Apr	365	104	70	1300	80	270	1:5	20%
May	135	134	4	290	75	180	0:6	0%
Jun	848	160	20	4180	63	445	2:6	33%
Jul	134	117	40	250	53	216	0:6	0%
Aug	416	276	52	947	240	564	2:5	40%
Sep	385	180	48	930	73	748	2:6	33%
Oct	373	388	76	600	200	600	2:5	40%
Nov	86	63	50	200	51	85	0:6	0%
Dec	158	60	48	510	50	120	1:5	20%
All Data	**273**	**120**	**4**	**4180**	**50**	**270**	**11:69**	**16%**

San Lorenzo River at Highlands Park (149)

Geometric Mean Objective (200 MPN/100 mL)

Figure 14 below shows monthly fecal coliform concentrations for San Lorenzo River at the Highlands Park station from 2/15/2000 to 9/6/2005. The mean concentrations do not exceed the water quality objective.

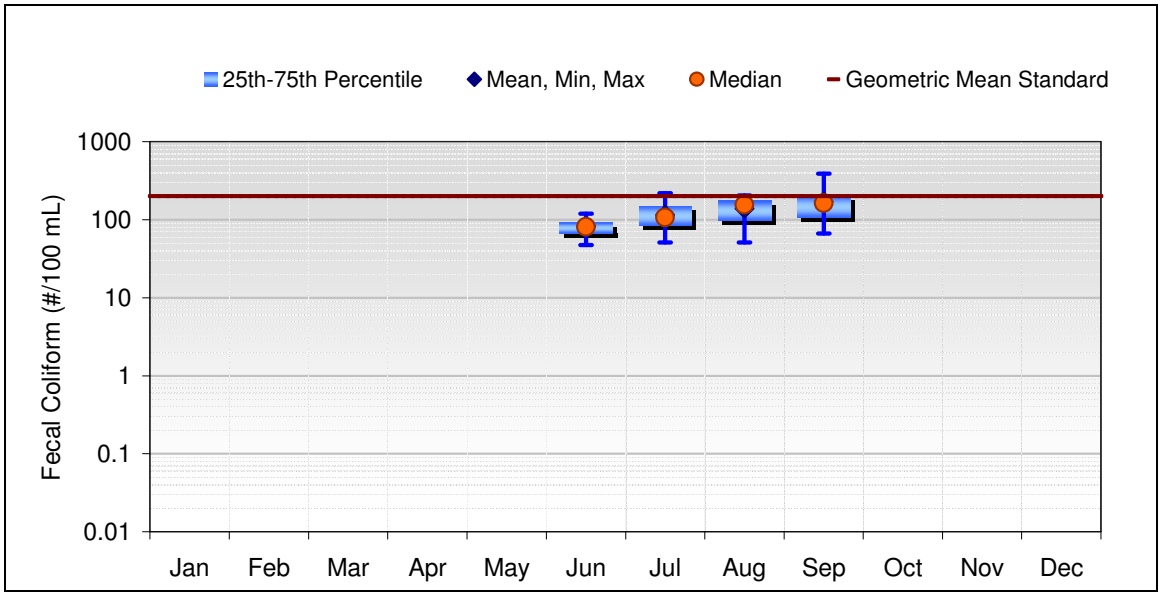

Figure 14. San Lorenzo River Fecal Coliform at Highlands Park (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (February 15, 2000 – September 6, 2005)

Table 14 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 11% of the time.

Table 14. San Lorenzo River Fecal Coliform at Highlands Park Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 2/15/2000 to 9/6/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	0	0	0	0	0	0	0:0	n/a
Feb	0	0	0	0	0	0	0:0	n/a
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	83	81	48	120	68	91	0:9	0%
Jul	115	107	51	218	85	151	1:24	4%
Aug	139	155	51	205	99	176	2:28	7%
Sep	171	164	66	387	108	204	6:23	26%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**135**	**128**	**48**	**387**	**88**	**175**	**9:84**	**11%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 15 shows monthly fecal coliform concentrations for San Lorenzo River at Highlands Park station from 2/15/2000 to 9/6/2005. Mean concentrations do not exceed the water quality objective.

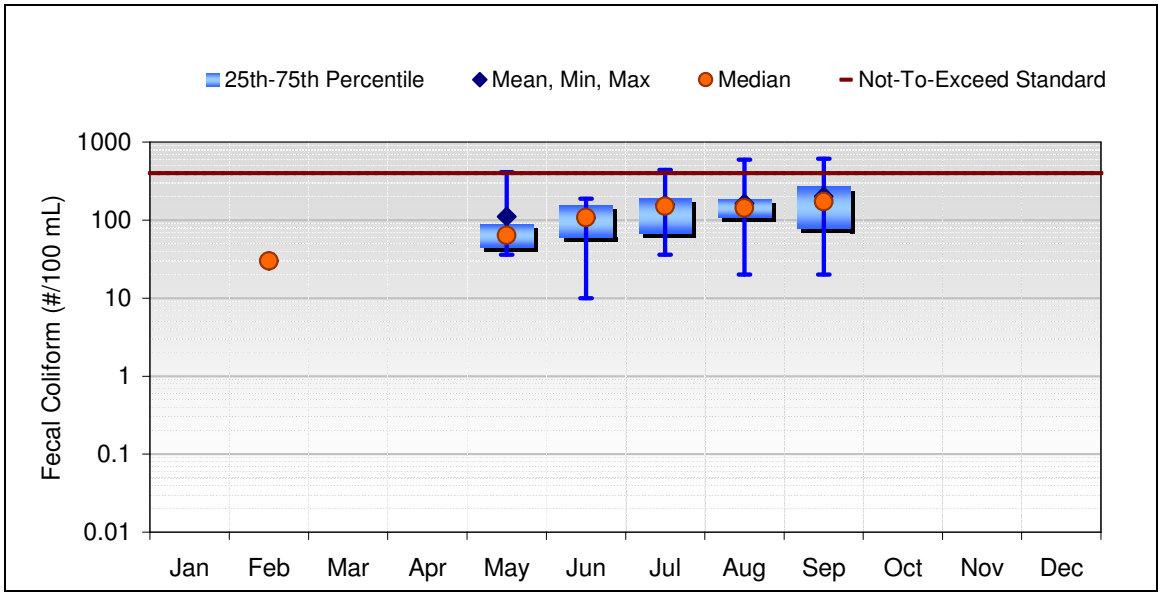

Figure 15. San Lorenzo River Fecal Coliform at Highlands Park (#/100 mL) and Water Contact Maximum Water Quality Objective (February 15, 2000 – September 6, 2005)

Table 15 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 5% of the time.

Table 15. San Lorenzo River Fecal Coliform at Highlands Park Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 2/15/2000 to 9/6/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	0	0	0	0	0	0	0:0	n/a
Feb	30	30	30	30	30	30	0:1	0%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	112	64	36	412	45	90	1:7	14%
Jun	107	108	10	188	60	156	0:25	0%
Jul	158	151	36	440	69	195	1:26	4%
Aug	163	144	20	596	110	189	1:28	4%
Sep	201	173	20	612	78	272	2:24	8%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**153**	**140**	**10**	**612**	**70**	**184**	**5:111**	**5%**

San Lorenzo River above Love Creek (180)

Geometric Mean Objective (200 MPN/100 mL)

Figure 16 below shows monthly fecal coliform concentrations for San Lorenzo River above Love Creek station from 1/4/2000 to 1/23/2006. The mean concentrations do not exceed the water quality objective.

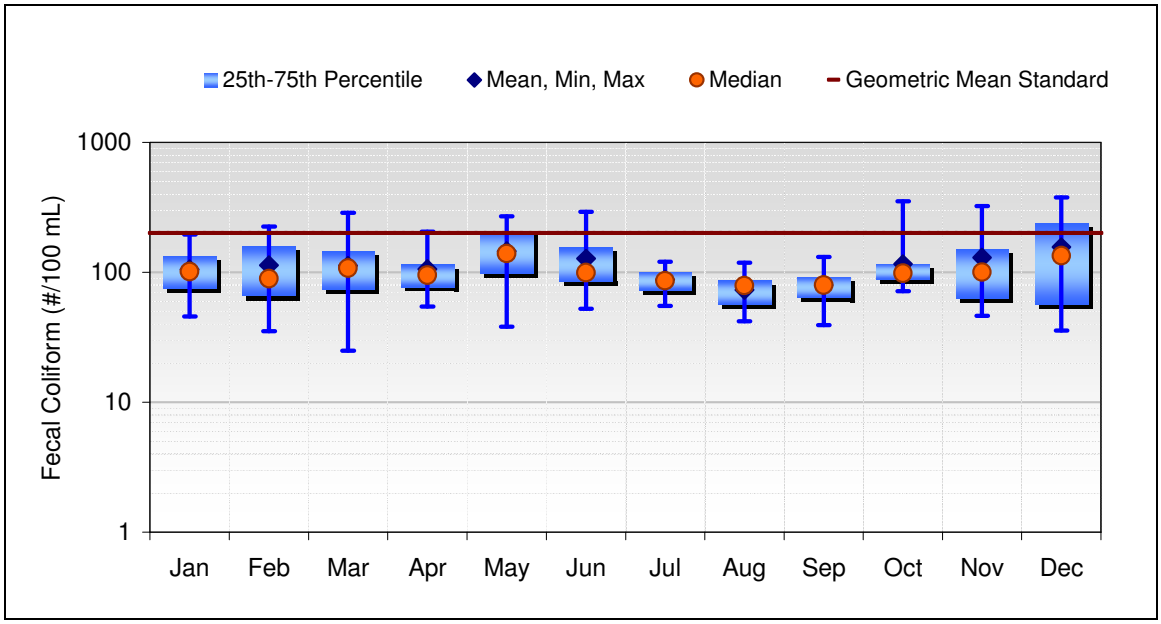

Figure 16. San Lorenzo River Fecal Coliform Above Love Creek (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 – January 23, 2006)

Table 16 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 11% of the time.

Table 14. San Lorenzo River Fecal Coliform Above Love Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	105	102	46	195	75	134	0:24	0%
Feb	113	90	35	225	66	160	3:19	16%
Mar	112	108	25	287	73	145	1:25	4%
Apr	105	95	54	205	77	115	2:28	7%
May	146	139	38	270	99	208	7:24	29%
Jun	127	99	53	293	85	155	4:25	16%
Jul	88	86	55	121	73	101	0:27	0%
Aug	73	79	42	118	57	86	0:25	0%
Sep	80	80	39	132	64	92	0:20	0%
Oct	115	99	72	352	89	116	2:26	8%
Nov	130	100	46	323	63	150	5:25	20%
Dec	157	134	36	377	57	240	9:27	33%
All Data	**113**	**94**	**25**	**377**	**71**	**132**	**33:295**	**11%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 17 shows monthly fecal coliform concentrations for San Lorenzo River above Love Creek station from 1/4/2000 to 1/23/2006. Mean concentrations do not exceed the water quality objective.

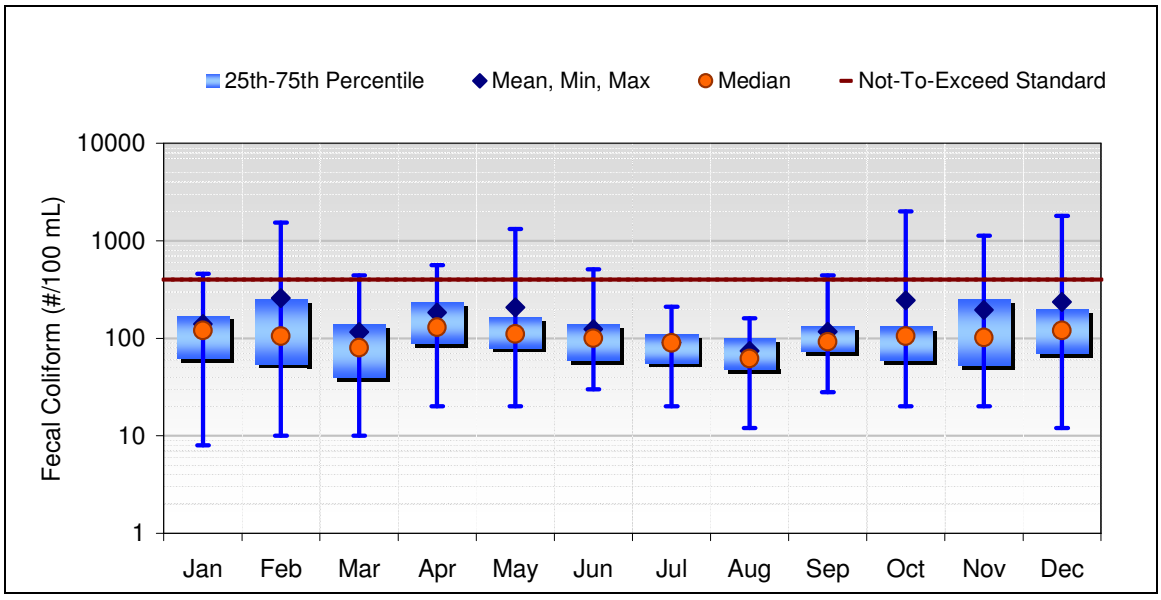

Figure 17. San Lorenzo River Fecal Coliform Above Love Creek (#/100 mL) and Water Contact Maximum Water Quality Objective (January 4, 2000 – January 23, 2006)

Table 17 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 8% of the time.

Table 17. San Lorenzo River Fecal Coliform Above Love Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	141	120	8	460	62	171	1:31	3%
Feb	258	105	10	1540	55	255	5:24	21%
Mar	116	80	10	440	40	140	2:27	7%
Apr	185	130	20	560	90	235	4:27	15%
May	208	111	20	1320	80	165	3:24	13%
Jun	124	100	30	510	60	140	1:27	4%
Jul	91	90	20	210	56	109	0:27	0%
Aug	74	62	12	160	49	100	0:26	0%
Sep	117	92	28	440	73	132	1:27	4%
Oct	245	105	20	2000	60	132	2:26	8%
Nov	195	102	20	1130	53	255	3:26	12%
Dec	236	120	12	1800	71	200	3:27	11%
All Data	**164**	**100**	**8**	**2000**	**60**	**150**	**25:319**	**8%**

San Lorenzo River at Pacific Avenue, Brookdale (241)

Geometric Mean Objective (200 MPN/100 mL)

Figure 18 below shows monthly fecal coliform concentrations for San Lorenzo River at Pacific Avenue, Brookdale station from 7/11/2000 to 9/6/2005. The mean concentrations do not exceed the water quality objective.

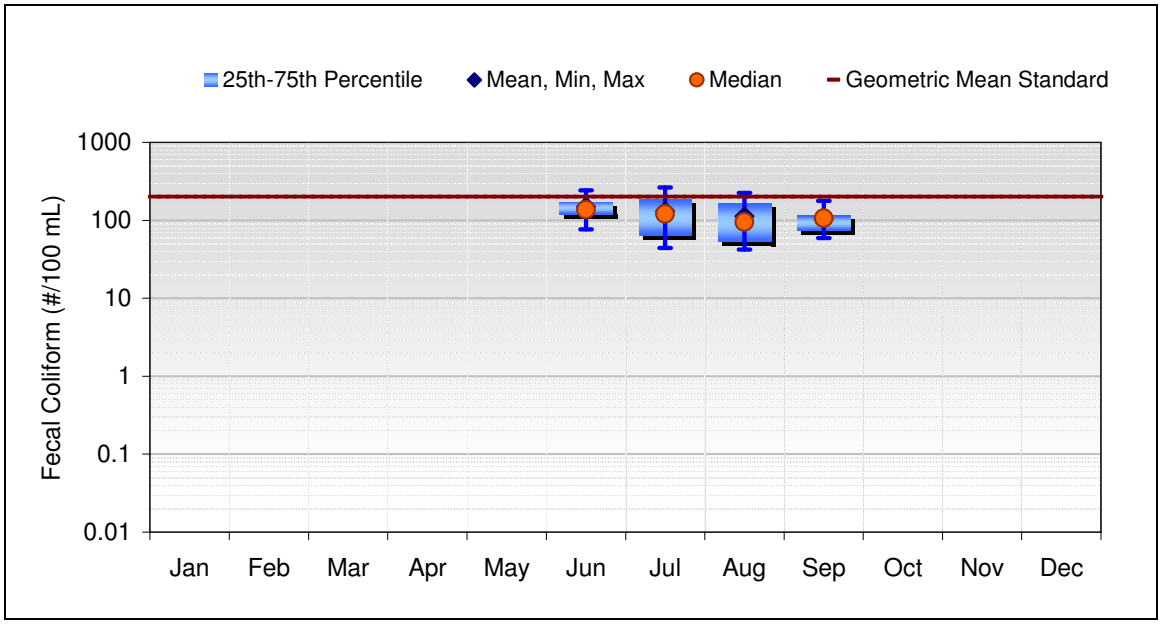

Figure 18. San Lorenzo River Fecal Coliform at Pacific Avenue, Brookdale (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (July 11, 2000 – September 6, 2005)

Table 18 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 18% of the time.

Table 18. San Lorenzo River Fecal Coliform at Pacific Avenue, Brookdale Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 7/11/2000 to 9/6/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	0	0	0	0	0	0	0:0	n/a
Feb	0	0	0	0	0	0	0:0	n/a
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	150	137	77	243	120	172	2:8	25%
Jul	130	121	44	262	64	187	5:23	22%
Aug	112	95	42	224	53	168	5:26	19%
Sep	102	107	60	177	75	115	0:11	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**121**	**111**	**42**	**262**	**63**	**173**	**12:68**	**18%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 19 shows monthly fecal coliform concentrations for San Lorenzo River at Pacific Avenue, Brookdale station from 7/11/2000 to 9/6/2005. Mean concentrations do not exceed the water quality objective.

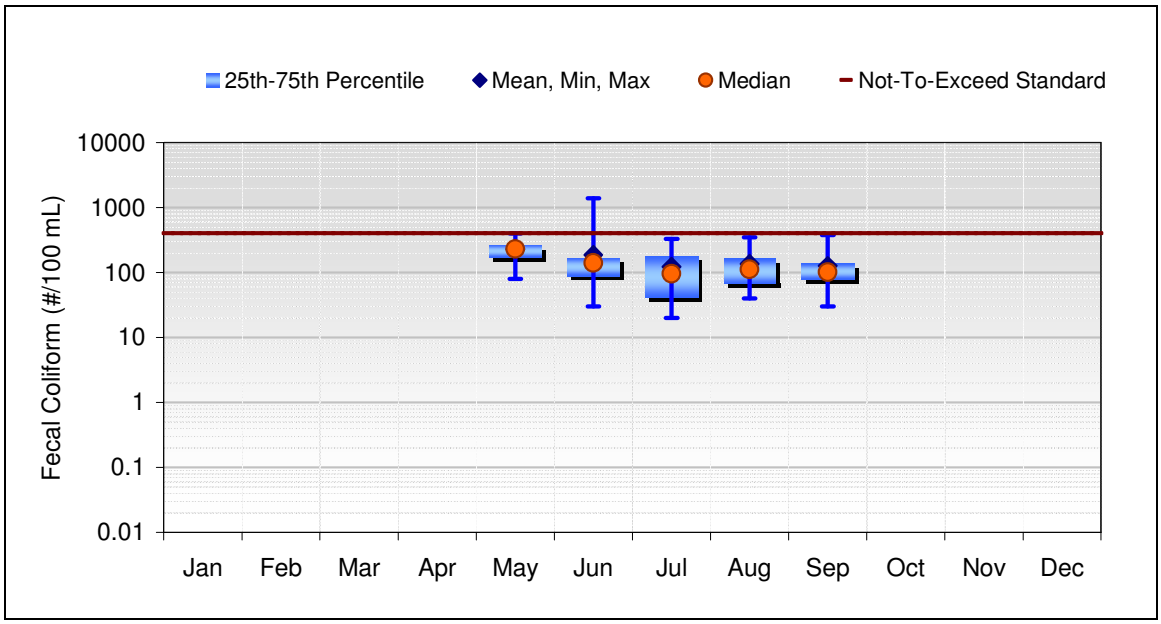

Figure 19. San Lorenzo River Fecal Coliform at Pacific Avenue, Brookdale (#/100 mL) and Water Contact Maximum Water Quality Objective (July 11, 2000 – September 6, 2005)

Table 19 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 1% of the time.

Table 19. San Lorenzo River Fecal Coliform at Pacific Avenue, Brookdale Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 7/11/2000 to 9/6/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	0	0	0	0	0	0	0:0	n/a
Feb	0	0	0	0	0	0	0:0	n/a
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	228	230	80	400	174	262	0:6	0%
Jun	188	140	30	1390	90	169	1:24	4%
Jul	123	96	20	328	42	181	0:26	0%
Aug	137	112	40	348	69	166	0:27	0%
Sep	127	102	30	380	79	138	0:18	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**149**	**124**	**20**	**1390**	**68**	**172**	**1:101**	**1%**

San Lorenzo River at River Street (245)

Geometric Mean Objective (200 MPN/100 mL)

Figure 20 below shows monthly fecal coliform concentrations for San Lorenzo River at River Street station from 1/4/2000 to 1/23/2006. The mean concentrations exceed the water quality objective during December.

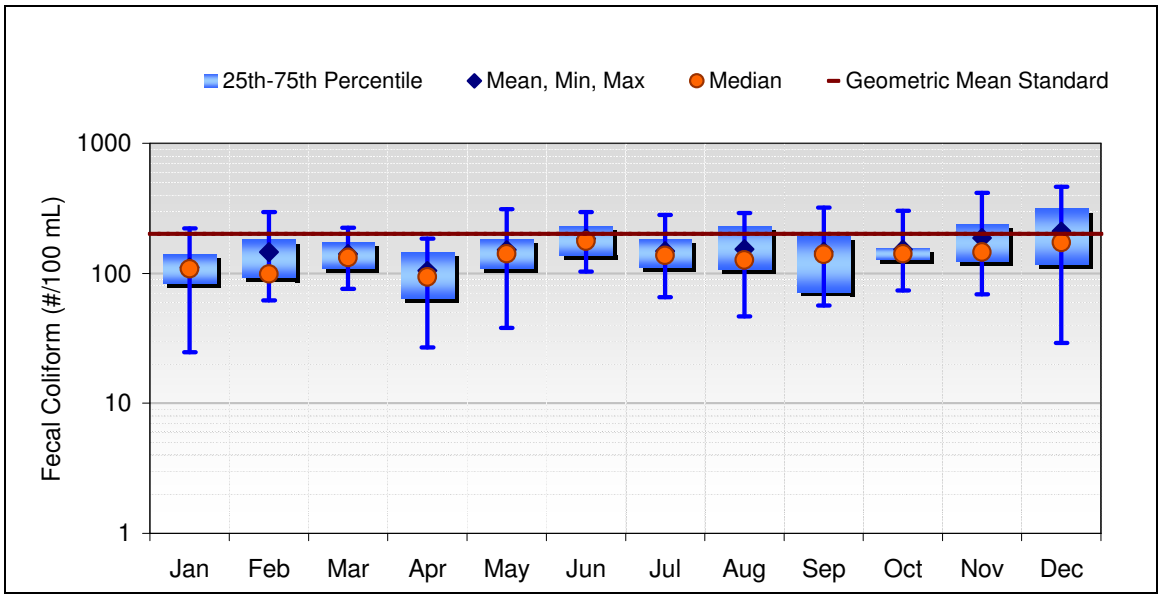

Figure 20. San Lorenzo River Fecal Coliform at River Street (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 4, 2000 to January 23, 2006)

Table 20 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 22% of the time.

Table 20. San Lorenzo River Fecal Coliform at River Street Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Geometric Mean Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	111	108	25	222	84	139	2:25	8%
Feb	145	99	62	296	93	181	4:19	21%
Mar	141	133	76	224	110	173	2:22	9%
Apr	105	94	27	185	64	147	0:26	0%
May	151	141	38	310	110	184	5:24	21%
Jun	185	177	103	297	137	232	10:23	43%
Jul	148	137	66	281	112	184	4:25	16%
Aug	153	127	46	291	108	231	9:31	29%
Sep	147	140	56	321	72	195	5:22	23%
Oct	153	141	74	301	128	156	4:24	17%
Nov	187	146	69	416	124	240	9:25	36%
Dec	210	173	29	464	117	316	10:28	36%
All Data	**153**	**140**	**25**	**464**	**99**	**184**	**64:294**	**22%**

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 21 shows monthly fecal coliform concentrations for San Lorenzo River at River Street station from 1/4/2000 to 1/23/2006. Mean concentrations do not exceed the water quality objective.

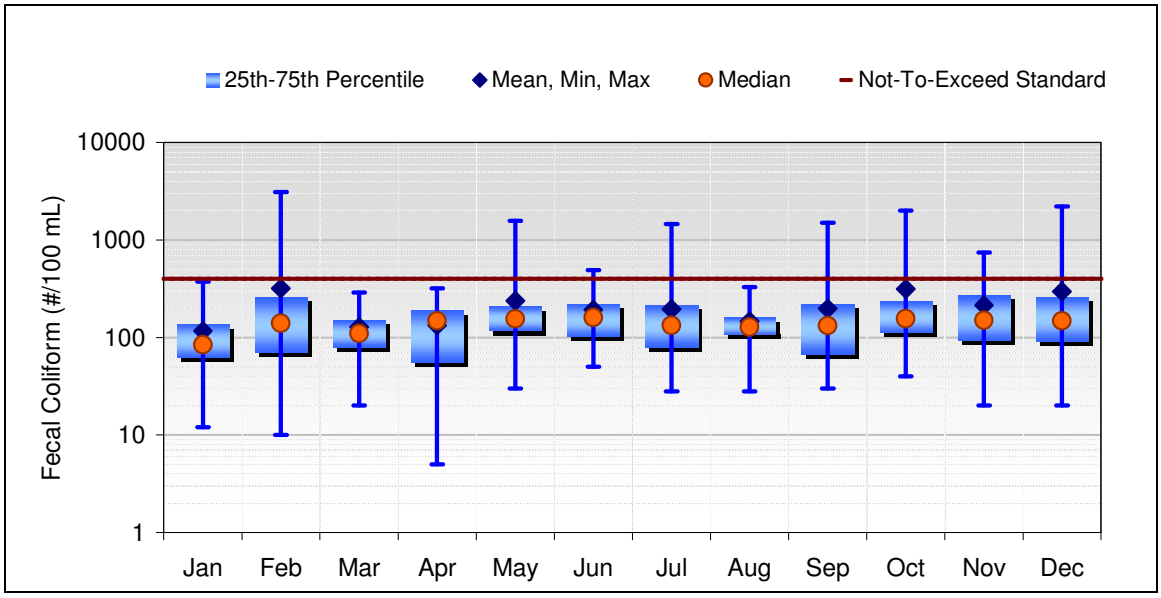

Figure 21. San Lorenzo River Fecal Coliform at River Street (#/100 mL) and Water Contact Maximum Water Quality Objective (Janaruy 4, 2000 – January 23, 2006)

Table 21 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 8% of the time.

Table 21. San Lorenzo River Fecal Coliform at River Street Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 1/4/2000 to 1/23/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	117	84	12	372	63	137	0:32	0%
Feb	317	140	10	3100	71	258	4:24	17%
Mar	128	110	20	290	80	150	0:25	0%
Apr	133	148	5	320	56	190	0:27	0%
May	238	155	30	1570	118	208	3:24	13%
Jun	193	160	50	490	102	222	3:27	11%
Jul	195	133	28	1452	80	216	2:30	7%
Aug	146	128	28	328	108	160	0:29	0%
Sep	198	132	30	1500	68	220	2:25	8%
Oct	314	156	40	2000	113	235	4:26	15%
Nov	215	150	20	740	94	270	4:27	15%
Dec	297	148	20	2210	92	260	3:29	10%
All Data	**205**	**136**	**5**	**3100**	**80**	**220**	**25:325**	**8%**

Two Bar Creek at San Lorenzo River (290)

Geometric Mean Objective (200 MPN/100 mL)

There are not enough water quality data at the Two Bar Creek at San Lorenzo Station to calculate the geometric mean. The most recent data available is from 11/29/2001 – 1/12/2006. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 22 shows monthly fecal coliform concentrations for Two Bar Creek at San Lorenzo River station from 11/29/2001 – 1/12/2006. Mean concentrations exceed the water quality objective September through December.

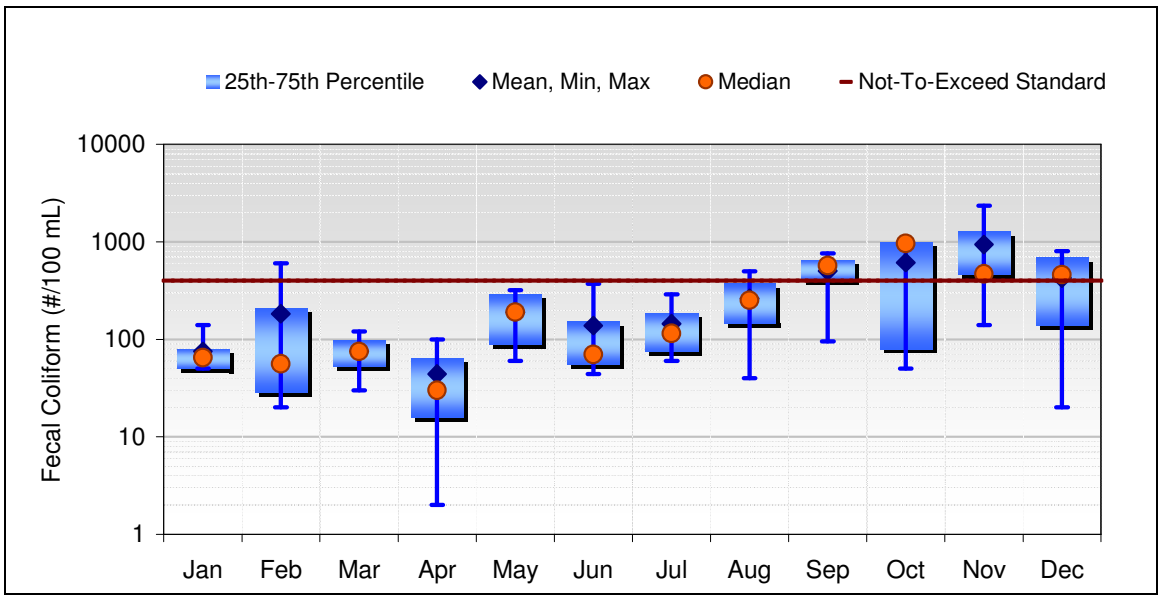

Figure 22. Two Bar Creek Fecal Coliform at San Lorenzo River (#/100 mL) and Water Contact Maximum Water Quality Objective (November 29, 2001 – January 12, 2006)

Table 22 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 30% of the time.

Table 22. Two Bar Creek Fecal Coliform at San Lorenzo River Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 11/29/2001 to 1/12/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	75	65	50	140	50	80	0:6	0%
Feb	183	56	20	600	29	210	1:4	25%
Mar	75	75	30	120	53	98	0:4	0%
Apr	44	30	2	100	16	65	0:3	0%
May	190	190	60	320	90	290	0:4	0%
Jun	139	70	44	370	56	153	0:4	0%
Jul	145	115	60	290	75	185	0:4	0%
Aug	263	252	40	496	146	374	1:3	33%
Sep	504	570	95	760	405	653	4:6	67%
Oct	614	960	50	990	80	990	3:5	60%
Nov	940	470	140	2350	470	1270	4:5	80%
Dec	423	460	20	800	140	690	3:6	50%
All Data	**327**	**115**	**2**	**2350**	**60**	**490**	**16:54**	**30%**

San Lorenzo River above Two Bar Creek (300)

Geometric Mean Objective (200 MPN/100 mL)

There are not enough water quality data at the San Lorenzo River above Two Bar Creek Station to calculate the geometric mean. The most recent data available is from 11/06/2000 – 1/12/2006. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 23 shows monthly fecal coliform concentrations for San Lorenzo River at Two Bar Creek station from 11/06/2000 – 1/12/2006. Mean concentrations exceed the water quality objective in July and November.

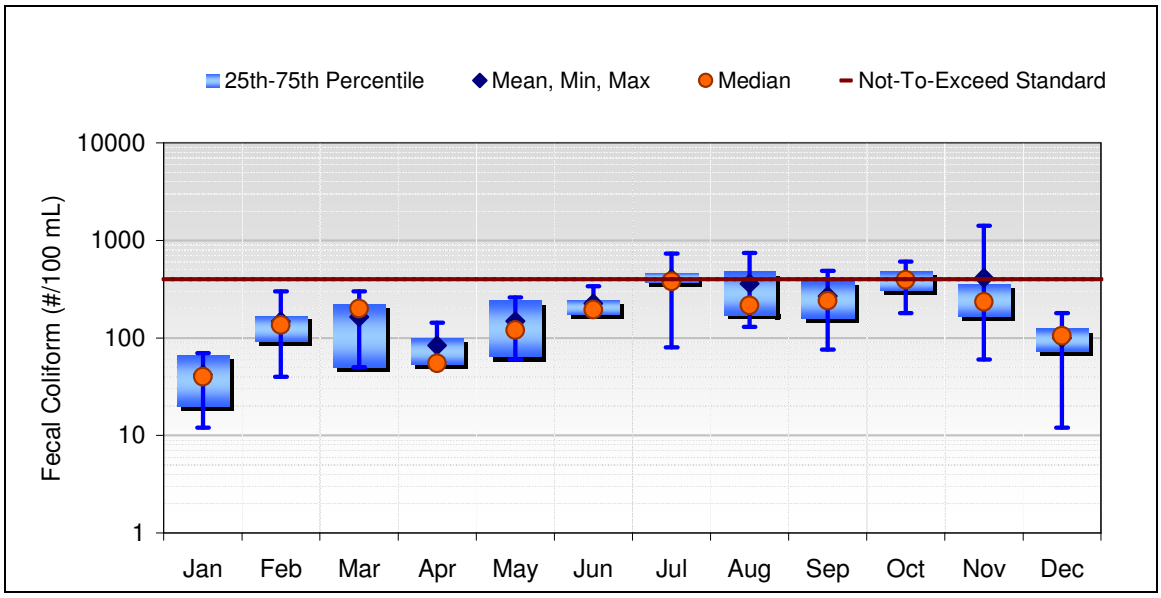

Figure 23. San Lorenzo River Fecal Coliform at Two Bar Creek (#/100 mL) and Water Contact Maximum Water Quality Objective (November 6, 2000 – January 12, 2006)

Table 23 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 14% of the time.

Table 23. San Lorenzo River at Two Bar Creek Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 11/6/2000 to 1/12/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	42	40	12	70	20	68	0:6	0%
Feb	148	136	40	300	92	170	0:5	0%
Mar	164	200	50	300	50	220	0:5	0%
Apr	84	55	52	144	54	100	0:3	0%
May	149	120	60	260	64	240	0:5	0%
Jun	226	196	172	340	175	246	0:4	0%
Jul	404	380	80	730	370	460	2:5	40%
Aug	362	216	130	740	173	478	1:3	33%
Sep	267	240	76	488	160	380	2:6	33%
Oct	395	395	180	610	308	483	2:4	50%
Nov	413	235	60	1410	165	358	1:6	17%
Dec	100	105	12	180	74	125	0:6	0%
All Data	**225**	**171**	**12**	**1410**	**70**	**298**	**8:58**	**14%**

Carbonera Creek at Branciforte Creek (0110)

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There are not enough water quality data at the Carbonera Creek station from 10/19/2000 to 06/15/2006 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

Figure 24 below shows monthly fecal coliform concentrations for Carbonera Creek at the Branciforte Creek confluence from 10/19/2000 to 06/15/2006. The means do not exceed the water quality objective. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months either had no sample or only one sample taken.

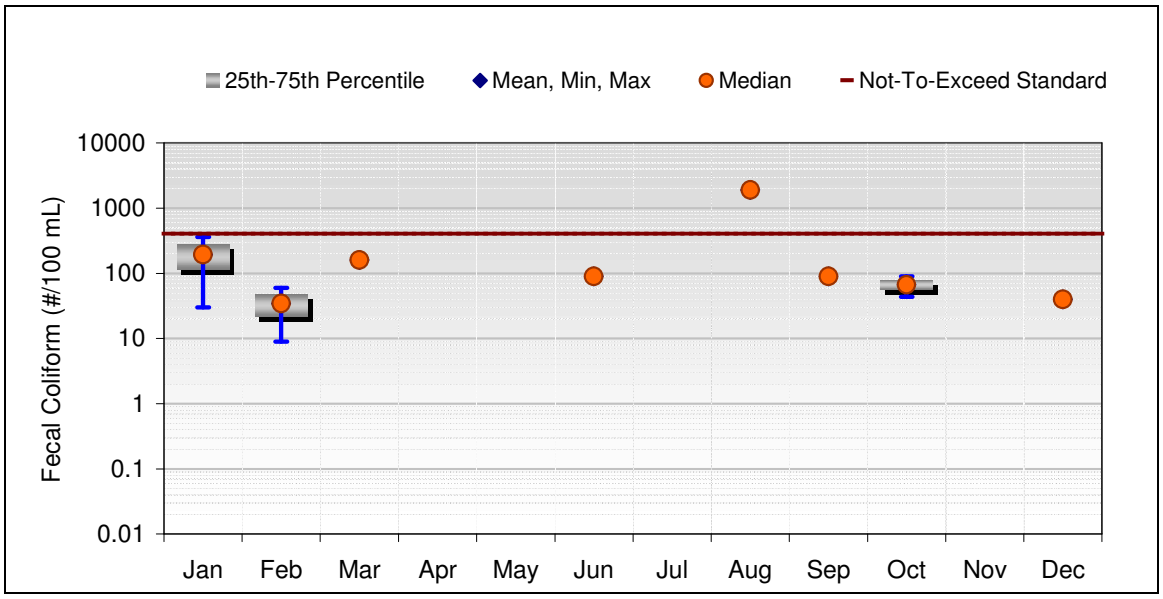

Figure 24. Carbonera Creek at Branciforte Creek Fecal Coliform (#/100 mL) and Water Contact Recreation Maximum Water Quality Objective (October 19, 2000 – February 26, 2002)

Table 24 below provides summary statistics of the above figure. Overall, the water quality objective was exceeded 9% of the time. There are not enough data to determine impairment conditions, because many months had either no sample or only one sample taken.

Table 24. Carbonera Creek Fecal Coliform at Branciforte Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 10/19/2000 to 6/15/2006)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	195	195	30	360	113	278	0:2	0%
Feb	35	35	9	60	22	47	0:2	0%
Mar	160	160	160	160	160	160	0:1	0%
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	90	90	90	90	90	90	0:1	0%
Jul	0	0	0	0	0	0	0:0	n/a
Aug	1900	1900	1900	1900	1900	1900	1:1	100%
Sep	90	90	90	90	90	90	0:1	0%
Oct	67	67	44	90	56	79	0:2	0%
Nov	0	0	0	0	0	0	0:0	n/a
Dec	40	40	40	40	40	40	0:1	0%
All Data	**261**	**90**	**9**	**1900**	**42**	**125**	**1:11**	**9%**

Carbonera Creek at Highway 17

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at the Carbonera Creek station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E. coli* Quality Criteria (235 MPN/100 mL)

Figure 25 below shows monthly *E. coli* concentrations for Carbonera Creek at Highway 17 from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to fully determine impairment conditions because many months had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

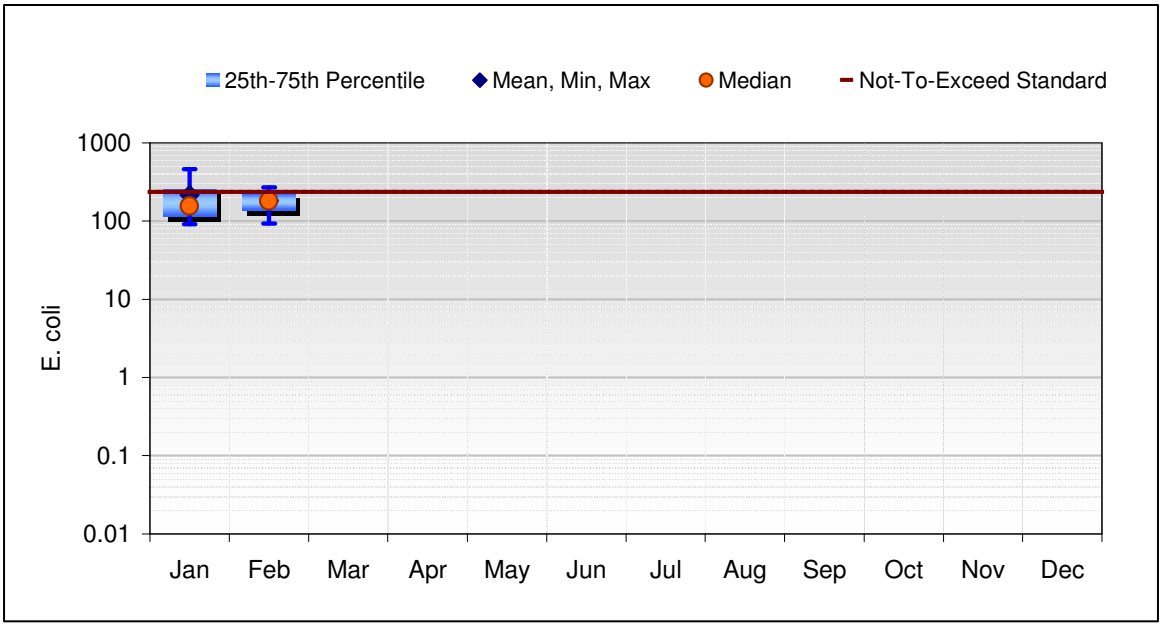

Figure 25. Carbonera Creek at Highway 17 (#/100 mL) and *E. coli* Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005)

Table 25 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 33% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January and February.

Table 25. Carbonera Creek *E. coli* at Highway 17 Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Criteria

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%

Jan	215	155	91	460	113	258	1:4	25%
Feb	182	182	93	270	137	226	1:2	50%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**204**	**155**	**91**	**460**	**100**	**250**	**2:6**	**33%**

Carbonera Creek above Camp Evers Creek

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at this station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E. coli* Quality Criteria (235 MPN/100 mL)

Figure 26 below shows monthly *E. coli* concentrations for Carbonera Creek above Camp Evers Creek from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

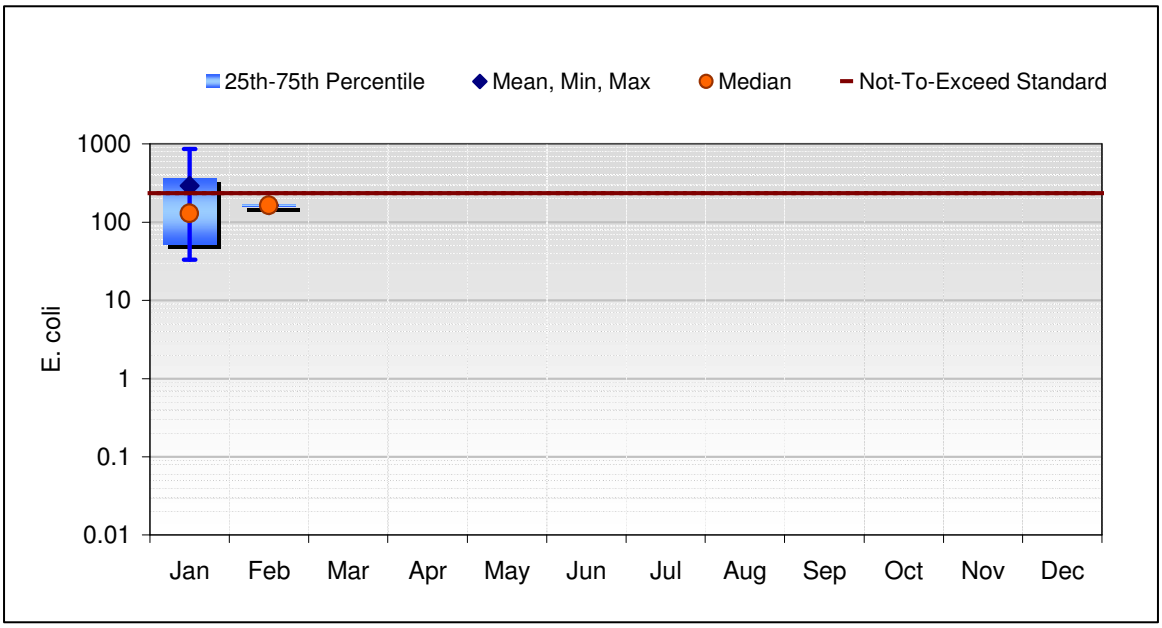

Figure 26. Carbonera Creek above Camp Evers Creek (#/100 mL) and *E. coli* Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005-February 17, 2005)

Table 26 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 17% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January.

Table 26. Carbonera Creek *E. coli* above Camp Evers Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Criteria

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	291	130	33	870	53	368	1:4	25%
Feb	165	165	150	180	158	173	0:2	0%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**249**	**165**	**33**	**870**	**82**	**195**	**1:6**	**17%**

Carbonera Creek at Disc Drive

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at this station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E. coli* Quality Criteria (235 MPN/100 mL)

Figure 27 below shows monthly *E. coli* concentrations for Carbonera Creek above Camp Evers Creek from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

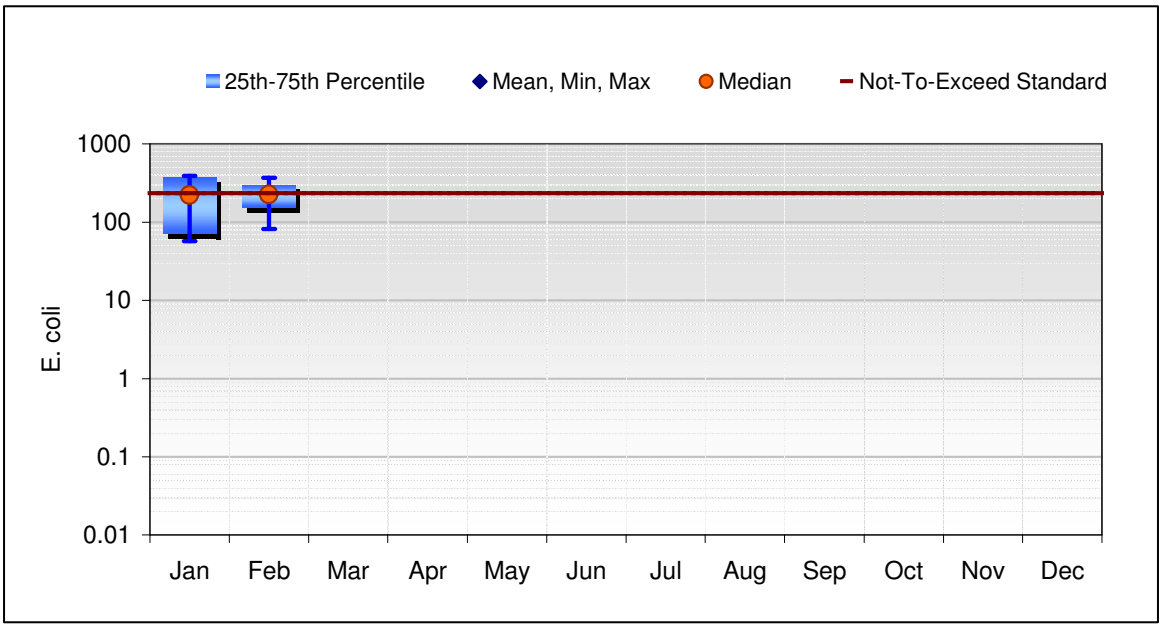

Figure 27. Carbonera Creek at Disc Drive (#/100 mL) and Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005)

Table 27 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 50% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January and February.

Table 27. Carbonera Creek *E. coli* at Disc Drive Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Criteria

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	223	223	57	390	71	375	2:4	50%
Feb	226	226	82	370	154	298	1:2	50%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**224**	**226**	**57**	**390**	**77**	**370**	**3:6**	**50%**

Camp Evers Creek at Carbonera Creek

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at this station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E. coli* Quality Criteria (235 MPN/100 mL)

Figure 28 below shows monthly *E. coli* concentrations for Carbonera Creek above Camp Evers Creek from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

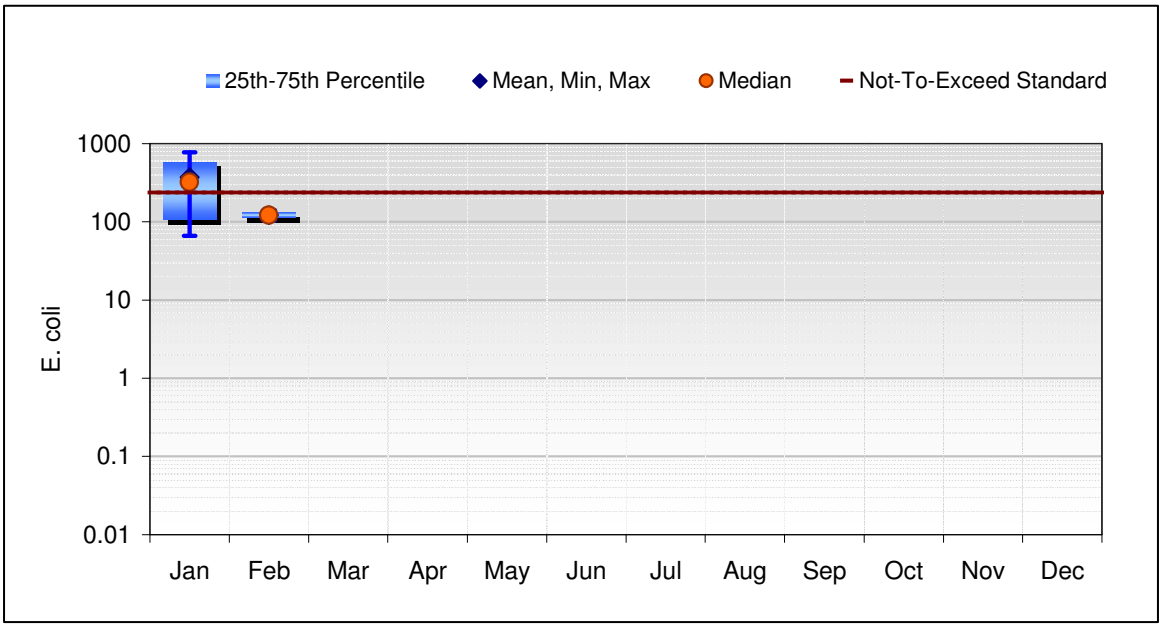

Figure 28. Camp Evers Creek at Carbonera Creek (#/100 mL) and Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005)

Table 28 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 33% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January.

Table 28. Camp Evers Creek at Carbonera Creek Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Objective

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	369	320	66	770	107	583	2:4	50%
Feb	122	122	104	140	113	131	0:2	0%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**287**	**130**	**66**	**770**	**108**	**425**	**2:6**	**33%**

Camp Evers Creek at Whispering Pines

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at this station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E. coli* Quality Criteria (235 MPN/100 mL)

Figure 29 below shows monthly *E. coli* concentrations for Carbonera Creek above Camp Evers Creek from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

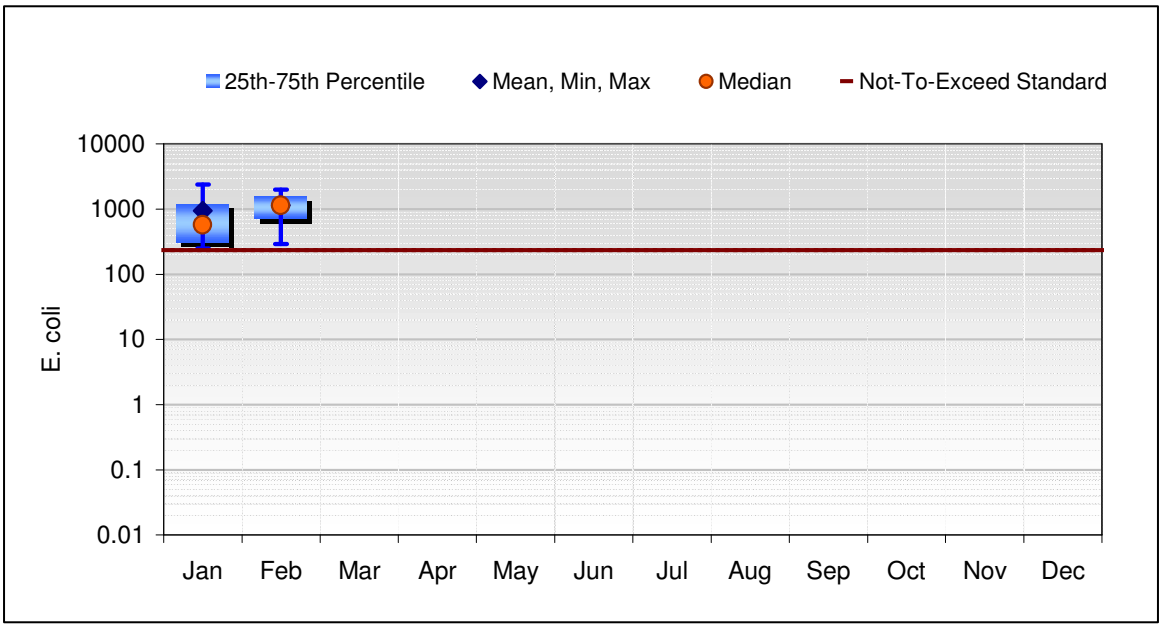

Figure 29. Camp Evers Creek at Whispering Pines (#/100 mL) and Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005

Table 29 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 100% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January and February.

Table 29. Camp Evers Creek at Whispering Pines Data Summary (#/100 mL) and Exceedance of Water Contact Recreation Maximum Criteria

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	950	575	250	2400	310	1215	4:4	100%
Feb	1145	1145	290	2000	718	1573	2:2	100%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**1015**	**575**	**250**	**2400**	**300**	**1705**	**6:6**	**100%**

Camp Evers Creek at Cold Stream Way

Geometric Mean *E. coli* Water Quality Criteria (126 MPN/100 mL)

There are not enough water quality data at this station from 1/6/2005 to 2/17/2005 to calculate the geometric mean. No months have the minimum of five samples needed to calculate geometric means.

Maximum Water *E .coli* Quality Criteria (235 MPN/100 mL)

Figure 30 below shows monthly *E. coli* concentrations for Carbonera Creek above Camp Evers Creek from 1/6/2005 to 2/17/2005. The mean concentrations do not exceed the water quality criteria. However, as shown in the figure below, there are not enough data to determine impairment conditions, because many months either had no samples. The month of January in 2005 had four samples and the month of February in 2005 had two samples.

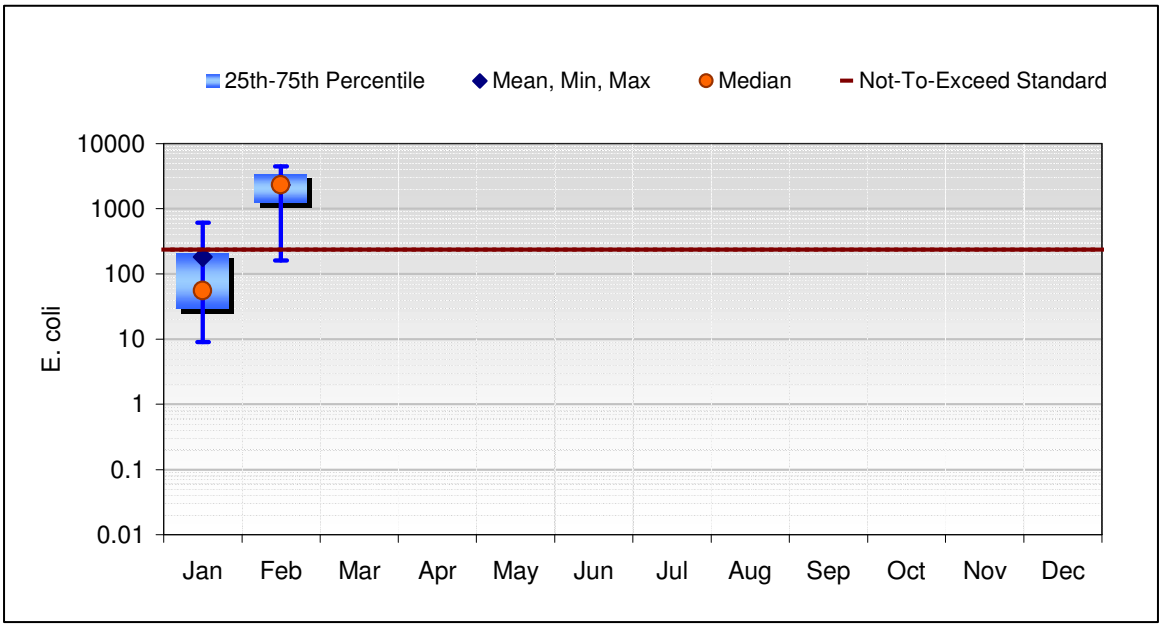

Figure 30. Camp Evers Creek at Cold Stream Way (#/100 mL) and Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005)

Table 30 below provides summary statistics of the above figure. Based on two months of sampling, the water quality criterion was exceeded 33% of the time. There are not enough data to determine impairment conditions for all months, but the impairment occurred in January and February.

Table 30. Camp Evers Creek at Cold Stream Way (#/100 mL) and Water Contact Recreation Maximum Water Quality Criteria (January 06, 2005- February 17, 2005)

Summary Statistics (Data: 1/6/2005 to 2/17/2005)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	183	56	9	610	29	209	1:4	25%
Feb	2330	2330	160	4500	1245	3415	1:2	50%
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	0	0	0	0	0	0	0:0	n/a
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**898**	**118**	**9**	**4500**	**46**	**498**	**2:6**	**33%**

APPENDIX C. MICROBIAL SOURCE TRACKING DATA

This appendix presents microbial source tracking data. The table headings are defined as follows:

Isolate number: A unique number that Dr. Samadpour gave to each isolate from the water samples the County of Santa Cruz submitted.

Provider number: This number identifies what water sample was analyzed on a given date. In other words, if the County of Santa Cruz took four water samples on a given date, this column tells the reader which water sample was analyzed.

Stantum: The sampling station number (A map of the sampling stations is provided in Figure 8.)

Note: The specific fecal coliform source.

Source: The category of the fecal coliform source

FeColi: Fecal coliform concentration per 100 mL of water

Log FC: The logged fecal coliform concentration per 100 mL of water

Rain 1: Rainfall within the previous 24-hour time period

Rain 3: Rainfall within the previous 72-hour time period

Rain 7: Rainfall within the previous 168-hour time period

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
65360	12802-003-1	003	avian	Bird	1/28/2002	70	1.845098	0	0.85	1.11
65361	12802-003-1	003	avian	Bird	1/28/2002	70	1.845098	0	0.85	1.11
65363	12802-003-2	003	avian	Bird	1/28/2002	60	1.7781513	0	0.85	1.11
65366	12802-003-3	003	avian	Bird	1/28/2002	110	2.0413927	0	0.85	1.11
65362	12802-003-2	003	dog	Dog	1/28/2002	60	1.7781513	0	0.85	1.11
65358	12802-003-1	003	human	Human	1/28/2002	70	1.845098	0	0.85	1.11
65364	12802-003-2	003	rodent	Rodent	1/28/2002	60	1.7781513	0	0.85	1.11
65365	12802-003-3	003	unknown	Unknown	1/28/2002	110	2.0413927	0	0.85	1.11
65359	12802-003-1	003	raccoon	Wildlife	1/28/2002	70	1.845098	0	0.85	1.11
65367	12802-003-3	003	deer	Wildlife	1/28/2002	110	2.0413927	0	0.85	1.11
65745	21202-003-4	003	human	Human	2/12/2002	40	1.60206	0	0	1.69
65746	21202-003-4	003	rodent	Rodent	2/12/2002	40	1.60206	0	0	1.69
65743	21202-003-1	003	unknown	Unknown	2/12/2002	20	1.30103	0	0	1.69
65744	21202-003-4	003	unknown	Unknown	2/12/2002	40	1.60206	0	0	1.69
66216	003-1	003	avian	Bird	3/25/2002	820	2.9138139	0	0.1	1.83
66219	003-2	003	septage/ ss/ human	Human	3/25/2002	700	2.845098	0	0.1	1.83
66220	003-3	003	human	Human	3/25/2002	770	2.8864907	0	0.1	1.83
66221	003-3	003	human	Human	3/25/2002	770	2.8864907	0	0.1	1.83
66222	003-3	003	human	Human	3/25/2002	770	2.8864907	0	0.1	1.83
66223	003-3	003	raw sewage	Human	3/25/2002	770	2.8864907	0	0.1	1.83
66224	003-4	003	human	Human	3/25/2002	610	2.7853298	0	0.1	1.83
66225	003-4	003	rodent	Rodent	3/25/2002	610	2.7853298	0	0.1	1.83
66214	003-1	003	unknown	Unknown	3/25/2002	820	2.9138139	0	0.1	1.83
66215	003-1	003	unknown	Unknown	3/25/2002	820	2.9138139	0	0.1	1.83
66217	003-2	003	unknown	Unknown	3/25/2002	700	2.845098	0	0.1	1.83

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
66218	003-2	003	unknown	Unknown	3/25/2002	700	2.845098	0	0.1	1.83
66226	003-4	003	beaver/ otter	Wildlife	3/25/2002	610	2.7853298	0	0.1	1.83
67331	003-1	003	Gull	Bird	5/21/2002	940	2.9731279	0	0.95	0.95
67335	003-3	003	avian	Bird	5/21/2002	710	2.8512583	0	0.95	0.95
67330	003-1	003	septage/ ss/ human	Human	5/21/2002	940	2.9731279	0	0.95	0.95
67332	003-1	003	raw sewage	Human	5/21/2002	940	2.9731279	0	0.95	0.95
67333	003-2	003	human	Human	5/21/2002	750	2.8750613	0	0.95	0.95
67334	003-2	003	human	Human	5/21/2002	750	2.8750613	0	0.95	0.95
67336	003-3	003	raw sewage	Human	5/21/2002	710	2.8512583	0	0.95	0.95
67337	003-3	003	unknown	Unknown	5/21/2002	710	2.8512583	0	0.95	0.95
71843	003-1	003	avian	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71845	003-1	003	avian	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71846	003-1	003	avian	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71847	003-1	003	Gull	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71849	003-1	003	avian	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71850	003-1	003	avian	Bird	12/10/2002	480	2.6812412	0.1	0.38	0.38
71852	003-2	003	Gull	Bird	12/10/2002	580	2.763428	0.1	0.38	0.38
71853	003-2	003	avian	Bird	12/10/2002	580	2.763428	0.1	0.38	0.38
71857	003-2	003	avian	Bird	12/10/2002	580	2.763428	0.1	0.38	0.38
71858	003-2	003	avian	Bird	12/10/2002	580	2.763428	0.1	0.38	0.38
71859	003-2	003	gull	Bird	12/10/2002	580	2.763428	0.1	0.38	0.38
71863	003-3	003	avian	Bird	12/10/2002	900	2.9542425	0.1	0.38	0.38
71865	003-3	003	avian	Bird	12/10/2002	900	2.9542425	0.1	0.38	0.38
71870	003-3	003	avian	Bird	12/10/2002	900	2.9542425	0.1	0.38	0.38
71872	003-3	003	Gull	Bird	12/10/2002	900	2.9542425	0.1	0.38	0.38
71851	003-1	003	horse	Horse	12/10/2002	480	2.6812412	0.1	0.38	0.38
71848	003-1	003	raw sewage	Human	12/10/2002	480	2.6812412	0.1	0.38	0.38
71854	003-2	003	human	Human	12/10/2002	580	2.763428	0.1	0.38	0.38
71855	003-2	003	human	Human	12/10/2002	580	2.763428	0.1	0.38	0.38
71856	003-2	003	human	Human	12/10/2002	580	2.763428	0.1	0.38	0.38
71864	003-3	003	human	Human	12/10/2002	900	2.9542425	0.1	0.38	0.38
71866	003-3	003	human	Human	12/10/2002	900	2.9542425	0.1	0.38	0.38
71867	003-3	003	human	Human	12/10/2002	900	2.9542425	0.1	0.38	0.38
71871	003-3	003	human	Human	12/10/2002	900	2.9542425	0.1	0.38	0.38
71842	003-1	003	unknown	Unknown	12/10/2002	480	2.6812412	0.1	0.38	0.38
71860	003-2	003	unknown	Unknown	12/10/2002	580	2.763428	0.1	0.38	0.38

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
71861	003-2	003	unknown	Unknown	12/10/2002	580	2.763428	0.1	0.38	0.38
71869	003-3	003	unknown	Unknown	12/10/2002	900	2.9542425	0.1	0.38	0.38
71844	003-1	003	otter	Wildlife	12/10/2002	480	2.6812412	0.1	0.38	0.38
71862	003-2	003	otter	Wildlife	12/10/2002	580	2.763428	0.1	0.38	0.38
72062	003-1	003	avian	Bird	12/18/2002	140	2.146128	0	0.58	14.28
72064	003-2	003	avian	Bird	12/18/2002	130	2.1139434	0	0.58	14.28
72066	003-2	003	Gull	Bird	12/18/2002	130	2.1139434	0	0.58	14.28
72068	003-2	003	Gull	Bird	12/18/2002	130	2.1139434	0	0.58	14.28
72070	003-3	003	avian	Bird	12/18/2002	270	2.4313638	0	0.58	14.28
72073	003-3	003	avian	Bird	12/18/2002	270	2.4313638	0	0.58	14.28
72069	003-3	003	dog	Dog	12/18/2002	270	2.4313638	0	0.58	14.28
72063	003-1	003	human	Human	12/18/2002	140	2.146128	0	0.58	14.28
72065	003-2	003	septage	Human	12/18/2002	130	2.1139434	0	0.58	14.28
72067	003-2	003	human	Human	12/18/2002	130	2.1139434	0	0.58	14.28
72071	003-3	003	human	Human	12/18/2002	270	2.4313638	0	0.58	14.28
72072	003-3	003	human	Human	12/18/2002	270	2.4313638	0	0.58	14.28
72058	003-1	003	unknown	Unknown	12/18/2002	140	2.146128	0	0.58	14.28
72059	003-1	003	unknown	Unknown	12/18/2002	140	2.146128	0	0.58	14.28
72060	003-1	003	unknown	Unknown	12/18/2002	140	2.146128	0	0.58	14.28
72061	003-1	003	unknown	Unknown	12/18/2002	140	2.146128	0	0.58	14.28
72402	003-1	003	avian	Bird	1/13/2003	360	2.5563025	0	0	1.8
72403	003-1	003	avian	Bird	1/13/2003	360	2.5563025	0	0	1.8
72406	003-2	003	avian	Bird	1/13/2003	300	2.4771213	0	0	1.8
72407	003-3	003	avian	Bird	1/13/2003	520	2.7160033	0	0	1.8
72408	003-3	003	avian	Bird	1/13/2003	520	2.7160033	0	0	1.8
72405	003-2	003	dog	Dog	1/13/2003	300	2.4771213	0	0	1.8
72409	003-3	003	dog	Dog	1/13/2003	520	2.7160033	0	0	1.8
72400	003-1	003	human	Human	1/13/2003	360	2.5563025	0	0	1.8
72401	003-1	003	human	Human	1/13/2003	360	2.5563025	0	0	1.8
72404	003-2	003	human	Human	1/13/2003	300	2.4771213	0	0	1.8
72738	003-1	003	avian	Bird	2/18/2003	140	2.146128	0	0	1.47
72739	003-1	003	Gull	Bird	2/18/2003	140	2.146128	0	0	1.47
72745	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47
72747	003-3	003	gull	Bird	2/18/2003	270	2.4313638	0	0	1.47
72749	003-3	003	gull	Bird	2/18/2003	270	2.4313638	0	0	1.47
72750	003-3	003	Gull	Bird	2/18/2003	270	2.4313638	0	0	1.47
72796	003-1	003	Gull	Bird	2/18/2003	140	2.146128	0	0	1.47
72797	003-1	003	avian	Bird	2/18/2003	140	2.146128	0	0	1.47
72800	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47
72801	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
72802	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47
72803	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47
72804	003-2	003	avian	Bird	2/18/2003	130	2.1139434	0	0	1.47
72805	003-3	003	avian	Bird	2/18/2003	270	2.4313638	0	0	1.47
72807	003-3	003	bovine	Cow	2/18/2003	270	2.4313638	0	0	1.47
72746	003-2	003	horse	Horse	2/18/2003	130	2.1139434	0	0	1.47
72740	003-1	003	septage	Human	2/18/2003	140	2.146128	0	0	1.47
72741	003-1	003	septage	Human	2/18/2003	140	2.146128	0	0	1.47
72744	003-2	003	human	Human	2/18/2003	130	2.1139434	0	0	1.47
72748	003-3	003	septage/ human	Human	2/18/2003	270	2.4313638	0	0	1.47
72798	003-1	003	human	Human	2/18/2003	140	2.146128	0	0	1.47
72799	003-1	003	human	Human	2/18/2003	140	2.146128	0	0	1.47
72803	003-2	003	human	Human	2/18/2003	130	2.1139434	0	0	1.47
72806	003-3	003	human	Human	2/18/2003	270	2.4313638	0	0	1.47
72808	003-3	003	human	Human	2/18/2003	270	2.4313638	0	0	1.47
72742	003-1	003	unknown	Unknown	2/18/2003	140	2.146128	0	0	1.47
72743	003-2	003	deer	Wildlife	2/18/2003	130	2.1139434	0	0	1.47
73154	003-1	003	gull	Bird	3/18/2003	1190	3.075547	0	0.39	2.08
73157	003-1	003	gull	Bird	3/18/2003	1190	3.075547	0	0.39	2.08
73159	003-2	003	gull	Bird	3/18/2003	1310	3.1172713	0	0.39	2.08
73161	003-2	003	Gull	Bird	3/18/2003	1310	3.1172713	0	0.39	2.08
73162	003-2	003	avian	Bird	3/18/2003	1310	3.1172713	0	0.39	2.08
73163	003-2	003	avian	Bird	3/18/2003	1310	3.1172713	0	0.39	2.08
73165	003-2	003	avian	Bird	3/18/2003	1310	3.1172713	0	0.39	2.08
73172	003-3	003	avian	Bird	3/18/2003	1130	3.0530784	0	0.39	2.08
73173	003-3	003	avian	Bird	3/18/2003	1130	3.0530784	0	0.39	2.08
73175	003-3	003	avian	Bird	3/18/2003	1130	3.0530784	0	0.39	2.08
73176	003-3	003	avian	Bird	3/18/2003	1130	3.0530784	0	0.39	2.08
73150	003-1	003	dog	Dog	3/18/2003	1190	3.075547	0	0.39	2.08
73164	003-2	003	dog	Dog	3/18/2003	1310	3.1172713	0	0.39	2.08
73168	003-2	003	canine	Dog	3/18/2003	1310	3.1172713	0	0.39	2.08
73174	003-3	003	canine	Dog	3/18/2003	1130	3.0530784	0	0.39	2.08
73151	003-1	003	septage	Human	3/18/2003	1190	3.075547	0	0.39	2.08
73152	003-1	003	septage	Human	3/18/2003	1190	3.075547	0	0.39	2.08
73166	003-2	003	septage	Human	3/18/2003	1310	3.1172713	0	0.39	2.08
73167	003-2	003	septage	Human	3/18/2003	1310	3.1172713	0	0.39	2.08
73169	003-3	003	human	Human	3/18/2003	1130	3.0530784	0	0.39	2.08
73178	003-3	003	human	Human	3/18/2003	1130	3.0530784	0	0.39	2.08
73155	003-1	003	rodent	Rodent	3/18/2003	1190	3.075547	0	0.39	2.08
73156	003-1	003	rodent	Rodent	3/18/2003	1190	3.075547	0	0.39	2.08
73160	003-2	003	rodent	Rodent	3/18/2003	1310	3.1172713	0	0.39	2.08
73153	003-1	003	unknown	Unknown	3/18/2003	1190	3.075547	0	0.39	2.08

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
73158	003-2	003	unknown	Unknown	3/18/2003	1310	3.1172713	0	0.39	2.08
73170	003-3	003	unknown	Unknown	3/18/2003	1130	3.0530784	0	0.39	2.08
73171	003-3	003	unknown	Unknown	3/18/2003	1130	3.0530784	0	0.39	2.08
73177	003-3	003	unknown	Unknown	3/18/2003	1130	3.0530784	0	0.39	2.08
85261	003 rep	003	avian	Bird	10/18/2003	700	2.845098		0	0
85262	003 rep	003	avian	Bird	10/18/2003	700	2.845098		0	0
85259	003	003	human	Human	10/18/2003	900	2.9542425		0	0
85257	003	003	rodent	Rodent	10/18/2003	900	2.9542425		0	0
85258	003	003	Unknown	Unknown	10/18/2003	900	2.9542425		0	0
85260	003 rep	003	Unknown	Unknown	10/18/2003	700	2.845098		0	0
84945	003-1	003	avian	Bird	10/21/2003	640	2.80618		0	0
84946	003-2	003	avian	Bird	10/21/2003	480	2.6812412		0	0
84947	003-2	003	gull	Bird	10/21/2003	480	2.6812412		0	0
84948	003-2	003	avian	Bird	10/21/2003	480	2.6812412		0	0
84943	003-1	003	raccoon	Wildlife	10/21/2003	640	2.80618		0	0
84944	003-1	003	raccoon	Wildlife	10/21/2003	640	2.80618		0	0
85578	003-1	003	avian	Bird	11/5/2003	260	2.4149733	0.39	0.39	1.2
85579	003-1	003	gull	Bird	11/5/2003	260	2.4149733	0.39	0.39	1.2
85583	003-2	003	avian	Bird	11/5/2003	100	2	0.39	0.39	1.2
85582	003-2	003	bov	Cow	11/5/2003	100	2	0.39	0.39	1.2
85577	003-1	003	canine	Dog	11/5/2003	260	2.4149733	0.39	0.39	1.2
85580	003-2	003	Unknown	Unknown	11/5/2003	100	2	0.39	0.39	1.2
85581	003-2	003	Unknown	Unknown	11/5/2003	100	2	0.39	0.39	1.2
86553	12-08-03-3B	003	gull	Bird	12/8/2003	740	2.8692317		1.31	1.64
86550	12-08-03-3A	003	rodent	Rodent	12/8/2003	820	2.9138139		1.31	1.64
86551	12-08-03-3A	003	rodent	Rodent	12/8/2003	820	2.9138139		1.31	1.64
86554	12-08-03-3B	003	rodent	Rodent	12/8/2003	740	2.8692317		1.31	1.64
86552	12-08-03-3B	003	Unknown	Unknown	12/8/2003	740	2.8692317		1.31	1.64
86549	12-08-03-3A	003	raccoon	Wildlife	12/8/2003	820	2.9138139		1.31	1.64
87450	003-2	003	gull	Bird	1/21/2004	20	1.30103		0	0
87452	003-3	003	avian	Bird	1/21/2004	30	1.4771213		0	0
87448	003-1	003	human	Human	1/21/2004	50	1.69897		0	0
87451	003-3	003	human	Human	1/21/2004	30	1.4771213		0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
87447	003-1	003	rodent	Rodent	1/21/2004	50	1.69897		0	0
87449	003-2	003	rodent	Rodent	1/21/2004	20	1.30103		0	0
87446	003-1	003	raccoon	Wildlife	1/21/2004	50	1.69897		0	0
90658	003-1	003	avian	Bird	3/23/2004	300	2.4771213		0	0
90659	003-2	003	gull	Bird	3/23/2004	240	2.3802112		0	0
90660	003-2	003	avian	Bird	3/23/2004	240	2.3802112		0	0
90662	003-3	003	avian	Bird	3/23/2004	160	2.20412		0	0
90663	003-3	003	gull	Bird	3/23/2004	160	2.20412		0	0
90656	003-1	003	bovine	Cow	3/23/2004	300	2.4771213		0	0
90661	003-2	003	rodent	Rodent	3/23/2004	240	2.3802112		0	0
90664	003-3	003	rodent	Rodent	3/23/2004	160	2.20412		0	0
90657	003-1	003	Unknown	Unknown	3/23/2004	300	2.4771213		0	0
93173	003-1	003	gull	Bird	5/18/2004	290	2.462398		0	0
93176	003-2	003	avian	Bird	5/18/2004	290	2.462398		0	0
93178	003-2	003	avian	Bird	5/18/2004	290	2.462398		0	0
93181	003-3	003	avian	Bird	5/18/2004	290	2.462398		0	0
93182	003-3	003	avian	Bird	5/18/2004	290	2.462398		0	0
93177	003-2	003	human	Human	5/18/2004	290	2.462398		0	0
93180	003-3	003	human	Human	5/18/2004	290	2.462398		0	0
93174	003-1	003	Unknown	Unknown	5/18/2004	290	2.462398		0	0
93179	003-3	003	Unknown	Unknown	5/18/2004	290	2.462398		0	0
93175	003-1	003	raccoon	Wildlife	5/18/2004	290	2.462398		0	0
95419	6-15-04-003-1	003	avian	Bird	6/15/2004	1380	3.1398791	0	0	0
95422	6-15-04-003-2	003	avian	Bird	6/15/2004	1280	3.10721	0	0	0
95424	6-15-04-003-3	003	avian	Bird	6/15/2004	1320	3.1205739	0	0	0
95425	6-15-04-003-3	003	gull	Bird	6/15/2004	1320	3.1205739	0	0	0
95426	6-15-04-003-3	003	avian	Bird	6/15/2004	1320	3.1205739	0	0	0
95507	6-16-04-003-1	003	gull	Bird	6/15/2004	620	2.7923917	0	0	0
95508	6-16-04-003-1	003	gull	Bird	6/15/2004	620	2.7923917	0	0	0
95510	6-16-04-003-2	003	avian	Bird	6/15/2004	660	2.8195439	0	0	0
95511	6-16-04-003-2	003	avian	Bird	6/15/2004	660	2.8195439	0	0	0
95513	6-16-04-003-3	003	avian	Bird	6/15/2004	640	2.80618	0	0	0
95417	6-15-04-003-1	003	dog	Dog	6/15/2004	1380	3.1398791	0	0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
95423	6-15-04-003-2	003	dog	Dog	6/15/2004	1280	3.10721	0	0	0
95506	6-16-04-003-1	003	horse	Horse	6/15/2004	620	2.7923917	0	0	0
95509	6-16-04-003-2	003	human	Human	6/15/2004	660	2.8195439	0	0	0
95418	6-15-04-003-1	003	rodent	Rodent	6/15/2004	1380	3.1398791	0	0	0
95512	6-16-04-003-3	003	rodent	Rodent	6/15/2004	640	2.80618	0	0	0
95514	6-16-04-003-3	003	Rodent	Rodent	6/15/2004	640	2.80618	0	0	0
95420	6-15-04-003-2	003	Unknown	Unknown	6/15/2004	1280	3.10721	0	0	0
95421	6-15-04-003-2	003	Unknown	Unknown	6/15/2004	1280	3.10721	0	0	0
95779	6-24-04-003-1	003	avian	Bird	6/24/2004	240	2.3802112	0	0	0
95782	6-24-04-003-1	003	gull	Bird	6/24/2004	240	2.3802112	0	0	0
95784	6-24-04-003-2	003	avian	Bird	6/24/2004	210	2.3222193	0	0	0
95787	6-24-04-003-3	003	gull	Bird	6/24/2004	220	2.3424227	0	0	0
95788	6-24-04-003-3	003	bovine	Cow	6/24/2004	220	2.3424227	0	0	0
95780	6-24-04-003-1	003	dog	Dog	6/24/2004	240	2.3802112	0	0	0
95781	6-24-04-003-1	003	dog	Dog	6/24/2004	240	2.3802112	0	0	0
95785	6-24-04-003-2	003	dog	Dog	6/24/2004	210	2.3222193	0	0	0
95783	6-24-04-003-2	003	rodent	Rodent	6/24/2004	210	2.3222193	0	0	0
95786	6-24-04-003-3	003	Unknown	Unknown	6/24/2004	220	2.3424227	0	0	0
97558	07-19-2004-003-1	003	avian	Bird	7/19/2004	350	2.544068	0	0	0
97559	07-19-2004-003-2	003	avian	Bird	7/19/2004	270	2.4313638	0	0	0
97564	07-19-2004-003-3	003	avian	Bird	7/19/2004	400	2.60206	0	0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
97563	07-19-2004-003-3	003	canine	Dog	7/19/2004	400	2.60206	0	0	0
97556	07-19-2004-003-1	003	human	Human	7/19/2004	350	2.544068	0	0	0
97557	07-19-2004-003-1	003	human	Human	7/19/2004	350	2.544068	0	0	0
97565	07-19-2004-003-3	003	human	Human	7/19/2004	400	2.60206	0	0	0
97560	07-19-2004-003-2	003	Unknown	Unknown	7/19/2004	270	2.4313638	0	0	0
97561	07-19-2004-003-2	003	Unknown	Unknown	7/19/2004	270	2.4313638	0	0	0
97562	07-19-2004-003-2	003	unknown	Unknown	7/19/2004	270	2.4313638	0	0	0
97650	07-20-2004-003-2	003	avian	Bird	7/20/2004	290	2.462398	0	0	0
97651	07-20-2004-003-2	003	avian	Bird	7/20/2004	290	2.462398	0	0	0
97654	07-20-2004-003-3	003	avian	Bird	7/20/2004	240	2.3802112	0	0	0
97646	07-20-2004-003-1	003	canine	Dog	7/20/2004	210	2.3222193	0	0	0
97647	07-20-2004-003-1	003	sewage	Human	7/20/2004	210	2.3222193	0	0	0
97649	07-20-2004-003-2	003	human	Human	7/20/2004	290	2.462398	0	0	0
97653	07-20-2004-003-3	003	rodent	Rodent	7/20/2004	240	2.3802112	0	0	0
97652	07-20-2004-003-3	003	Unknown	Unknown	7/20/2004	240	2.3802112	0	0	0
97648	07-20-2004-003-1	003	Raccoon	Wildlife	7/20/2004	210	2.3222193	0	0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
98751	8-02-04-003-1	003	avian	Bird	8/2/2004	160	2.20412	0	0	0
98753	8-02-04-003-1	003	avian	Bird	8/2/2004	160	2.20412	0	0	0
98754	8-02-04-003-2	003	gull	Bird	8/2/2004	190	2.2787536	0	0	0
98755	8-02-04-003-2	003	avian	Bird	8/2/2004	190	2.2787536	0	0	0
98756	8-02-04-003-2	003	avian	Bird	8/2/2004	190	2.2787536	0	0	0
98757	8-02-04-003-3	003	avian	Bird	8/2/2004	200	2.30103	0	0	0
98758	8-02-04-003-3	003	avian	Bird	8/2/2004	200	2.30103	0	0	0
98759	8-02-04-003-3	003	avian	Bird	8/2/2004	200	2.30103	0	0	0
98752	8-02-04-003-1	003	Raccoon	Wildlife	8/2/2004	160	2.20412	0	0	0
99407	8-04-04-003-1	003	avian	Bird	8/4/2004	170	2.2304489	0	0	0
99408	8-04-04-003-1	003	avian	Bird	8/4/2004	170	2.2304489	0	0	0
99409	8-04-04-003-1	003	gull	Bird	8/4/2004	170	2.2304489	0	0	0
99410	8-04-04-003-2	003	avian	Bird	8/4/2004	110	2.0413927	0	0	0
99411	8-04-04-003-2	003	gull	Bird	8/4/2004	110	2.0413927	0	0	0
99412	8-04-04-003-2	003	avian	Bird	8/4/2004	110	2.0413927	0	0	0
99414	8-04-04-003-3	003	avian	Bird	8/4/2004	60	1.7781513	0	0	0
99415	8-04-04-003-3	003	Unknown	Unknown	8/4/2004	60	1.7781513	0	0	0
99413	8-04-04-003-3	003	Raccoon	Wildlife	8/4/2004	60	1.7781513	0	0	0
99793	8-18-04-003-1	003	gull	Bird	8/18/2004	180	2.2552725	0	0	0
99794	8-18-04-003-1	003	gull	Bird	8/18/2004	180	2.2552725	0	0	0
99795	8-18-04-003-2	003	avian	Bird	8/18/2004	180	2.2552725	0	0	0
99797	8-18-04-003-2	003	gull	Bird	8/18/2004	180	2.2552725	0	0	0
99798	8-18-04-003-3	003	gull	Bird	8/18/2004	200	2.30103	0	0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
99799	8-18-04-003-3	003	avian	Bird	8/18/2004	200	2.30103	0	0	0
99800	8-18-04-003-3	003	gull	Bird	8/18/2004	200	2.30103	0	0	0
99801	8-18-04-003-3	003	gull	Bird	8/18/2004	200	2.30103	0	0	0
99792	8-18-04-003-1	003	canine	Dog	8/18/2004	180	2.2552725	0	0	0
99796	8-18-04-003-2	003	canine	Dog	8/18/2004	180	2.2552725	0	0	0
102503	003-2	003	avian	Bird	9/21/2004	160	2.20412	0	0.02	0.02
102505	003-3	003	gull	Bird	9/21/2004	188	2.2741578	0	0.02	0.02
102506	003-3	003	gull	Bird	9/21/2004	188	2.2741578	0	0.02	0.02
102507	003-3	003	avian	Bird	9/21/2004	188	2.2741578	0	0.02	0.02
102117	003-1	003	human	Human	9/21/2004	176	2.2455127	0	0.02	0.02
102504	003-2	003	Unknown	Unknown	9/21/2004	160	2.20412	0	0.02	0.02
102118	003-1	003	Raccoon	Wildlife	9/21/2004	176	2.2455127	0	0.02	0.02
102119	003-1	003	raccoon	Wildlife	9/21/2004	176	2.2455127	0	0.02	0.02
65368	12802-022-1	022	avian	Bird	1/28/2002	120	2.0791812	0	0.85	1.11
65371	12802-022-2	022	Gull	Bird	1/28/2002	120	2.0791812	0	0.85	1.11
65372	12802-022-2	022	Gull	Bird	1/28/2002	120	2.0791812	0	0.85	1.11
65373	12802-022-2	022	avian	Bird	1/28/2002	120	2.0791812	0	0.85	1.11
65376	12802-022-3	022	avian	Bird	1/28/2002	100	2	0	0.85	1.11
65370	12802-022-1	022	human	Human	1/28/2002	120	2.0791812	0	0.85	1.11
65374	12802-022-3	022	septage/ ss/ human	Human	1/28/2002	100	2	0	0.85	1.11
65375	12802-022-3	022	septage/ ss/ human	Human	1/28/2002	100	2	0	0.85	1.11
65369	12802-022-1	022	unknown	Unknown	1/28/2002	120	2.0791812	0	0.85	1.11
65751	21202-022-2	022	duck	Bird	2/12/2002	24	1.3802112	0	0	1.69

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
65752	21202-022-3	022	avian	Bird	2/12/2002	12	1.0791812	0	0	1.69
65747	21202-022-1	022	feline	Cat	2/12/2002	16	1.20412	0	0	1.69
65749	21202-022-2	022	Bovine	Cow	2/12/2002	24	1.3802112	0	0	1.69
65750	21202-022-2	022	swine	Unknown	2/12/2002	24	1.3802112	0	0	1.69
65748	21202-022-1	022	beaver/ otter	Wildlife	2/12/2002	16	1.20412	0	0	1.69
66232	022-3	022	avian	Bird	3/25/2002	72	1.8573325	0	0.1	1.83
66230	022-3	022	dog	Dog	3/25/2002	72	1.8573325	0	0.1	1.83
66234	022-4	022	dog	Dog	3/25/2002	56	1.748188	0	0.1	1.83
66227	022-1	022	human	Human	3/25/2002	76	1.8808136	0	0.1	1.83
66228	022-1	022	raw sewage	Human	3/25/2002	76	1.8808136	0	0.1	1.83
66229	022-1	022	raw sewage	Human	3/25/2002	76	1.8808136	0	0.1	1.83
66233	022-4	022	rodent	Rodent	3/25/2002	56	1.748188	0	0.1	1.83
66235	022-4	022	rodent	Rodent	3/25/2002	56	1.748188	0	0.1	1.83
66546	022-2	022	rodent	Rodent	3/25/2002	52	1.7160033	0	0.1	1.83
66547	022-2	022	rodent	Rodent	3/25/2002	52	1.7160033	0	0.1	1.83
66231	022-3	022	otter	Wildlife	3/25/2002	72	1.8573325	0	0.1	1.83
67343	022-2	022	avian	Bird	5/21/2002	300	2.4771213	0	0.95	0.95
67345	022-3	022	avian	Bird	5/21/2002	190	2.2787536	0	0.95	0.95
67338	022-1	022	raw sewage	Human	5/21/2002	320	2.50515	0	0.95	0.95
67339	022-1	022	rodent	Rodent	5/21/2002	320	2.50515	0	0.95	0.95
67340	022-1	022	unknown	Unknown	5/21/2002	320	2.50515	0	0.95	0.95
67341	022-1	022	unknown	Unknown	5/21/2002	320	2.50515	0	0.95	0.95
67344	022-3	022	unknown	Unknown	5/21/2002	190	2.2787536	0	0.95	0.95
67342	022-2	022	otter	Wildlife	5/21/2002	300	2.4771213	0	0.95	0.95
71834	022-1	022	avian	Bird	12/10/2002	320	2.50515	0.1	0.38	0.38
71835	022-1	022	avian	Bird	12/10/2002	320	2.50515	0.1	0.38	0.38
71839	022-3	022	avian	Bird	12/10/2002	190	2.2787536	0.1	0.38	0.38
71840	022-3	022	Bovine	Cow	12/10/2002	190	2.2787536	0.1	0.38	0.38
71841	022-3	022	Bovine	Cow	12/10/2002	190	2.2787536	0.1	0.38	0.38
71836	022-1	022	human	Human	12/10/2002	320	2.50515	0.1	0.38	0.38
71837	022-3	022	otter	Wildlife	12/10/2002	190	2.2787536	0.1	0.38	0.38
72087	022-3	022	avian	Bird	12/18/2002	88	1.9444827	0	0.58	14.28
72088	022-3	022	bovine	Cow	12/18/2002	88	1.9444827	0	0.58	14.28
72078	022-1	022	human	Human	12/18/2002	76	1.8808136	0	0.58	14.28
72083	022-2	022	raw sewage	Human	12/18/2002	68	1.8325089	0	0.58	14.28

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
72084	022-2	022	human	Human	12/18/2002	68	1.8325089	0	0.58	14.28
72074	022-1	022	unknown	Unknown	12/18/2002	76	1.8808136	0	0.58	14.28
72075	022-1	022	unknown	Unknown	12/18/2002	76	1.8808136	0	0.58	14.28
72076	022-1	022	unknown	Unknown	12/18/2002	76	1.8808136	0	0.58	14.28
72077	022-1	022	unknown	Unknown	12/18/2002	76	1.8808136	0	0.58	14.28
72079	022-2	022	unknown	Unknown	12/18/2002	68	1.8325089	0	0.58	14.28
72080	022-2	022	unknown	Unknown	12/18/2002	68	1.8325089	0	0.58	14.28
72081	022-2	022	unknown	Unknown	12/18/2002	68	1.8325089	0	0.58	14.28
72082	022-2	022	unknown	Unknown	12/18/2002	68	1.8325089	0	0.58	14.28
72085	022-3	022	unknown	Unknown	12/18/2002	88	1.9444827	0	0.58	14.28
72086	022-3	022	unknown	Unknown	12/18/2002	88	1.9444827	0	0.58	14.28
72089	022-3	022	Unknown	Unknown	12/18/2002	88	1.9444827	0	0.58	14.28
72414	022-2	022	avian	Bird	1/13/2003	112	2.049218	0	0	1.8
72416	022-3	022	avian	Bird	1/13/2003	144	2.1583625	0	0	1.8
72417	022-3	022	avian	Bird	1/13/2003	144	2.1583625	0	0	1.8
72411	022-1	022	canine	Dog	1/13/2003	136	2.1335389	0	0	1.8
72415	022-2	022	horse	Horse	1/13/2003	112	2.049218	0	0	1.8
72410	022-1	022	human	Human	1/13/2003	136	2.1335389	0	0	1.8
72412	022-1	022	septage/ human	Human	1/13/2003	136	2.1335389	0	0	1.8
72413	022-2	022	human	Human	1/13/2003	112	2.049218	0	0	1.8
72418	022-3	022	unknown	Unknown	1/13/2003	144	2.1583625	0	0	1.8
72728	022-1	022	avian	Bird	2/18/2003	76	1.8808136	0	0	1.47
72730	022-2	022	avian	Bird	2/18/2003	68	1.8325089	0	0	1.47
72733	022-2	022	avian	Bird	2/18/2003	68	1.8325089	0	0	1.47
72737	022-3	022	avian	Bird	2/18/2003	88	1.9444827	0	0	1.47
72784	022-1	022	avian	Bird	2/18/2003	76	1.8808136	0	0	1.47
72785	022-1	022	avian	Bird	2/18/2003	76	1.8808136	0	0	1.47
72786	022-1	022	avian	Bird	2/18/2003	76	1.8808136	0	0	1.47
72787	022-1	022	avian	Bird	2/18/2003	76	1.8808136	0	0	1.47
72791	022-2	022	avian	Bird	2/18/2003	68	1.8325089	0	0	1.47
72792	022-3	022	avian	Bird	2/18/2003	88	1.9444827	0	0	1.47
72795	022-3	022	avian	Bird	2/18/2003	88	1.9444827	0	0	1.47
72727	022-1	022	Bovine	Cow	2/18/2003	76	1.8808136	0	0	1.47
72794	022-3	022	bovine	Cow	2/18/2003	88	1.9444827	0	0	1.47

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
72729	022-1	022	dog	Dog	2/18/2003	76	1.8808136	0	0	1.47
72731	022-2	022	human	Human	2/18/2003	68	1.8325089	0	0	1.47
72732	022-2	022	septage/ human	Human	2/18/2003	68	1.8325089	0	0	1.47
72734	022-3	022	raw sewage	Human	2/18/2003	88	1.9444827	0	0	1.47
72788	022-2	022	raw sewage	Human	2/18/2003	68	1.8325089	0	0	1.47
72789	022-2	022	raw sewage	Human	2/18/2003	68	1.8325089	0	0	1.47
72790	022-2	022	septage/ human	Human	2/18/2003	68	1.8325089	0	0	1.47
72793	022-3	022	human	Human	2/18/2003	88	1.9444827	0	0	1.47
72735	022-3	022	rodent	Rodent	2/18/2003	88	1.9444827	0	0	1.47
72736	022-3	022	rodent	Rodent	2/18/2003	88	1.9444827	0	0	1.47
73184	022-1	022	avian	Bird	3/18/2003	60	1.7781513	0	0.39	2.08
73189	022-2	022	avian	Bird	3/18/2003	70	1.845098	0	0.39	2.08
73192	022-2	022	avian	Bird	3/18/2003	70	1.845098	0	0.39	2.08
73193	022-2	022	avian	Bird	3/18/2003	70	1.845098	0	0.39	2.08
73180	022-1	022	dog	Dog	3/18/2003	60	1.7781513	0	0.39	2.08
73181	022-1	022	dog	Dog	3/18/2003	60	1.7781513	0	0.39	2.08
73185	022-1	022	dog	Dog	3/18/2003	60	1.7781513	0	0.39	2.08
73179	022-1	022	septage/ human	Human	3/18/2003	60	1.7781513	0	0.39	2.08
73188	022-2	022	human	Human	3/18/2003	70	1.845098	0	0.39	2.08
73199	022-3	022	human	Human	3/18/2003	50	1.69897	0	0.39	2.08
73186	022-1	022	rodent	Rodent	3/18/2003	60	1.7781513	0	0.39	2.08
73187	022-1	022	rodent	Rodent	3/18/2003	60	1.7781513	0	0.39	2.08
73195	022-3	022	rodent	Rodent	3/18/2003	50	1.69897	0	0.39	2.08
73183	022-1	022	unknown	Unknown	3/18/2003	60	1.7781513	0	0.39	2.08
73191	022-2	022	unknown	Unknown	3/18/2003	70	1.845098	0	0.39	2.08
73182	022-1	022	raccoon	Wildlife	3/18/2003	60	1.7781513	0	0.39	2.08
73190	022-2	022	otter	Wildlife	3/18/2003	70	1.845098	0	0.39	2.08
73194	022-2	022	otter	Wildlife	3/18/2003	70	1.845098	0	0.39	2.08
73196	022-3	022	otter	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
73197	022-3	022	otter	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
73198	022-3	022	raccoon	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
73200	022-3	022	deer	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
73201	022-3	022	otter	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
73202	022-3	022	otter	Wildlife	3/18/2003	50	1.69897	0	0.39	2.08
85264	022	022	avian	Bird	10/18/2003	72	1.8573325		0	0
85266	022 rep	022	avian	Bird	10/18/2003	92	1.9637878		0	0
85267	022 rep	022	avian	Bird	10/18/2003	92	1.9637878		0	0
85265	022 rep	022	canine	Dog	10/18/2003	92	1.9637878		0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
85263	022	022	horse	Horse	10/18/2003	72	1.8573325		0	0
84949	022-1	022	avian	Bird	10/21/2003	10	1		0	0
84954	022-2	022	avian	Bird	10/21/2003	60	1.7781513		0	0
84950	022-1	022	canine	Dog	10/21/2003	10	1		0	0
84953	022-2	022	canine	Dog	10/21/2003	60	1.7781513		0	0
84951	022-2	022	rodent	Rodent	10/21/2003	60	1.7781513		0	0
84952	022-2	022	rodent	Rodent	10/21/2003	60	1.7781513		0	0
85585	022-1	022	avian	Bird	11/5/2003	60	1.7781513	0.39	0.39	1.2
85586	022-1	022	avian	Bird	11/5/2003	60	1.7781513	0.39	0.39	1.2
85588	022-2	022	avian	Bird	11/5/2003	60	1.7781513	0.39	0.39	1.2
85589	022-2	022	human	Human	11/5/2003	60	1.7781513	0.39	0.39	1.2
85584	022-1	022	rodent	Rodent	11/5/2003	60	1.7781513	0.39	0.39	1.2
85587	022-2	022	rodent	Rodent	11/5/2003	60	1.7781513	0.39	0.39	1.2
86555	12-08-03-22A	022	avian	Bird	12/8/2003	150	2.1760913		1.31	1.64
86556	12-08-03-22A	022	gull	Bird	12/8/2003	150	2.1760913		1.31	1.64
86558	12-08-03-22B	022	avian	Bird	12/8/2003	200	2.30103		1.31	1.64
86557	12-08-03-22A	022	sewage	Human	12/8/2003	150	2.1760913		1.31	1.64
86559	12-08-03-22B	022	sewage	Human	12/8/2003	200	2.30103		1.31	1.64
86560	12-08-03-22B	022	raccoon	Wildlife	12/8/2003	200	2.30103		1.31	1.64
97655	07-20-2004-022-1	022	avian	Bird	7/20/2004	44	1.6434527	0	0	0
97656	07-20-2004-022-1	022	avian	Bird	7/20/2004	44	1.6434527	0	0	0
97660	07-20-2004-022-2	022	avian	Bird	7/20/2004	64	1.80618	0	0	0
97661	07-20-2004-022-2	022	avian	Bird	7/20/2004	64	1.80618	0	0	0
97662	07-20-2004-022-3	022	avian	Bird	7/20/2004	64	1.80618	0	0	0
97664	07-20-2004-022-3	022	avian	Bird	7/20/2004	64	1.80618	0	0	0
97658	07-20-2004-022-2	022	Rodent	Rodent	7/20/2004	64	1.80618	0	0	0

Isolate.	Provider Sample	Stantum	Note	Source	Sample Date	Fe. Coli	Log FC	RAIN-1	RAIN-3	RAIN-7
97659	07-20-2004-022-2	022	rodent	Rodent	7/20/2004	64	1.80618	0	0	0
97657	07-20-2004-022-1	022	Unknown	Unknown	7/20/2004	44	1.6434527	0	0	0
97663	07-20-2004-022-3	022	Unknown	Unknown	7/20/2004	64	1.80618	0	0	0
99416	8-04-04-022-1	022	avian	Bird	8/4/2004	72	1.8573325	0	0	0
99417	8-04-04-022-1	022	avian	Bird	8/4/2004	72	1.8573325	0	0	0
99418	8-04-04-022-1	022	avian	Bird	8/4/2004	72	1.8573325	0	0	0
99421	8-04-04-022-2	022	avian	Bird	8/4/2004	68	1.8325089	0	0	0
99422	8-04-04-022-2	022	avian	Bird	8/4/2004	68	1.8325089	0	0	0
99423	8-04-04-022-3	022	avian	Bird	8/4/2004	80	1.90309	0	0	0
99424	8-04-04-022-3	022	avian	Bird	8/4/2004	80	1.90309	0	0	0
99419	8-04-04-022-2	022	Unknown	Unknown	8/4/2004	68	1.8325089	0	0	0
99420	8-04-04-022-2	022	Raccoon	Wildlife	8/4/2004	68	1.8325089	0	0	0
99425	8-04-04-022-3	022	Raccoon	Wildlife	8/4/2004	80	1.90309	0	0	0

DRAFT

USE ATTAINABILITY ANALYSIS FOR SAN LORENZO RIVER ESTUARY IN SANTA CRUZ COUNTY, CALIFORNIA

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March 17, 2006

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Appendices

List of Acronyms and Abbreviations

This document contains numerous acronyms and abbreviations. In general, an abbreviation will be given in parentheses ( ) following the first time a title or term is used, and the abbreviation will be used in almost all cases in place of that term later. The following alphabetical list of abbreviations used in this document is provided for the convenience of the reader:

CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
City	City of Santa Cruz
County	County of Santa Cruz
CWA	Clean Water Act
CWC	California Water Code
DHS	California Department of Health Services
E. coli	*Escherichia coli* bacteria
Estuary	San Lorenzo River Estuary
FDA	United States Department of Health and Human Services Food and Drug Administration
MF	Membrane Filter
MPN	Most Probable Number
NMFs	National Marine Fisheries
NOAA	National Oceanic and Atmospheric Administration
REC-1	Water Contact Recreation
REC-2	Non-contact Water Recreation
River	San Lorenzo River
SHELL	Referring to the beneficial use of shellfishing
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
Water Board	Central Coast Water Board
WDR	Waste Discharge Requirements
WQO	Water Quality Objective
WWTP	Waste Water Treatment Plant

1. Introduction

Section 303(c) of the Clean Water Act (CWA) requires each State to develop water quality standards that protect the chemical, physical, and biological integrity of the State's waterbodies. Water quality standards under the Clean Water Act consist of three elements: Use Classification, Water Quality Criteria, and Antidegradation Policy (CWA § 303(c)(2); 40 C.F.R §§ 130.3, 131.6, 131.10, 131.11). Use Classification, termed "beneficial uses" under California law, are "uses specified in water quality standards for each water body or segment whether or not they are being attained." (40 C.F.R § 131.3(f)). Beneficial uses must be consistent with the goal of CWA section 101(a)(2)[1], which is to provide for "the protection and propagation of fish, shellfish, and wildlife and ... recreation in and on the water" (the so-called "fishable/swimmable" uses), unless the state demonstrates that those uses are not attainable. Beneficial uses must also consider, among others, the use and value of water for public water supplies, agriculture and industry, and the water quality standards of downstream waters (40 C.F.R. § 131.10).

Beneficial uses for surface waters in the Central Coast Region of California are designated in The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Coast Region, 1994. The Basin Plan lists the beneficial uses for approximately 1,000 water bodies under their jurisdiction.

San Lorenzo River Estuary is located within the City of Santa Cruz. Beneficial uses for this waterbody include: Contact and Non-contact Recreation (REC-1 and REC-2), Wildlife Habitat (WILD), Cold Freshwater Habitat (COLD), Migration of Aquatic Organisms (MIGR), Spawning, Reproduction, and/or Early Development (SPWN), Preservation of Biological Habitats of Special Significance (BIOL), Rare, Threatened, or Endangered Species (RARE), Estuarine Habitat (EST), Commercial and Sport Fishing (COMM), and Shellfish Harvesting (SHELL).

Recently, while reviewing bacteria water quality objectives related to Total Maximum Daily Loads (TMDLs), Central Coast Water Board (Water Board) staff questioned the validity of assigning the SHELL beneficial use to an area where it is highly unlikely that any shellfish are living. The San Lorenzo River Estuary has never been thoroughly examined to determine if the SHELL beneficial use is appropriate to this waterbody. The definition of this beneficial use is:

> *Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial or sport purposes. This includes waters that have in the past, or may in the future, contain significant shellfisheries.*

[1] Hereto referred to as the fishable/swimmable use.

Preliminary assessments indicate that the beneficial use of shellfishing may not be appropriate. Beneficial uses attained on or after November 28, 1975 are "existing uses" and indicate that there is evidence that the use is occurring or that water quality is sufficient to allow the use to occur. A beneficial use that is determined to be "existing" may not be removed. To remove a use that is not intended to satisfy the minimum of "fishable/swimmable," it must be demonstrated that the use is not attainable through one of the factors listed in 40 CFR 131.10(g). To remove "fishable/swimmable" uses, a use attainability analysis (UAA), supported by at least one of the factors listed in 40 CFR 131.10(g), must be conducted. (U.S. EPA Water Quality Standards Handbook, pp. [2-6]-[2-8].)

Staff believes the 1976 listing of a shellfish beneficial use for San Lorenzo River Estuary was in error. In the 1975 Basin Plan, San Lorenzo River Estuary did not have shellfishing listed as a beneficial use. In 1976, the Estuary was listed as having shellfishing as a beneficial use, with no supporting documentation or rationale. Shanta Keeling, author of this report, questioned other staff at the Water Board as to why this change was made. Water Board staffs' recollection was that in 1976, several waterbodies in the region were given a SHELL beneficial use, without supporting documentation, for what appeared to be administrative reasons. **Although legally a UAA must be performed in order to remove the beneficial use of shellfishing from the San Lorenzo River Estuary, staff wants to emphasize that the initial listing of this waterbody for SHELL did not appear to be scientifically based[2].**

The purpose of this UAA is to provide an assessment of the beneficial use of shellfishing for San Lorenzo River Estuary that would serve as the basis for amending the Basin Plan to remove the beneficial use of shellfish for this waterbody. Such a determination must coordinate with the pathogen Total Maximum Daily Load (TMDL) for this waterbody so the TMDL sets the proper level of water quality protection.

[2] See section 4.6 for additional information on this subject.

2. Characterization of the Segments and Watershed

The San Lorenzo River Estuary is located in Santa Cruz County, California (see Figure 1).

In general, the lagoon systems along the Central California coastline typically develop a sandbar at the ocean interface in the spring or summer months, due to decreased summer and fall fresh water flows and increased tidal delivery of sand to the beach environment (Swanson, 2003).

Figure 1: Map of Santa Cruz area (Swanson Hydrology)

The following watershed characterization is from a State Water Resources Control Board draft staff report (SWRCB, 1982, pp. 12):

"The San Lorenzo River drains an area of 138 square miles in northern Santa Cruz County. The river flows southward to empty into Monterey Bay at the City of Santa Cruz (Figure 2 and Figure 3). Much of the watershed is rugged and forested as is typical of the Coast Range south of San Francisco.

"The climate of the watershed is affected by its proximity to the Pacific Ocean. Winters are cool and wet with an average annual rainfall of about 47 inches, ranging from about 30 inches in the City of Santa Cruz to 60 inches at the community of Boulder Creek. Summers are warm and dry although cooled at times by morning fog at the lower elevations. Eighty-two percent of the rainfall occurs in the period December through April."

The following is a characterization from Swanson Hydrology & Geomorphology's Biogeochemical Function of the San Lorenzo River Lagoon (2003):

"Hydrologic alterations have restricted the summer lagoon habitat in coastal streams such as the San Lorenzo River, resulting in relatively rapid increases in groundwater elevations and the inundation of an unvegetated beach environment. Therefore, the San Lorenzo River Lagoon rarely remains closed for a sustained period of time [anywhere between a couple days and a 3-4 weeks], either due to natural exceedance of the water storage area in the Lagoon or unauthorized breachings of the sandbar (pp. 2).

"The physical distribution of water within the San Lorenzo Lagoon has a direct impact on the amount and the quality of the available aquatic habitat. When the mouth of the lagoon is breached, the water depth and areas of inundation are controlled by the tidal elevations, as shown by the diurnal variations in water depth recorded during the early 2002 season. Following closure (the development of the sand bar at the mouth), the lower stream channel gradually continues to inundate upstream locations as the water surface elevation increases and water backs up behind the sandbar (pp. 9)."

For the purposes of this report, San Lorenzo River Estuary will be defined as the San Lorenzo River mouth's outlet at the ocean, inland to the Water Street Bridge. When a sand bar closes the Estuary outlet to the ocean, estuarine water levels can rise up to Water Street. Staff analysis of conductivity data is shown in Appendix D.

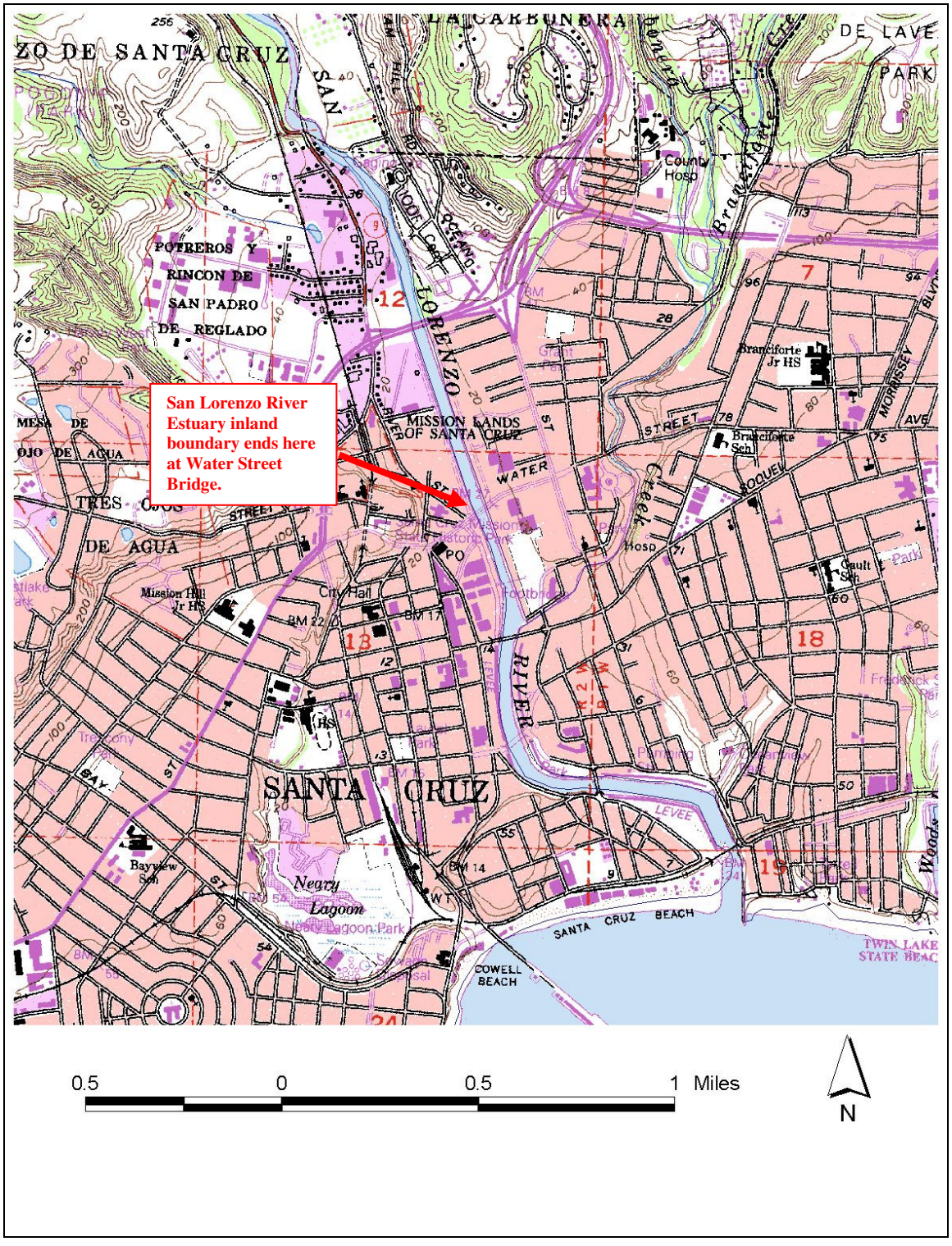

Figure 2: Map of San Lorenzo River Estuary

Figure 3: Photos of San Lorenzo River Estuary (Swanson Hydrology)

3. Methodology

A use attainability analysis (UAA) is a structured scientific assessment of the physical, chemical, biological, and economic factors affecting the attainment of a designated use (40 CFR 131.3). The purpose of a UAA is to provide information in order to decide whether a designated use is attainable or not.

Staff used the following methodology for this UAA: Staff analyzed existing water quality data, conducted reconnaissance work in the area, contacted persons with knowledge of the area and performed a literature review on the lifecycle and habitat requirements of shellfish. These methods allowed staff to compare information gathered to the six factors that may provide a legal basis for changing or removing a designated use (40 CFR 131.10(g)). These factors are:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use.

(2) Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.

(3) Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.

(4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use.

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unless these conditions may be compensated, unrelated to water quality preclude attainment of aquatic life protection uses.

(6) Controls more stringent than those required by Sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.

To remove a designated use that is not an existing use, the state must demonstrate that attaining the designated use is not feasible under one or more of the six conditions listed above. If a state wishes to remove any fishable/swimmable uses, it must perform a UAA (40 C.F.R. § 131.10(j)). Prior to removing a use, the state also must provide notice and an opportunity for a public hearing (40 C.F.R § 131.10(e)).

The determination of whether or not a use is "existing" must include an evaluation of both the actual occurrence of the use activity (e.g., have shellfish been present?) and whether or not the level of water quality necessary to support the use has been achieved at any time since November 28, 1975. If the level of water quality necessary to support a use has been achieved within that time period, the use is considered "existing" and must be protected, regardless of whether or not the use activity has actually occurred.

Figure 4 shows the generalized methodology used in this UAA process. This methodology was taken from the Impaired Waters Guidance (SWRCB, 2005) for completing a UAA. Explicit in these analyses is a determination of specific waterbody attributes that are either conducive to attaining or preventing a given use. These attributes are evaluated to determine if certain modifications or controls would allow the use to be attainable and, if so, the feasibility or reasonableness of those options.

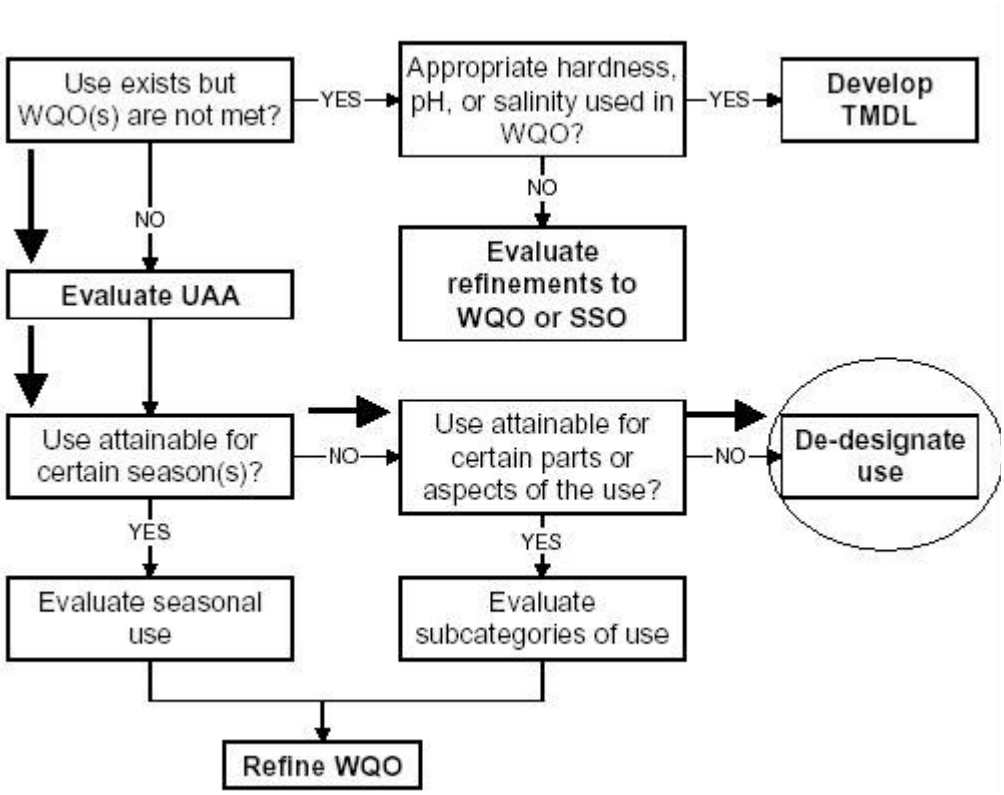

Figure 4: Summary of steps to determine whether to de-designate the SHELL beneficial use.

3.1 Methodology Steps

3.1.1 Step 1: Is the designated use being attained?

A beneficial use that is currently being attained, or that has been attained anytime on or after November 28, 1975 (the date on which the Federal Water Quality regulations took effect), is defined as an "existing use." A beneficial use that is defined as an existing use is evidence that the use is occurring or that water quality is sufficient to allow the use to occur. An existing designated use may not be removed.

Staff researched reports, performed literature reviews and contacted knowledgeable individuals in order to ascertain if the use is being attained.

3.1.2 Step 2: Is water quality sufficient to attain the beneficial use?

When a beneficial use does not appear to exist, the waterbody may still "attain" the use. For example, a waterbody that is not being used as a drinking water supply source may be of sufficient quality and quantity to be a future source of drinking water. In this case, the beneficial use is being attained (although it is not being used) and that beneficial use may not be removed from the waterbody.

Therefore, for the SHELL beneficial use, we evaluated the concentration of bacteria in the waterbody from 1975 to present. Additionally, Water Board staff tried to determine if the hydrology, salinity and temperature of the water, along with the substrate of the waterbody, would allow shellfish to live in these environments.

Step 2a: Can the condition be compensated for with effluent discharges without violating water conservation requirements?

If the condition can be compensated for with effluent discharges without violating water conservation requirements, the use may not be removed.

3.1.3 Step 3: What factors preclude the attainment of the beneficial use?

This step determined what factors preclude the attainment of the beneficial use.

3.1.4 Step 4: Is restoration feasible?

In this step we evaluated if there was any practical way to restore the beneficial use of shellfishing.

4. Data Collection and Evaluation

4.1 Discussion of Bacterial Water Quality Objectives to Protect the Beneficial Use of Shellfishing

The Central Coast Water Board's Basin Plan's numeric water quality objective for bacteria for the SHELL beneficial use reads as follows:

> *At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 mL, nor shall more than 10% of the samples collected during any 30-day period exceed 230/100 mL for a five-tube decimal dilution test or 330/100 mL when a three-tube decimal dilution test is used.*

The DHS' standards for fecal coliform are as follows[3]:

> *i. The total coliform median or geometric mean MPN of the water does not exceed 70 per 100 mL and not more than 10 percent of the samples exceed a MPN of 230 per 100 mL for a five-tube decimal dilution test.*

[3] These numbers are derived from the United States Department of Health and Human Services Food and Drug Administration (FDA), which operates a specific regulatory program directed at shellfish known as the National Shellfish Sanitation Program (1990). If these standards are not attained, the growing areas will be shut down on either a conditional or restricted basis.

> *ii. The fecal coliform median or geometric mean MPN of the water does not exceed 14 per 100 mL and not more than 10 percent of the samples exceed a MPN of 43 for a five-tube decimal dilution test.*

In California, DHS uses the fecal coliform standard most often to classify growing areas (as opposed to total coliform).

Staff chose to use DHS' standards of fecal coliform concentrations for the beneficial use of shellfishing for the UAA because they are the most conservative and are the most protective of the beneficial use of shellfishing. The Basin Plan's total coliform standards will not be used because 1) fecal coliform standards are more stringent and therefore more protective of water quality, and 2) total coliform standards in the Basin Plan are not currently used by DHS to manage the shellfish growing areas in other areas of California, and, 3) the majority of data we have from the County of Santa Cruz are fecal coliform numbers as opposed to total coliform. DHS uses fecal coliform standards to determine whether or not a growing area should be open or closed, therefore, monitoring for fecal coliform is more protective of the beneficial use of shellfishing, since that is the numeric objective that determines whether the public may consume the shellfish, commercially or recreationally.

4.2 Water Quality Data

The County of Santa Cruz has been collecting bacterial water quality data in the San Lorenzo River Estuary since May 5, 1975. From May 5, 1975 to May 26, 2004, the San Lorenzo River Estuary has never achieved the United States Department of Health Service's National Shellfish Sanitation Program's standards of 14 MPN/100 mL fecal coliform. Please see Appendix A for Water Quality Data.

4.3 Site Visit

Staff visited San Lorenzo River Estuary at a low tide on July 14, 2004. Staff visually inspected the area to look for the presence of shellfish. Staff took water quality measurements (pH, specific conductivity, dissolved oxygen, temperature and salinity) and observed the substrate characteristics. Please see Appendix B for the field sheets.

Staff visited three different sites in the San Lorenzo River Estuary. In the first site, which was approximately 100 yards south of the trestle, staff visually inspected the area and did not see any shellfish present. This site is approximately 100 yards away from the ocean. Staff inspected the sandy substrate and the pilings from the trestle and did not observe any living shellfish. Nor did staff see any shellfish on the rock/concrete on the side of the Estuary. There was one broken mussel shell, with no organism inside, that staff found in the sand. This shell may have washed in from the ocean. The second site, which was only about a hundred yards away from the first in the direction of the ocean, had a sandy substrate and staff did not observe any shellfish.

Staff also visited what would be considered the "end" of the San Lorenzo River Estuary, where the Water Street Bridge crosses the River. The end is roughly defined as the last area where any traces of salt water makes its way up the River. No shellfish were found in this area.

4.4 Information From Other Agencies

Staff contacted several other agencies to gather information on the potential presence of shellfishing in San Lorenzo River Estuary. The following is what staff discovered:

4.4.1 California Department of Health Services

Discussions with A. Marc Commandatore of the California Department of Health Services (DHS) (pers. comm. A. Commandatore, 6/7/04) indicate that there have not been any commercial shellfish leases in the area. The closest historic commercial shellfishing lease was in Elkhorn Slough, which is approximately 15 miles south east of San Lorenzo River Estuary. During historic shellfish operations, seed shellfish were used. In other words, Elkhorn Slough was not harvesting native shellfish for commercial sale.

DHS does not do bacterial sampling for recreationally collected shellfish and therefore does not have data indicating if/where shellfish are collected in the San Lorenzo River Estuary.

4.4.2 California Department of Fish and Game

Department of Fish and Game staff person Paul Reilly (pers. comm. Reilly, 6/23/04) is unsure if people are collecting shellfish or if they exist in the Estuary.

4.4.3 County of Santa Cruz, Environmental Health Services

County of Santa Cruz, Environmental Health Services staff person Steve Peters (pers. comm. Peters 6/16/04) indicated that he is not aware of any recreational shellfish collecting in this waterbody. He indicated that there might be too much flushing for shellfish to occur in these areas. He did mention that there are some tiny–size of a thumbnail–fresh water clams where the water is continually fresh. He is not aware of anyone who consumes these clams.

In a separate conversation with a different employee at the County of Santa Cruz, Environmental Health Services, Robert Golling (pers. comm. Golling, 12/2/04), staff learned that he observed the fresh water clam Corbicula in Felton, which is about 7 miles from the ocean. He did not observe any shellfish any closer to the ocean. It is his opinion that the Corbicula could possibly live as far down the river where freshwater still exists. In other words, Corbicula may exist where the salt-water gradient ends (i.e. where the tidal influence ends). He mentioned a location on the San Lorenzo River–off the Highway 1 Bridge–where there is a possibility of Corbicula living.

4.4.4 Consultants – 2nd Nature

Nicole Beck and Maggie Mathias (pers. comm. 11/30/04), are evaluating Scott Creek Lagoon, Laguna Creek Lagoon, San Lorenzo Lagoon (upper and lower), Aptos Lagoon and Soquel Lagoon. Their project is entitled, Comparative Lagoon Ecological Assessment Project. This study is being conducted in conjunction with NOAA (National Oceanic and Atmospheric Administration) and NMFs (National Marine Fisheries).

Although the purpose of their study is not to determine whether filter-feeding shellfish are present in San Lorenzo River Estuary, Beck and Mathias are very familiar with the sampling efforts that have taken place in this area and therefore are able to inform Water Board staff of their observations.

Sampling, of one kind or another, has been taking place in San Lorenzo River Estuary for 5 or 6 years now (approximately 1999–2004). During their sample collections and observations of this estuary, samplers have not seen any living shellfish, whether during snorkeling, wading, or performing benthic invertebrate sampling.

There was one benthic invertebrate sample taken at the Railroad Trestle in San Lorenzo River Estuary, in which samplers found a few pieces of old, brittle clamshell, approximately 3 mms across.

Whether these few tiny pieces of clamshell are evidence that a clam was once living in the sediment in San Lorenzo River Estuary is difficult to determine. Since there were no living shellfish found, it is difficult to assert that shellfish are actually able to live and reproduce in this environment.

4.4.5 Consultant to the City of Santa Cruz

Gary Kittleson (Kittleson Environmental Consulting) is a biologist who does environmental consulting for the City of Santa Cruz. Kittleson was involved in an extensive study where they de-watered a section of the San Lorenzo River Estuary. During this study, Gary closely examined the study area and did not observe any shellfish (pers. comm. 1/25/05).

4.4.6 UC Santa Cruz Biology Professor

Dr. Peter Raimondi said there are definitely shellfish that occur in San Lorenzo River Estuary, right at the mouth (pers. comm. 2/23/05). Although there are shellfish that occur at the mouth, they only occur occasionally. The right weather and hydrology conditions need to be present in order to support a population. This happens in cycles. Sometimes shellfish are present in low numbers and sometimes they are not present at all. Dr. Raimondi also spoke with other invertebrate experts at UC Santa Cruz. They indicated that they do not have a species list for the estuary area. The reason for this is that none of these people have ever found marine bivalves in these areas (at least not of edible size – i.e. small ones may live for a while then die when conditions get anoxic or become freshwater).

He has never seen or heard of anyone collecting shellfish in that area for bait or consumption purposes, at least in the last 20 years. Even the marine life in the area do not feed on the shellfish that may occasionally occur there. He stated that in order to find some of these shellfish, one would need to excavate in the sand a ways to find these shellfish. Therefore, the likelihood of anyone but a researcher uncovering one of these shellfish is highly unlikely.

4.5 Literature Review

Staff conducted library research at the California Polytechnic State University, San Luis Obispo. Staff looked for journal articles as well as textbooks to determine if shellfish are or were present in San Lorenzo River Estuary. Additionally, staff looked for information regarding typical habitats for shellfish to see if this waterbody would support hypothetical shellfish populations; i.e. does this waterbody have the correct temperature, salinity, substrate, etc.

Staff did not find any journal articles that indicated that shellfish were living in San Lorenzo River Estuary. Subsequently, staff found no information that there were individuals collecting shellfish in these areas.

Textbook information was broad. The textbooks did not give any specific information on shellfish living in this waterbody. The biological, chemical and physical information regarding shellfish reproduction and habitat was wide-ranging for all the different species of shellfish. For example, some shellfish are able to tolerate a wider range of salinities than others. Others had more specific requirements having to do with temperature and salinity. This made it difficult to determine whether shellfish would be able to survive or not in this waterbody.

4.6 Basin Plan Designation Questionable

San Lorenzo River Estuary was not designated for SHELL in the 1975 Basin Plan. In a Central Coast Water Board Resolution 76-05, Table 2-2 indicates that San Lorenzo River Estuary now has SHELL as a beneficial use. The Resolution provided no explanation for this change and the corresponding staff report could not be located either in the Central Coast Water Board's office or by contacting State Water Resources Control Board staff. Staff does not have any information as to why San Lorenzo River Estuary was not listed for SHELL in 1975 and then was listed for SHELL in 1976. Staff believes this is further evidence to suggest there was no documentation for San Lorenzo River Estuary being listed for SHELL in the first place.

4.7 Public Outreach Meeting, November 15, 2005

Staff sought stakeholder input during a public meeting held at the Health Services Agency in Santa Cruz on November 15, 2005. The County of Santa Cruz facilitated the meeting. Staff presented our consideration to de-designate the beneficial use of

shellfishing from the San Lorenzo River Estuary and gave a brief presentation why. Staff asked all in attendance (see Appendix C for details) the following questions and asked them to fill out a form with any information they might have:

1) Do YOU think the shellfishing beneficial use exists in either the San Lorenzo River Estuary or the Soquel Lagoon? If you think shellfishing is occurring, why do you think so? Or if not, why do you think so?
2) Do you know of anyone you think Regional Board staff should contact regarding this issue?

There were over 20 people in attendance at this meeting and no one submitted a form. At that time staff had already spoken in detail with four of the attendees at the meeting.

5. Evaluation of Attainability of the Shellfishing Beneficial Use

The shellfishing beneficial use specifies uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial or sport purposes. This includes waters that have in the past, or may in the future, contain significant shellfisheries (emphasis added). In this next section, we evaluate the attainability of the shellfishing beneficial use.

5.1 Attainability of Shellfishing Beneficial Use

5.1.1 Step 1: Is the beneficial use being attained?

The presence of shellfish and/or any records of shellfish being present *since* November 28, 1975 would demonstrate that the SHELL beneficial use exists. Staff's investigation found no known records, individual or agency knowledge that shows shellfish collection occurred anytime after November 28, 1975.

5.1.2 Step 2: Is water quality sufficient to attain the beneficial use?

Bacterial concentrations are persistently higher than water quality objectives, as presented in section 4, and water quality has never been sufficient to attain the beneficial use of shellfishing since November 28, 1975.

Step 2a: Can the condition be compensated for with effluent discharges without violating water conservation requirements?

San Lorenzo River Estuary is not an effluent dominated waterbody. Nor would any amount of increased effluent discharges help to create an environment where shellfish would be able to survive.

5.1.3 Step 3: What factors preclude the attainment of the beneficial use?

The habitat of this area is not consistently conducive to the growth and reproduction of a substantial population of shellfish. Staff does not completely understand exactly why the habitat is not supportive of shellfish but hypothesizes that it has to do with the substrate of the Estuary, along with seasonal closures of the mouth and the subsequent effects this

creates. Historically, San Lorenzo River Estuary temporarily lost its connection to the ocean, or "closed," during the portions of the dry season.

The contemporary conditions of closure in this waterbody, while still driven principally by natural phenomenon, are affected by both the infrastructure surrounding the waterbody and by activities relating to habitat enhancement, flood control, and recreational use. San Lorenzo River Estuary usually closes and opens on its own (except when illegal breaching efforts take place).

5.1.4 Step 4: Is restoration feasible?

"Restoration" does not seem feasible because habitat and closures at certain times of the year are similar to the natural conditions of the Estuary. Additionally, even if changes were made to this waterbody (which seems economically infeasible), the return of a sizeable and consistent shellfish population to the area is highly questionable as it is unclear when/if shellfish inhabited these areas in any substantial number in the last half of the 1900's.

6. Findings of the UAA

6.1 Basis for Removal of Designated Use

The CFR factors for allowing a State to remove a designated use are listed in 131.10(g). Based on staff's UAA, three factors preclude attainment of SHELL in San Lorenzo River Estuary.

(2) Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met;

(4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use.

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unless these conditions may be compensated, unrelated to water quality preclude attainment of aquatic life protection uses.

6.2 Alternatives for Addressing the SHELL Beneficial Use Designation

6.2.1 Alternative A – Removing the SHELL beneficial use

In this case, SHELL is determined to be an inappropriate beneficial use for this waterbody. Additionally, it seems the Central Coast Water Board designated the Estuary as SHELL, assuming the waterbody had shellfishing present without evaluating it to

confirm the use. San Lorenzo River Estuary has not demonstrated the SHELL beneficial use qualities nor have there been any societal demands to use this waterbody in this way. Therefore, as a result of a combination of factors described in 40 CFR 131.10(g)(2), (4), and (5) of the Federal water quality standards regulation, Water Board staff concludes that the SHELL designation of San Lorenzo River Estuary does not apply.

6.2.2 Alternative B – No action. Maintain SHELL beneficial use designation

In this case, the status quo is maintained. Not taking any action would make it difficult to write and enforce a pathogen TMDL for San Lorenzo River Estuary because the numeric targets would have to be SHELL targets, even though the SHELL use is questionable. Enforcing a TMDL with SHELL numeric targets may impose unnecessary economic impacts on the City and County when they try to implement management measures to achieve a low level of bacteria concentration to protect a use that does not exist. Additionally, it may not be possible to achieve a level that is this low due to potential amounts of natural background levels of coliform.

6.3 Considerations Required for Recommended Alternative

Staff recommends alternative A. In making this recommendation, staff has considered all factors set out in §13241 of the Porter-Cologne Water Quality Control Act:

(a) *Past, present, and probable future beneficial uses of water.*
Shellfish collection did not likely exist in the recent past (i.e. the last 50 years, 1950 - present); shellfishing does not appear to exist currently; and shellfishing is unlikely to be a beneficial use in the future.

(b) *Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.*
Water quality objectives are currently not being met to support the beneficial use of SHELL, however the San Lorenzo River Estuary pathogen TMDL addresses bacterial water quality objectives and bacterial loading in the context of the REC-1 and REC-2 beneficial uses. Once the requirements in the TMDL are implemented, the environmental characteristics (bacterial concentrations) are expected to improve over existing conditions.

(c) *Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.*
Although past and current water quality conditions do not allow for the attainment of SHELL beneficial use, there are other habitat factors such as substrate, salinity, temperature and flow that cannot be reasonably achieved through coordinated control of various factors in the area. However, improved concentrations of bacteria should occur via TMDL implementation, regardless of removal of the SHELL beneficial use.

(d) *Economic considerations.*

With regard to economic considerations, the recommended alternative is not expected to impose any additional cost on either the City or County and may reduce costs by making it more likely to achieve the REC-1 bacterial water quality objectives as opposed to the SHELL bacterial water quality objectives.

(e) *The need for developing housing within the region.*
Alternative A will have no significant impact on the need for developing housing within the region.

(f) *The need to develop and use recycled water.*
The need to develop and use recycled water will not be affected by the proposed modifications.

6.4 Anti-Degradation

Staff considered that there might be concern about the following: Does removal of the SHELL beneficial use allow higher levels of bacteria to further impair the Estuary? The current bacteria level in this waterbody regularly exceeds water quality objectives for REC-1 and REC-2 uses. The pathogen TMDL for San Lorenzo River Estuary establishes substantial reductions in allowable bacteria loading, regardless of the proposed de-designation.

The recommended alternative is also consistent with the Anti-degradation Policy, as it will not lower the water quality of the Estuary, relative to existing conditions. In assigning water quality objectives to the REC-1 and REC-2 uses that exist, this alternative fulfills the requirement of protecting the level of water quality necessary to protect existing and anticipated beneficial uses.

6.5 Future Considerations

Amending the potential SHELL designated use of San Lorenzo River Estuary does not preclude re-designation of this use should conditions within this waterbody change in the future. For example, should some major hydrologic changes modify the habitat of this waterbody to the point where shellfish would be able to grow and thrive in numbers that would allow for their collection and consumption, the beneficial use designation could be modified.

7. References

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