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, California

Final Project Report

Prepared on February 27, 2008
For the March 20-21, 2008 Water Board Meeting

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

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401
Phone • (805) 549-3147
http://www.waterboards.ca.gov/centralcoast/

To request copies of the Basin Plan Amendment and Final Project Report for Total Maximum Daily Loads for Pathogens in San Lorenzo River Watershed (Including San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek and Lompico Creek), Santa Cruz, California, please contact Shanta Keeling at (805) 549-3464, or by email at skeeling@waterboards.ca.gov.
Documents also are available at:
http://www.waterboards.ca.gov/centralcoast/TMDL/303dandTMDLprojects.htm

STATE OF CALIFORNIA

ARNOLD SCHWARZENEGGER, Governor
LINDA S. ADAMS, Agency Secretary, California Environmental Protection Agency

State Water Resources Control Board

Tam Doduc, *Chair*	Civil Engineer, Water Rights
Gary Wolff, *Vice Chair*	Professional Engineer, Water Quality
Charles R. Hoppin	Water Quality
Arthur G. Baggett, Jr.	Attorney, Water Supply & Water Rights
Frances Spivey-Weber	Public Member

Dorothy Rice*, Executive Director*

California Regional Water Quality Control Board
Central Coast Region

Jeffrey S. Young, *Chair*	Water Supply
Russell M. Jeffries, *Vice Chair*	Industrial Water Use
Leslie S. Bowker	County Government
Monica S. Hunter	Public
Gary C. Shallcross	Recreation, Fish or Wildlife
David T. Hodgin	Water Quality
Daniel M. Press	Water Quality
John H. Hayashi	Irrigated Agriculture
Vacant	Municipal Government

Roger Briggs*, Executive Officer*
Michael Thomas*, Assistant Executive Officer*

This report was prepared under the direction of

Lisa H. McCann*, Environmental Program Manager*
Chris Rose*, Senior Environmental Scientist*

by

Shanta Keeling, *Water Resources Control Engineer*
Angela Carpenter, *Water Resources Control Engineer*
Kim Sanders, *Environmental Scientist*

with the assistance of

Larry Harlan, *Environmental Scientist*
Katie McNeill, *Environmental Scientist*
David LaCaro*, Environmental Scientist*
Michael Higgins, *Water Resources Control Engineer*
Ryan Lodge*, Water Resources Control Engineer*

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. 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 domesticated animals/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 historic 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 domesticated animals/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 onsite wastewater disposal system failures, and domesticated animals/livestock. Some of the natural sources were partially controllable.

1.1.4. Lompico Creek

[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.

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 domesticated animals/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 domesticated animals/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, sanitary sewer collection leaks, homeless persons, onsite wastewater disposal system discharges and domesticated animals/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 historic (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* (emphasis added) 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." 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-per 100 mL, nor

shall more than 10% of samples collected during any 30-day period exceed 400 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 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 per 100 mL, nor shall more than 10% of samples collected during any 30-day period exceed 4000 per 100 mL.

1.4.3 Shellfish Harvesting

The Basin Plan states, 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] 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).

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

The Basin Plan contains the following discharge prohibition (Chapter Five, Section IV.B).

> "Waste discharges to the following inland waters are prohibited:…All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins and all water contact recreation areas except where benefits can be realized from direct discharge of reclaimed water."

The Central Coast Water Board originally adopted the above prohibition in 1975. 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). This program requires the Regional Water Boards to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. The program allows dischargers to comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan prohibitions by participating in the development and implementation of NPS Pollution Control Implementation Programs.

Protecting water quality was the *intent* of the original prohibition whether the sources are from point or nonpoint sources. Staff concluded the existing prohibition should remain for point source discharges. However, staff concluded, that for nonpoint source discharges, a modification to the current prohibition in the Basin Plan would be more explicit for nonpoint source discharges specifically. Responsible parties will comply with the modified prohibition consistent with mechanisms described in Nonpoint Source Implementation Policy, and as described in the modified prohibition itself. Therefore, staff proposes a modification to the current prohibition in the Basin Plan along with approval of these TMDLs to implement the State Board's Nonpoint Source Implementation Policy. (For more information, see Section 10.2 titled Proposed San Lorenzo River Watershed Prohibition Revision).

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, 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.

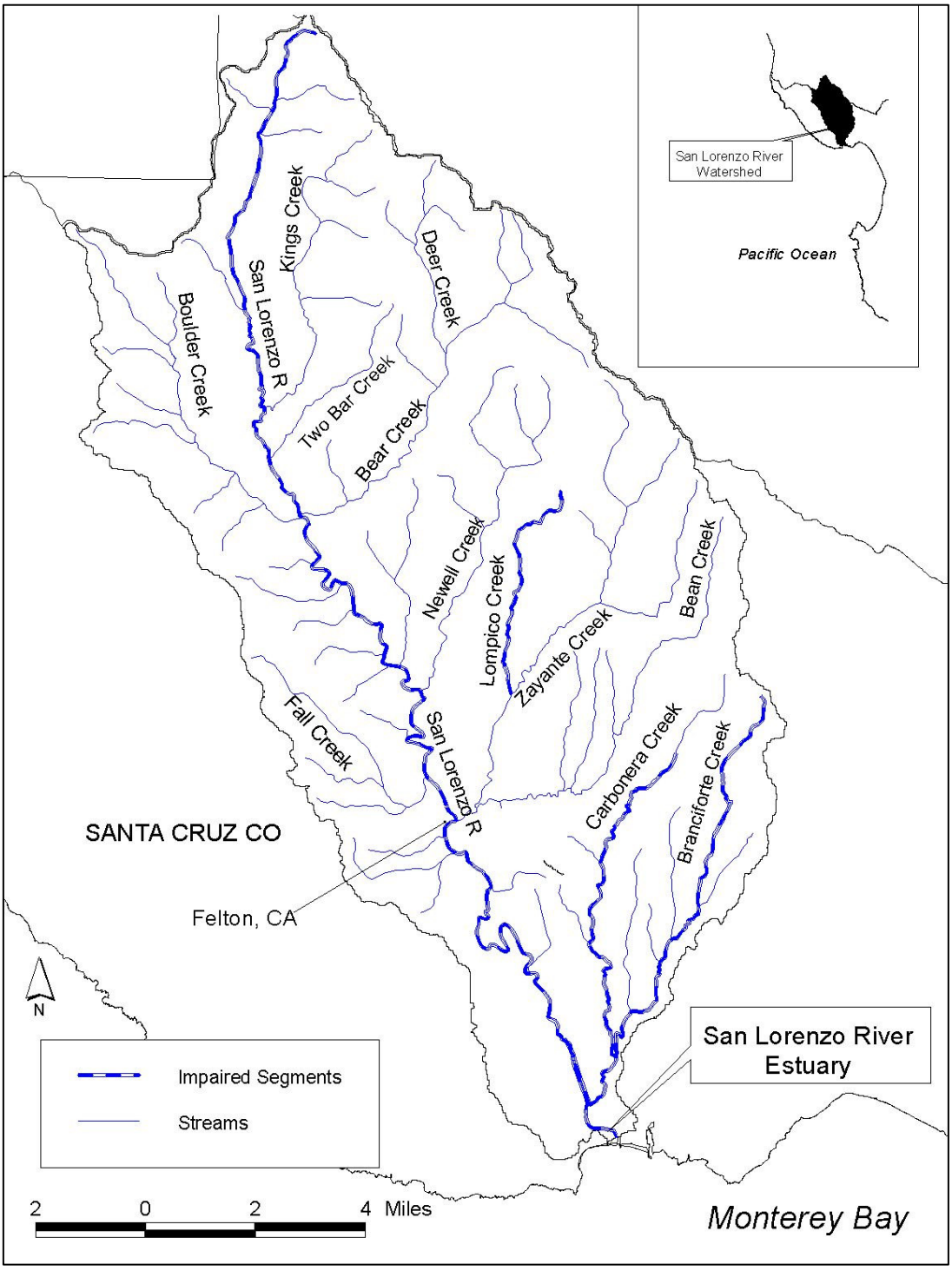


Figure 1. San Lorenzo Watershed Boundary with San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Lompico, and Carbonera Creek (Camp Evers Creek is Shown in Figure 8)

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.

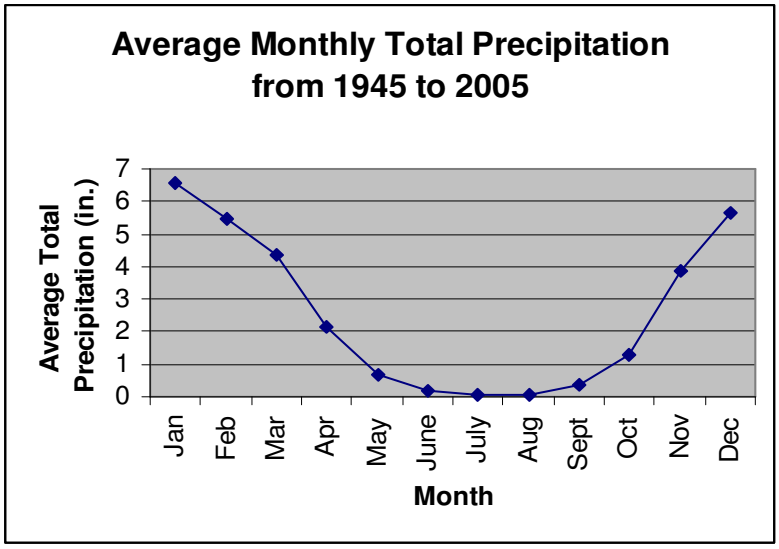


Figure 2. City of Santa Cruz Average Monthly Precipitation (Averages taken from 1948 through 2005)

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.

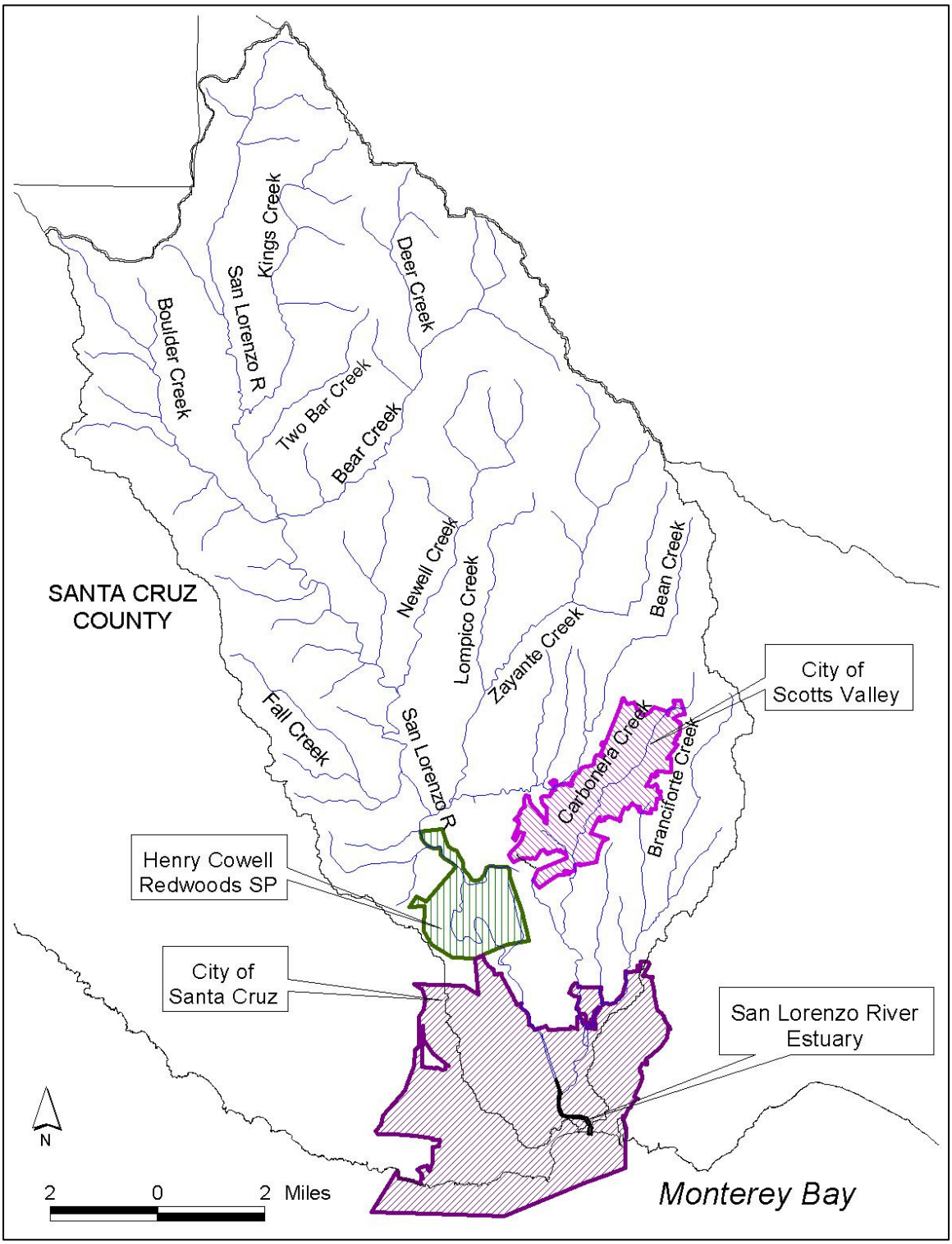


Figure 3. City of Santa Cruz, City of Scotts Valley, and Henry Cowell Redwoods State Park Boundaries Within Santa Cruz County

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

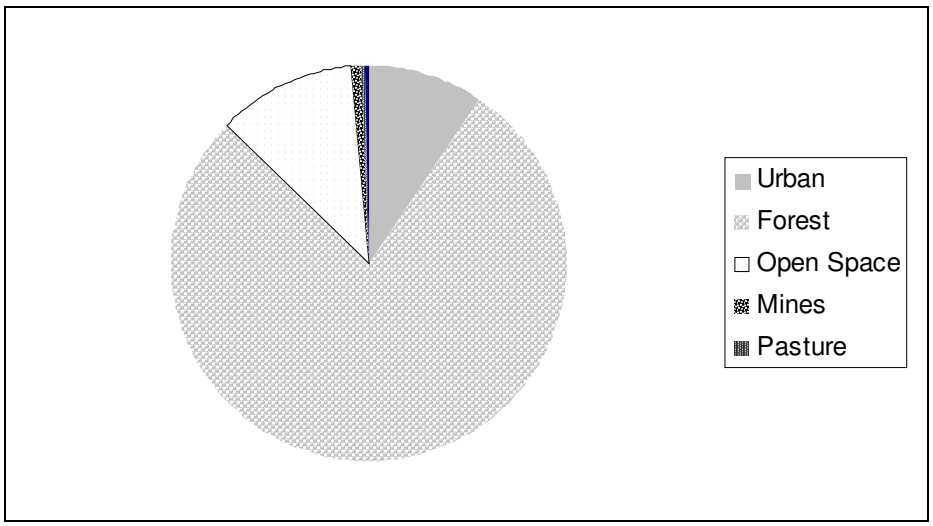


Figure 4. Percent Land Use in the San Lorenzo River Watershed[3]

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 treatment system discharges can occur from forest lands because most rural residential properties that utilize onsite wastewater treatment 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. Domesticated animals/livestock discharges can occur on rural residential properties that contain forest lands and open space.

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

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

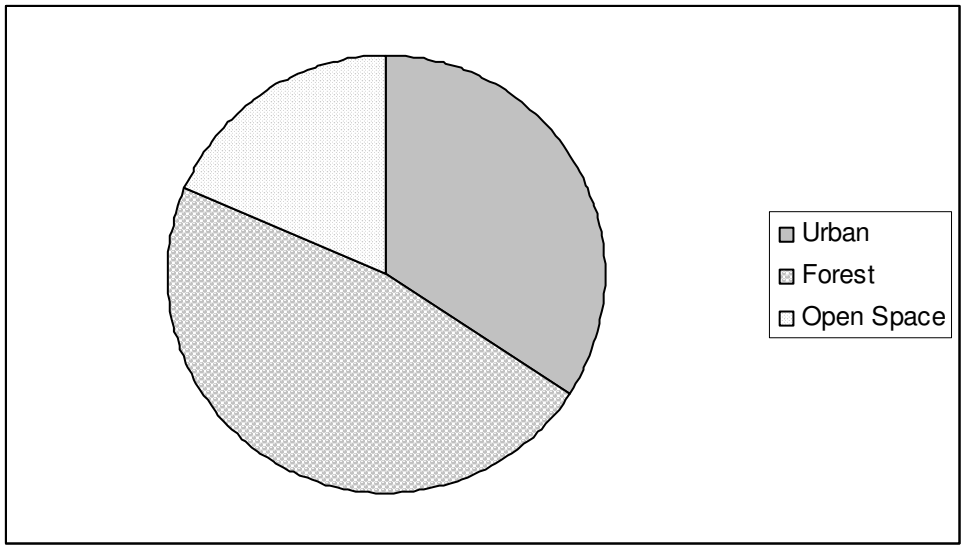


Figure 5. Percent Land Use for Carbonera Creek Watershed[4]

Figure 5 shows 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. Domesticated animals/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.

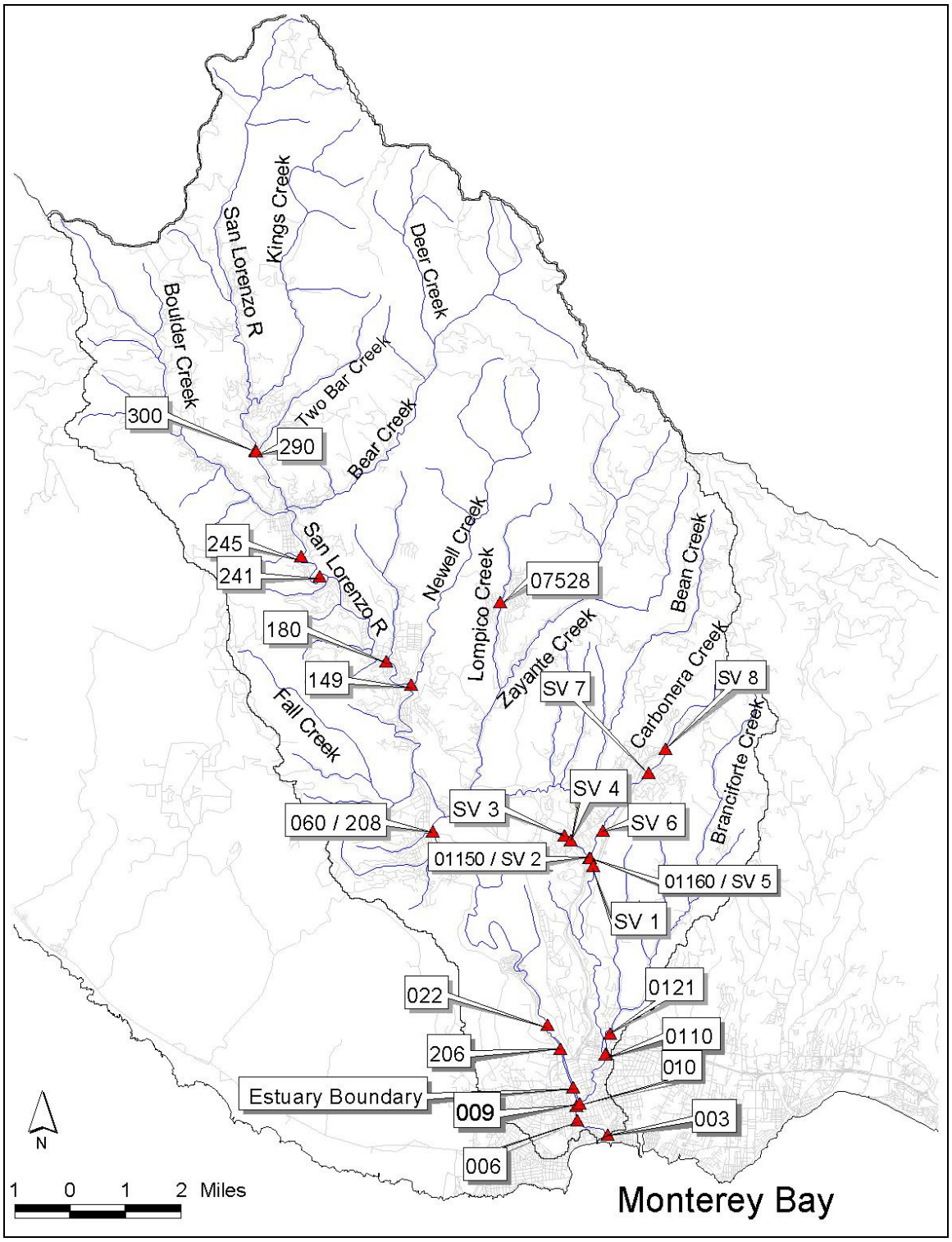


Figure 6 . Water Quality Sampling Stations in the San Lorenzo River Watershed

Some of the sampling stations shown above 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.

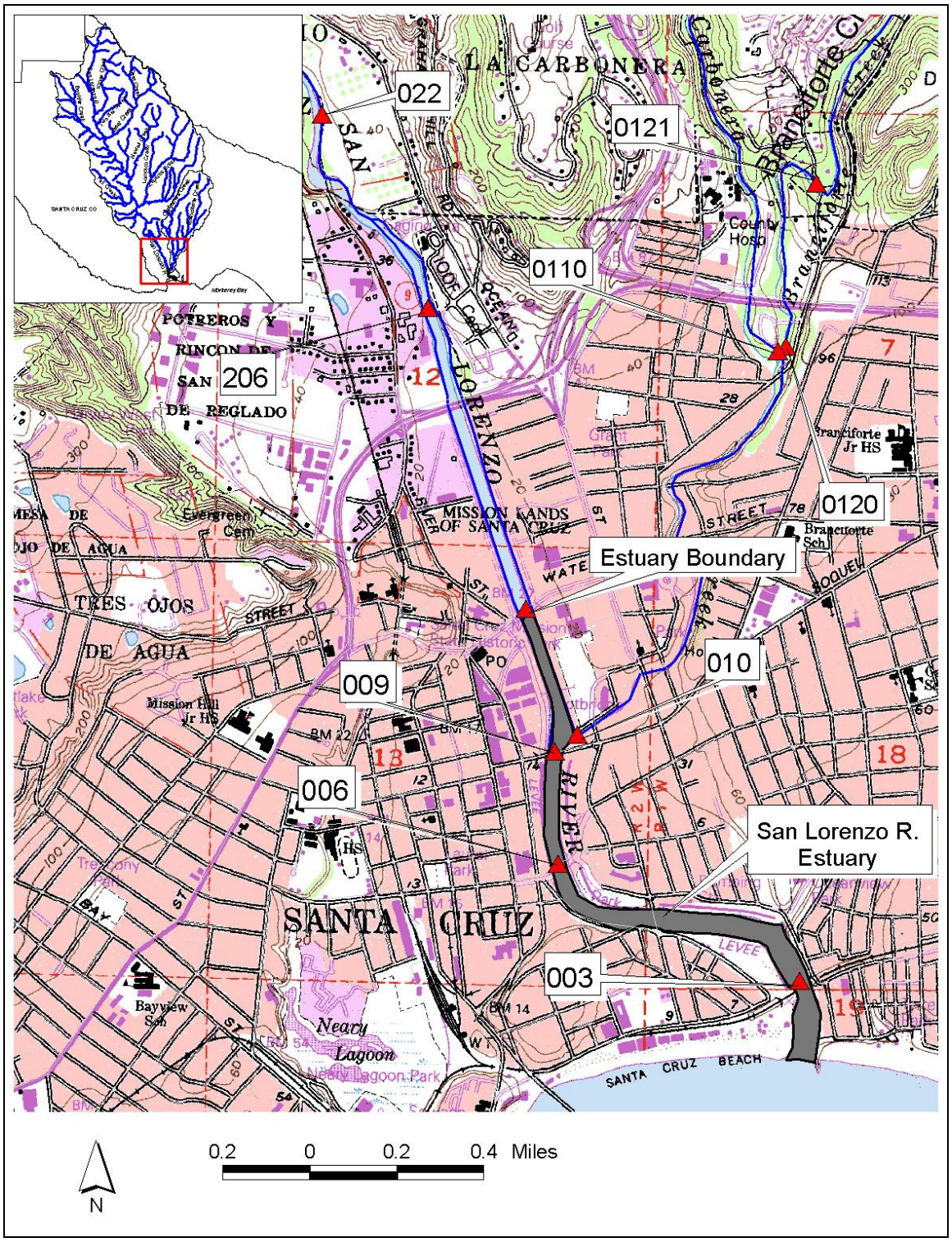


Figure 7. San Lorenzo River Estuary and Vicinity Sampling Stations

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.

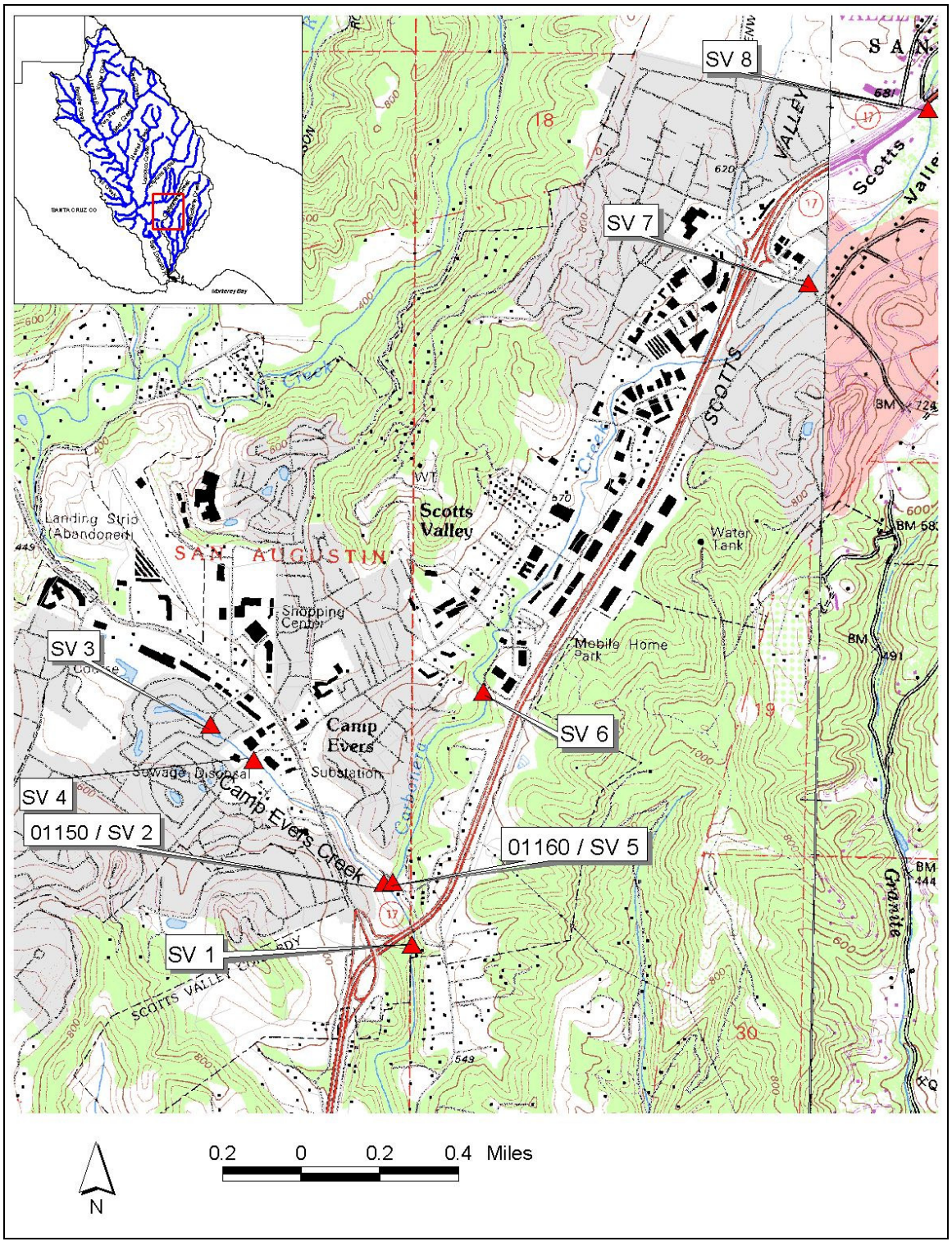


Figure 8 . Carbonera Creek and Scotts Valley Vicinity Sampling Stations

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	Approximately 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
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

Station #	Water Body	Station	Number of Fecal Coliform Samples	Frequency of Fecal Coliform Samples	Period of Record for Fecal Coliform
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 was 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 is 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
			2004-2005	7	490		
			2005			14	94
San Lorenzo River @ Henry Cowell Park Bridge	San Lorenzo River (Branciforte Creek	208	1999-2000	9	307		

[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
	Upstream to Henry Cowell State Park Reach						
			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 is 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 25^{th} - 75^{th} 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 25^{th} percent deviation, the 75^{th} 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 Scott's 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 was available in the year 2004. There were no "winter" samples taken. The most recent *E. coli* data for the San Lorenzo River @ Soquel Avenue Bridge station was taken in 1996.

Staff considered this entire reach impaired.

[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.

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 is insufficient in quantity. 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 @ Isbel 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] 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.

[10] Staff used water quality data from April-October to represent the dry season.
[11] Staff used water quality data form November-March to represent the wet season.

Although the City of Santa Cruz's data shows 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.

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.)

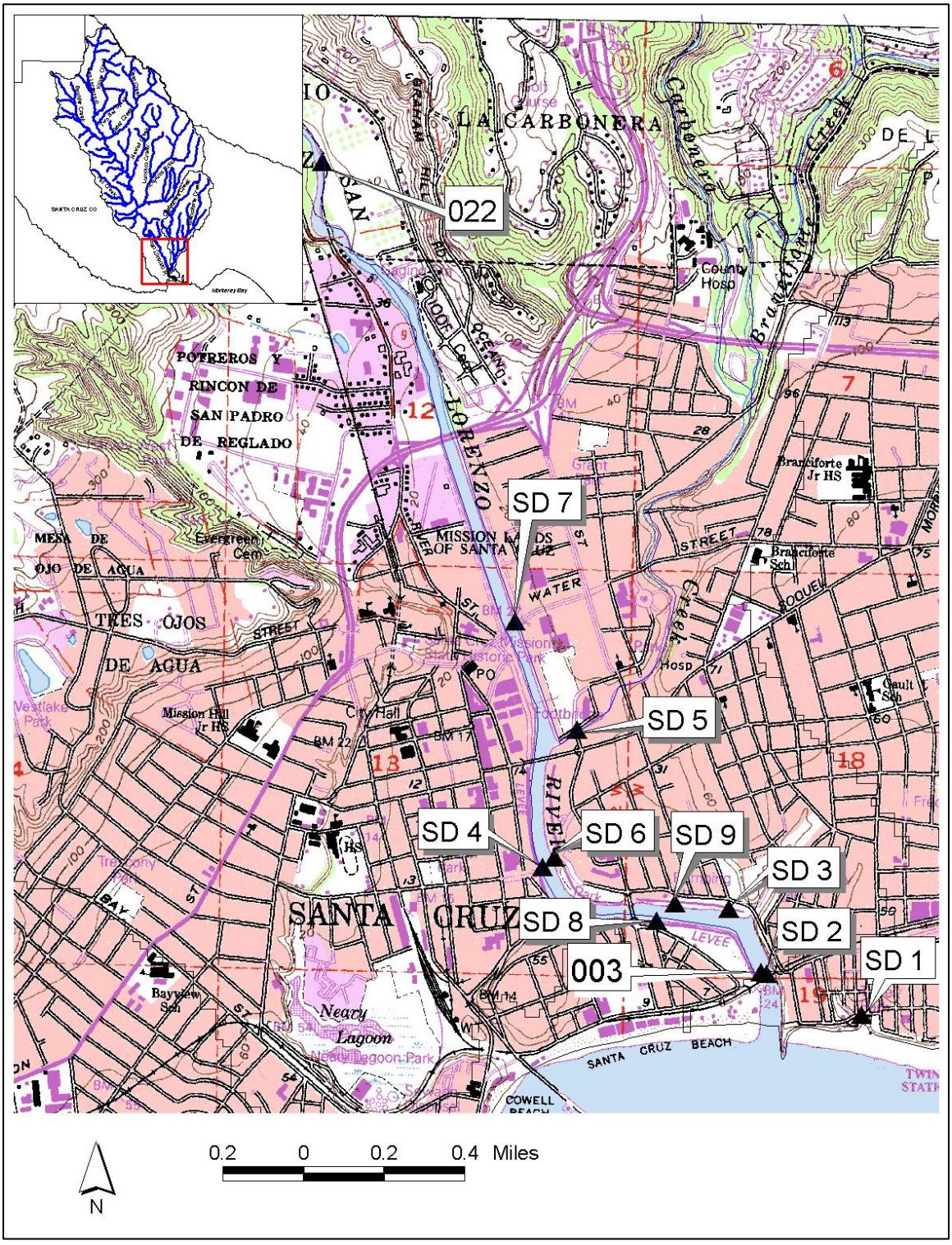


Figure 9. San Lorenzo River Estuary Ribotyping Data Stations and Storm Drains (Sites 003 and 022 were ribotyping data stations.)

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 domesticated animals/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 storm sewer systems (MS4s) required to be covered by an NPDES permit; onsite wastewater treatment 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 domesticated animals/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.

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

[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.

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) (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.

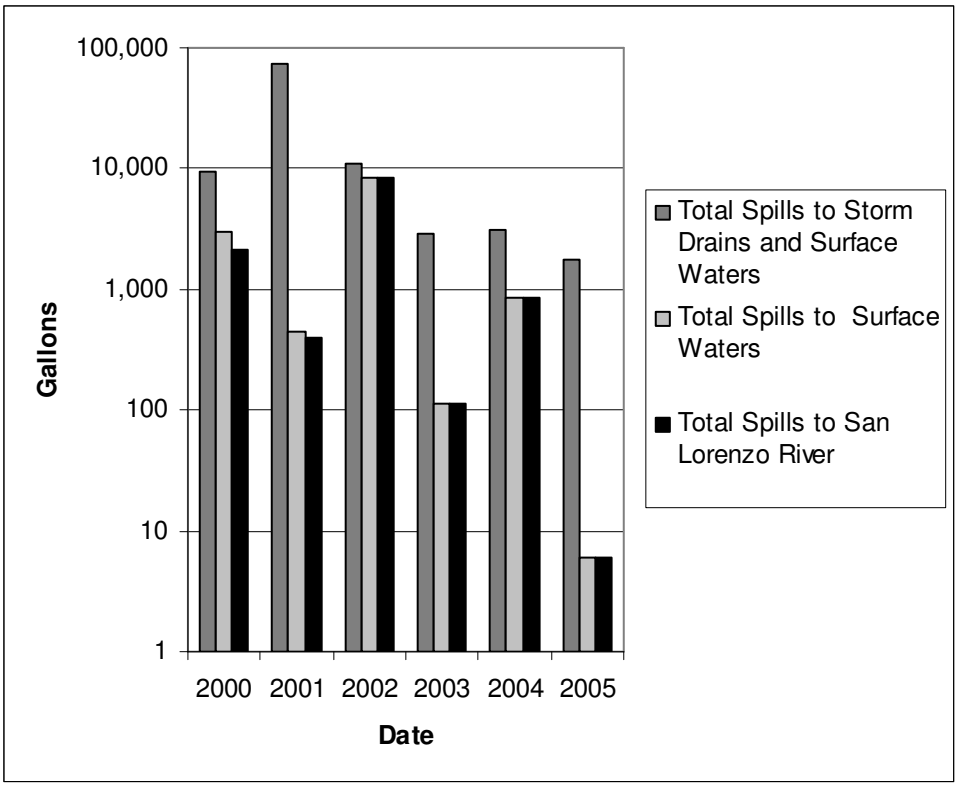


Figure 10. Spill Volumes within the City of Santa Cruz

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 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 that occurred on February 25, 2002 resulted in an approximately 312,000-gallon spill 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.

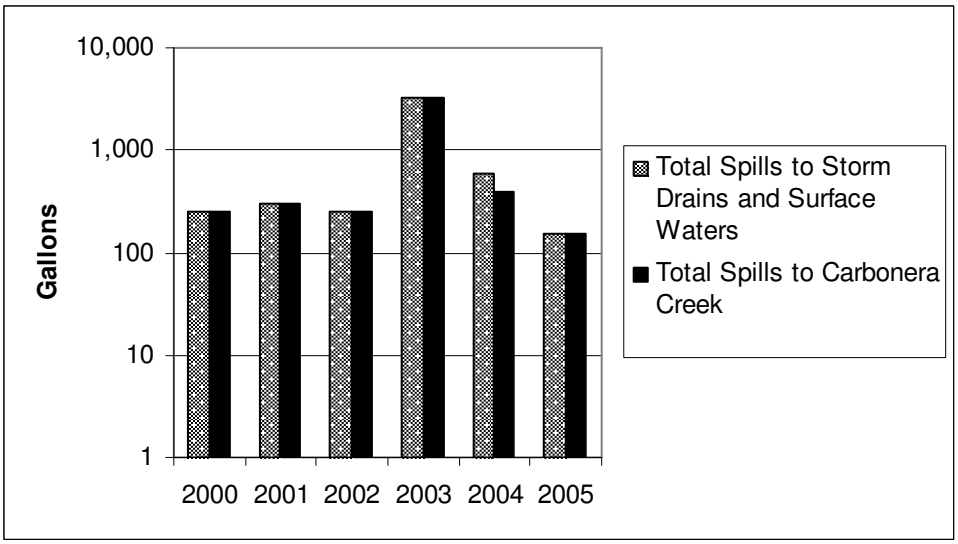


Figure 11. Spill Volumes within the City of Scotts Valley

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 assure alarms work. City of Scotts Valley staff physically check each alarm within the entire system to assure the alarms work. Central Coast Water Board staff concluded the alarm inspections are a very effective means to assure alarms work. The City of Scotts Valley also now inspects pumps at lift stations on a more frequent basis.

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).

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 their 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, a diver 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).

[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

Staff determined these discharges do not impact water quality. The reasons are (1) disposal sites and collection systems comply with Basin Plan onsite sewage 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 Herman 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.

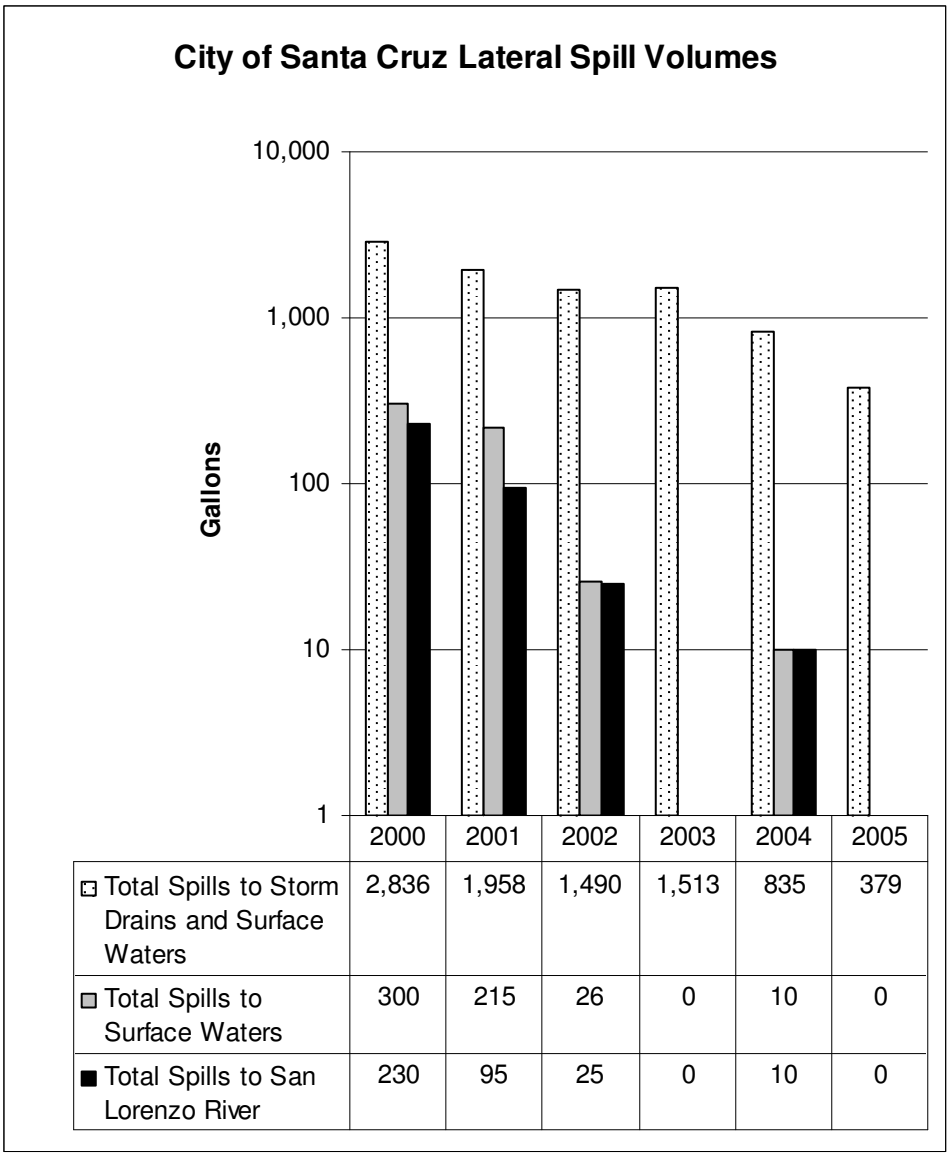
4.1.1.a.5. Private Laterals/Pump Station Spills

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.

[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 and proposes implementation measures to identify private lateral leaks and repair the leaks (see section 10.1.2).

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.)

However, private laterals within the City of Scotts Valley may leak. Leaks can form in a variety of ways such as earth movement or faulty construction. During the winter, these leaks can flow to surface waters. During the non-rainy seasons, leaks can enter creeks in close proximity to leaking private laterals.

Staff estimates a small portion of the human waste in the Watershed may originate from private laterals and proposes implementation measures to identify private lateral leaks and repair the leaks (see section 10.1.2).
.

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

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.

[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.

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 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 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 municipally owned and operated storm sewer systems required to be covered by 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 Treatment System Discharges

Onsite wastewater treatment 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 treatment 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 only 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 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 systems within the City of Scotts Valley. According to Ken Anderson, City of Scotts Valley Public Works director, there are approximately 25-40 onsite 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. Staff concludes these systems are close enough to Carbonera Creek to cause potential problems in the event they inadequately treat wastewater. 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).

The City is requiring all failed systems to connect to the existing wastewater collection system. Therefore, Water Board staff is recommending the current practice of connecting failed systems continue until all onsite systems are connected to the collection system within the City of Scotts Valley.

Staff recommends (in the Implementation Plan in section 10.1.1.b) the City report to the Water Board the number of onsite disposal systems that have connected to the wastewater collection system and the number of unconnected systems. The City must provide the locations of unconnected disposal systems.

4.1.1.e. Domesticated 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 domesticated 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.

[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.

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 domesticated animals and livestock are sources of pathogens that can be controlled.

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 significant contributors of the pathogen indicator organisms to the San Lorenzo River Estuary were natural sources. 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) domesticated animals/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 domesticated animals/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 tank 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 systems to discharge partially treated wastewater to surface waters. Most onsite sewage disposal systems are located upstream in areas that are more likely to impact the San Lorenzo River.

6. Domesticated Animals and Livestock

Staff concluded domesticated 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) domesticated animals/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 tank 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. Domesticated Animals and Livestock

Staff concluded domesticated 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. Domesticated 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 municipally owned and operated storm sewer systems (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) domesticated animals/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 Sewage Disposal System Discharges

There are over 13,000 onsite wastewater disposal tank 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. Domesticated Animals and Livestock

Staff concluded domesticated 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. Domesticated 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) domesticated animals/livestock discharges, and 6) leaks from the City of Scotts Valley collection system (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems). 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 modified 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 Sewage Disposal System Discharges

Some homes on the east side of Highway 17 utilize onsite wastewater disposal tank 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 sewage 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. Domesticated Animals and Livestock

Staff concluded domesticated 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. Domesticated Animals and Livestock" for more information.)

6. Leaks from the Scotts Valley Municipal Collection System

Staff concluded the relatively new age of this collection system and the lack of significant subsurface infiltration into the collection demonstrated the collection system and private laterals were not a large contributor.

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

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.

[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.

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.

Domesticated 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 rise above 200 MPN/100mL. These levels are used because they are the water quality objectives that gauge the protection of the water contact recreation beneficial use (see Section 1.4). Exceedance of this water quality objective is considered critical (for this analysis) when:

1. A prolonged exceedance of the objective occurs.
2. When the exceedance is consistent throughout one or more seasons.

Exceedance of the water quality objective/criterion is usually measured by calculating

the log mean of sample data from a monitoring site. A log mean is used because pathogen indicator organism levels can be highly variable, subject to plumes of fecal contamination resulting in high levels for a short duration. The log mean reduces the sensitivity to outliers or unusually high concentrations.

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. Conversely, increased stream flows may dilute fecal coliform concentrations.

Another uncertainty is staff had limited information to develop relative contributions. In other words, staff concluded that both "controllable" and "non-controllable" sources are contributing fecal input into the waterbodies. However, there is uncertainty surrounding the "load" that each of these sources is contributing.

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
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=293 MPN/100 mL	Apr and Oct	

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
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
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean= 207 MPN/100 mL	None	

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
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
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean=303 MPN/100 mL	Sep, Oct, Nov	Higher concentrations during first rains

Station	Water Quality Objective	Statistical Value	Months Exceeding Water Quality Objective	Comments
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 other 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 per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 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.

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

[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).

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, 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.

8. TMDL CALCULATION AND ALLOCATIONS

A TMDL is the pollutant loading capacity that a water body can accept while protecting beneficial uses. Usually, TMDLs are expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of pathogens,

[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.

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 per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 per 100 mL.

8.1. Proposed Wasteload and Load Allocations

The allocations for all non-natural (controllable) sources and corresponding responsible party are equal to the TMDL concentrations. The allocation is the same for each responsible party. The responsible party shall not discharge or release a load of pathogen indicator organisms that will increase the load above the assimilative capacity or TMDL concentration of a water body. 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)**	**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)	Allocation-1
Camp Evers Creek and Carbonera Creek	City of Scotts Valley (Storm drain discharges)	Allocation-1
San Lorenzo River, Branciforte Creek, Lompico Creek, and Carbonera Creek	Santa Cruz County (Storm drain discharges)	Allocation-1
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, and Carbonera Creek	City of Santa Cruz (Sanitary sewer collection system leaks)	Allocation-1
Carbonera Creek, Camp Evers Creek	City of Scotts Valley (Sanitary sewer collection system leaks)	Allocation-1
LOAD ALLOCATIONS		
Waterbody	**Responsible Party (Source)**	**Receiving Water Fecal Coliform (MPN/100mL)**
San Lorenzo River Estuary , San Lorenzo River, Branciforte Creek , Carbonera Creek, and Camp Evers Creek	Owners of private sewer laterals residing in the Cities of Santa Cruz and Scotts Valley (Private laterals connected to municipal sanitary sewer collection system)	Allocation-1
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek , Camp Evers Creek and Lompico Creek	Owners of onsite wastewater treatment systems residing in the County of Santa Cruz and the City of Scotts Valley (Onsite wastewater treatment system discharges)	Allocation-1
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 regulated by WQ Order No. 2003-0005-DWQ [storm water general permit])	Allocation-1
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek, Camp Evers Creek, and Lompico Creek	Owners/operators of land used for/containing domesticated animals/livestock (Domesticated animals/livestock)	Allocation-1
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-1
San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Lompico Creek, Camp Evers Creek, and Carbonera Creek	No responsible party (Natural sources)	Allocation-1

[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.

Allcoation-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 200/100mL, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 mL.

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.

The Central Coast Water Board will also accept public comments at the March 21, 2008 Central Coast Water Board public hearing.

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.

All actions proposed utilize either 1) mechanisms that are already required by the Central Coast Water Board or 2) a proposed Basin Plan prohibition revision. (The Basin Plan prohibition revision is discussed in Section 10.2.)

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

10.1.1.a. Requirements for the City of Santa Cruz

The City of Santa Cruz Sanitary Sewer Collection System is required to prevent spills and leaks pursuant to NPDES Permit No. CA 0048194 (current number) and WDR Order R3-2005-0003 (current number). 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. 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.

The Executive Officer or the Central Coast Water Board will amend the Monitoring and Reporting Program of the City of Santa Cruz's NPDES permit to incorporate monitoring for fecal coliform and reporting results.

10.1.1. b. Requirements for the City of Scotts Valley

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 (March 21, 2008) in compliance with their existing NPDES permit and WDR and the Water Board is not requiring additional implementation measures (associated with sanitary sewer collection system leak prevention) of the City of Scotts Valley at this time (with the exception of monitoring as mentioned in the following paragraph). 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 Santa Cruz 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 City of Scotts Valley NPDES permit 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 of private laterals to sanitary sewer collection systems are responsible for maintenance of their private laterals. However, the Cities of Santa Cruz and Scotts Valley have the authority to require private lateral upgrades. The Cities of Santa Cruz and Scotts Valley may choose to implement a program to detect and require repair of leaks from private laterals. The Central Coast Water Board would consider implementation (by the Cities of Santa Cruz and/or Scotts Valley) of such a program, as proof of compliance by owners with private laterals with the San Lorenzo River

Subbasin prohibition. If the Cities of Santa Cruz and/or Scotts Valley implement such a program, the Central Coast Water Board will request and use reporting from the Cities of Santa Cruz and/or Scotts Valley to evaluate individual private lateral owner compliance with the San Lorenzo River Subbasin prohibition.

Within one year following approval of these TMDLs by the California Office of Administrative Law, if the Cities of Santa Cruz and/or Scotts Valley do not submit an approved program to detect and repair leaks from private laterals, or if the Central Coast Water Board or Executive Officer determines that such an existing or proposed program is insufficient, then landowners with private laterals must demonstrate compliance individually with the San Lorenzo Subbasin prohibition.

If landowners with private laterals must demonstrate compliance individually with the San Lorenzo River Subbasin prohibition, then within one year following approval of the TMDLs by the California Office of Administrative Law, the Executive Officer will notify owners and/or operators of land that have private lateral connections to the sanitary sewer system of the City of Santa Cruz and/or Scotts Valley, of the San Lorenzo River Subbasin prohibition and conditions for compliance with the prohibition. Compliance with the San Lorenzo River Subbasin prohibition is described in Chapter Five, section IV.B. of the Water Quality Control Plan.

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

Enrollees of the State Water Resources Control Board's General Permit for the Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit for storm water) must control discharges of pathogens to and in storm drains (currently NPDES No. S000004).

The Cities Santa Cruz and Scotts Valley and the County of Santa Cruz must control discharges of pathogens to and in storm drains when enrolled in the General Permit for storm water discharges.

Within one year following approval by the Office of Administrative Law (OAL) of these TMDLs, or if enrolled in the General Permit for stormwater discharge, then when the next annual report is due, or to meet any other Water Board-issued storm water requirements (e.g. when the State General Permit for stormwater discharges is renewed) the Cities Santa Cruz and Scotts Valley and the County of Santa Cruz will be required to:

1. Submit for approval a management program that identifies pathogen-specific best management practices targeting pathogen sources from:
    a. Birds, pets, rodents and wildlife, dumpster leachate, and humans.

    The best management practices should include, but not be limited to: those identified in a Storm Water Management Plan (if existing or being developed), public education, participation and outreach regarding sources of pathogens in surface

waters, health risks associated pathogens in surface waters, and specific actions the public can take to reduce pathogen loading into surface waters.
2. Submit for approval a fecal indicator bacteria (e.g. fecal coliform) monitoring and reporting plan. Receiving water and storm water outfall monitoring will be required.
3. Incorporate a description of implementation and monitoring activities in any existing or developing Storm Water Management Plan, and corresponding reporting, associated with a General Permit for storm water discharges.

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 Domesticated Animal/Livestock Discharges

Owners and/or operators of land used for/containing domesticated animals (including, but not limited to: horses, cattle, goats, sheep, dogs, cats, or any other animals in the care of owners/operators) in the San Lorenzo River Subbasin must comply with the San Lorenzo River Subbasin prohibition.

Within one year following approval of these TMDLs by the California Office of Administrative Law, the Executive Officer will notify owners and/or operators of lands used for/containing domesticated animals, of the San Lorenzo River Subbasin prohibition and conditions for compliance with the prohibition, as described in Chapter Five, section IV.B. of the Water Quality Control Plan.

Owners and/or operators of land used for/containing domesticated animals will be notified regarding the requirement to comply with the modified prohibition. The notification will initiate dialogue between the Central Coast Water Board and owners and/or operators in an effort to achieve compliance with the modified prohibition and improved water quality. Compliance with the modified prohibition is described below; more detailed information regarding compliance with the modified prohibition will occur as dialogue between the Central Coast Water Board and owners and/or operators ensues.

Compliance with the modified prohibition must be demonstrated by:

1. Submitting documentation demonstrating there are no discharges from fecal sources by domesticated animals into waters of the San Lorenzo River Subbasin, or
2. Submitting a nonpoint source pollution control implementation program for approval by the Executive officer that is consistent with the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (see an explanation of this program below in this section), May 20, 2004, or
3. Complying with Waste Discharge Requirements or an NPDES permit, or a conditional waiver of waste discharge requirements that explicitly addresses compliance with the TMDLs for Pathogens in the San Lorenzo Watershed.

The Executive Officer will review and approve, or request modification of, the nonpoint source pollution control implementation program or documentation submitted in compliance with the modified prohibition within six months of the submittal date.

The *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* 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. Water Board staff recommends the Central Coast Water Board utilize the San Lorenzo River Subbasin Prohibition to implement a Nonpoint Source Pollution Control Implementation Program for domesticated animal/livestock discharges. NPS dischargers can comply either individually or collectively as participants in third-party coalitions. The "third-party" Programs are restricted to entities that are not actual dischargers under Central Coast Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, watershed coalitions, government agencies, or any mix of the above. All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy.

Key Element 1: A NPS Control Implementation Program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs) and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Central Coast Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Central Coast Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 10, Monitoring Program).

Key Element 5: Each Central Coast Water Board shall make clear, in advance, the

potential consequences for failure to achieve a Program's objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

10.1.5. Onsite Wastewater Disposal System Discharges

For onsite 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 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.

Although the County is implementing the "Wastewater Management Plan for the San Lorenzo River Watershed," individual homeowners are ultimately the responsible parties for their onsite wastewater disposal systems.

For onsite systems within the City of Scotts Valley, Water Board staff concluded the City is already taking appropriate actions to control discharges from onsite 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 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 sewage 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.

[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 (OSDS) are ultimately responsible for assuring their OSDSs are not degrading water quality.

Within one year of approval of these TMDLs by the California Office of Administrative Law, the Executive Officer or the Central Coast Water Board will:

Require owners of OSDS in the county areas of the San Lorenzo River Watershed to submit evidence that their OSDS are not degrading water quality. Or, in lieu of/or addition to these submittals by owners of OSDS, will determine if the County of Santa Cruz is making adequate progress towards implementing the San Lorenzo River Management Plan, or an updated plan, as it pertains to reducing pollution sources from OSDS.

Require owners of OSDS in the City of Scotts Valley to submit evidence demonstrating they are in compliance with the City of Scotts Valley's program that requires failed OSDS to connect to the sanitary sewer collection system. The Central Coast Water Board will request this information triennially until all onsite wastewater disposal systems with the potential to impact surface water have connected to the City of Scotts Valley sanitary sewer collection system. Or, in lieu of/or addition to these submittals by owners of onsite wastewater disposal systems, will consult with the City of Scotts Valley to determine if the number of remaining unconnected systems is approaching zero at a rate necessary to achieve the TMDLs by the target date (described in Timeline and Milestones, Section 10.4, below).

10.1.6. Homeless Persons/Encampment Discharges

Owners/operators of land that contains homeless persons/encampments in the San Lorenzo River Subbasin must comply with the San Lorenzo River Subbasin prohibition.

Within one year following approval of these TMDLs by the California Office of Administrative Law, the Executive Officer will notify owners/operators of lands that contain homeless persons/encampments of the San Lorenzo River Subbasin prohibition and conditions for compliance with the prohibition, as described in Chapter Five, section IV.B. of the Water Quality Control Plan.

10.2. Proposed San Lorenzo River Watershed Prohibition Modification

The *Water Quality Control Plan, Central Coast Region* (Basin Plan) contains the following discharge prohibition (Chapter Five, Section IV.B) adopted by the Central Coast Water Board in 1975:

> "Waste discharges to the following inland waters are prohibited:…All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio

> Creek Subbasins and all water contact recreation areas except where benefits can be realized from direct discharge of reclaimed water."

As explained in Section 1.5, Waste Discharge Prohibition, the State Board adopted the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (Program) in May 2004.

Water Board staff concluded the existing prohibition does not apply to nonpoint source discharges. Therefore, staff proposes to modify the prohibition to address specific nonpoint sources of pollution, and that compliance with the modified prohibition should be consistent with the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program*

Therefore, staff proposes the following modification to the existing prohibition in the Basin Plan (please note that new language is underlined).

> Waste discharges to the following inland waters are prohibited:…(2) All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins and all water contact recreation areas except where benefits can be realized from direct discharge of reclaimed water.
>
> Owners and/or operators of lands used for/containing non-regulated activities and/or infrastructure that could discharge or contain a discharge of human waste (including, but not limited to homeless persons/encampments, private laterals to public sewage collection systems, or any other activity or infrastructure in the care of said owners/operators), and owners and/or operators of land used for/containing domesticated animals (including, but not limited to: horses, cattle, goats, sheep, dogs, cats, or any other animals in the care of said owners/operators), in the San Lorenzo River Subbasin and Aptos-Soquel Subbasin must comply with this prohibition. However, this prohibition does not apply to said owners and/or operators if they:
>
> 1. Submit documentation demonstrating, to the satisfaction of the Executive Officer, that there are no discharges of, or containing, fecal sources by humans and/or domesticated animals into waters of the San Lorenzo River Subbasin or Aptos-Soquel Subbasin, or
>
> 2. Submit a nonpoint source pollution control implementation program for approval by the Executive Officer that is consistent with the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program*, May 20, 2004; such a program must include management practices that control pollution discharges, monitoring and reporting to Central Coast Regional Water Quality Control Board, or
>
> 3. Comply with Waste Discharge Requirements or an NPDES permit, or a conditional waiver of waste discharge requirements that explicitly addresses compliance with the:

a. Total Maximum Daily Loads for Pathogens in San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek and Lompico Creek (RB3-2008-0001)
b. Total Maximum Daily Loads for Pathogens in Soquel Lagoon, Soquel Creek, and Noble Gulch (RB3-2008-0002)
c. Total Maximum Daily Loads for Pathogens in Aptos Creek, Valencia Creek, and Trout Gulch (RB3-2008-0003).

This modification to the prohibition takes effect three years after the Total Maximum Daily Loads are approved by the California Office of Administrative Law.

10.3. Evaluation of Implementation Progress

Central Coast Water Board staff will conduct a review of implementation actions according to the schedule identified in Section 10. Central Coast Water Board staff will use annual reports, NPS Pollution Control Implementation Programs, as well as other available information, to review water quality data and implementation progress toward achieving the allocations and the numeric targets.

Central Coast Water Board staff may conclude that ongoing implementation efforts are insufficient to ultimately achieve the allocations and numeric target. If staff makes this determination, staff will recommend that additional reporting, monitoring, or implementation efforts be required either through approval by the Executive Officer or by the Central Coast Water Board. Central Coast Water Board staff may conclude, at the time of review, that they expect implementation efforts to result in achieving the allocations and numeric target. In that case, staff will recommend that existing and anticipated implementation efforts should continue.

Responsible implementing parties will monitor according to the proposed monitoring plan (see Section 11) for at least three years, at which time Central Coast Water Board staff will determine the need for continuing or otherwise modifying the monitoring requirements.

10.4. 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.

10.5. 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

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.

[24] Average Santa Cruz County occupancy

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 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: The only new reporting requirement applies to the City of Scotts Valley. Water Board staff is recommending the City of Scotts Valley report to the Water Board triennially progress made toward connecting onsite sewage disposal systems to the community collection system. Water Board staff concludes the cost associated with this reporting is minimal.

Domesticated Animals/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.

Domesticated Animals/Livestock Plan Implementation: There are a variety of methods owners of domesticated animals/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
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

Responsible Party	Monitoring Site	Sampling Period	Number of Samples[1]	Constituent(#/100 mL)
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.

REFERENCES

Applied Survey Research, http://www.appliedsurveyresearch.org/homeless-sc.htm

California Regional Water Quality Control Board, Central Coast Region *Water Quality Control Plan, Central Coast Region,* September 8, 1994 (amended April 14, 1995 via Resolution 95-04)

California Regional Water Quality Control Board, Central Coast Region *San Lorenzo River Pathogen Project Plan*, June 1, 2004

California Regional Water Quality Control Board, San Francisco Bay Region, *Pathogens in the Napa River Watershed Total Maximum Daily Load*, Staff Report, June 14, 2006

Ecology Action, *Manure Management Survey Results*, 2006

Ecology Action, E-mail dated 5-1-2007 from Jennifer Harrison

Griffith, John F., Stephen B. Weisberg, Charles D. McGee. Evaluation of Microbial Source Tracking Methods using Mixed Fecal Sources in Aqueous Test Samples, 2003

American Miniature Horse Association. Retrieved January 24, 2007 from http://www.amha.com/MarketTools/Profitity.html

CityTownInfo.com. Scotts Valley, Ca. Year 2005 population based on year 2000 Census data and estimated % population change. Retrieved January 22, 2007 from http://www.citytowninfo.com/places/california/scotts-valley,

http://www.hellosantacruz.com/Census.Cfm, December 19, 2004. Retrieved January 22, 2007.

http://www.progressivefarmer.com/farmer/animals/article/0,24672,1113452,00.html. Retrieved January 24, 20007.

http://santacruzrealestate.biz/cities/san_lorenzo_valley/index.htm, Information Designs © 2002-2005. Retrieved January 22, 2007

http://www.santacruzsentinel.com/archive/2005/Cotober/22/local/stories/01local.htm. October 22, 2005 Retrieved April 27, 2006

http://www.security-ness.com/DesignDetail.html. Retrieved January 23, 2007

Ricker, John. Water Quality Division Director. County of Santa Cruz. Health Services Agency. Personal Communication. September 18, 2007.

Ricker, John. Water Quality Division Director. County of Santa Cruz. Health Services Agency. Personal Communication. October 15, 2007.

Riverson, J. 2003. Fecal Coliform Investigation and Analysis Spreadsheet (FECIA) [computer program]. Version 3, 8/25/2003. Tetra Tech, Inc., 2003. Fairfax, VA

Santa Cruz County Health Services Agency, Environmental Health Service, City of Santa Cruz Clean Beach Initiative Projects, *Repair of Leaking Sewer Lines and Diversion of Storm Drain Flow to Sanitary Sewer Monitoring Results,* October, 2007

Santa Cruz County Health Services Agency, Environmental Health Service, *An Evaluation of Wastewater Disposal and Water Quality in the San Lorenzo River Watershed,* September 1989

Santa Cruz County, Health Services Agency, Environmental Health Services, *Draft San Lorenzo River Watershed Management Plan Update,* October, 2001

Santa Cruz County, Health Services Agency, Environmental Health Services**,** *Final Assessment of Sources of Bacterial Contamination* at Santa Cruz County Beaches, March 2006

Santa Cruz County Health Services Agency, Environmental Health Services, *San Lorenzo River Watershed Management Plan Update*, *Evaluation of Urban Water Quality, Task 4 Report,* August, 2001

Santa Cruz County Planning Department, *The San Lorenzo River Watershed Management Plan*, December 1979

Santa Cruz County, Health Services Agency, Environmental Health Services**,** *Wastewater Management Plan for the San Lorenzo River Watershed,* February 1995

State Water Resources Control Board, 2004. Fact Sheet. Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, May 20. (Adopted August 26, 2004).

State Water Resources Control Board, 2004. Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, May 20. (Adopted August 26, 2004).

United States Environmental Protection Agency, *Ambient Water Quality Criteria for Bacteria-1986*, January 1986

United States Environmental Protection Agency, *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 840-B-92-002,* January 1993

United States Environmental Protection Agency, *Protocol for Developing Pathogen*

TMDLs, January 2001