California Regional Water Quality Control Board
Central Coast Region

Total Maximum Daily Loads for Fecal Coliform in Soquel Lagoon, Soquel Creek, and Noble Gulch, Santa Cruz County, California

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

Adopted by the
California Regional Water Quality Control Board
Central Coast Region
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Documents also are available at: http://www.waterboards.ca.gov/centralcoast/TMDL/index.htm

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1. PROJECT DEFINITION

1.1. Introduction

Soquel Lagoon was identified as impaired for pathogens and was placed on the 1996 Clean Water Act 303(d) list of impaired waters. Based on historic and recent data, concentrations exceeded the water quality objectives for fecal coliform. Staff proposed allocations and implementation actions for identified controllable sources in Soquel Lagoon.

Soquel Creek and Noble Gulch are located in the Soquel Lagoon Watershed and were not listed on the Clean Water Act section 303(d) list of impaired waters for pathogens. The Central Coast Water Board found that Soquel Creek and Noble Gulch were impaired for fecal coliform. Therefore, staff also proposed allocations and implementation actions for identified controllable sources in Soquel Creek and Noble Gulch.

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

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 to account for any lack of knowledge concerning the relationship between load limits and water quality.

1.2. Listing Basis

According to the 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 (United States Environmental Protection Agency, *Protocol for Developing Pathogen TMDLs*, January 2001)." Therefore, scientists and public health officials typically choose to monitor nonpathogenic bacteria that are usually associated with pathogens transmitted by fecal contamination but are more easily sampled and measured. These associated bacteria are called indicator organisms, or fecal indicator bacteria (FIB). 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 water quality objectives to represent pathogenic organisms.

Soquel Lagoon was placed on the 303(d) list of impaired waters in 1996. The Soquel Lagoon was placed on the list of impaired waters based on fecal indicator bacteria data

from the Santa Cruz County Environmental Health Department; the data had exceedances of water quality objectives in all years for which there was data (1986 to 1994). Additional data collected between 1994 and 2005 also had exceedances of water quality objectives.

1.3. Beneficial Uses

The Basin Plan describes beneficial uses for water bodies in the Central Coast Region. The Soquel Lagoon beneficial uses are:

- Contact and Non-contact Recreation,
- Wildlife Habitat,
- Cold Freshwater Habitat,
- Migration of Aquatic Organisms,
- Spawning, Reproduction and/or Early Development,
- Rare, Threatened or Endangered Species,
- Estuarine Habitat,
- Commercial and Sport Fishing, and
- Shellfish Harvesting.

Central Coast Water Board staff is proposing to remove the shellfish harvesting beneficial use in the Soquel Lagoon. This is primarily based on the fact that staff found no evidence of the shellfish harvesting beneficial use in the Soquel Lagoon (Lagoon), nor the potential to support such a use. Hydraulic modifications, seasonal Lagoon closure to tidal circulation, lack of suitable physical conditions and lack of evidence of any historic (since 1975) or current shellfish harvesting have led Central Coast Water Board staff to propose removal of the shellfish harvesting beneficial use in the Lagoon. Appendix-D, "Use Attainability Analysis for the Soquel Lagoon," provides the basis for staff's proposal.

1.4. Water Quality Objectives

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

The Basin Plan contains specific water quality objectives for fecal coliform (Basin Plan, pg. III-10); the applicable objectives are listed in the following subsections and apply to all the waterbodies that are part of this project.

Escherichia coli (*E. coli*) are often used as fecal indicator bacteria. The Basin Plan does not include water quality objectives for *E. coli*. However, the United States Environmental Protection Agency (USEPA) recommends *E. coli* not exceed a log mean

of 126 CFU per 100 mL, based on not less than generally 5 samples equally spaced over a 30-day period (USEPA, *Ambient Water Quality Criteria for Bacteria-1986*, January 1986).

1.4.1. Water Contact Recreation

The following water quality objective protects the water contact beneficial use:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.[1] All the waterbodies assigned allocations in this project are designated this beneficial use.

1.4.2. Non-Contact Water Recreation

The following water quality objective protects the non-contact water beneficial use:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 2000 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 4000 MPN per 100 mL.

1.4.3 Shellfish Harvesting

The following water quality objective protects the shellfish harvesting beneficial use. However, please note that staff is proposing to remove the shellfish harvesting beneficial use (from the Soquel Lagoon) as part of this project. If this beneficial use is removed, then the following water quality objective will not apply.

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 10 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 Central Coast Water Board is proposing to remove the shellfish harvesting beneficial use; therefore, these objectives will not apply if the proposal is approved.

[1] 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).

1.4.4 Other Applicable Beneficial Uses

The Basin Plan does not include explicit numeric objectives for fecal coliform for the protection of other surface water beneficial uses.

1.5. Waste Discharge Prohibition

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

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

2. WATERSHED DESCRIPTION

2.1. Location, Climate, and Hydrology

Soquel Creek flows from its headwaters in the Santa Cruz Mountains toward the city of Capitola and drains into the Pacific Ocean. The Soquel Lagoon (the Lagoon) is formed in Soquel Creek's southernmost reach within the City of Capitola. According to the U.S. Census Bureau, the City of Capitola population in the year 2004 was approximately 9,640.

The Soquel Lagoon Watershed (Watershed) is approximately 42 square miles and is made up of several subwatersheds, including: Soquel Lagoon, Soquel Creek, Bates Creek and Noble Gulch (see Figure 2-1). The largest of the three, the Soquel Creek subwatershed, drains approximately 38 square miles.

Two waterbodies, Noble Gulch (the Gulch) and Bates Creek, drain into the downstream most, and most urbanized, two miles of Soquel Creek. Noble Gulch is piped underground for the last 0.4 mile prior to draining into the Lagoon from the northeast. Bates Creek drains into Soquel Creek from the northeast approximately two miles north of the mouth of the Lagoon. Several other creeks flow into Soquel Creek in the upper Soquel Watershed (Figure 2-1).

Capitola Public Works Department constructs a sandbar across the mouth of the Lagoon each year in May and monitors breaching in the winter to avoid flooding. The Lagoon's northernmost boundary is loosely defined as "somewhere between the Railroad Trestle and Nob Hill," based on the observance of "the saltwater prism, which during high tide can extend as far upstream as Nob Hill" (personal communication, Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, March 9, 2006). Nob Hill is a market located adjacent to the Lagoon approximately 0.7 miles north of the mouth of the Lagoon. Figure 2-2 illustrates the approximate location of the Lagoon in relation to other land references.

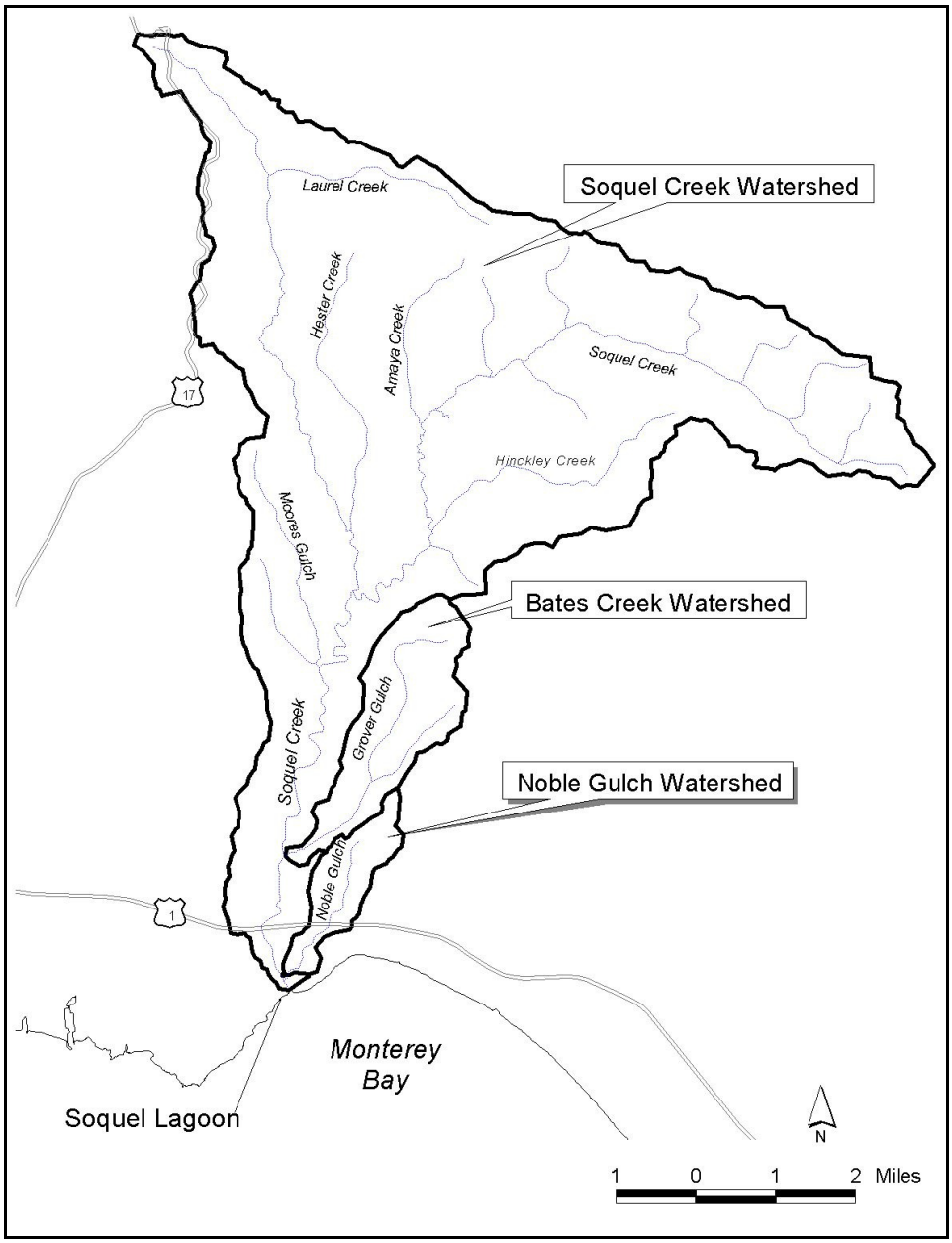

Figure 2-1. Waterbodies within the Soquel Watershed

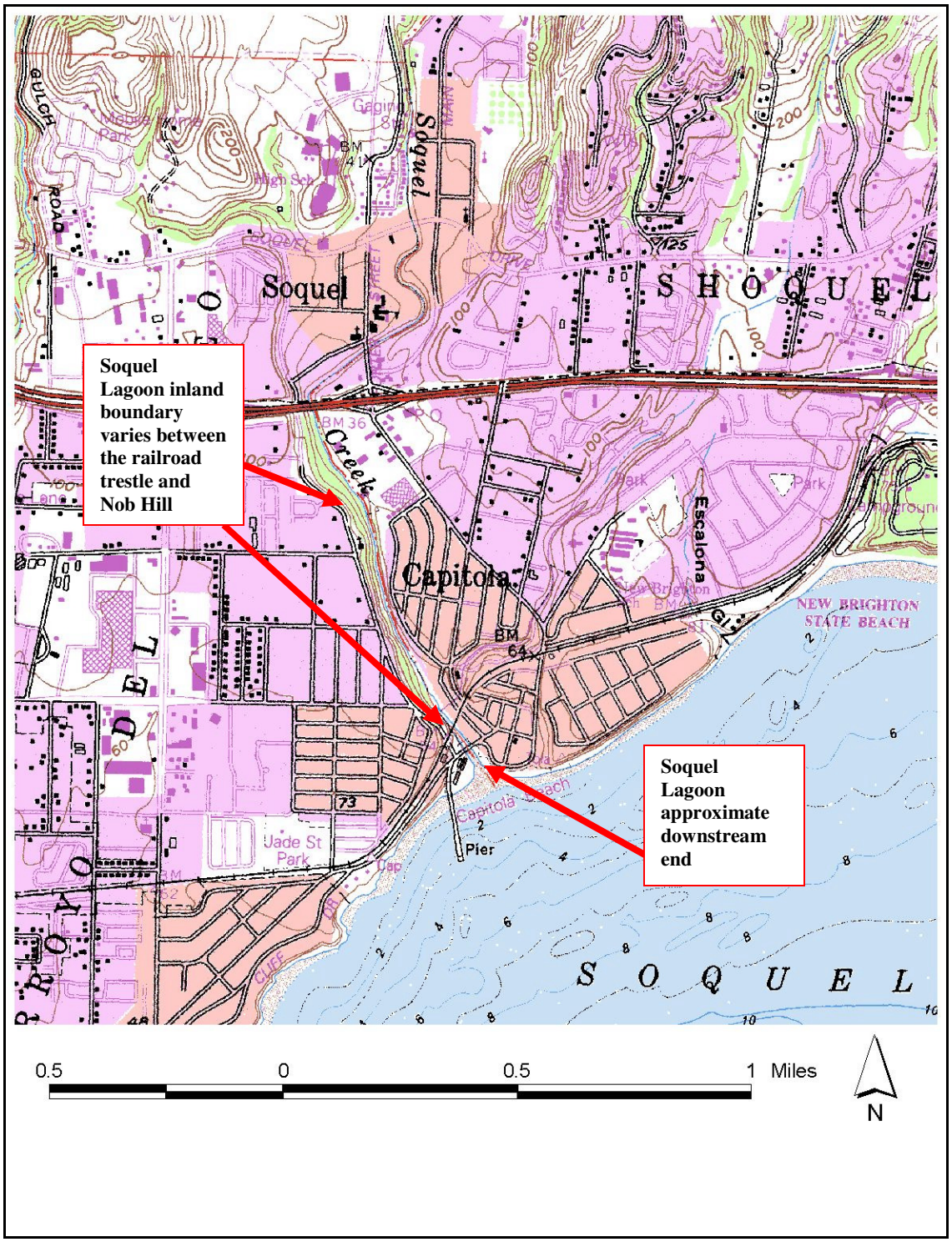

Figure 2-2. Soquel Lagoon Boundaries

The Watershed has a Mediterranean climate. Summers are warm and dry, cooled at times by fog at lower elevations due to the proximity of the Pacific Ocean. Winters are cool and wet. Average annual precipitation from October 1996 thorough April 2006 was approximately 21.80 inches at the City of Capitola (Figure 2-3). The wettest time of the year was generally from December to April.

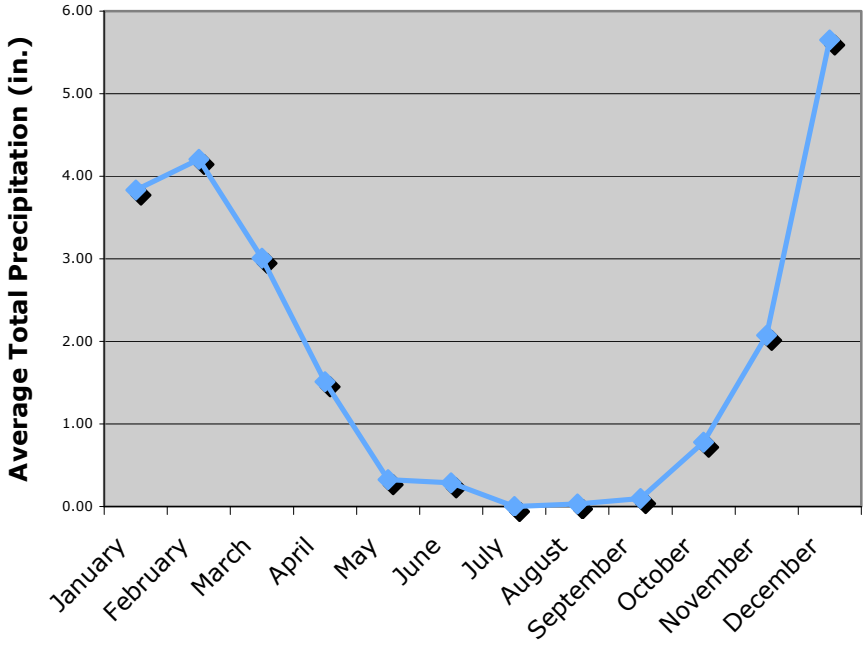

Figure 2-3. City of Capitola Average Monthly Precipitation from October 1996 through April 2006

Information provided in the *Assessment of Sources of Bacterial Contamination At Santa Cruz County Beaches* (Ricker and Peters, 2006) indicated that flow based on measurements at the mouth of Soquel Creek was 4.3 cubic feet per second (cfs) during mid-summer. The document also indicated that flow in Soquel Creek, approximately 0.7 mile upstream from the mouth, was 4.0 cfs and in Noble Gulch was 0.2 cfs. Both flow rates were estimates during mid-summer months. The flow rate estimate at approximately 0.7 mile upstream from the mouth was based on flow at the United States Geologic Survey gauge approximately 0.9 mile upstream of this location and was adjusted for input from the outfalls at this location. Outfall flow was based on the document, *Soquel Watershed Assessment and Enhancement Project Plan* (D.W. Alley, et al., 2003). The flow rate estimate in Noble Gulch was based on visual observation, and is an estimate of typical conditions. Although both of the later flow rates were estimates, they provide an idea of relative flow of the two waterbodies.

2.2. Land Use

The Watershed includes lands under the jurisdiction of the City of Capitola, the County of Santa Cruz, and California State Parks system. Figure 2-4 illustrates the California State Parks and City of Capitola lands in the Soquel Lagoon watershed.

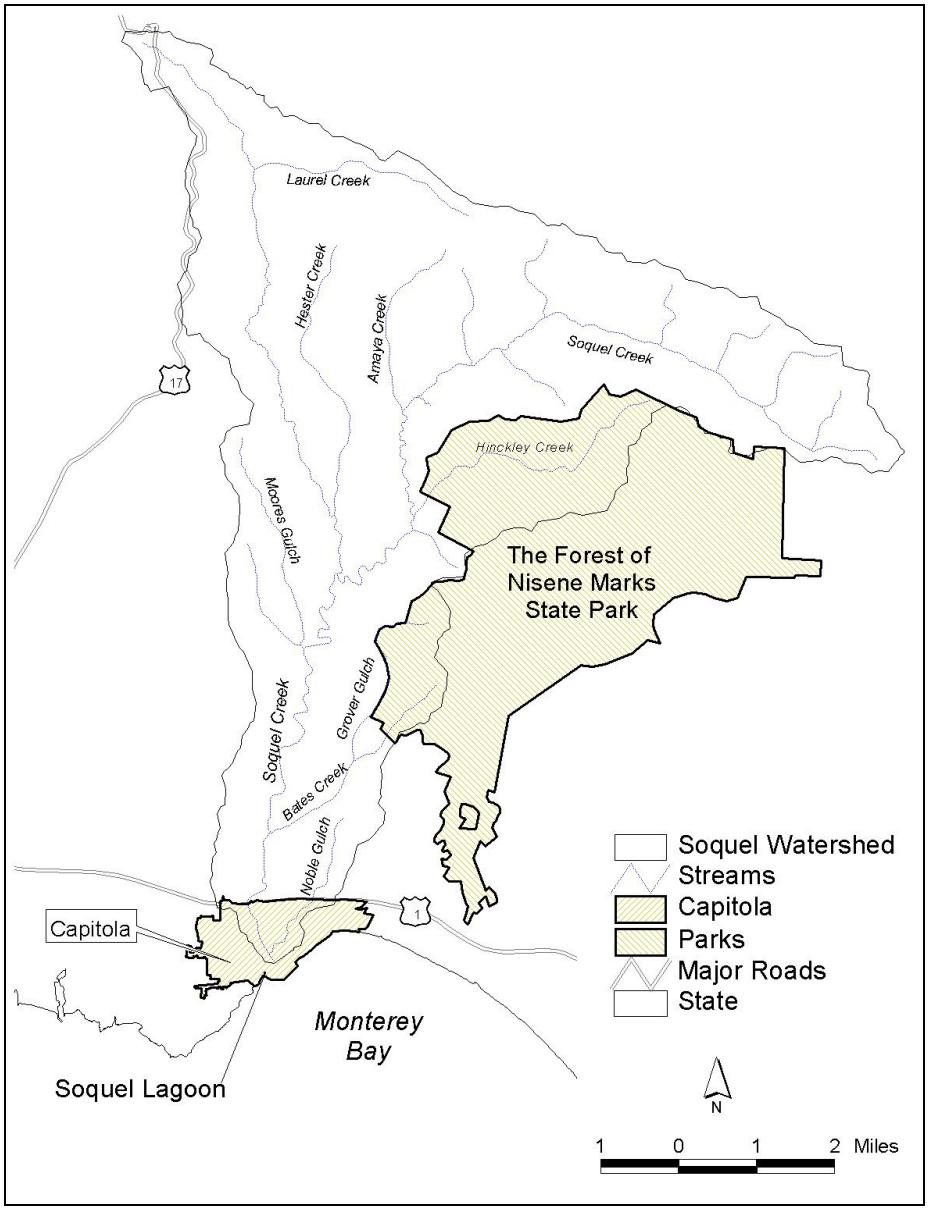

Figure 2-4. City of Capitola and the Forest of Nisene Marks State Park Boundaries

Land uses in the Watershed include bare lands, pasture, urbanized areas, and naturally vegetated lands that include areas covered with forest, shrubs, and grasses.

Ninety three percent of the land in the Soquel Creek Subwatershed is covered by naturally occurring vegetation. The second largest land use is urban at seven percent. The majority of urban land use is concentrated in the southern tip of Soquel Creek Subwatershed while forest and other naturally vegetated land uses cover the remainder. Pasture/hay, bare ground, and open water account for a combined area of less than one percent of the land area in the Soquel Creek Subwatershed.

Sixty eight percent of Noble Gulch Subwatershed is urban development, while 32 percent is naturally occurring vegetation.

The Bates Creek Subwatershed is farther upstream away from the more urbanized section of the Watershed than Noble Gulch. Therefore the majority of land (84 percent) is covered by naturally occurring vegetation. However, 10 percent of the land use is urban, and six percent is pasture/hay.

Table 2-1 summarizes the land uses occurring in the project Watershed.

Table 2-1 Land uses in major subwatersheds of the Soquel Lagoon Watershed[1].

	Land Use / percent of area covered by type		
Subwatershed	Urban	Naturally Vegetated	Pasture/hay
Soquel Creek	7%	93%	
Noble Gulch	68%	32%	
Bates Creek	10%	84%	6%

[1] Staff used data which represents land uses from 1988 to 1994. (Land uses have not changed significantly since 1994.)

3. DATA ANALYSIS

3.1. Water Quality Data

This section discusses the water quality data staff used to develop these TMDLs, the results of water quality analyses, and the impacted areas. Staff analyzed data from water quality sampling conducted by two sources: 1) The County of Santa Cruz Environmental Health Services, and 2) The Coastal Watershed Council (CWC). Data provided by the County was collected from 1986 to 2006; however, water board staff used only data collected from 2003 to 2006 between the Lagoon mouth and the West Branch of Soquel Creek at San Jose and Olive Springs Roads. Staff also analyzed Santa Cruz County data from 2003 to 2006 from Noble Gulch and Bates Creek. Data provided by the CWC was collected in 2004 and 2005 from storm drains in the Capitola area. Staff analyzed CWC data from those storm drains that emptied into the Lagoon.

There were several stations sampled along Noble Gulch with very small data sets. Santa Cruz County staff tried to isolate areas of highest contamination and sampled some of the locations only a few times or less since 2003. The data was not included here due to the small sample sizes and because staff concluded the data would not change the conclusions in this report. The data is included in Appendix A.

Additional data provided by the County of Santa Cruz was submitted late in the writing of this Final Project Report. Staff reviewed the data and concluded it would not change the implementation strategies of this report. However, staff included one of the data sets in this analysis because it replaced a former data set that had questionable data quality. The remainder of the data that was submitted late is included in Appendix A.

3.1.1. Soquel Creek

Fecal coliform sampling activities for Soquel Creek are shown in the table below.

Table 3-1. Santa Cruz County Environmental Health Services Fecal Coliform Sampling Locations and Period of Data Record in Soquel Creek

Station #	Station Location	Number of Samples from 2003 to 2006	Frequency of Samples from 2003 to 2006	Total Period of Record[1]
S0	Soquel Creek at Flume Outlet	211	2003 - Irregular 2004 to 2006 - Weekly	1987 to 2006
S04	Soquel Creek Above Stockton Bridge East	6	Irregular	1987 to 2005
S07	Soquel Creek at Railroad Trestle	58	Irregular	1986 to 2006
S23	Soquel Creek at Nob Hill	82	Irregular	1986 to 2006
S2315	Soquel Creek at Porter Street Bridge	35	Irregular	2003 to 2006
S6	West Branch Soquel Creek at San Jose at Olive Springs Road	42	Irregular	2003 to 2006

The County collected fecal coliform samples at the most downstream station in Soquel Creek (Soquel Creek at Flume Outlet; SO) at least weekly from 2003 to 2006 with the exception of three months in 2003 (Figure 3-1). Approximately eight to 10 samples were collected each month in 2005 and January of 2006 from the same station. Four additional stations in the lowest 1.75 miles of Soquel Creek and Lagoon (SO4-S2315) were sampled irregularly (Table 3-1). A fifth station (S6; approximately 4.5 miles upstream of Soquel Lagoon) was sampled irregularly.

Santa Cruz County staff sampled additional stations along Soquel Creek a few times since 2003. There were 12 total samples collected from six different sites in an approximately 0.5 mile reach upstream of the Soquel Creek at Porter Street Bridge station. Water Board staff included the stations (S232, S2321, S24, S234, S253, and S275) and data in Appendix A. Staff did not include the data in Table 3.1 because of the number of stations with such small data sets.

The sampling stations of Soquel Lagoon and Creek from the mouth to the upper watershed provided information as follows. Staff determined stations downstream of and

1 Data collection periods of record may contain gaps. Only data from 2003 to 2006 were used in the analysis.

including the Soquel Creek at Railroad Trestle sampling station (S07) provided information on fecal coliform levels in the Noble Gulch Subwatershed. Stations from the Soquel Creek at Nob Hill sampling station (S23) to the Soquel Creek at Porter Street Bridge sampling station (S2315) provided information regarding fecal coliform for a reach above the Lagoon but still within the urban section of the Soquel watershed and including some of Bates Creek watershed. The West Branch Soquel Creek at San Jose at Olive Springs Road sampling station (S6; Figure 3-2) provides information regarding water quality from approximately half way upstream in the watershed, which is a receiving water for mostly rural residential and naturally vegetated land.

Figure 3-1 and Figure 3-3 illustrate monitoring site locations and proportion of data exceeding water quality objectives.

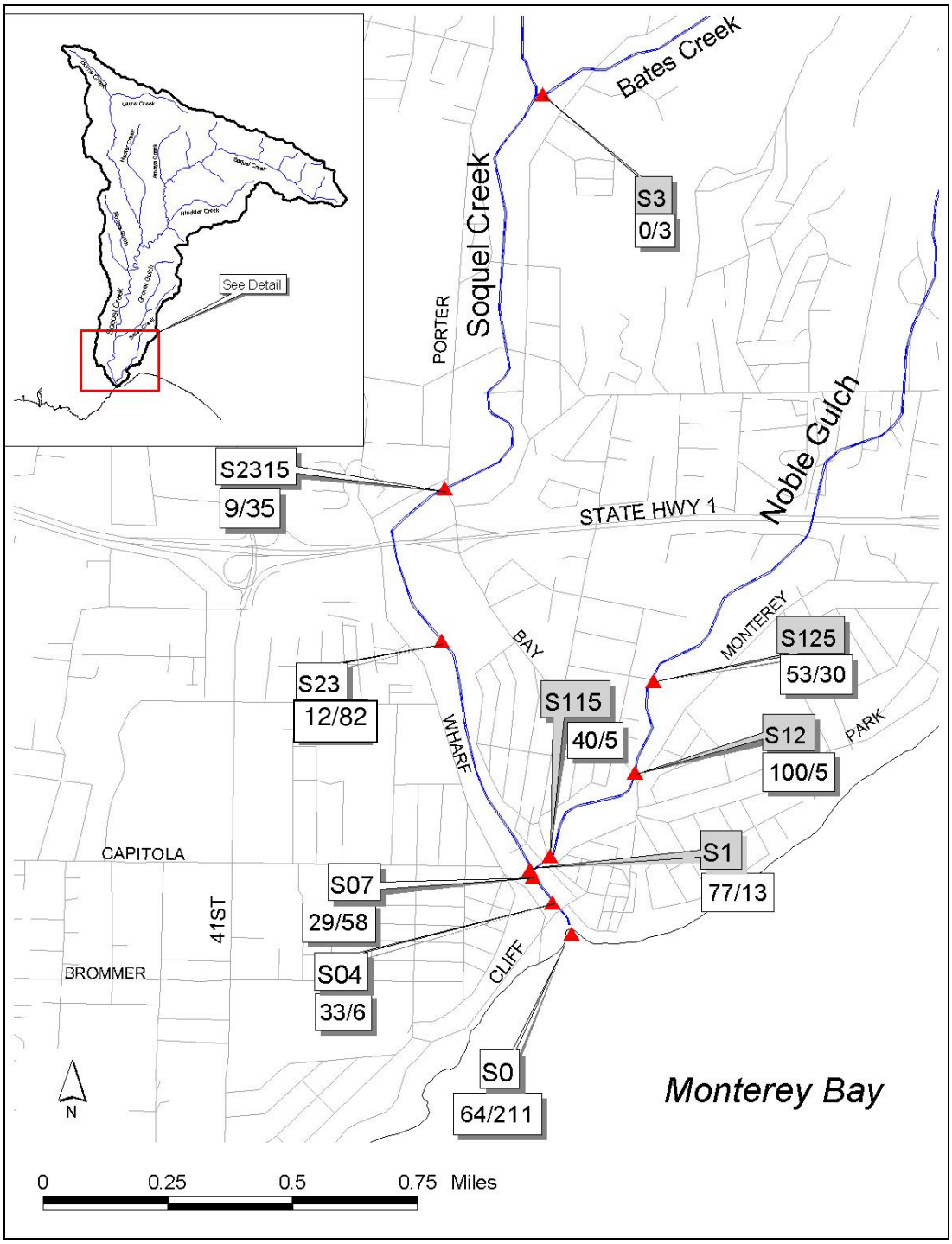

Figure 3-1. Soquel Creek, Noble Gulch, and Bates Creek Sampling Stations showing station numbers. Below each station number is the percent of data exceeding 400 MPN over the number of samples since January 1, 2003 (for example, Station S07 exceeded the 400 MPN objective 29 percent of the time based on 58 samples). Noble Gulch and Bates Creek Sampling Stations were shaded to separate them from the Soquel Creek stations.

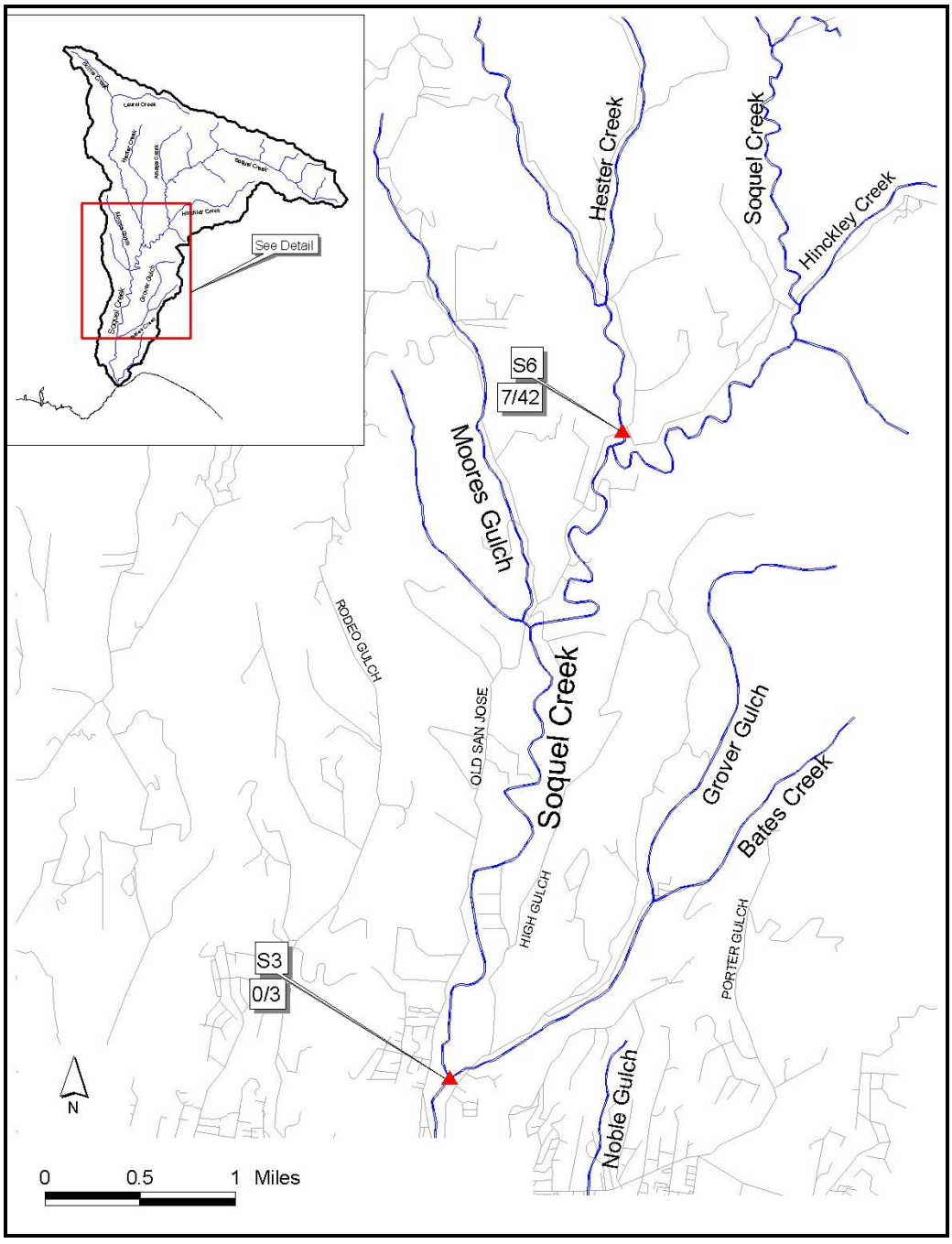

Figure 3-2. West Branch Soquel Creek at San Jose at Olive Springs Road Sampling Station (S6). (This Sampling Station was too far upstream in the Watershed to include on Figure 3-1). The Bates Creek Sampling Station (S3) from Figure 3-1 was included for reference. Both stations show percent exceedance over number of samples since January 1, 2003.)

3.1.2. Noble Gulch

Recent fecal coliform sampling activities for Noble Gulch are shown in the Table below.

Table 3-2. Santa Cruz County Environmental Health Services Fecal Coliform Sampling Locations and Period of Data Record in Noble Gulch

Station #	Station Location	Number of Samples from 2003 to 2006	Frequency of Samples from 2003 to 2006	Total Period of Record[1]
S1	Noble Gulch at Soquel Creek	13	Irregular	1986 to 2005
S115	Noble Gulch at Pacific Cove Entrance	5	Irregular	2005
S12	Noble Gulch at Tunnel at Bay	5	Irregular	2003 to 2005
S125	Noble Gulch at St. Joe's Church	30	Irregular	2003 to 2006

Santa Cruz County Environmental Health Services sampled four stations on Noble Gulch irregularly (Figure 3-1). All data is included in Appendix 1 of this report.

Although Noble Gulch flowed at approximately 0.05 the rate of the flow of Soquel Creek (see Section 2.1 *Location, Climate, and Hydrology*), it discharged directly into the Lagoon. Therefore, analyzing data from Noble Gulch was important to the water quality analysis of this report.

1 Data collection periods of record may contain gaps.

3.1.3. Bates Creek

Recent fecal coliform sampling activities for Bates Creek are shown in the Table below.

Table 3-3. Santa Cruz County Environmental Health Services Fecal Coliform Sampling Locations and Period of Data Record in Bates Creek

Station #	Station Location	Number of Samples from 2003 to 2006	Frequency of Samples from 2003 to 2006	Total Period of Record[1]
S3	Bates Creek at Soquel Creek	3	Irregular	2004 to 2005

The County collected fecal coliform samples at one Bates Creek station (Bates Creek at Soquel Creek; S3) on three occasions in 2004 and 2005 (Figure 3-1). This sampling site was just upstream of the confluence of Soquel Creek and Bates Creek. Although this is a small data set, it is included here to show that this is the only data from 2003 to 2006 and to support the conclusion in the monitoring section that more data is needed from this Creek.

3.1.4. Storm Drains

Santa Cruz County staff collected very few water samples from 2003 to 2006 in storm drains that drain to Soquel Creek because the sampling stations were either under the water level of Soquel Creek and could not be sampled, or they were dry. Therefore, staff did not use data from these samples in their analysis.

The data provided by CWC used in this report was *E. coli* data collected at two storm drain sampling stations. Two samples were collected in 2004 and eight samples were collected in 2005 from two storm drains that emptied into Soquel Creek and Lagoon (the data is included in Appendix A). Staff analyzed the 2005 data only, because the 2004 data set was small. Staff reviewed the 2004 data and determined it would not change the conclusions of this report. One station, the Creekside sampling station, was located approximately 0.8 mile upstream of the mouth of the Lagoon and a second station, the Monterey Ave. station, was located along Monterey Ave. approximately 0.3 mile northeast of the Lagoon.

3.1.5. Data Analysis Method

Staff analyzed Santa Cruz County Environmental Health water quality sampling results using a program titled "Fecal Coliform Investigation and Analysis Spreadsheet" (FECIA). FECIA is a fully automated spreadsheet designed to assist in characterization and quantification of pathogenic indicator organism water quality objectives exceedances. Observed data are compared against specified values equal to water quality objectives to determine the magnitude and frequency of exceedances.

Staff used the FECIA program to generate the data analysis figures and tables located in Appendix B of this report. Figures were generated for each sampling station. Each figure displays analyzed data collected from 2003 to 2006 as shown in the tables in Section 3.1 *Water Quality Data*. The figures display either the water contact recreation beneficial use geometric mean water quality objective or the water contact recreation beneficial use maximum water quality objective. The maximum water quality objective (400 MPN) was used when the County of Santa Cruz took less than five samples in a 30-day period. Concentration ranges, the range of concentrations within the 25^{th} -75^{th} percentile range, the mean concentration, and the median concentration are shown in the resulting FECIA analysis.

Some sampling stations lacked enough data for staff to conclude impairment based on water quality objectives. Therefore, staff based their conclusions regarding impairment on the *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List (*State Water Resources Control Board, adopted on September 2004).

Staff also generated tables that summarized data on a monthly basis. Tables were generated for each sampling station. Each table 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.

There were only two 2004 CWC data samples, therefore formal analysis was unnecessary. CWC data from 2005 was analyzed by creating an Excel table of data and statistics. The data from both years and the Excel table of the 2005 statistics are located in Appendix 1 of this report.

3.2. Data Analysis Summary

This section summarizes data analysis results contained in Appendices A and B. For each station sampled by Santa Cruz County, the percent violation of the geometric mean and maximum water quality objective are provided as well as the number of sample sets used to calculate the percent violation. FECIA calculated violations of the geometric mean water quality objective when five or more samples were available in a 30-day period. Sampling stations are listed from the most downstream station (top row of the table) to the most upstream station (bottom row of the table) on all three waterbody tables.

3.2.1. Soquel Creek

Table 3-4 shows the percent violation of the geometric mean objective, maximum water quality objective, and the number of samples used to determine the percent violation of these objectives in Soquel Creek.

Table 3-4. Soquel Creek Percent Violations of Water Quality Objectives since January 1, 2003

Station #	Station Location	Geometric Mean Water Quality Objective (200 MPN fecal coliform)		Maximum Water Quality Objective (400 MPN fecal coliform)	
		% Violations	Number of Samples Sets	% Violations	Number of Samples
S0	Soquel Creek at Flume Outlet	87	193	64	211
S04	Soquel Creek Above Stockton Bridge East	100	2	33	6
S07	Soquel Creek at Railroad Trestle	80	25	29	58
S23	Soquel Creek at Nob Hill	19	53	15	82
S2315	Soquel Creek at Porter Street Bridge	(1)	(1)	9	35
S6	West Branch Soquel Creek at San Jose at Olive Springs Road	(1)	(1)	7	42

(1) Insufficient data to calculate geometric mean

Note that samples from each of the monitoring stations in Soquel Creek exceeded one or both of the fecal coliform water quality objectives.

Staff did not analyze the 12 samples from the 0.5 mile reach upstream of the Soquel Creek at Porter Street Bridge sampling station using FECIA analysis. However, staff considered this data in determining the impaired reaches. Staff noted that only one of the 12 samples exceeded the maximum water quality objective (at 810 MPN/100mL; the maximum water quality objective is 400 MPN/100mL). All except one of the remaining 11 samples were less than 200 MPN/100mL.

3.2.2. Noble Gulch

Table 3-5 shows the percent violation of the geometric mean objective, maximum water quality objective, and the number of samples used to determine the percent violation of these objectives in Noble Gulch.

Table 3-5. Noble Gulch Percent Violations of Water Quality Objectives

Station #	Station Location	Geometric Mean Water Quality Objective (200 MPN fecal coliform)		Maximum Water Quality Objective (400 MPN fecal coliform)	
		% Violations	Number of Samples Sets	% Violations	Number of Samples
S1	Noble Gulch at Soquel Creek	100	2	77	13
S115	Noble Gulch at Pacific Cove Entrance	(1)	(1)	40	5
S12	Noble Gulch at Tunnel at Bay	(1)	(1)	100	5
S125	Noble Gulch at St. Joe's Church	100	5	53	30

Note that samples from each of the monitoring stations in Noble Gulch exceeded one or both of the fecal coliform water quality objectives.

Bates Creek

Table 3-6 shows the percent violation of the geometric mean objective, maximum water quality objective, and the number of samples used to determine the percent violation of these objectives in Bates Creek.

Table 3-6. Bates Creek Percent Violations of Water Quality Objectives

Station #	Station Location	Geometric Mean Water Quality Objective (200 MPN fecal coliform)		Maximum Water Quality Objective (400 MPN fecal coliform)	
		% Violations	Number of Samples Sets	% Violations	Number of Samples
S3	Bates Creek at Soquel Creek	(1)	(1)	0	3

Note that there was insufficient data to determine whether Bates Creek was meeting or exceeding the geometric mean of 200 MPN/100mL objective. However, the three samples indicated that the maximum water quality objective for fecal coliform was being achieved.

3.2.3. Storm Drains

Table 3-7 shows the percent violation of the *E. coli* water quality criterion and the number of samples used to determine the percent violation of these objectives in storm drains.

Table 3-7. Coastal Watershed Council 2005 *E. coli* Data and Statistics

Location	Date	*E. coli* (MPN/100mL)	% of samples >*E. coli* Target (235MPN)	Number of Samples
Creekside	**7/27/2005**	5		
	8/29/2005	379		
	9/29/2005	20		
	10/26/2005	173		
			25%	4
Monterey Ave.	**7/27/2005**	323		
	8/29/2005	3873		
	9/29/2005	598		
	10/26/2005	4884		
			100%	4

3.3. Identification of Impaired Reaches

This section characterizes the impaired reaches of Soquel Creek, Noble Gulch, Bates Creek, and the status of storm drains sampled by CWC in terms of *E. coli* levels. The subwatersheds and the waterbodies are identified using Figures 2-5 and 3-1.

3.3.1. Soquel Creek

Soquel Creek was impaired from the mouth of the Lagoon upstream to the Soquel Creek at Porter Street Bridge sampling station (the first sampling station that did not have impaired water quality). The percentage of exceedances at each sampling station decreased moving upstream from 64 percent at the mouth of the Lagoon to nine percent at the Soquel Creek at Porter Street Bridge station.

The trend of decreasing fecal coliform levels extended into the next approximately 0.5 mile unimpaired reach upstream of the Soquel Creek at Porter Street Bridge sampling station. Staff concluded this reach was unimpaired based on 12 samples from six stations within this 0.5 mile reach. Although a robust data set was lacking at any one station within the reach, considered together, there was only one data point out of 12 that exceeded the maximum water quality objective in this reach.

The farthest upstream station (West Branch Soquel Creek at San Jose at Olive Springs Road, approximately 4.5 miles upstream of the Lagoon) at which data was collected exceeded the water quality objective in seven percent of the samples. Staff determined this station was also unimpaired.

3.3.2. Noble Gulch

Fecal coliform objectives were exceeded in Noble Gulch at three of the four sampling stations downstream of and including the Noble Gulch at St. Joe's Church sampling station, approximately 0.6 mile upstream of the confluence of Noble Gulch and Soquel Creek.

Although the unanalyzed data sets (described above in Section 3.1 *Water Quality Data*) for this waterbody were small, the data, when considered together, supported the conclusion that Noble Gulch was impaired. All of the data (nine samples collected in February and March of 2005 within an approximately 0.75 mile reach upstream from Highway One) at four stations exceeded the water quality objective.

Staff concluded all reaches of Noble Gulch were impaired because there were no monitoring stations meeting water quality objectives.

3.3.3. Bates Creek

Only one station was sampled in Bates Creek located just prior to the confluence of Bates and Soquel Creeks. No fecal coliform maximum objective (400 MPN per 100 mL) exceedances were recorded at this station for the 3 samples collected from 2004 to 2005. Staff was unable to make a conclusion regarding the potential impairment of this waterbody due to the small data set. However, sampling of Soquel Creek immediately downstream of Bates Creek is required in the monitoring plan in Section 11. Samples from this location will help to determine water quality from Bates Creek.

3.3.4. Storm Drains

E. coli water quality criterion was exceeded at the Creekside and Monterey Ave (CWC) sampling stations in 2005. Exceedances at the Creekside station occurred one time out of four. Exceedances at the Monterey Ave. station occurred four times out of four. Both storm drains empty into Soquel Creek. Although the sample sizes were small, Central Coast Water Board staff concluded this data suggests that stormwater discharges carry pathogens to Soquel Creek. Additionally, staff concluded that more samples should be collected from storm drains in this area. The Monitoring Plan in Section 11 of this report establishes requirements for the County of Santa Cruz to sample storm drains.

3.3.5. Impaired Reaches

Staff developed the TMDLs in this report for the impaired reaches of the waterbodies described above and the corresponding subwatersheds. Staff summarized the impaired reaches as:

1) Soquel Lagoon and Soquel Creek from the mouth of the Lagoon upstream to the Soquel Creek at Porter Street Bridge sampling station, and
2) The entire reach of Noble Gulch.

3.4. Microbial Source Analysis Results

Genetic ribotyping is one method of microbiological source analysis and was utilized to identify microbiological sources in Soquel Lagoon and Noble Gulch. The genetic ribotyping method differentiated sources of *E. coli*. Monsour Samadpour of the University of Washington Public Health Department has worked with over 100,000 *E. coli* samples and 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 the 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 for ribotyping analysis from three of the sampling stations on Soquel Creek (S0, S04, and S23), one of the sampling stations on Noble Gulch (S1), and an additional station on Noble Gulch (S11D) that was originally thought to be a storm drain (Noble Gulch is piped underground for its last approximately 0.4 mile prior to entering Soquel Creek). The sampling stations are shown in Figure 3-3.

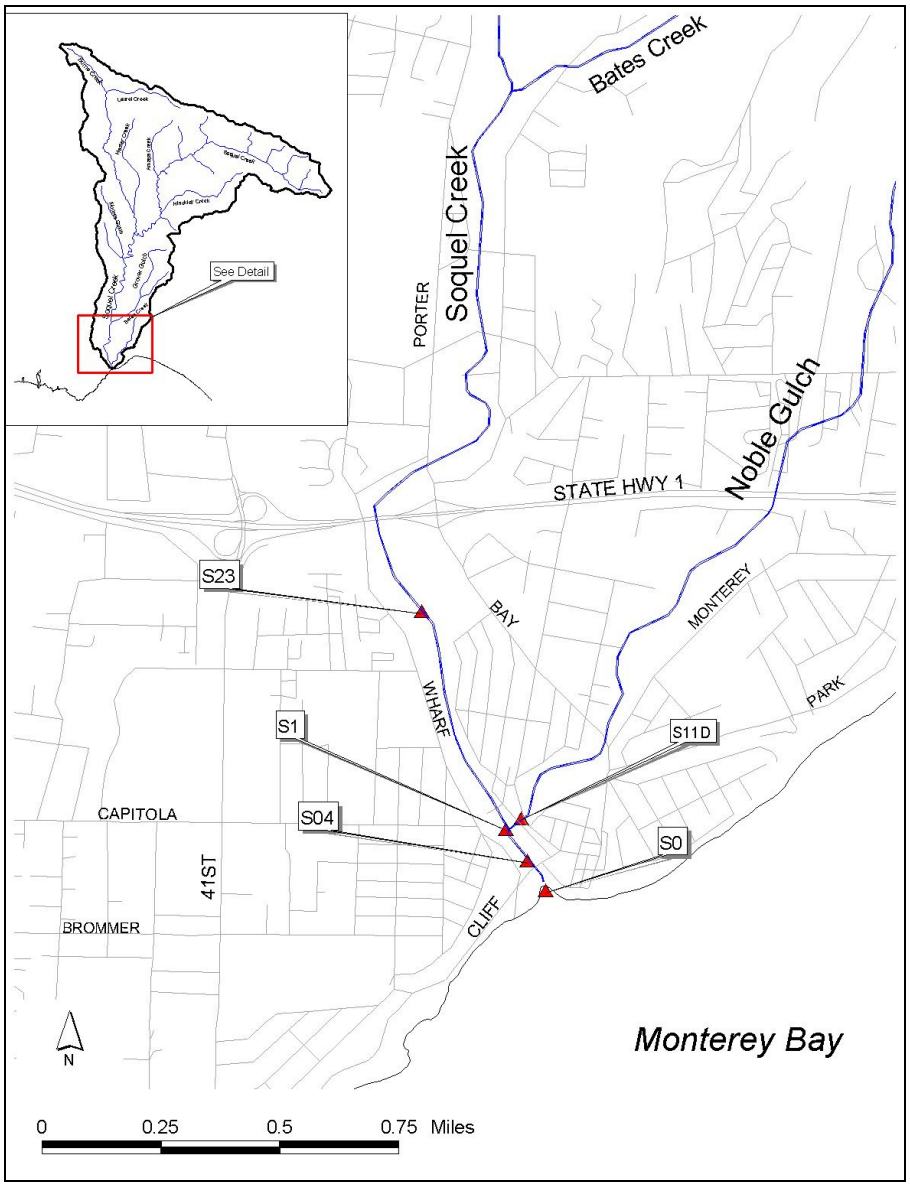

Figure 3-3. Soquel Creek and Noble Gulch Ribotyping Data Collection Stations

Ribotyping samples were collected between January 13, 2004 and March 17, 2005. Percent source contributions from samples collected during both wet and dry seasons combined are presented in Table 3-8. Table 3-9 contains the percent source contributions separated into wet and dry seasons.

Table 3-8. Percent Source Contributions from Ribotyping Data

Sites	Soquel Creek at Flume Outlet (SO)	Soquel Creek Above Stockton Bridge East (S04)	Soquel Creek at Nob Hill (S23)	Noble Gulch at Soquel Creek (S1)	Noble Gulch at Blue Gum and Riverview (S11D)
Dates	**1/13/04 to 9/21/04**	**6/6/05 to 2/17/05**	**1/21/04 to 2/17/05**	**1/13/03 to 2/17/05**	**7/11/05 to 9/28/05**
Source	**Percent Source Contribution**				
Bird	54	46	48	64	36
Wildlife	7	31	10	16	21
Rodent	13	7	14	10	14
Dog	13	10	9	2	21
Human	6	0	6	4	4
Unknown	5	1	9	4	0
Cat	1	4	3	0	0
Horse	0	0	1	0	1
Cow	0	0	0	0	0
Marine Mammal	0	0	0	0	0
Total Water Samples	36	21	51	16	9
Total Isolate Samples	112	68	151	50	28

Based on this combined wet and dry season study, birds were the largest contributing source of *E. coli* at 36 percent or more from all five sampling stations. Other sources, wildlife (raccoon, deer, and opossum), dog, and rodent were present at all five stations and contributed a significant percentage of the fecal coliform. We also observed a four to six percent human contribution to fecal coliform at all but one of the sampling stations, Soquel Creek above Stockton Bridge East. However, this station was downstream of another station that did have a human source. Horse was identified as contributing one percent of the fecal coliform isolates in both Soquel Creek and Noble Gulch.

Dog, human, horse, and cat sources were considered controllable sources because they are present as a result of human activities and land management. Bird, wildlife, and rodent sources are generally considered natural and uncontrollable because their presence is generally not a result of human activities. However, bird, wildlife, and rodent sources are controllable to some degree. For example, these animals are attracted to trash dumpsters and areas where human activities involving food occur. Therefore, they are present partially as a result of human activities. Some of their waste can be controlled by managing those human activities.

Table 3-9. Variation of Fecal Coliform Sources During Wet and Dry Seasons (January 2003 - September 2005)

Sites	Soquel Creek at Flume Outlet (SO)		Soquel Creek Above Stockton Bridge East (S04)		Soquel Creek at Nob Hill (S23)		Noble Gulch at Soquel Creek (S1)		Noble Gulch at Blue Gum and Riverview (S11D)	
Dates	**1/13/04 to 9/21/04**		**6/6/05 to 2/17/05**		**1/21/04 to 2/17/05**		**1/13/03 to 2/17/05**		**7/11/05 to 9/28/05**	
	Wet[1]	**Dry[2]**	**Wet[1]**	**Dry[2]**	**Wet[1]**	**Dry[2]**	**Wet[1]**	**Dry[2]**	**Wet[1]**	**Dry[2]**
Total Water Samples	36		21		51		16		9	
Total Isolate Samples	10	102	10	58	22	129	19	31	0	28
Total Days of Wet Season Sampling	1		1		2		2		0	
Source	**Percent Source Contribution**									
Bird	40	55	40	47	32	51	63	65	(1)	36
Wildlife	10	7	10	34	23	8	32	6	(1)	21
Marine Mammal	0	0	0	0	0	0	0	0	(1)	0
Dog	30	12	10	10	5	9	5	0	(1)	21
Human	10	6	0	0	5	6	0	6	(1)	4
Horse	0	0	0	0	5	0	0	0	(1)	4
Cow	0	0	0	0	0	0	0	0	(1)	0
Cat	0	1	20	2	0	4	0	0	(1)	0
Unknown	10	5	0	2	14	9	0	6	(1)	4
Rodent	0	15	20	5	18	13	0	16	(1)	14

[1] Wet = Samples collected during a time when rain occurred within the previous 72 hours
[2] Dry = Samples collected during a time when more than 72 hours occurred without rain
(1) No samples collected during the wet season at this station.

There was not enough wet season data to draw conclusions about wet versus dry season sources (Table 3-9). In order to accurately characterize the relative contribution from different sources of fecal contamination at a particular location, it is important to analyze 50-100 bacterial isolates (individual colonies) collected from that location over time (*Assessment of Sources of Bacterial Contamination At Santa Cruz County Beaches*, Ricker and Peters, 2006). None of the above data sets collected on wet days were based on sufficient isolate numbers. However, data derived from wet season sampling can still be used in terms of identifying at least some of the contributing sources. This is why wet and dry season data was analyzed in Table 4.1 after being combined.

No contribution from cows was recorded in this study. However, had there been greater numbers of samples collected in the wet season, particularly after the first rain event, cow or other livestock animal sources, in addition to a higher contribution from horses, may have been detected. Farm animal contribution is discussed further in Section 4.1.4. *Domestic Animal Discharges*.

A second reason for performing wet season sampling is to determine if the human component increases during wet weather. This would suggest that onsite-wastewater disposal systems are dysfunctional and/or that the sewer collection system is leaking and waste is transported to storm drain systems during storm events. Additional information included in Sections 4.1.3. *Onsite Wastewater Disposal System Discharges* and 4.1.1. *Sanitary Sewer Collection System Spills and Leaks* was used to determine whether or not septic or sewer systems were a significant source of pathogens to the Soquel Lagoon.

4. SOURCE ANALYSIS

This source analysis was based on existing water quality data, wastewater spill data, microbial source data, land use, flow estimates, discussions with staff at County of Santa Cruz Health Services Agency, City of Capitola Public Works, Santa Cruz County Sanitation District (SCCSD), Coastal Watershed Council, and observations made in the field. This analysis also considered information provided in a report prepared by the County of Santa Cruz, Environmental Health Services, Water Resources Program titled *Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches* prepared in March, 2006.

4.1. Sources of Pathogen Indicator Organisms Investigated

This section discusses pathogen sources of concern in the Soquel Watershed that are subject to regulation by the Central Coast Water Board. The modes by which various sources provided in Tables 3-8 and 3-9 reach the Soquel Lagoon are discussed.

4.1.1. Sanitary Sewer Collection System Spills and Leaks

Sewage can reach the Lagoon from sewer line overflows (spills) or leaks. Sewage spills can occur when roots, grease buildup, or other debris block sewer lines. Some spills from the Santa Cruz County Sanitation District's (SCCSD's) collection system reached the Soquel Lagoon in 2002, 2003, and 2004. Leaks can occur from cracked lines or lines with faulty connections. When sewer lines are blocked or leaking, sewage may run onto the street, into gutters, and into storm drains. Sewer leaks can also occur in small volumes and below the ground. These types of leaks often continue unnoticed. SCCSD provided evidence that several sewer main lines were leaking prior to and including last year. Sewage spills and leaks contain human waste. Ribotyping analysis indicated that at two Lagoon sampling stations humans generated six percent of the sampled fecal coliform. Humans were also identified as generating four percent of the fecal coliform in two stations on Noble Gulch. Staff concluded that sewage was a likely source of pathogens in the Lagoon; however, staff also concluded that current management practices and permit requirements are adequate to control these sources.

The Watershed does not have a Waste Water Treatment Plant (WWTP) within its boundaries. However, the Watershed has a collection system that collects wastewater from the City of Capitola and a portion of Santa Cruz County within the Watershed's boundaries and takes this wastewater to the City of Santa Cruz's WWTP. The SCCSD's Waste Discharge Requirements (WDR No. R3-2005-0043) addresses the County's collection system. Areas of the Soquel Watershed not connected to the SCCSD collection system are on onsite-wastewater disposal systems.

The State Water Resources Control Board adopted 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.

The SCCSD main line (main) crosses underneath Soquel Creek and the Lagoon. The main crosses Soquel Creek at Porter Street between Soquel Wharf Road and Main Street, and the Soquel Lagoon near the Nob Hill at Soquel Creek sampling station where the main crosses toward Soquel Wharf Road. It crosses in a third location at the Stockton Avenue Bridge. Locations are labeled A, B, and C, respectively, on Figure 4-1. The main also parallels Noble Gulch throughout most of its reach (within approximately 25 to 400 feet). The main is inspected once every year during routine cleaning (personal communication, Diane Romeo, Sanitation Engineering, SCCSD, May 5, 2006).

The SCCSD Engineering and Operations Staff supplied a report, *Capitola Video Results* (March, 2006), summarizing an inspection of sections of the sewer main in the City of Capitola. The report indicated that the sewers adjacent to Soquel Creek and in the upper village area were constructed primarily in the 1960s of rigid clay or asbestos concrete. It also summarized the results of the investigation of approximately 4,460 feet of sewer main that was televised in February 2006 after winter storm events produced 0.71 inches of rain. There were only a few spots where water was observed trickling into the pipe due to saturated soils. However, due to cracking, offset joints, chipping, and non-water tight lateral connections showing a slime build up (indicative of water leaking into the system), it was evident that the sewer main was most likely leaking inwardly and outwardly. The report also indicated that several lateral connections at the main were leaking (lateral connections are discussed in Section 4.1.1.a *Private Laterals/Private Pump Station Spills*). During the wet season, these conditions contribute to sewer system overflow (or spills) by rainfall and groundwater infiltration. Conversely, sewage exfiltration potential exists in dry seasons (exfiltration occurs when sewage leaks underground).

The report indicated that the sewer main in the worst condition was along Cherry and San Jose Avenues located in the Esplanade section of Capitola, which is east of and adjacent to the Lagoon. Several sections were cracked and lateral connections extended into the sewer main with slime build up below. Many as-built plans were missing and the mapping of the sewer lines was incomplete. Some of the manholes in the Capitola village area showed inlet piping that may or may not be abandoned. Occasionally, sewer mains that were considered abandoned were determined functional and connected to

residences. Furthermore, some of the manholes were constructed of brick. Water in the rainy season can leak around the bricks and into the sewer system causing overflows (or spills).

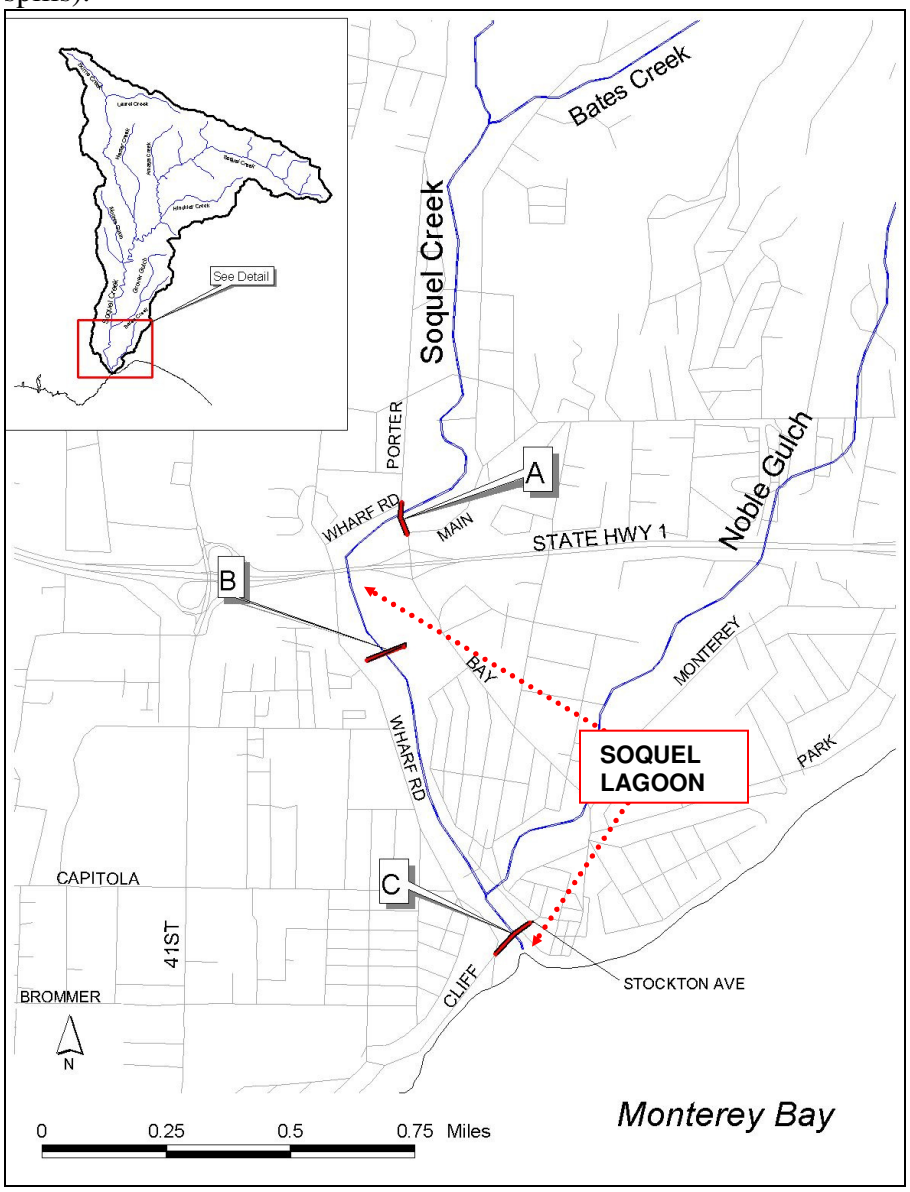

Figure 4-1. Locations where the sewer main crosses under Soquel Creek (A: Porter Street between Soquel Wharf Road and Main Street, B: Near Nob Hill at Soquel Creek sampling station toward Soquel Wharf Road, and C.: Stockton Avenue Bridge)

Additionally, sections of main along Riverview Avenue (located approximately 125 to 200 feet from the Lagoon) were found in poor condition in past inspections. Furthermore, a videotape prepared last year showed that the Soquel Wharf Road sewer main was in poor condition with areas where a portion of the pipe was missing. Of the

13 manholes on this sewer, at least nine were constructed of brick (*Capitola Video Results*, SCCSD Operations and Engineering, 2006).

Several hundred feet of sewer main located east of Soquel Creek were replaced with PVC pipe since the 1980s. Communication with Rachel Lather of the SCCSD in July of 2006 indicated that a section of the sewer main was replaced recently along Riverview Avenue in the Esplanade area between Oak Drive and Gilroy Drive. Other sections along Riverview Avenue were replaced previous to that section. Lather also described sections of the main scheduled for replacement in 2006 and 2007 that include an additional section along Riverview Avenue, and several sections within the Esplanade. Repairs will also include taking the sewer main off the cliff face along Grand Avenue where it was exposed. The section of main on Soquel Wharf Road will not be replaced in the coming year due to the topography and geology of the area in which it is located. Other sections of main were thought to be in worse condition and to have a greater impact on water quality. Lather also told Central Coast Water Board staff that there was close communication with John Ricker, Water Resources Program Coordinator, Health Services Agency, County of Santa Cruz, when prioritizing the Capital Improvement Projects of the SCCSD for the following year. Furthermore, the SCCSD submitted a Collection System Management Plan per the requirements of the WDR in February of 2006. The plan summarized how sections of the main are inspected and by whom, assumptions about the system used to project long term Capital Improvement Projects, and the basis for priority of replacement. Collection system replacement is based on investigations of the general condition of the system.

The sewers' problems were not just leaks, but also blocks and spills. Sewer main blocks that did not require clean up action, in addition to blocks that resulted in spills were partially due to the faultiness of the collection system as described above. Staff concluded that blocks and spills were also due to obstructions such as grease, wood, rags, and hair. Spill data was compiled into the following graph in Figure 4-2.

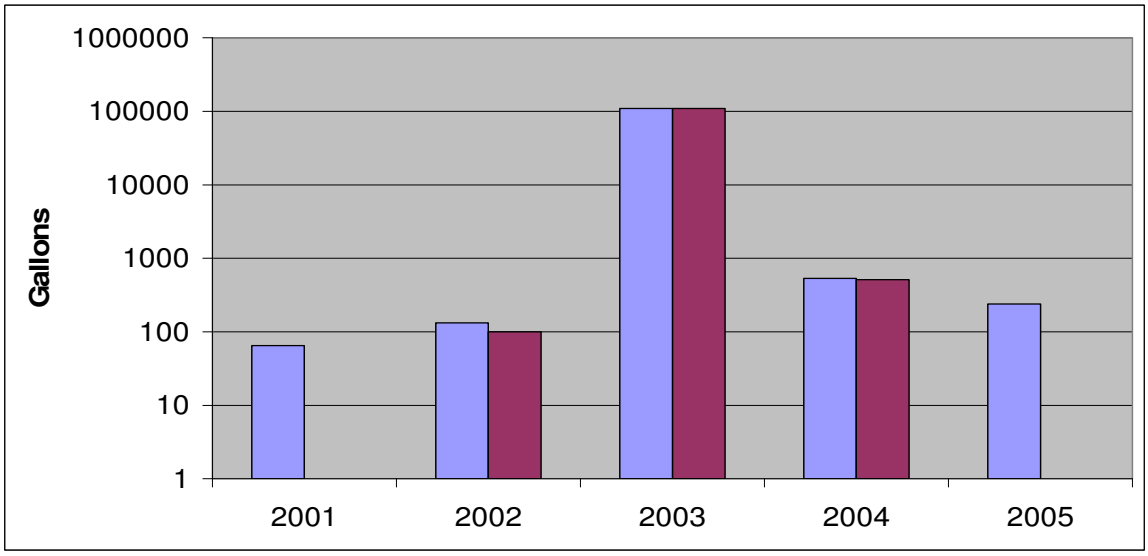

Figure 4-2. Total Domestic Sewage Spilled into Soquel Creek/Lagoon and Storm Drain System from 2001 to 2005. Blue bars represent total spills to Soquel Creek/Lagoon and Storm Drains. Red bars represent total spills only to Soquel Creek/Lagoon.

Table 4-1 shows the total annual spill volumes and the number of spills that occurred from January 1, 2001 through September 11, 2005 within the SCCSD boundaries.

		Total Spills to Storm Drains and Surface Waters	Total Spills to Soquel Creek/Lagoon
2001	Gallons	65	0
	Number of Spills	3	0
2002	Gallons	132	100
	Number of Spills	3	1
2003	Gallons	109,250	109,000
	Number of Spills	4	2
2004	Gallons	535	510
	Number of Spills	4	2
2005	Gallons	240	0
	Number of Spills	8	0

Table 4-1. Annual Spill Volume and Number of Spills within the Santa Cruz County Sanitation District

From 2001 through 2005, 22 spills were reported that were a result of SCCSD collection system failure within the Soquel Watershed. The largest spill volume occurred in 2003 amounting to 109,205 gallons, of which 109,000 gallons reached Soquel Creek. Two spills that occurred that year were relatively large with one measuring 100,000 gallons and the other measuring 9,000 gallons. The 9,000-gallon spill also entered Noble Gulch. The total volume of spills in each of the other four years was 535 gallons or less. Spills did not reach the Soquel Lagoon in 2001 and 2005.

The SCCSD implemented an overflow emergency response plan to minimize the effects of spills upon surface waters. When spills occurred, the SCCSD determined if the spills entered storm drains. If the spill entered the storm drain, they determined where the spill migrated and "trapped" the spill. The SCCSD extracted the spills from the storm drains and hauled the sewage to the wastewater treatment plant. Spills that did not reach water bodies were vacuumed, absorbed, raked-up, or diluted with fresh water.

Based upon the information above, Central Coast Water Board staff concluded collection system leaks were a chronic problem. This source contributes to exceedance of water quality objectives. However, staff concluded that collection system problems are being

sufficiently addressed through the current practices of the SCCSD and the annual reports they must submit in compliance with their WDR.

4.1.1.a Private Laterals/Private Pump Station Spills

The SCCSD provided a report regarding videotaped sewer lines in the City of Capitola (*Capitola Video Results*, SCCSD Operations and Engineering, 2006) summarized above in Section 4.1.1. *Sanitary Sewer Collection System Spills and Leaks*. The report indicated that lateral connections to the sewer main were missing saddles (which help to make them water tight), and that the mortar (also to keep them water tight) was cracked or non-existent. Many laterals showed slime build up at the connection to the main indicating that water was leaking into the main. The report also indicated that lateral connections were leaking inwardly and outwardly and that some lateral connections were "break-in" style with lateral pipe extending into the sewer main that could have contributed to blockages. Furthermore, most of the laterals were found "low lying" with the lateral flow line below the flow line of the main with solids and standing water in the lateral. However, because the inspection only televised the sewer main it was difficult to determine the condition of the lateral pipes themselves. Rachel Lather of the SCCSD acknowledges that laterals are a problem in the Capitola Village but is uncertain as to the extent of the problem. She also said that some laterals in the Village could have been built as long ago as the 1930s (personal communication, June 26, 2006).

The SCCSD provided spill reports from 2001 to 2006. One spill in 2002 estimated at 37 gallons was the only reported spill from a private lateral. There were no spills reported from private pump stations. However, Russ Bateson, Operations Manager of the SCCSD, indicated that there were approximately 10 spills per year throughout the district (including other watersheds in addition to Soquel) from private laterals that went unreported (personal communication, June 28, 2006).

When the main is replaced or repaired, lateral connections along that section of the main are repaired by the SCCSD as well (personal communication, Diane Romeo, Sanitation Engineering, SCCSD, May 11, 2006). Repair of the sewer main was discussed in Section 4.1.1. *Sanitary Sewer Collection System Spills and Leaks* above and is discussed in Section 10.1.1. *Sanitary Sewer Collection System Spills and Leaks*. The report described sections of the main that were recently replaced and in good condition, but that had leaking lateral connections. These sections of main will not be replaced again until they need repair. Therefore the leaking lateral connections will not be replaced either, unless homeowners replace them.

Staff concluded it was highly probable that the lateral pipes were leaking and that the sewage was transported to the Lagoon. Furthermore, as stated in Section 3.4 *Microbial Source Analysis Results*, ribotyping analysis indicated that at two Lagoon sampling stations humans generated six percent of the sampled fecal coliform. Humans were also identified as generating four percent of the fecal coliform in two stations on Noble Gulch.

The SCCSD recently adopted a Code (Santa Cruz County District Code Sections 7.04.325 and 7.04.375; March 2006) regarding sanitary sewer collection system maintenance of systems serving four or more units. Staff concludes that the ordinance may only reduce this source by a small amount as the ordinance does not address private laterals. Summarized, the Code requires that owners of such properties:

1) Maintain their sanitary sewer system to prevent overflows, including flushing once during an eighteen month period;
2) Immediately stop an overflow if one occurs and have the problem repaired by a licensed plumber within five working days;
3) Report spills to the SCCSD within 24 hours and submit a written report; and
4) Certify that the sanitary sewer system was inspected prior to the sale of the house or building if the house or building was constructed, or the sewer system was inspected, more than 20 years prior to the date of sale.

The district may impose penalties of up to $2,500.00 against a property owner who fails to perform any act required in the ordinance if the spill reaches public or private property other than the property owner's property.

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

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

Storm drain discharges have the potential to contain human waste from municipal system sewage spills and leaks (discussed in Section *4.1.1. Sanitary Sewer Collection System Spills and Leaks*). Storm drain discharges also have the potential to contain urban runoff, including pet waste and dumpster leachate, which are controllable sources, and bird and rodent waste, which are sources that are controllable to some degree (as explained in this section). Based on the ribotyping analysis (Section 3.4 *Microbial Source Analysis Results*) and land use that is mainly urban surrounding the Lagoon, staff concluded that these sources were likely present in the storm drain discharge within the Soquel Watershed and that these sources lead to exceedances of water quality objectives and criterion in Soquel Lagoon and Creek. These sources and their transport mechanisms are discussed below.

Water samples collected via the CWC within storm drains were few. Although the sample sizes were small, Central Coast Water Board staff concluded this data may suggest stormwater discharges carry pathogens to Soquel Creek but this should be considered in conjunction with other evidence (such as urban runoff pathogen contributions in other watersheds, ribotyping data, and land uses). Additionally, staff concluded that more samples should be collected from storm drains in this area. Noble Gulch was impaired throughout the range of sampling stations. Whatever is contributing to the Monterey Ave (storm drain) station could also contribute to impairment of Noble Gulch as it is very close in proximity. One reason for small sample sizes in this watershed by CWC was that storm drains chosen for sampling were dry during the

sampling periods. The Monitoring Plan in Section 11 of this report establishes requirements for the County of Santa Cruz to sample storm drains.

The City of Capitola received funds from the Clean Beaches Initiative Grant Program to reduce pathogenic indicator organism inputs at Capitola Beach and Soquel Creek. The *Village Drainage Improvement Plan* (City of Capitola, 2004) described the top priority projects to be implemented with the funds. The number one priority of the Plan was a dry weather diversion system that was recently completed. The diversion system is expected to improve water quality and reduce pathogen loading from the sources described above in the Lagoon during the time of operation, May through October. Runoff from the Esplanade and restaurants between the Esplanade and Soquel Creek was identified as a key source of pathogenic indicator organism pollution. A portion of this runoff directly entered the Lagoon through the Fog Bank outfall. The diversion, which included the construction of a small subsurface pump station, will redirect this runoff to the sanitary sewer system and eventually to the wastewater treatment facility in the City of Santa Cruz.

4.1.2.a. Controllable Bird Waste

Fecal coliform ribotyping results indicate birds were a source of fecal coliform in the Lagoon (46 percent or greater at all three Soquel Creek sampling stations) and in Noble Gulch. Birds frequent locations such as dumpsters and trash cans as feeding sites. Birds were known to congregate in the Lagoon area on sandbars. They were also attracted to this area due to the presence of outdoor seating at restaurants and people that feed birds. Bird waste may reach storm drains and surface waters when storms occur or in other forms of urban runoff. Bird waste associated with dumpsters, trashcans, and trash that is littered can be controlled.

Employees from restaurants adjacent to the Lagoon have not been observed rinsing bird waste off roofs. However, restaurateurs periodically pressure wash their sidewalks with water that drains to storm drains (personal communication, Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, March 30, 2006). Staff observed one esplanade restaurant employee pressure washing their patio during field reconnaissance; the Implementation Plan in Section *10.1.2. Storm Drain Discharges)* recommends methods to minimize wash water that may contain bird pathogens as a source.

4.1.2.b. Pet Waste

From the ribotyping analysis, 21-percent of the identified isolates originated from dogs in Noble Gulch (at Blue Gum and Riverview). Fecal coliform from cats was also identified in Soquel Creek, to a lesser degree. Noble Gulch was narrow and fairly steep in stretches, and lacked a wide floodplain. Therefore, residences surrounding Noble Gulch were located proximal to this waterbody. Residences along Soquel Creek were also very close to the Creek in some stretches. There was the potential for residences adjacent to waterbodies in the Soquel Watershed to dispose of their pet waste by depositing it directly into the waterbody. Pet wastes can also reach these waterbodies via storm drain discharges during wet seasons through surface runoff. During dry seasons, pet wastes

can reach storm drains if wash water or excess water from other sources comes into contact with pet waste.

Staff observed several leashed dogs in Perry Park adjacent to the Lagoon during field reconnaissance (March 16, 2006). Staff observed numerous signs in this park and two additional Soquel Creek adjacent parks that advise dog walkers to pick up after their dog. Bags were also provided for picking up dog waste.

The Capitola Municipal Code includes an ordinance that requires dog owners/walkers to immediately remove and dispose of dog feces after defecation on public property (6.12.100 Public defecation). The County of Santa Cruz has a similar ordinance (6.12.080 Animal defecation prohibited where). The presence of signs and disposal bags likely helped to reduce dog waste from entering storm drain systems and ultimately the Lagoon, however, dogs continued to contribute pathogens to the Lagoon. The Implementation Plan in Section 10.1 recommends methods to minimize these sources.

4.1.2.c. Controllable Rodent and Wildlife Waste

Microbial source tracking results indicated rodents and wildlife contributed pathogen indicator organisms to the Lagoon. Controllable rodent and wildlife waste can reach the Lagoon through storm water discharges. The Implementation Plan in Section 10.1 recommends methods to minimize this source.

4.1.2.d. Dumpster Leachate

When it rains, rainwater can enter dumpsters and discharge leachate. Leachate is formed when dumpsters are uncovered and containers leak. During dry seasons, bird waste may reach surface waters when trash-holding areas are hosed off or washed. Wash water may reach storm water drains and surface waters.

During field reconnaissance staff observed two recycling dumpsters upside down next to a restaurant on a sidewalk over-hanging the Lagoon. The dumpsters appeared to have been hosed out with water and were drying.

The maintenance of trash receptacles in sanitary condition is in progress (*Assessment of Sources of Bacterial Contamination At Santa Cruz County Beaches,* Ricker and Peters, 2006). However, an evaluation of this program is needed. The Implementation Plan in Section 10.1.2. Storm *Drain Discharges*) recommends methods to evaluate the progress of sanitary trash receptacle maintenance.

4.1.2.e. Human Waste Discharges

Illegal human waste discharges can reach surface waters via storm drains. Staff concluded homeless persons in non-riparian areas were a source of human pathogens in the Lagoon. Supporting this conclusion was the finding that humans were identified as contributing four to six percent of the fecal coliform in water samples from all but one sampling station. Tamara Doan of the Coastal Watershed Council, who collects water samples in the Watershed, stopped monitoring the storm drain pipe draining Highway One to Soquel Creek in 2004 because homeless persons were living in the pipe. Personal

effects believed to belong to homeless persons were observed in 2005, however, no persons were observed.

Central Coast Water Board staff received information from the Capitola Police Department that evidence of homeless encampments included ground covers under shrubs in commercial areas or camping in vehicles (personal communication, Todd Mayer, Captain, Capitola Police Department, May 4, 2006; forwarded through email from Steve Jesberg, Public Works Director, City of Capitola, May 4, 2006).

Law enforcement cited overnight sleepers and campers. The City of Capitola Public Work department broke down large encampments (personal communication, Todd Mayer, Captain, Capitola Police Department, May 4, 2006; forwarded through email from Steve Jesberg, Public Works Director, City of Capitola, May 4, 2006).

There was no specific confirmation that homeless encampments were affecting surface waters. However, because evidence of homeless encampments has been observed in non-riparian areas and because sanitary disposal facilities are not always available for these sites, Central Coast Water Board staff determined it was highly likely that human waste reached surface waters. Additionally, as discussed in Section 3.4 *Microbial Source Analysis Results*, humans were a source of the fecal coliform in the water samples collected in Soquel Creek.

Staff proposes actions regarding homeless persons and encampments in the Implementation Plan in Section 10.

4.1.3. Onsite Wastewater Disposal System Discharges

Onsite wastewater disposal systems (OWDSs) are potential sources of fecal coliform in surface waters. However, Water Board staff concluded OWDSs were not contributing to water quality impairment in Soquel Watershed.

Staff suspected that rare onsite-wastewater disposal system failures occurred at rural residences in the upper Subwatersheds of Soquel Creek, Noble Gulch, and in the Subwatershed of Bates Creek. During dry periods, sewage from failing onsite-wastewater disposal systems probably did not reach a waterway unless a failure occurred close to a creek. However, on rare occasions during wet periods pathogen indicator organisms from failed onsite-wastewater disposal systems may have flowed to ditches, roadways, creeks, and ultimately Soquel Creek.

Soquel Creek was impaired up to the Soquel Creek at Porter St. Bridge sampling location. This sampling location indicated no impairment. Upstream of this station for approximately 0.5 mile, residences and business were on the Santa Cruz Sanitary Sewer Collection System. Any OWDSs would have been located upstream of this unimpaired reach. Therefore, staff concluded OWDSs were not a contributor to the impairment in Soquel Creek.

Furthermore, development within in the Soquel Watershed is recent and of low density relative to development within the San Lorenzo watershed in which there is encroachment of homes and OWDSs to the San Lorenzo River. Soquel Creek generally has a wider floodplain and most of the relatively new development meets current septic standards (personal communication, John Ricker, Water Resources Program Coordinator, Health Services Agency, County of Santa Cruz, April 20, 2006).

The entire reach of Noble Gulch was impaired. Dwellings not connected to the Santa Cruz Sanitary Sewer Collection System begin at approximately the north end of Ashwood Way, north of Soquel Drive, and adjacent to Noble Gulch OWDSs extended north into less developed areas. Staff found approximately nine dwellings within 125 feet of the Gulch and of those, three were within about 50 feet of the Gulch. Staff assumed that each dwelling had an associated OWDS. The soil mapping units in which the dwellings were located (identified in the USDA Soil Survey for Santa Cruz County, California, 1980) had slow permeability with the potential for OWDS absorption fields to not function properly. However, John Ricker, Santa Cruz County Environmental Health Services, Water Resources Division Director, was contacted and said that there were no problem areas that he knew of in the entire Soquel Watershed.

Staff determined that because: (1) Nobel Gulch was impaired downstream of these OWDSs (but not upstream of the OWDSs) (*Comment inserted after TMDLs approved by Water Board: Staff determined that the preceding statement was confusing, but did not delete it because the TMDLs were approved as written. OWDTSs were found not to be a source contributing to impairment in Noble Gulch*); (2) there were a small number of suspect systems upstream of this impaired reach; and (3) there was no other evidence of failing systems, staff would not name OWDSs as a source and will not require implementation for OWDSs. However, if staff finds evidence during the implementation phase of the TMDL that septic systems are a source causing exceedance of water quality objectives, staff will address this source accordingly.

Although staff concluded OWDSs were not a source leading to the impairment of surface waters in this Watershed as this time, municipalities and the Water Board either already have or are drafting regulatory maintenance plans. Santa Cruz County currently has an ordinance (7.38.035 Requirement of Adequate Sewage Disposal) that requires adequate individual sewage disposal and maintenance of the individual sewage disposal system. There is currently no regular inspection of these systems. The County of Santa Cruz and the City of Capitola proposed implementing an OWDSs maintenance and management program to reduce OWDS failures in their draft Storm Water Management Plan (SWMP), but an explanation of the OWDSs maintenance and management program was not included in the SWMP. Furthermore, the Central Coast Water Board has not yet approved the SMWP.

Additionally, Water Board staff is in the process of developing revisions to existing Basin Plan criteria for onsite wastewater systems. The proposed criteria include recommendations and requirements for proper siting, design, maintenance and management of onsite wastewater systems. The proposed Basin Plan revisions also will

require municipalities to develop onsite wastewater management plans (which the current criteria only recommend). In addition Water Board staff is in the process of developing a waiver of waste discharge requirements for owners of onsite wastewater systems that will ensure proper siting, design, maintenance and management. All owners of new onsite wastewater systems will have to enroll in the waiver if they plan to operate in areas without onsite wastewater management plans approved by the Executive Officer. Local permitting agencies will be required to characterize and address water quality impacts from existing onsite wastewater systems in management plans.

4.1.4. Domestic Animal Discharges

4.1.4.a Farm Animals and Livestock Discharges

Staff determined that farm animal and livestock discharges were not a source of pathogens in the Soquel Lagoon or Creek, however, they were a likely source in Noble Gulch. Land use analysis indicated that 121 acres of the Soquel Watershed was covered by pastureland or hay (areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops). Approximately 92 percent of this total was within the Subwatershed of Bates Creek. Staff did not have evidence that Bates Creek was impaired.

Staff observed horses in proximity to the Soquel Creek flood plain during field reconnaissance, however, the horses were located upstream of the unimpaired reaches of Soquel Creek. During the same field visit staff also noted that chickens, roosters, and cattle were present along Soquel San Jose Road which is adjacent to the Soquel flood plain in some stretches, but again this was upstream of the reaches of Soquel Creek considered impaired.

According to Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, there were horses in pasture on the north side of Highway One, east of Noble Gulch between Silver Birch and Monterey Ave. within the Noble Gulch watershed (personal communication, April 13 and July 5, 2006). Peters also observed horses above Soquel Drive around Victory Lane and Cunnison Lane.

Central Coast Water Board staff observed cattle on Cunnison Lane West of Noble Gulch (personal observation, June 26, 2006). Staff found several corrals adjacent to and in proximity of the Gulch on aerial imagery from Google Earth (Google Earth, 2008). The corrals were between approximately Highway One and the north end of Victory Lane/Coyote Canyon. The same imagery also showed pastures along the Gulch or in close range of it.

The ribotyping analysis used in this report suggested that approximately one percent of the contribution of fecal coliform originated from horses at one sampling location in both Soquel Creek and Noble Gulch. There was no fecal coliform from cows identified in the sampling. However, there was no wet season sampling conducted at the Noble Gulch sampling station. Also, the wet season information for Soquel Creek at Nob Hill was based on only 22 isolates from only two days of wet season sampling. As stated above,

reliable pathogen indicator organism analysis should include 50 – 100 isolates collected from one location over time. Therefore more contribution from horses as well as cattle may have been identified if sampling was more robust and conducted during the wet season. Additionally, there is substantial evidence from other watersheds that when cattle are present in the watershed fecal coliform from cows travels to the respective waterbody.

Staff concluded that horses and/or other farm animals likely contributed pathogens to Noble Gulch. Waste from farm animals and/or livestock is controllable and therefore staff is proposing actions in Section 10 *Implementation Plan*.

4.1.4.b. Pet Waste in Areas Not Draining to an MS4

Staff concluded that pet waste in areas that do not drain to MS4s likely contributed pathogens to surface waters in the Soquel Creek watershed.

As discussed above, results from ribotyping analysis suggested that 21 percent of the identified isolates from fecal coliform present in Noble Gulch (at Blue Gum and Riverview) were from dogs. Fecal coliform from cats was also identified in Soquel Creek, to a lesser degree. Ribotyping analysis from other watersheds in the Central Coast Region typically indicated that dog and pet waste was a source of fecal indicator bacteria in surface waters. Additionally, County staff has observed pet waste in riparian areas, some of which likely reached surface waters.

Staff concluded that pet waste in areas that do not drain to MS4s, was a source of pathogens that can be controlled.

4.1.5. Homeless Person/Encampment Discharges Not Draining to an MS4

Staff discussed discharge from homeless persons that is flowing to creeks from storm drains in Section 4.1.2.e. *Human Waste Discharges*. Homeless person/encampment discharges also drain directly into surface waters. However, homeless persons that discharged directly to surface waters from riparian areas were not regulated by a SWMP program. Homeless encampments were present in the Soquel Lagoon Watershed riparian areas and may have been a significant human pathogen source. In addition to human waste, homeless person/encampments may also generate wastes from other sources such as rodent, pet, and bird.

Staff concluded homeless person/encampment discharges must be addressed. Staff based this conclusion upon 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 following information also supports staff's conclusion. Tamara Doan of the Coastal Watershed Council began sampling the Soquel Watershed in 2000. She indicated there was evidence of encampments in the area directly under the North abutment of the Highway One overpass. Additionally, those working for the Coastal Watershed Council

observed "signs" of encampments from May 2000 through August 2005 in the area (including riparian habitat) directly behind the Mid-County Senior Center (near sampling station Soquel Creek at Nob Hill at the upstream end of the Lagoon). The "signs" included barbeques, lawn chairs, sleeping bags, and food stashes (personal communication, April 19, 2006).

According to Doan the upper watershed had more signs of temporary human use than actual homeless encampments. She observed human waste at the confluence of Soquel and Moore Creek 4.6 miles upstream of the Lagoon.

Staff concluded that homeless persons were not as likely in Noble Gulch as it was visible to homeowners due to the proximity of houses and backyards to the Gulch. However, one stretch of the Gulch just south of Highway One provided better cover as it was not as visible to homeowners (personal communication, Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, April 21, 2006)).

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.

Because homeless encampments were observed in riparian areas and because there were no sanitary disposal facilities available for these sites, Central Coast Water Board staff determined it was highly likely that human waste reached surface waters. Additionally, as discussed in Section 3.4 *Microbial Source Analysis Results*, humans were a source of the fecal coliform in the water samples collected in Soquel Creek.

Central Coast Water Board staff concluded homeless encampments are a pathogenic indicator organism source and is proposing additional actions in the Implementation Plan in Section 10.

4.1.6. Natural Sources

Ribotyping data indicate that birds and other wildlife contribute to fecal coliform loading in the Soquel Lagoon. Birds made up between 36 percent and 64 percent, wildlife contributed between seven percent and 31 percent, and rodents contributed between seven percent and 14 percent of the isolates identified by ribotyping. A direct one-to-one transfer from the percent of identified isolates to the percent of total contribution cannot be made with the ribotyping data. However, the ribotyping results do suggest that wildlife contributions could be significant.

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

Staff determined the relative order of controllable sources that contributed pathogen indicator organisms to the Soquel Lagoon. They are listed here in relative order beginning with the largest source first:

1) Storm Drain Discharges to MS4s, including but not limited to discharges from domestic animals, humans, and controllable wildlife.
2) Sanitary Sewer Collection System Spills and Leaks (including discharges from private laterals connected to municipal sanitary sewer collection systems).
3) Domestic animal discharges not draining to MS4s, including farm animals, livestock and pets.
4) Human Waste Discharges from homeless persons/encampments not draining to MS4s.

Evidence regarding natural sources lead staff to conclude that the contribution may have been significant. Staff estimated most of the natural sources were not controllable.

The order was based on the information in Sections 3 *Data Analysis* and 4 *Source Analysis* 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 County staff to complete the source analysis conclusions.

Storm drain discharges likely contributed the most pathogen indicator organisms to the Soquel Lagoon. Land from which storm water runoff was generated was larger than the total land containing any of the other sources named below. Many contributors to stormwater pathogen indicator organisms, including the four likely greatest contributors based on ribotyping analysis (birds, wildlife, rodents, and dogs), lived within urban land which was the second largest land use in the watershed and the largest land use surrounding the Lagoon. Storm drains from this urban land emptied into the reaches of Soquel Creek in which impairment occurred.

Sanitary Sewer Collection System spills and leaks were likely the second greatest contributor of pathogen indicator organisms in the Lagoon. Based on video analysis performed by the SCCSD, the sewer collection system was determined to leak in proximity of the Lagoon. Furthermore, old pipes exist throughout the City of Capitola. Stormwater and subsurface flow was suspected of carrying this sewage to the Lagoon. Staff concluded that because it was known that the system was leaking and the majority of the known leaking sections were in the proximity of the Lagoon, this was a greater source of pathogen indicator organisms to the Lagoon than the remaining two sources of livestock and homeless. Furthermore, system spills reached the Lagoon in 2002, 2003,

and 2004 and human DNA was identified in the Lagoon downstream of areas of the watershed containing the sewer collection system.

Staff concluded that domestic animals, including farm animals /livestock and pets, and homeless persons/encampments were not as great a source of pathogen indicator organisms to the Lagoon as the above sources. The lower ranking of this source category was partly based on ribotyping analysis through which livestock contribution of pathogen indicator organisms was identified as one percent in both Soquel Creek and Noble Gulch. Additionally, the proportion of the area known to contain livestock in the watershed is not great. This source category was ranked slightly higher than homeless because staff identified more specific areas known to contain livestock than areas containing homeless persons. Furthermore, domestic animals are typically more permanent in their locations relative to homeless persons who are of a transient nature.

Staff considered that human DNA found in the Lagoon may have come from homeless persons and not from the other sources described above in this conclusion section. However, staff concluded that although pathogenic indicator organism contribution of homeless living in riparian areas was more direct to the waterbody when it occurred, because the number of homeless was uncertain, and their encampments may have been temporary, homeless persons contributed less to the lagoon than the above sources.

4.3. Comparison with Sources in Other Pathogen Impaired Waters

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

Sanitary Sewer Collection System Spills and Leaks: The San Lorenzo River Watershed TMDL identified the municipal collection systems as a source in the San Lorenzo River Watershed. This TMDL includes similar results.

Storm Drain Discharges: The San Lorenzo River Watershed Pathogen TMDL Project Report also indicated stormwater contributed pathogens to surface waters.

Homeless Persons/Encampments Discharges: The San Lorenzo River Watershed Pathogen TMDL Project Report also indicated homeless encampment discharges contributed pathogens to surface waters.

Farm Animals and Livestock: The San Lorenzo River Watershed Pathogen TMDL Project Report also indicated farm animals and livestock discharges contributed pathogens to surface waters.

5. CRITICAL CONDITIONS AND SEASONAL VARIATION

This section discusses factors affecting impairment, critical conditions, and seasonal fecal coliform variations.

5.1. Critical Conditions and Uncertainties

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

Staff concluded that there are no critical conditions.

Many factors contributed to the Soquel Lagoon impairment. These factors included the following: 1) discharge of pathogens to waterbodies in the Soquel Watershed; 2) stream flow transmission; and 3) survival and possible instream fecal coliform population growth.

Some uncertainties are inherent with pathogen indicator organisms. Stream flows may serve to either increase or dilute fecal coliform concentrations. Stagnant pools may be areas where fecal coliform increases due to evaporation or increasing numbers of cells, i.e., through naturalized bacteria. Conversely, increased stream flows may dilute fecal coliform concentrations.
There is uncertainty regarding the relative contributions of identified sources. Staff concluded that both "controllable" and "non-controllable" sources are contributing fecal input into the waterbodies. However, there is uncertainty surrounding the relative load that each of these sources is contributing.

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

5.2. Seasonal Variations

Staff analyzed Soquel Creek and Noble Gulch fecal coliform data on a seasonal basis (Table 5-1). Data from sampling stations without enough data to detect a seasonal trend were not included. Staff considered monthly water quality objective exceedances. The table provides seasonal trend conclusions for three sampling stations in the Soquel Watershed. The three stations were the only stations from which enough data was collected in order to consider seasonal trends.

Table 5-1. Soquel Creek and Noble Gulch Seasonal Analysis

Station	Fecal Coliform Water Quality Objective	Months Exceeding Fecal Coliform Water Quality Objective	Comments
Soquel Creek at Flume Outlet	Fecal Coliform Geomean=200 MPN/100 mL	Mean: All months	No seasonal trend.
		Median: All months	
	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean: All months except April	
		Median: May to Dec.	
Soquel Creek at Railroad Trestle	Fecal Coliform Geomean=200 MPN/100 mL	Mean: June, Oct., Nov., Dec.	No seasonal trend.
		Median: Jan., June, Oct., Nov., Dec.	
Noble Gulch at St. Joe's Church	Fecal Coliform not to Exceed=400 MPN/100 mL	Mean: Feb., March, April, May, Sep., Nov., and Dec.	No seasonal trend.
		Median: Feb., March, April, May, Sep., Nov., and Dec.	

Staff concluded there were no significant seasonal variations based on the data available. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions.

5.3. Conclusion

Though several conditions potentially account for the documented impairment, staff concluded there were no critical conditions or significant seasonal variations. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions or seasonal variations.

6. NUMERIC TARGETS

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

The numeric target used to develop the TMDL is:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.[2]

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

Natural non-controllable sources are a contributor of fecal indicator bacteria (FIB) in Soquel Watershed. Some doubt exists whether the non-controllable fraction of FIB alone are causing receiving water concentration of FIB to exceed the numeric target. However, there is evidence that non-controllable sources alone may not cause receiving water concentration to exceed the numeric target, i.e., that the numeric target can be achieved by managing controllable sources of FIB. For example, Waddell and Scott's Creeks are coastal streams with lagoons similar to Soquel. 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 Soquel Watershed. Staff acknowledges that Aptos Creek 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.

[2] 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).

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 the TMDLs will result in attaining the numeric target. For these TMDLs, this link is established because the numeric target concentrations are the same as the TMDLs and water quality objectives, expressed as a concentration. Sources of pathogen indicator organisms have been identified that cause the elevated concentrations of pathogen indicator organisms in the receiving water body. Therefore, reductions in pathogenic indicator organism loading from these sources should cause a reduction in the pathogenic indicator organism concentrations measured. The numeric targets are protective of the recreational beneficial uses; hence the TMDLs define appropriate water quality.

8. TMDL CALCULATIONS AND ALLOCATIONS

A TMDL is the pollutant loading capacity that a water body can accept while protecting beneficial uses. TMDLs can be expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of pathogens, it is more logical for these TMDLs to be expressed as a concentration. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure [40 CFR §130.2(I)]. Concentration TMDLs make more sense in this situation because the public health risks associated with recreating in contaminated waters scales with pathogen indicator concentration, and indicator organisms (e.g. fecal coliform) are not readily controlled or measured on a mass basis. Therefore, we are establishing the TMDLs as a concentration of indicator organisms in the Soquel Lagoon, Soquel Creek, and Noble Gulch.

<u>TMDLs are established for the following reaches in the following water bodies:</u>

Soquel Lagoon: all waters of Soquel Lagoon.
Soquel Creek: beginning from the mouth of Soquel Creek, upstream and along Soquel Creek to the bridge at Porter Street.
All reaches of Noble Gulch.

<u>The TMDLs for Soquel Lagoon, Soquel Creek, and Noble Gulch are:</u>

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

8.1. Wasteload and Load Allocations

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

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

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

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

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

The parties responsible for the allocations to controllable sources are not responsible for the allocation to natural sources.

Table 8-1 shows the allocations and parties responsible for the allocations.

Table 8-1. Allocations and Responsible Parties

Waste Load Allocations		
Waterbody Subject to Allocation	**Responsible Party (Source) NPDES/ORDER Number**	**Receiving Water Fecal Coliform (MPN/100mL)**
Soquel Lagoon[1]	City of Capitola (Storm drain discharges to MS4s required to be covered by and NPDES permit) Storm Water General Permit NPDES No. CAS000004	Allocation-1[a]
Soquel Creek [2] Noble Gulch[3]	County of Santa Cruz and City of Capitola (Storm drain discharges to MS4s required to be covered by and NPDES permit) Storm Water General Permit NPDES No. CAS000004	Allocation-1[a]
Soquel Lagoon[1] Soquel Creek [2] Noble Gulch[3]	Santa Cruz County Sanitation District (Sanitary sewer collection system spills and leaks) Order No. R3-2005-0043	Allocation-2[b]
Load Allocations		
Waterbody Subject to Allocation	**Responsible Party (Source)**	**Receiving Water Fecal Coliform (MPN/100mL)**
Soquel Lagoon[1] Soquel Creek [2] Noble Gulch[3]	Owners and operators of land used for/containing pets (Pet waste not draining to MS4s)	Allocation-1[a]
Noble Gulch[3]	Owners and operators of land used for/containing farm animals and livestock (Farm Animals and Livestock discharges)	Allocation-1[a]
Soquel Lagoon[1] Soquel Creek [2] Noble Gulch[3]	Owners/operators of land that include homeless persons/encampments (Homeless person/encampment discharges not draining to MS4s)	Allocation-2[b]
Soquel Lagoon[1]	No responsible party	Allocation-1[a]

Soquel Creek [2] Noble Gulch[3]	(Natural sources)	

[1] All waters of the Soquel Lagoon
[2] Beginning and including the downstream most reach of Soquel Creek, up to and including Soquel Creek at the bridge crossing at Porter Street.
[3] All reaches of Noble Gulch.

[a] Allocation-1: Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.

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

Should all control measures be in place and pathogen indicator organism levels remain high, investigations (e.g., genetic studies to isolate sources or other appropriate monitoring) can be used to determine if the high levels of indicator organisms are 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 numeric 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 would be based on evidence that uncontrollable natural sources alone were the cause of exceedances of the numeric targets.

In some situations, a responsible party may demonstrate that their allocation is met by demonstrating that all necessary control measures to achieve the allocation are in place. Staff will review these situations on a case-by-case basis.

The parties responsible for the allocations to controllable sources are not responsible for the allocation to natural sources.

The TMDL is achieved when the numeric target is consistently met in the impaired waters of Soquel Lagoon, Soquel Creek, and Noble Gulch.

8.2. Margin of Safety

Each 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)). A margin of safety is incorporated implicitly in the TMDLs through conservative assumptions; a margin of safety has been established implicitly through the use of protective numeric targets equal to existing water quality objectives for the Soquel Lagoon, Soquel Creek, and Noble Gulch.

The pathogen TMDLs for the Soquel Lagoon, Soquel Creek and Noble Gulch are the water quality objective for protection of the water contact recreation beneficial use. 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 existing water quality objective, 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 relative to the load effect from controlled sources on 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 (TAC) to meet periodically.

Staff communicated with key personnel from the County of Santa Cruz, County of Santa Cruz Sanitation District, Coastal Watershed Council, and City of Capitola.

Central Coast Water Board staff presented project reports for these TMDLs at two meetings. Central Coast Water Board staff solicited comments at both these meetings. One meeting was held during the early phase of the Central Coast Water Board project plan 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 will prepare environmental documents indicating any potential environmental impacts and considering alternative allocations schemes or implementation strategies prior to soliciting formal public comments on these TMDLs and implementation plan.

Central Coast Water Board staff solicited public comments before the Water Board public hearing to consider adoption of the Soquel Lagoon, Soquel Creek, and Noble Gulch TMDLs. Staff received comments from:

1. Teri Caddell, A-1 Septic Service, Inc. in a letter dated December 6, 2007,
2. John Ricker, Water Resources Division Director, Santa Cruz County Environmental Health Services, in an email dated January 23, 2008. Comments from the abovementioned individual/agency are included as Attachment 7 to the staff report. Some comments resulted in changes to the Project Report and are noted in Attachment 7.

On March 21, 2008 in Salinas, California, the Central Coast Water Board held a public hearing and heard and considered all public comments and evidence in the record regarding the TMDLs, Implementation plan and removal of the shellfish harvesting beneficial use. The TMDLs and implementation plan were amendments included in resolution no. R3-2008-0002. The Central Coast Water Board also adopted resolution no. R3-2008-0002 on March 21, 2008.

On November 6, 2008, the Central Coast Water Board's Executive Officer withdrew resolution no. R3-2008-0002 from consideration for adoption by the State Water Resources Control Board. The Executive Officer withdrew the resolution for consideration due to State Board staff's request to clarify language regarding the amendments before submittal to the State Water Resources Control Board for approval. The clarifications included changing the allocations to human sources to zero, clarifying and simplifying the prohibition language and changing some of the nonpoint sources to point sources.

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

10. IMPLEMENTATION PLAN

The purpose of the Implementation Plan is to describe the steps necessary to reduce pathogen loads and 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. A monitoring plan designed to measure progress toward water quality goals is included in the following section.

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

Staff differentiated existing versus proposed requirements as presented below.

10.1. Implementation Actions

Staff discusses the proposed actions necessary for the water bodies to attain pathogen indicator organism water quality objectives in this section. The actions are presented with the sources of pathogen indicator organisms to the Soquel Creek Watershed.

10.1.1. Sanitary Sewer Collection System Spills and Leaks

Entities with jurisdiction over sewer collection systems in the Soquel Lagoon Watershed can demonstrate compliance with these TMDL load allocations through Waste Discharge Requirements and/or NPDES permits.
The Santa Cruz County Sanitation District (SCCSD) must continue to implement its Collection System Management Plan, as required by Waste Discharge Requirements (WDR Order No. R3-2005-0043).

In addition, the SCCSD is required to improve maintenance of their sewage collection system, including identification, correction, and prevention of sewage leaks in portions of the collection systems that run through, or adjacent to, impaired surface waters within the Soquel Creek Watershed.

To this end, within six months following adoption of these TMDLs by the Office of Administrative Law, the Executive Officer will issue a letter pursuant to Section 13267 of the California Water Code requiring: 1) submittal within one year of, a technical report that describes how and when the SCCSD will conduct improved collection system maintenance in portions of the collection system most likely to affect impaired surface water bodies, with the end result being compliance with its TMDL allocation, 2) stream monitoring for fecal coliform or another fecal indicator bacteria and reporting of these monitoring activities, and 3) annual reporting of self-assessment as to whether the SCCSD is in compliance with the TMDL allocation.

10.1.2. Storm Drain Discharges

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

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

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

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

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

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

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

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

10.1.3 Private Sewer Laterals to the Sanitary Collection System

Individual owners and operators of private laterals to sanitary sewer collection systems are ultimately responsible for maintenance of their private laterals and are, therefore, responsible for complying with the Human Fecal Material Discharge Prohibition; compliance with the Human Fecal Material Discharge Prohibition implies compliance with their load allocation for these TMDLs.

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

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

10.1.4. Domestic Animal Discharges Not Regulated by WQ Order No. 2003-0005-DWQ [Storm Water General Permit]

Owners and/or operators of lands containing domestic animals (including pets, farm animals, and livestock) in the Soquel Creek Watershed and Noble Gulch Watershed must comply with the Domestic Animal Waste Discharge Prohibition; compliance with the Domestic Animal Waste Discharge Prohibition implies compliance with the load allocation for these TMDLs.

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

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

10.1.5. Homeless Person/Encampment Discharges Not Regulated by WQ Order No. 2003-0005-DWQ [Storm Water General Permit]

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

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

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

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

10.2. Evaluation of Implementation Progress

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

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

evidence that natural, or background sources alone were the cause of exceedances of the Basin Plan water quality objective for fecal indicator bacteria.

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

10.3. Timeline and Milestones

Staff anticipates that the allocations, and therefore the TMDL, will be achieved thirteen years from the date the TMDL becomes effective (which is upon approval by the California Office Administrative Law). This estimation is in part based on the difficulty of identifying responsible parties of nonpoint sources and their inexperience with complying with the Aptos-Soquel prohibition. The estimation is also based on the uncertainty of the time required for in-stream water quality improvements resulting from management practices to be realized. Staff anticipates that the full in-stream positive effect of all the management measures will be realized gradually.

Stormwater permits or nonpoint source implementation programs may include additional provisions that the Central Coast Water Board determines are necessary to control pollutants (CWA section 402(p)(3)(B)(iii)). The Central Coast Water Board will consider additional requirements if implementation of management practices do not result in achievement of water quality objectives.

10.4. Economic Considerations

Overview

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

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

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

Cost Estimates

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

Staff notes that the County and Cities have a difficult time collecting costs for the SWMP from individual property owner, and could require a proposition 218 vote. This may impose a financial hardship upon the County and Cities. The federal Clean Water Act requires compliance with NPDES permits. The costs associated with compliance with the TMDL are, therefore, no different than the costs required to comply with the NPDES permit.

Planning or Program Development Actions: Central Coast 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 South 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 $18.00 to $46.00. 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 $21.00 to $130.00 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 Soquel Watershed, staff calculated an average annual cost from the range of costs for recently approved Phase II SWMPs in Region 3 ($21.00 in Seaside to $130.00 in the City of Monterey). Staff calculated an average annual cost of $77.00 per household. Staff used this cost per household to estimate the cost per year of SWMP implementation in the County of Santa Cruz and the City of Capitola.

Soquel Lagoon Unincorporated Area: 10,429 (population) (http://www.homegain.com/local_real_estate/CA/soquel.html, June 5, 2007) (÷ 2.71 persons per household[3] (http://quickfacts.census.gov/qfd/states/06/06087.html) (x $77.00 cost per household per year)) = $296,322 per year.

City of Capitola: 10,033 (population) http://www.ci.capitola.ca.us/capcity.nsf/vlookup/FINAL%20ELEMENT%20-%20COUNCIL%20ADOPTED%203-25-04_2/$file/FINAL%20ELEMENT%20-%20COUNCIL%20ADOPTED%203-25-04_2.pdf, March 2004) (÷2.11 persons per household (http://www.ci.capitola.ca.us/capcity.nsf/vlookup/FINAL%20ELEMENT%20-%20COUNCIL%20ADOPTED%203-25-04_2/$file/FINAL%20ELEMENT%20-

[3] Average Santa Cruz County occupancy

%20COUNCIL%20ADOPTED%203-25-04_2.pdf) (x $77.00 cost per household per year) = $366,133 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:

Soquel Lagoon Unincorporated Area: $296,322 per year x 1.02 % minimum increase=302,248 minimum increase
$296,322 per year x 1.15 % maximum increase=340,770 maximum increase

City of Capitola: $366,133 per year x 1.02 % minimum increase=373,456 minimum increase
$366,133 per year x 1.15 % maximum increase=$421,053 maximum increase

Inspections/Monitoring: Central Coast Water Board staff is proposing the above Agencies monitor storm drains. The purpose of the monitoring is to determine the effectiveness of management measures. (The Central Coast Water Board will not impose targets/allocations as effluent limits on an Agency.)

Central Coast Water Board staff estimated monitoring will the County and City approximately $5,000 per year. According to John Ricker County of Santa Cruz Environmental Health Services, the cost of sampling is $40 for sample collection and field analysis plus $20 for each bacterial sample (personal communication, September 18, 2007), for a total of $60 per sample. Staff proposed the County sample each storm drain 10 times per year. Staff also estimated approximately 5 sample sites will be analyzed per year. Therefore, staff estimated the total water sampling cost per year at approximately $3,000 ($60/sample x 10 samples x 5 sites). Water Board staff also assumed County or City staff resources will cost $200 per sampling day. Therefore total sampling costs per year including staff resources would cost approximately $5,000 ($3,000 + ($200/sampling day x 10 sampling days/year)).

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.

Farm Animals and Livestock

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

Farm Animals and Livestock Plan Implementation:

There are a variety of methods owners of farm animals and livestock can 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 the U.S. EPA, 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 $4000.00. (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: Central Coast Water Board staff estimated 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. Central Coast Water Board staff estimates that 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 Encampment Waste Plan Implementation:

The Central Coast Water Board will identify possible properties with homeless encampments. The methods used to control these wastes will be developed by landowners. However, some possibilities for controlling wastes 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 Central Coast Water Board will identify possible properties with homeless encampments. Identified responsible parties are required to submit reports to the Water Board. All land responsible parties shall submit a report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from homeless encampments. Central Coast Water Board staff estimate this report will require approximately eight hours of the responsible parties time.

Cost Summary

These costs are reasonable relative to the water quality benefits to be derived.

11. MONITORING PLAN

11.1. Introduction

The Monitoring Plan outlines the monitoring sites, frequency of monitoring, and parties responsible for monitoring. The monitoring for compliance and evaluation of these TMDLs are the minimum staff concludes is necessary. However, if a change in these requirements is warranted after the TMDLs are approved, the Executive Officer and/or the Central Coast Water Board will require such changes.

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, where appropriate, to the monitoring plan outlined below.

Central Coast Water Board staff proposes fecal coliform monitoring in receiving waters at the following stations:

- Soquel Lagoon at Flume Outlet/Inlet
- Soquel Creek above Noble Gulch
- Soquel Creek at 2525 Main Street
- Soquel Creek at Bates Creek
- Noble Gulch at Soquel Creek
- Noble Gulch at Highway One
- Noble Gulch at Victory Lane/Coyote Canyon

In addition to the receiving water locations, staff also proposes fecal coliform monitoring in stormwater at the Monterey Ave. station. This is the same station sampled by the Coastal Watershed Council (CWC) located along Monterey Avenue approximately 0.6 mile east of Soquel Lagoon and approximately 100 feet southwest of Noble Gulch. The City of Capitola and the County of Santa Cruz will identify additional stormwater outfall locations at which stormwater will be sampled and submit for approval by the Executive Office of the Central Coast Water Board.

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 activities will commence as directed by the Executive Officer of the Central Coast Water Board. Each party responsible for monitoring will be required to provide the data to the Central Coast Water Board.

Table 11-1 identifies the responsible party, monitoring site, sampling period, number of samples, and constituent. Most stations have more than one responsible party indicated for monitoring. This reflects the fact that multiple parties are known, or, potential sources of pathogens and thus share responsibility for monitoring. The responsible party must provide the data to the Central Coast Water Board.

Table 11-1. Monitoring Required

RECEIVING WATER MONITORING				
Responsible Party	**Monitoring Site**	**Sampling Period**	**Number of Samples**	**Constituent (#/100 mL)**
City of Capitola, Santa Cruz County	Soquel Lagoon at Flume Outlet	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
City of Capitola, Santa Cruz County	Soquel Creek above Noble Gulch	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
City of Capitola, Santa Cruz County	Soquel Creek at 2525 Main Street	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
City of Capitola, Santa Cruz County	Soquel Creek at Bates Creek	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
City of Capitola, Santa Cruz County	Noble Gulch at Soquel Creek	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
City of Capitola, Santa Cruz County	Noble Gulch at Victory Lane/Coyote Canyon	Weekly	1	Fecal Coliform
		One month in each of the last three years of sampling [1]	5	
STORM WATER MONITORING				
Responsible Party	**Monitoring Site**	**Sampling Period**	**Number of Samples[1]**	**Constituent (#/100 mL)**
City of Capitola and Santa Cruz County	Monterey Ave. (previously sampled CWC station)	Dry Season	5	Fecal Coliform
		Wet Season	5	
City of Capitola and Santa Cruz County	To be determined	Dry Season	5	Fecal Coliform
		Wet Season	5	
City of Capitola and Santa Cruz County	To be determined	Dry Season	5	Fecal Coliform
		Wet Season	5	
City of Capitola and Santa Cruz County	To be determined	Dry Season	5	Fecal Coliform
		Wet Season	5	
City of Capitola and Santa Cruz County	To be determined	Dry Season	5	Fecal Coliform
		Wet Season	5	

[1] Responsible Party must determine which month will produce samples with the best representation of water quality conditions, i.e., not at the end of major storm events, not when Creek is dry.

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). The Central Coast Water Board staff will review data every three years to determine compliance with these TMDLs. If the executive officer determines additional monitoring is needed, he shall request it pursuant to Section 13267 or other appropriate sections of the California Water Code.

11.3. Reporting

The Central Coast Water Board will issue a Water Code Section 13267 letter to the parties responsible for receiving water monitoring and implementation reporting described in Table 10-1. Section 13267 states the Water Board may investigate water quality and the Water Board may require suspected dischargers to furnish monitoring program reports.

The parties responsible for implementation and monitoring will incorporate the results of monitoring efforts in reports filed pursuant to the NPDES, WDR, Small MS4 Stormwater Permit, Nonpoint Source Implementation Program, or other correspondence as requested by the Central Coast Water Board pursuant to California Water Code Section 13267 or 13383.

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

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12. APPENDIX-A DATA

Please see accompanying appendix to this report.

13. APPENDIX-B DATA ANALYSIS

Please see accompanying appendix to this report.

14. APPENDIX-C MICROBIAL SOURCE TRACKING DATA

Please see accompanying appendix to this report.

15. APPENDIX-D USE ATTAINABILITY ANALYSIS

Please see accompanying appendix to this report.