

**SAN LORENZO
WASTEWATER MANAGEMENT PLAN**

**PROGRAM STATUS REPORT
1996-1998**

March, 2000

County of Santa Cruz
Health Services Agency
Environmental Health Service

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SAN LORENZO WASTEWATER MANAGEMENT PLAN PROGRAM STATUS REPORT, 1996-1998

Summary

This document describes the activities of the San Lorenzo Wastewater Management Program for the period from 1996 through 1998. This program has been implemented by the Santa Cruz County Environmental Health Services since late 1985 and was formalized through the adoption of the San Lorenzo Wastewater Management Plan by the County Board of Supervisors and the California Central Coast Regional Water Quality Control Board in the spring of 1995.

The program provides for management and improvement of approximately 13,000 individual onsite sewage disposal systems in the 138 square mile San Lorenzo River Watershed. Primary uses of the San Lorenzo River include recreation, fishery habitat, and municipal water supply for 85,000 customers. Historically, the River has been subject to elevated bacteria and nitrate levels, with septic systems suspected as the primary pollution source. Proper septic system functioning has been challenged by age of systems, small lot size, high winter groundwater levels, steep slopes, close proximity to waterways, and common occurrence of clay soils or excessively drained soils. The Wastewater Management Program has sought to overcome these constraints through water quality monitoring, system inspection, upgrade of systems to effective standards, public education, and tracking of system performance.

Table 1: Summary of Wastewater Management Activities in the San Lorenzo Watershed, 1986-98

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Total
Inspections - Surveys and Rechecks	687	496	96	158	284	1842	1723	1658	1343	1169	1532	1795	1562	14,345
Repair Permit Applications	207	151	160	177	235	268	361	336	310	303	317	333	290	3,448
Tank Pumping (Private Pumpers)	--	--	1210	1721	1789	1796	1893	1752	1954	1984	1936	2039	2072	20,146
Water Samples	1391	1191	1119	1009	1056	1087	1293	1227	1164	1623	1243	827	1198	15,428

Activities within the main elements of the Wastewater Plan can be summarized as follows:

Evaluation of Existing Onsite Sewage Disposal Systems - Over 10,500 parcels have been inspected, and over 80 boreholes or shallow monitoring wells have been installed to evaluate soil and groundwater conditions. Data on inspection results, pumping history, septic system characteristics, and site characteristics has been entered into a computerized database for 11,650 of the 13,000-14,000 septic systems in the Watershed. This information has been combined with data from water quality monitoring to evaluate the current performance and the potential for continued use of individual onsite disposal systems in various communities of the Watershed. Despite the constraints present, the large majority (at least 85%) of the systems evaluated were found to be functioning well, and it expected that all but about 10% can ultimately be upgraded to meet current standards using conventional technology. The remainder will likely require use of alternative systems or nonconforming systems with a higher level of oversight.

Disposal System Improvements Completed - Minimum standards for septic system repairs were established by ordinance in 1993, and were strengthened further in 1995, pursuant to the adopted Wastewater Management Plan. Approximately 3400 applications for septic system repairs have been submitted since 1986, resulting in the upgrade of at least 2500 systems. (The lower number of upgraded systems results from multiple upgrades on some systems or a decision by 20% of the applicants not to pursue the upgrade after an application was submitted.) The number of system repair applications is currently about 300 per year, an increase of 50% since the beginning of the program. The impetus for system upgrade has been: independent property owner initiative (66%), building remodel (9%), loan inspection (11%), complaint investigation (5%), and inspections done under the Management Plan (9%). In 1996-98, 90% of the system repairs were able to meet the requirements for a standard conventional system. At the end of 1998, 40 alternative systems had been installed in the Watershed: 24 mounded bed systems, 3 at-grade systems, 9 sand filters, and 4 other enhanced treatment units. (Pressure distribution systems are no longer considered alternative.) At least 15 more permits for alternative systems were pending.

Inspection and Maintenance - Inspection and maintenance activities consist of County inspections, public education, private pumping activities, and management activities by homeowners. Frequently septic problems have been corrected through improved system management by the property owners. System upgrades and improved management have resulted in a significant decline in failure rates from 5-14% during the initial inspections of Class I areas to 1-3% during reinspections in 1995, and 1-5% during reinspections in the wet year of 1997.

Evaluation of Potential for Community Disposal Systems - The Management Plan calls for an evaluation of the potential for use of community disposal systems for areas where there are severe constraints for meeting current standards using conventional septic systems. Under this program, community disposal alternatives have been explored for parts of Boulder Creek, Brook Lomond, Ben Lomond, Glen Arbor, and Felton. For all areas, community disposal systems were found to be less cost-effective than use of individual systems (including alternative systems) and were found to be unaffordable without some kind of grant funding. A community disposal system could be considered for downtown Boulder Creek, which might be eligible for economic development grants since constraints to standard sewage disposal is limiting expansion of the business district. A community disposal feasibility study has been completed for 900 parcels in the Greater Pasatiempo area and a sewer project is currently being pursued for that area.

New Development - Any new development in the Watershed must fully meet current standards, including a one acre minimum parcel size, regardless of the date of parcel creation. This requirement was implemented in 1983 in response to State direction to prevent an increase in cumulative impacts from septic systems. Expansion of existing development does not need to meet the minimum parcel size, but other standards must be met. Expansion of existing development provides a good trigger to bring older systems up to current standards. During the period of 1992-98, 244 permit applications for septic systems to serve new homes have been received, and about 390 applications for major residential additions have been received. (Only 115 of the new homes have been completed.) Over 224 septic system repairs have been related to building remodels (almost 10% of the total repairs).

Water Quality Monitoring - An average of about 1000 water samples per year are currently being collected to measure trends in water quality and identify problem areas. Both nitrate and bacteria levels are significantly elevated above natural background levels in the River and many of its tributaries. Although there have been episodes of bacterial contamination from individual septic system failures, much of the bacteria contamination seems to be related to nonspecific nonpoint contamination in the relatively dense urban areas. Most of the nitrate increase is attributable to septic systems, particularly in sandy soils. There have been significant localized improvements in bacteria levels, and there appears to be an improving trend in bacterial levels at most stations during the past 2-

3 years. Nitrate levels in Boulder Creek and the River north of Ben Lomond also have declined significantly, although some of this appears to be related to wetter conditions and greater dilution. Although the total nitrate loads have not declined as much as the concentrations, at the end of this period they do appear to be greatly diminished.

Program Administration and Financing - In fiscal year 1997-98, the overall budget for countywide wastewater management activities was \$102,500, with an additional \$237,5000 for activities specific to the San Lorenzo. (Roughly 60% of the parcels in the county with septic systems are located within the San Lorenzo Watershed.) These budget figures do not include permit processing activities. The program is funded primarily by annual service charges collected from property owners with septic systems. Since 1996-97, the countywide service charges has been \$6.90, with an additional \$18.56 paid by property owners in the San Lorenzo Watershed. In late 1995, the State Water Resources Control Board approved the County's request for \$2.2 million from the State revolving Fund to set up a loan program to facilitate septic system repairs. This program has been available since summer of 1998.

Implementation of Nitrate Management Plan - The San Lorenzo Wastewater Management Plan includes the San Lorenzo Nitrate Management Plan, which was developed to address all major sources of elevated nitrate in the River. The overall objective is to reduce summer nitrate levels by 15-30% over the next 10-20 years. Following are the primary activities that have been undertaken:

- An upgrade to the Boulder Creek Country Club treatment plant has been completed to provide enhanced treatment and allow wastewater reclamation on the golf course. This is expected to greatly reduce nitrate levels in Boulder Creek and the middle reach of the River by approximately 75%. The effects are already apparent.
- The sewage disposal ordinance was amended in 1995 to require enhanced treatment for nitrogen removal for all large systems and all systems serving new or expanded development in sandy soils of the watershed. Shallow systems are required in other areas.
- An improved livestock management program is being implemented by County staff in conjunction with livestock interests to reduce the discharge of nitrate and other contaminants from livestock operations (primarily horse stables) in the Watershed.

Recommendations for Program Modifications - Based on program success to date, and a need to effectively and realistically address community concerns, the following modifications to the Wastewater Management Program are recommended:

1. Change reporting frequency to every 3 years.
2. Modify the Memorandum of Understanding (MOU) between the County and the Regional Board to reflect provisions of Wastewater Management Plan and recent developments in alternative system technology.
 - a. Formalize the allowance of enhanced treatment units for new development to provide nitrogen removal in lieu of sand filters and allow reduced groundwater separation for enhanced treatment
 - b. Allow at-grade systems and enhanced treatment systems for new development.
3. Allow limited new development using enhanced treatment on up to 20 lots less than one acre in size in downtown commercial areas in order to allow needed expansion of commercial uses.
4. Within new land divisions, allow new development on individual lots less than one acre in size and/or allow leachfields on easements in order to allow cluster development where the density will still be greater than one acre per unit. Consider allowing community leachfields.

SAN LORENZO WASTEWATER MANAGEMENT PLAN

PROGRAM STATUS REPORT

1996-1998

Introduction

The San Lorenzo Wastewater Management Plan was prepared by the Santa Cruz County Health Services Agency, Environmental Health Service, to improve onsite wastewater disposal practices, protect public health, and improve water quality in surface water and groundwater of the San Lorenzo River Watershed. The Plan formalizes a management program that was initiated by the County beginning in 1985. The Plan was adopted by the Santa Cruz County Board of Supervisors on May 2, 1995. It was adopted by the California Regional Water Quality Control Board, Central Coast Region, on April 14, 1995 and was incorporated by reference into the Basin Plan by Resolution No. 95-04. The Wastewater Management Plan also incorporates the San Lorenzo Nitrate Management Plan, which was developed to reduce the discharge of nitrates into the watershed from wastewater disposal, livestock operations, and other sources.

The County Environmental Health Service has prepared periodic status reports regarding implementation of the management program in 1987, 1988, 1989, and 1996. Resolution 95-04 requires that an annual report shall be prepared each year and submitted to the Regional Water Board and other interested parties. County staff believes that a three year reporting frequency is more workable and is submitting this document to cover the program activities conducted from 1996 through 1998. As specified in the Resolution, the report is organized into the following subsections, which generally correspond to components of the Plan:

1. Background and Description of Management Area
2. Evaluation of Existing Onsite Sewage Disposal Systems
3. Disposal System Improvements Completed (including alternative systems)
4. Inspection and Maintenance
5. Evaluation of Potential for Community Disposal Systems
6. New Development
7. Water Quality Monitoring
8. Program Administration
9. Information Management
10. Implementation of Nitrate Management Plan

Background and Study Area

The San Lorenzo River Watershed drains an area of 138 square miles, discharging to Monterey Bay at the City of Santa Cruz (Figure 1). The River is the primary municipal water source of the greater Santa Cruz area, with approximately 85,000 customers. Approximately 75,000 people live within the Watershed and obtain water supply from smaller streams and groundwater basins within the Watershed. The River is highly valued for recreation and is an important steelhead and coho salmon stream.

Sewage disposal for most of the area is by individual onsite disposal systems. There are approximately 13,000 developed parcels with individual septic systems. Some 600 of these parcels have multiple septic systems. These multiple systems, combined with scattered septic systems located in sewered areas may add up to a total of more than 14,000 septic systems in the watershed. There are also several small community sewer systems which utilize in-basin disposal of treated sewage. The larger ones are: Boulder Creek Country Club (300 connections), Bear Creek Estates (30 connections), Rolling Woods (35 connections), and the Mount Hermon Association. There are also a number of schools, camps and commercial facilities using individual onsite disposal systems with relatively large flow volumes. The City of Scotts Valley which is also located within the Watershed has a large municipal sewer system, with treated sewage transmitted to Santa Cruz for ocean discharge. However, the City is implementing plans for in-basin wastewater reclamation to offset declining groundwater supplies.

Much of the development in the San Lorenzo Valley originates from old logging and summer home communities established before World War II. In the 1970's the area experienced a considerable building boom, with extensive new development and conversion of older homes to year round use. Since the early part of the century concerns have been raised regarding the impacts of sewage disposal on water quality and public health in the Valley. Many parcels in the Watershed are subject to one or more of the following constraints: small lots, high winter groundwater, clay soils, steep slopes, or close proximity to waterways. Over the past 50 years, there have been numerous efforts to develop a sanitary sewer system for the San Lorenzo Valley. However, these efforts have all failed due to questionable feasibility, high cost, potential environmental impacts, and a lack of public support. Nevertheless, concerns regarding impacts of septic systems have continued, and in 1982, the Regional Water Board imposed a sewage discharge prohibition on 2500 parcels in the designated "Class I" areas of the San Lorenzo Valley.

In late 1985, Santa Cruz County initiated a program to accurately characterize the problems and find solutions that could be implemented. Initial work consisted of comprehensive water quality monitoring, parcel-by-parcel inspections for failing septic systems, and implementation of minimum standards for system repairs. Results of the initial two years work were presented in the 1989 report, An Evaluation of Wastewater Disposal in the San Lorenzo River Watershed, which indicated good potential to alleviate problems through improved management of individual sewage disposal systems. The report formed the basis for the San Lorenzo Wastewater Management Plan, which was ultimately adopted in spring of 1995. The ongoing work has generally confirmed and built on the original findings and recommendations of the 1989 report.

Figure 1: San Lorenzo River Watershed

Evaluation of Existing Onsite Sewage Disposal Systems

A key component of the San Lorenzo Wastewater Management Program has been the evaluation of the existing wastewater disposal systems within different areas of the Watershed. The results of these evaluations provided the basis for the management approaches contained in the Plan and continue to guide system improvements. The evaluations of system performance are based on the following primary elements:

- parcel surveys (evaluations) for indications of malfunctioning systems;
- soil and groundwater investigations to identify expected constraints to proper performance;
- water quality surveillance to identify water quality impacts;
- compilation of existing data on existing system characteristics and performance; and,
- feasibility studies of long term wastewater disposal options for communities with the most significant constraints.

Parcel Evaluations (Surveys)

Over 10,500 septic systems were inspected since the program began in 1986 through 1998. More than 2650 parcels were inspected more than once. Basic information on completed inspections, tank pumping, and system upgrades during the period of 1986 through 1998 is presented in Table 2. A more detailed analysis of inspections and repairs for some of the more notorious problem areas (the former Class I areas) is presented in Table 3. Failure rates during the initial inspections were relatively high, but have come down significantly as the program has matured, as indicated particularly in the failure rates for the Class I areas. The declining failure rates and high proportion of systems that have been upgraded to meet standards is further indication of the good potential for continued satisfactory performance of onsite systems. Inspections are discussed further in a later section of this report, Inspection and Maintenance.

The number of field evaluations (surveys) of individual parcels was somewhat lower in 1996 through 1998 than it had been in 1991-1994 for several reasons. During 1996-97, considerable staff effort was directed to conducting reinspections in communities that had previously been surveyed. A new position that was created in 1995 to increase the number of system inspections was not filled until late May of 1996. A vacancy again occurred for about 4 months in early 1998, which reduced the number of inspections completed that year. An additional limited term position to conduct inspections was created in July, 1998 and filled in January 1999. Vacancies again occurred in both positions in July 1999. But it is expected that the number of surveys and rechecks will increase to meet the Plan objectives.

Table 2: Annual Inspections, Failures, Pumping, and Repairs in the San Lorenzo Watershed, 1986-98

ACTION	YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL	%
Total Inspections		688	497	97	160	284	1869	1882	1863	1535	1408	1798	2172	1838	12,496	1992-98 inspections
Surveys		687	496	95	157	276	1627	1485	1507	1204	472	989	1076	1249	7,982	64% of 92-98 insp.
Problems								115	152	124	38	67	82	62	640	46% of 92-98 probs.
								7.7%	10.1%	10.3%	8.1%	6.8%	7.6%	5.0%	8.0%	
Rechecks				1	1	8	215	238	151	139	697	543	719	313	2,800	22% of 92-98 insp.
Problems								20	19	23	34	35	33	9	173	12% of 92-98 probs.
								8.4%	12.6%	16.5%	4.9%	6.4%	4.6%	2.9%	6.2%	
Annual Checks				1				8	34	38	74	76	98	91	419	3% of 92-98 insp.
Problems								0	0	1	3	1	1	0	6	0% of 92-98 probs.
								0.0%	0.0%	2.6%	4.1%	1.3%	1.0%	0.0%	1.4%	
Complaints					2		27	122	124	116	136	164	135	165	962	8% of 92-98 insp.
Problems								78	81	73	91	104	65	69	561	40% of 92-95 probs.
								63.9%	65.3%	62.9%	66.9%	63.4%	48.1%	41.8%	58.3%	
County Loan Insp.			1					28	36	28	22	26	14	12	166	1% of 92-98 insp.
Problems								1	2	1	2	0	0	0	6	0% of 92-98 probs.
								3.6%	5.6%	3.6%	9.1%	0.0%	0.0%	0.0%	3.6%	
Total Insp. Results															1386	Total 92-98 probs.
Failures		51	25	2	10	4	31	65	111	93	64	83	72	76	687	
Greywater		76	51	3	10	31	146	122	118	108	58	73	86	55	937	
Failure Rate		18.5%	15.3%	5.2%	12.5%	12.3%	9.5%	9.9%	12.3%	13.1%	8.7%	8.7%	7.3%	7.1%	13.0%	
Annual Rainfall (in.)		62.6	25.9	25.4	29.9	28.3	28.6	50.4	70.6	28.5	67.6	54.9	54.1	72.2		
Tank Pumping		-	180	1210	1721	1789	1796	1893	1752	1954	1984	1936	2039	2072	20,326	
Cited Cause																
Maintenance		-	54	468	705	816	835	980	955	967	1089	923	1024	1107	9,923	49%
Loan Inspec.		-	65	485	479	408	404	445	392	435	345	432	487	488	4,865	24%
Failure		-	45	129	239	223	199	141	144	275	203	238	202	85	2,123	10%
Haulaway		-	7	24	138	149	140	119	40	86	137	143	146	129	1,258	6%
Other		-	9	104	160	193	218	208	221	191	210	200	180	263	2,157	11%
Reported Failure			12	95	130	105	125	105	149	152	208	189	92	151	1,513	
Failure Rate			7%	8%	8%	6%	7%	6%	9%	8%	10%	10%	5%	7%	7%	
Area Fail. Rate			0.1%	0.7%	1.0%	0.8%	1.0%	0.8%	1.1%	1.2%	1.6%	1.5%	0.7%	1.2%	--	
Reported High Level			54	232	411	387	341	410	434	486	441	418	452	476	4,542	
Pre-Failure rate			30%	19%	24%	22%	19%	22%	25%	25%	22%	22%	22%	23%	22%	
Area Pre-Failure Rate			0.4%	1.8%	3.2%	3.0%	2.6%	3.2%	3.3%	3.7%	3.4%	3.2%	3.5%	3.7%	--	
Repairs		207	151	160	177	235	268	361	336	310	303	317	333	290	3,448	
Applications								318	266	230	243	245	286	208	1,796	80%
Finalled Permits								254	241	217	222	243	268	189	2,547	74%
Info. Available		143	152	122	131	163	202	254	241	217	222	243	268	189		
Cause																
Maintenance		57	78	89	97	113	101	139	147	150	181	169	222	146	1,689	66%
Build. Permit		2	4	4	3	9	21	43	32	9	16	38	18	25	224	9%
Loan		3	12	15	25	39	67	38	29	22	3	15	6	7	281	11%
Complaint		1	9	7	5	1	2	12	10	24	13	12	17	8	121	5%
Survey/Invest		80	49	7	1	1	11	22	23	12	9	9	5	3	232	9%

Notes:

- For 1986 - 1991, complete inspection records are available only for surveys. After 1991, inspections include: surveys, rechecks, complaint investigations, and loan inspections. Total summaries for inspections only are for the period 1992-95. For repair actions, records may be inconsistent prior to July, 1991, when systematic data entry began. Pumping records are good after Sept., 1988, when submittal of pumping reports became mandatory.
- Numbers of problems under inspections, and total failure rates (unless otherwise indicated) are the total number of leachfield failures and greywater discharges for that year divided by the total number of inspections for that year. Under each type of inspection, the percentage of problems found during that type of inspection is also indicated for each year.
- Under tank pumping, the area failure rate is the number of failures, divided by the total number of parcels in the study area.
- Number of repairs is the number of repair permits applied for in that year. Repair figures for 1986 and 1987 also include other repair activities that do not require a permit.

Table 3: Annual Inspection, Failures, and Repairs in Class I Areas, 1986-95

AREA	YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Kings Creek														
466 Parcels														
Total Inspections		430	0	0	0	0	37	58	34	21	78	65	410	27
Failures		25	0	0	0	0	3	3	7	5	7	9	13	1
Greywater		42	0	0	0	0	1	2	1	2	8	3	13	2
Failure Rate		14.4%	-	-	-	-	0.9%	1.1%	1.7%	1.5%	3.2%	2.6%	5.6%	0.6%
Repairs		73	37	18	14	22	15	19	18	7	10	14	18	6
Boulder Creek														
611 Parcels														
Total Inspections		0	332	95	0	0	53	128	55	25	75	33	29	25
Failures		0	16	2	0	0	3	3	4	5	2	3	4	3
Greywater		0	16	3	0	0	0	6	4	1	2	2	2	0
Failure Rate		0.0%	5.2%	0.8%	-	-	0.5%	1.5%	1.3%	1.0%	0.7%	0.8%	1.0%	0.5%
Repairs		21	59	21	14	23	24	25	16	10	5	10	12	8
Ben Lomond														
610 Parcels														
Total Inspections		0	0	0	103	26	363	182	7	46	49	37	137	9
Failures		0	0	0	2	0	3	6	2	8	2	2	5	0
Greywater		0	0	0	7	4	38	2	1	12	10	2	2	1
Failure Rate		-	-	-	1.5%	0.7%	6.7%	1.3%	0.5%	3.3%	2.0%	0.7%	1.1%	0.2%
Repairs		14	31	19	18	27	18	21	16	12	12	8	12	7
Glen Arbor														
146 Parcels														
Total Inspections		0	0	0	0	0	152	8	2	10	34	40	10	15
Failures		0	0	0	0	0	2	0	0	3	1	2	1	1
Greywater		0	0	0	0	0	3	2	0	1	1	2	0	0
Failure Rate		-	-	-	-	-	3.4%	1.4%	0.0%	2.7%	1.4%	2.7%	0.7%	0.7%
Repairs		10	5	4	9	5	6	7	8	4	4	3	0	3
Felton														
820 Parcels														
Total Inspections		0	0	0	54	59	447	231	20	38	105	70	27	69
Failures		0	0	0	8	1	4	7	4	4	3	9	2	3
Greywater		0	0	0	3	2	40	10	1	3	3	0	2	4
Failure Rate		-	-	-	1.3%	0.4%	5.4%	2.1%	0.6%	0.9%	0.7%	1.1%	0.5%	0.9%
Repairs		20	20	28	17	28	26	24	19	14	21	17	20	9

Notes:

For 1986 - 1990 complete inspection records are available for surveys only. After 1990 inspections include: surveys, rechecks, complaint investigations, and loan inspections.

Failure Rates are the total number of leachfield failures and greywater discharges for that year divided by the total number of parcels in the area.

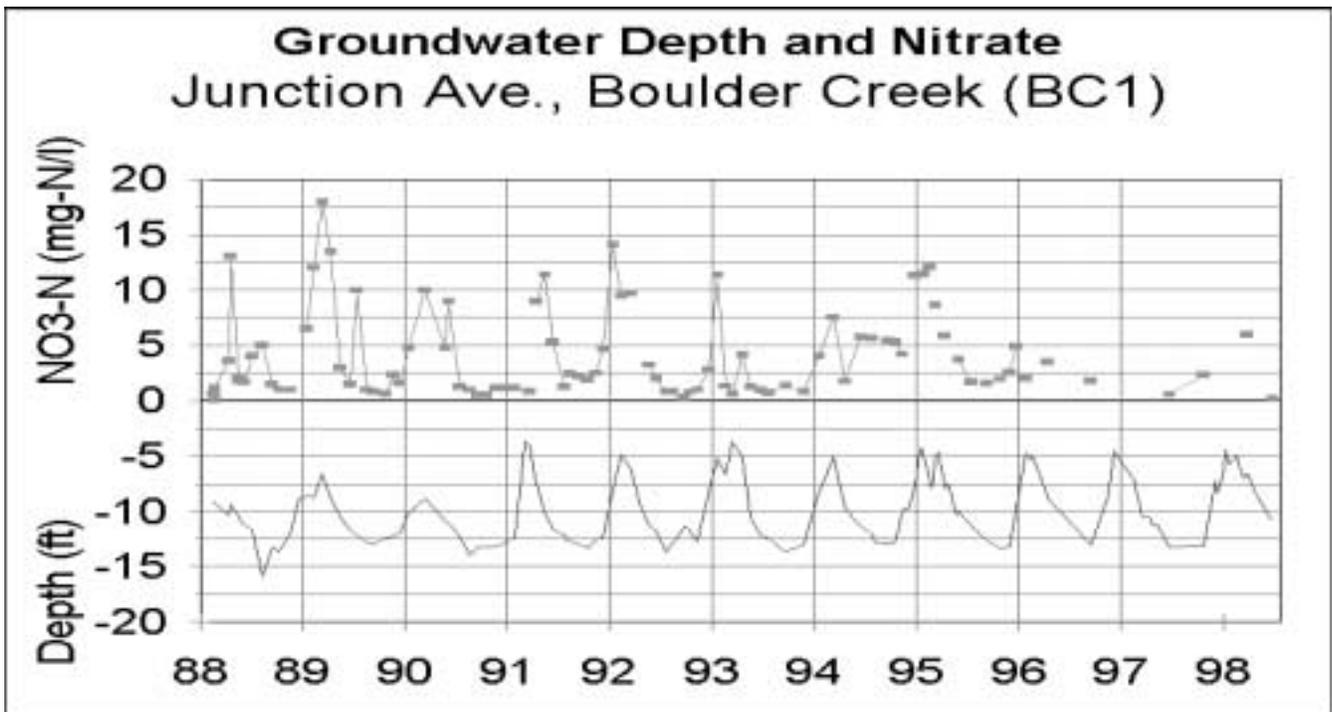
Number of repairs is the number of repair permits applied for in that year. Repair figures for 1986 and 1987 also include other repair activities that do not require a permit.

Soil and Groundwater Characterization

At the outset of the program, only about 25% of the parcels had any kind of soil information, and only about 5-10% had any kind of information on depth to groundwater. During 1986, over 50 boreholes were hand augured throughout the area. Twenty of these were cased for ongoing monitoring of groundwater levels. In 1988, another 5 wells were installed in Boulder Creek to a depth of 20 feet, with a concrete seal placed to make the wells more suitable for water quality monitoring. From 1988 to 1997, another 25 wells were installed, primarily in the Ben Lomond, Glen Arbor and Felton areas.

Groundwater and soil information from these wells was used to prepare maps of seasonal groundwater levels. This information was then extrapolated to nearby parcels to better evaluate overall conditions, particularly in the previously designated Class 1 areas. As a result, the number of parcels with useful groundwater data is 25% of the total (30-50% in the Class 1 areas). This information was invaluable in completing the analysis of long-term wastewater disposal options for these communities. These wells are also used to monitor the effects of rainfall on winter groundwater levels. Additional data on groundwater is generated as a part of septic permit review and is added to the groundwater maps and database, and is now being accessed using a geographic information system (GIS). Figure 2 shows a plot of groundwater levels and nitrate concentrations during the study period for a well in downtown Boulder Creek. The plot shows that groundwater levels are over 6 feet deep at least 90% of the time and are only shallower than 5 feet for 0-20 days per year. Six feet is used as the winter groundwater level for purposes of septic system repair in this particular area.

Figure 2: Groundwater Levels and Nitrate Concentrations in Shallow Groundwater; Junction Avenue, Boulder Creek



Water Quality Surveillance

Surface water and groundwater quality data was used to evaluate the extent to which onsite disposal systems were having an impact on water quality. Sampling was done in the shallow monitoring wells, in streams draining the communities, and in various roadside ditches. Groundwater data showed that elevated bacteria levels were generally not a problem, except occasionally in some wells in Boulder Creek. There was no obvious cause for these occasional high levels. Bacteria levels in ditches and streams were sometimes elevated, particularly during storm events. Much of the bacteria was found to come from urban nonpoint sources (see 1989 report), but individual system failures did occasionally cause high bacteria levels in ditches or streams. Nitrate was somewhat elevated in many locations, but did not exceed drinking water standards anywhere except occasionally in some shallow wells in the Boulder Creek area. These wells may have been located in effluent plumes. Most of the nitrate in the River was found to be coming from areas underlain by Santa Margarita sandstone. See the later section on Water Quality Monitoring for a further discussion of water quality results.

Data Compilation and Analysis

Data on inspection results, soil, groundwater levels, individual system characteristics, repairs, pumping records, and permits are all maintained in a comprehensive database. Data is currently available for over 11,650 of the 13,000-14,000 septic systems in the study area. This information was used to prepare summaries of system characteristics by community, and to project the types of system upgrades that would ultimately be needed in each area to meet standards contained in the Management Plan.

It has generally been found that despite the constraints present in many areas, the large majority of systems are performing well. There is good potential for upgrade to meet the standards contained in the Management Plan. In the communities with broad Valley bottoms, such as Felton, Boulder Creek, Glen Arbor, and Brook Lomond, there are areas of elevated groundwater that may require use of alternative systems to meet standards. However, in most areas, conditions are extremely variable from parcel to parcel. And only a small proportion of scattered parcels have severe constraints that preclude the use of standard systems.

Although alternative systems might be needed to meet standards for up to 10% of the parcels in some areas, continued use of onsite disposal systems is the most feasible approach for long term wastewater disposal in most areas. This was confirmed by the sewer feasibility studies for Ben Lomond, Brook Lomond, Glen Arbor, Felton and the larger Boulder Creek area (see Section on Community Disposal). A community collection and disposal system may still be pursued for the downtown Boulder Creek business area, where constraints to sewage disposal are limiting business expansion. However, pursuit of such a project is probably dependent on obtaining some sort of economic development grants to make the project affordable.

Some type of community disposal is being considered for 900 developed parcels in the Greater Pasatiempo area, where a sewer feasibility study was completed in 1997. Work is being done to further evaluate costs and lay the groundwork for a vote on whether or not to form an assessment district to design and construct a project.

Disposal System Improvements

The Wastewater Management Plan includes repair standards which provide for significant improvement in existing septic systems, most of which were installed to older, more lax guidelines. Systems are required to be upgraded to meet current repair standards when the old system is found to be failing and no longer functional, when a major remodel takes place, or when the property owner makes a voluntary decision to upgrade their system. Repair standards were tightened up considerably in late 1992, and again in May, 1995, when more stringent standards for increased groundwater separation and other factors from the Management Plan were implemented. These were formally adopted by ordinance in November, 1995.

Approximately 3400 applications for septic system repairs were submitted between 1986 and 1998, resulting in the repair or replacement of at least 2500 systems. Some of the applications have not been acted upon (20%), and some of the systems have been repaired more than once since 1986. The numbers of improvements and the cause of them are shown in Tables 2 and 3. The types of disposal system improvements completed are shown in Table 4. Information on system upgrades is much more complete and consistent since July 1991, when the current data management system was implemented. Currently, once a permit has been finalled, information on the type of installation is entered into the database. Full information has been entered for 91% of the upgrades that have been completed since 1991.

Independent property owner initiative continued to be the most significant cause of system repairs, responsible for 66% of the repairs (1690 systems since 1986). Another 9% (224 systems) were performed as a requirement of a building remodel or addition, and 11% (281) were done as a result of a loan inspection. Only 5% of the upgrades (121 systems) were done as a result of a complaint investigation, and 9% were done as a result of inspections done under the Management Plan. Although these latter are the smaller proportion, they are generally the ones that are harder to fix and that were having the greatest impact on public health and water quality. The number of voluntary repairs is probably stimulated by educational efforts of the Management Program, as suggested by the continued high number of repair permit applications received each year since 1990, when the Program got well underway (see Table 2).

Table 4 shows the types of repairs being completed. It should be pointed out that the designations of nonconforming systems in the Class 1 areas for 1986-93, that were used in the development of the Management Plan, were based on extrapolations from the database, and were not based on parcel-specific evaluations. After that time, systems that are being repaired have been formally designated as nonconforming if they could not meet standards. The proportions of actual nonconforming systems in 1994-98 is only 5-6% (41 systems), much lower than the 12% that was projected in the Management Plan. The number of alternative systems and haulaway systems is also much lower than originally projected. Alternative systems have proven to be considerably more expensive than anticipated in the Plan, at about \$20,000 per installation. A significant number of alternative upgrades are still pending, while the property owner secures financing. In 1996-98, 87% of the system replacements (417 out of 482 systems) were able to meet requirements for a standard system.

Table 4: Types of Repair Actions, Class I Areas and Entire Watershed

	Class I Areas 1986-1993		Class I Areas 1994-95		Class I Areas 1996-98		Entire Watershed 1994-95		Entire Watershed 1996-98	
Total Parcels (Developed)	2653		2653		2653		13000		13000	
Total Actions (a)	705	27%	98	4%	146	6%	439	3%	718	6%
(with information) (b)	705		88		146		397		697	
Disposal Upgrades (a)	490	18%	58	2%	93	4%	261	2%	511	4%
Standard Systems (c)	266	54%	49	84%	73	78%	219	84%	436	85%
Std. Pump Up Systems	40	8%	2	3%	4	4%	19	7%	27	5%
Nonconforming (d)	167	34%	3	5%	13	14%	12	5%	35	7%
Reduced Area	41	8%	3	5%	8	9%	12	5%	8	2%
Reduced GW Sep.	126	26%	-		3	3%	-		10	2%
No Expan. Area					2	2%			17	3%
Alternative (e)	10	2%	4	7%	2	2%	9	3%	10	2%
Haulaway (f)	7	1%	0	0%	1	1%	2	1%	3	1%
Other System Repairs (g)	215		30		49		178		238	
Tank Repair							102		189	
Greywater Sump			5				29		35	
Other Minor Repair							5		13	

Notes:

- a. Percentages shown are: the percent of all the parcels in the area for total actions, disposal upgrades, and other actions; the other percentages shown are the breakdown of the the different types of disposal upgrades.
- b. Only actions for which information is available are presented: for example, in 1994-95, 613 applications for repairs were received (including 448 for disposal system upgrades); 439 repairs were completed (finalled) (including 312 disposal systems); and actual system information is available in the database for 397 repairs (including 261 disposal systems).
- c. Standard systems are conventional septic systems which meet all requirements for a standard repair and do not include pump. Standard pump up systems also meet all requirments for a standard system but they do include a pump. These not include alternative or nonconformng systems, which have pumps.
- d. Nonconforming systems are those system upgrades which do not fully meet standards for either disposal area or groundwater separation requirments adopted in May, 1995. For 1986-1993, estimates of nonconforming systems were based on information in the database. For 1994-98, determinations of nonconforming were made for each system at th time of permit approval. There is much less information on groundwater depth available for most of the watershed ou the Class 1 areas, and determinations are generally made for individual parcels at the time of system repair.
- e. Alternative systems have included mound systems, pressure distribution, sand filters, at-grade systems. As of 1996, pressue distribution systems were no longer treated as alternative systems.
- f. Haulaway systems are those systems that use a sealed tank with alarm and regualr pumpout of sewage.
- g. Other system repairs in 1986-1990 include: tank replacements, greywater connections, plumbing repairs, installation o low flow devices, other actions taken to improve wastewater disposal. After that time, they are only minor repair applications for tank repairs/replacements, greywater sumps, curtain drains, or distribution boxes.

By the end of 1998, 40 alternative systems have been installed in the Watershed: 24 mounded bed systems, 3 at-grade systems, 9 sand filters, and 4 other enhanced (aerobic) treatment units. Pressure distribution systems are no longer considered alternative systems, with most of them now treated as nonconforming systems. A number of applications for alternative systems are still pending, but the cost of alternative systems has been a deterrent, and some property owners have preferred to go with a nonconforming system or a black water haulaway system. In the future, staff expects to see much more use of proprietary enhanced treatment units which can be relatively inexpensive and provide higher levels of nitrogen removal as needed to meet the nitrate reduction objectives in sandy soils.

In order to facilitate system upgrades, particularly using alternative systems, the County has worked with the State Water Resources Control Board to establish a low interest loan program using \$2.2 million from the State Revolving Fund. Funds are disbursed from a private lending institution (Bank of America) through a linked deposit program. Although this approach has been used in other states, this is the first time California has tried to use this sort of financial arrangement. It took some time to develop appropriate procedures and implement the program. One loan for an enhanced treatment system was completed in the summer of 1998. Although information on the loan program has been circulated, and inquiries have been made, there has not been as much interest as expected. Lack of response may be due to the generally low interest rates available for conventional loans, the high administrative fees charged, and the initial policy of restricting loans to use of alternative systems. County staff have reduced the fees, and are again actively soliciting interest in the program. Staff will also consider use of funds for additional types of septic repairs where there is a significant improvement in water quality. County staff continue to have some concerns about whether truly low income people will be able to qualify for the linked deposit loans. The County and State will consider other methods to help finance upgrades if there is a substantiated need.

Inspection and Maintenance

Inspection and maintenance activities consist of the following elements:

- S initial septic system inspections under the management survey program;
- S septic tank pumping and inspection by private septic tank pumpers;
- S loan inspections at time of sale or refinance, typically done by private pumpers;
- S annual inspection by County staff of alternative and nonconforming systems;
- S investigation of complaints or episodes of water quality degradation by County staff;
- S rechecks and follow up inspections by County staff of systems likely to have a high recurrence of problems, as indicated by prior surveys or investigations;
- S scheduled periodic reinspection of systems by County staff under the management program;
- S public education by County staff regarding proper maintenance techniques; and,
- S ongoing property owner oversight, maintenance and management.

County Inspections

Information on inspections and pumping for 1986-1998 is displayed in Table 2. The information is most complete after 1991, when standard automated record keeping was implemented. Inspections have been completed on approximately 10,500 systems. Over 2650 parcels have been inspected more than

once. It is interesting to note that during the period of 1992-98, the initial surveys have turned up the highest proportion of the total problems found (46%), followed by complaints (40%), rechecks (12%), and County loan inspections (1%). Complaint investigations had the highest incidence of problems found (58% of the complaints investigated revealed problems), followed by surveys (8%), rechecks (6%), County loan inspections (4%) and annual inspections (1%). This can be compared to the findings of private pumpers, which show a failure rate of 2.5 % during loan inspections and failure rate of 5.5% during maintenance pumping. Pumping information from loan inspections is less biased toward failures than the total pumping data which are biased toward a higher failure rate as people are more likely to call the pumper when they have problems with their system and multiple pumping may occur when the system is failing. Total pumping results show a failure rate of 7% and prefailure (high effluent level in tank or flowback) rate of 22%.

Below is a breakdown of the types of system corrections that have resulted from discovery of system failures (687 systems) or greywater bypasses (937 systems) during the period of 1992-98:

Resolution of Failures Found by Surveys, Complaints, and other Inspections:

- 34% - system upgrades under permit (74% disposal system upgrades, 15% greywater sumps, 11% tank repairs)
- 31% - actions not requiring a permit, but satisfactorily correcting the problem (repair of broken or clogged pipes, pumps or water leaks; washing machine removed; permanent flow reduction implemented)
- 33% - actions which require follow-up checks, or further action (tank pumped, water conservation/ flow reduction implemented, failure dried up, house vacated, warning letters sent, winter haulaway implemented)

Resolution of Greywater Bypasses:

- 14% - permits for greywater sumps or leachfield upgrades
- 66% - connection of greywater to septic system (with follow up check by County)
- 10% - repair of broken or clogged pipes
- 7% - removal of washing machine (with follow up check by County)
- 3% - miscellaneous other actions such as flow reduction

Rechecks of system problems that were corrected without a major system upgrade have shown that corrections were effective for all but 10-15% of the systems. The systems with continuing problems are required to make system upgrades to resolve the problem.

The County has only begun to implement a formalized program for reinspection of all parcels in the Watershed. As mentioned previously, there were staffing shortages in 1995 and in 1998. Not all of the parcels in the Watershed have received an initial inspection and the program seeks to balance both initial surveys and reinspections. Generally the initial surveys still turn up a higher rate of failures than reinspection of areas previously surveyed. Over 1800 parcels were reinspected in the relatively wet winters of 1995, 1996, and 1997, with a focus on the Boulder Creek and Kings Creek areas. Approximately 95% of the parcels showed satisfactory performance. As the failure rates from both surveys and rechecks are declining, staff is evaluating ways to direct inspections to better target potential problems. The utility and need for a set reinspection interval of 3-6 years as provided for in the Management Plan is also being reevaluated.

Pumping and Loan Inspections

Private septic tank pumpers have pumped and inspected almost as many systems as County inspectors have visited. Pumpers performed over 20,000 pumps on 9000 systems in the Watershed from 1988 through 1998. However, almost 35% of the 13,000 systems in the Watershed have no record of being pumped. Since September of 1988, pumpers have been required to submit to the County an individual inspection report for each tank pumped. These reports indicate the reason for pumping, condition of the tank, signs of surfacing effluent (failure), and signs of flowback or high effluent level in the tank which typically indicate leachfield dysfunction (prefailure). Information on pumping is presented in Table 2. Almost half the pumping was done as a result of general maintenance, with another 25% done for sale inspections. Other reasons given for pumping were system failure (11%) or pumping of a haulaway system (6%). It should be noted that haulaway pumps account for 17% of the pumping activity by volume.

Based on the pumping reports, 600 (6.5%) of the 9000 systems pumped were found to have surfacing effluent during their most recent pumping. Some 260 (12%) of the system upgrades completed were apparently triggered by a prior failing pumper's report, with no other apparent cause such as building or presale inspections. This is more than the 7% of upgrades that were triggered by County inspections. However, those figures also suggest that over half of the systems (some 360) found to be failing at the time of pumping have not yet been upgraded. Several years ago, staff conducted follow-up inspections of systems that were reported to have been failing in pumping reports, but no significant number of failures were found. (This effort was repeated in 1999 with similar results.) People seem to be able to resolve their problem through plumbing fixes and/or better management of their system.

Private septic tank pumpers perform the large majority of system inspections at the time of property transfer or refinancing. During the period of 1992-1998, they performed 3030 sale/loan inspections, compared to 176 performed by County staff during the same period. Pumping activity indicates that from 1992 through 1998, 23% of the properties in the Watershed had their tanks pumped for sales or refinancing. County staff regularly encourage the real estate community to also check the file records for a property prior to completing a purchase. In addition, whenever an alternative or nonconforming system is approved, a notice is recorded on the deed which can alert a potential buyer to any limitations or special characteristics of the septic system.

Education

Most of the septic system management activities in the Watershed are initiated and carried out by the property owners voluntarily without specific requirement by County. The Management Program needs to build on and support property owner initiative through strong education efforts. The fact that 35% of the tanks have not been pumped in the last 10 years, indicates that further education of property owner regarding system maintenance is needed. Education efforts so far have consisted of production and distribution of brochures, workshops, press releases, targeted mailings to new homeowners, and direct one on one consultation in the field and on the phone. Brochures on septic system use are distributed at a rate of about 700 per year. Many people have learned to properly manage their system to prevent overload and failure as a result of direct education by the field inspectors on the use of monitoring risers

and flow reduction, particularly during wet winter periods. The observed decrease in failure rates (Table 3) appears to have come greatly as a result of better system management on the part of property owners. (Only 25-35% of problem systems have been replaced.) An additional educational effort that is under consideration is a targeted mailing to owners who have not pumped their tanks.

Community Disposal Systems

In some areas that have many constraints to long term septic system performance, such as high groundwater, poor soils, and/or small lots, it may be more cost-effective to develop community disposal systems than to rely on use of individual alternative or nonconforming systems. The Management Plan provides for evaluation of the feasibility of community disposal options for such areas. Community disposal has been investigated for Boulder Creek, Ben Lomond, Brook Lomond, Glen Arbor, El Solyo Heights, and Felton. The results of these investigations are presented in Appendix H of the Management Plan, and in project reports prepared for the County by Questa Engineering Corporation: Boulder Creek Wastewater Feasibility Study (1991), and San Lorenzo Valley Community Wastewater Feasibility Studies (1994). The latter study was funded by the Regional Water Board.

Community wastewater disposal was found to be feasible for these areas, as was continued use and upgrade of individual onsite disposal systems. However, the cost per parcel of community disposal was estimated to cost more than twice as much as the average cost per parcel of individual system upgrades, and was deemed to be unaffordable without some kind of grant funding. There is currently no active pursuit of community disposal projects for those communities, although the Boulder Creek business community has deemed a downtown disposal system a high priority to promote economic development in the commercial district. Because that area is a commercial district there may eventually be a good possibility of obtaining economic development grants to support a community disposal project there. The other areas are generally moderate income residential areas, and would not likely qualify for any of the available grants.

In late 1995, the County initiated another community disposal study of the Greater Pasatiempo area, an area of 900 parcels on the ridge between Carbonera Creek and the lower San Lorenzo River. This area has a mixture of constraints including perched groundwater, clay soils in some areas, and sandy soils in many other areas which readily transmit nitrate to surface and ground water. When the area was surveyed in 1993, a 4% failure rate was found, comparable to Boulder Creek. However, the level of problems is much higher in more localized areas. In 1997, a feasibility study was completed which evaluated options for sewerage the entire area and connecting to the Santa Cruz sewer system, or more localized sewerage with treatment and local reclamation, with winter transmission to the ocean outfall via the existing Scotts Valley treated effluent line. There has been substantial informal public support for a project and county staff are taking steps to further define costs prior to initiating formation of an assessment district for the project.

During 1998, two community disposal systems were upgraded to provide a much higher level of treatment prior to land discharge in the watershed. The Boulder Creek Country Club Plant (CSA 7) was upgraded to provide denitrification and tertiary treatment for possible golf course reclamation. These improvements went online in May 1998. The Mount Hermon Association added a treatment plant to

provide for nitrogen removal prior to discharge to very sandy soils in the area. This went online in summer of 1998. The City of Scotts Valley is in the process of upgrading its plant to provide tertiary treatment for in basin reclamation which will reduce the pumpage from local groundwater basins. The plant will include a denitrification process and is expected to be on line in late 2000.

New Development and Expansion of Existing Uses

Since at least 1983, the County has implemented relatively stringent standards for septic system to serve new development in the Watershed. These standards are consistent with the State’s Basin Plan, with the additional requirement that no new development may occur on any parcel smaller than 1 acre, regardless of the date of parcel creation. Any significant expansion of an existing use does not need to meet the minimum parcel size, but must meet the current repair standards. If standards cannot be fully met, only a minor remodel less than 500 square feet is allowed, with no increase in the number of bedrooms. In the case of a nonresidential use, the amount of sewage discharge cannot increase if standards are not met. Prior to obtaining a building permit, an applicant must meet the appropriate septic requirements for the type of proposed project.

Expansion and remodel of existing development helps to trigger upgrades of older septic systems to meet current standards. It may also trigger the use of an alternative system on sites that cannot fully meet standards using a conventional system. A major remodel will not be allowed for any system that does not meet standards including groundwater separation, expansion area, and enhanced treatment to reduce nitrate discharge in fast percolating soils.

Table 5: Development Activity in the San Lorenzo Watershed, 1992-98

Application type	1992	1993	1994	1995	1996	1997	1998	Total 92-98	92-98 Finalled
Septic Permit Applications Received Related to Building Activity:									
New Septic	60	30	26	27	28	32	41	244	117
Septic Upgrade for Bldg. Permit	14	12	18	24	35	17	26	146	106
Building Permits Reviewed by Environmental Health:									
New Residence*	22	24	23	18	22	33	28	170	
Accessory Structure*	5	3	2	8	3	8	7	36	
Reconstruction/ Replacement*	12	14	11	11	16	13	13	90	
Major Remodel * (>500sf)	70	54	56	53	78	38	40	389	
Minor Remodel (no bedroom)	53	26	26	29	32	42	61	269	

* Building Permit approval requires that septic system meet current standards.

Table 5 indicates the types of development activities that have taken place, as reflected in the septic permit applications, and requests for building permit clearances. As can be seen from the table, new development is relatively minor in the Watershed, as compared to 13,000 parcels which are already developed. It has been estimated that the San Lorenzo Valley Planning Area is already 95% built out, given current zoning and geographic constraints. As a result of adoption of the Wastewater Management Plan in May 1995, the Regional Board and the County lifted the discharge prohibitions that had limited expanded development since late 1982 for the 2500 parcels in Class I areas. However, no significant increase in remodels or other development has been observed in those areas.

The requirement for at least a one acre parcel size for new development on septic systems, and the unaffordability of any community sewer system has limited creation of any new businesses in the downtown commercial districts. Given that there are a limited number of vacant commercial parcels in the San Lorenzo Valley (approximately 20), consideration will be given to allowing new development on those parcels, provided they utilize enhanced treatment technologies for nitrogen removal to minimize any cumulative impacts.

Water Quality Monitoring

Water quality monitoring is performed as a part of the wastewater management program in order to evaluate overall wastewater disposal impacts in communities, identify specific failing systems that need correction, and monitor the long term effect of management efforts in improving water quality. Sampling efforts consist of regular routine monitoring, investigative sampling, and special studies. The sampling locations for regular monitoring and special studies are shown in Appendix A. Samples are analyzed primarily for fecal coliform bacteria and nitrate, as well as standard physical parameters such as dissolved oxygen, temperature, conductivity, pH, and turbidity. At times measurements are also made of streamflow, other nitrogen compounds, and other forms of bacteria such as fecal streptococcus, enterococcus, and *E. coli*.

From the time the program was initiated in October, 1985, through the end of the 1997-98 water year on September 30, 1998, some 16,000 samples have been collected. 2,800 have been collected in the three years covered by this status report. The following types of samples were collected from 1995 to 1998:

- 5000 samples were collected as a part of regular routine monitoring,
- 2198 samples were collected as a part of special studies, and
- 1368 samples were collected as a part of follow up investigations of contamination sources;
- 6444 samples were collected were collected from surface water,
- 358 samples were collected from deep wells,
- 1086 samples were collected from shallow wells.

Approximately **half** of the total analyses included measurements of nitrate.

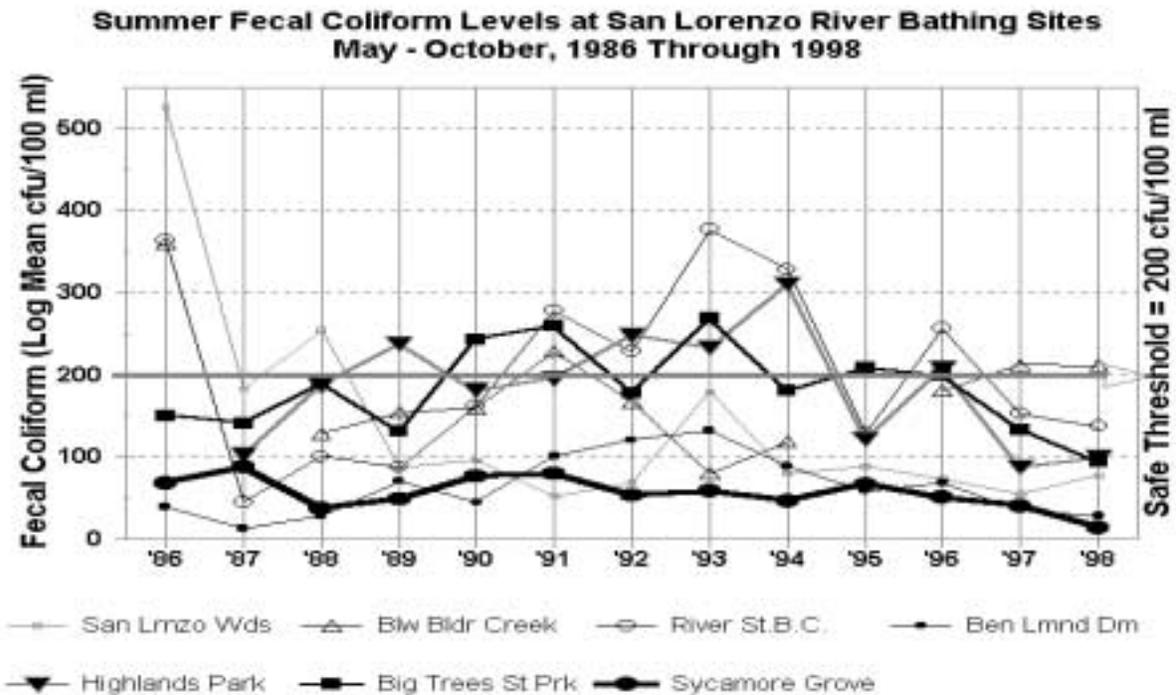
Data summaries from the primary stations are presented in Appendix A. Detailed analyses of the data have been presented in prior reports prepared by the County: An Evaluation of Wastewater Disposal in the San Lorenzo River Watershed (1989), and the San Lorenzo Nitrate Management Plan (Phase II Final Report) (1995). A brief summary of recent findings is presented in the following sections.

Findings Regarding Bacteria

Bacteria levels are monitored to indicate potential contamination by wastewater and to assess potential public health hazard at natural swimming areas in the Watershed. Because it is very difficult to monitor for specific pathogens, indicator bacteria are used to indicate the potential presence of sewage and disease causing organisms. Santa Cruz County typically uses fecal coliform as the primary indicator, with occasional use of fecal streptococcus, *E.coli*, and enterococcus. Unfortunately none of these indicators can conclusively indicate presence of sewage. If sewage is present, these organisms will be present in high numbers. However, these indicator bacteria may also originate from other animals or decaying material and they may be persistent in the environment under suitable conditions.

Non-sewage sources of elevated bacteria levels in the San Lorenzo Watershed include waterfowl, pets, livestock, decaying garbage, and general nonpoint urban pollution. Many of the San Lorenzo stream corridors are fairly densely developed, with resulting higher background levels of bacteria. Bacteria levels in the Watershed are generally less than levels found in other urbanized waterways in sewered areas of the County. Bacteria levels are consistently lower in parts of the Watershed that are less densely developed. A summary of summer fecal coliform levels at the major natural bathing areas of the Watershed is shown in Figure 3.

Figure 3: Summer Fecal Coliform Levels in the San Lorenzo River Bathing Areas



In addition to moderately elevated background levels of fecal coliform, specific instances of bacterial input from septic systems and other sources has been identified during the monitoring efforts. One objective of the wastewater program is to keep bacteria levels in the River well below the current safe swimming standard of 200 cfu/100ml. When levels of 300 or more are found, detailed follow up sampling is conducted to identify a source. Often however, the bacteria levels decline before a specific source can be found.

Findings from the samples collected since 1989 are consistent with the conclusions drawn in the 1989 report. There does not appear to be any high level of chronic, cumulative bacterial contamination originating from functioning septic systems in the Watershed. This is indicated by a lack of significant bacteria counts in the shallow groundwater monitoring wells that have been installed through out the area, and by the behavior of the occasional elevated levels that do occur in the streams. Failures of individual systems have been found to cause high fecal coliform levels in watershed streams (600-1300 cfu/100ml), but the bacteria levels drop back down to background levels (100-200 cfu/100ml) once the failure is corrected.

Long term bacteria levels did not seem to follow a discernable pattern during the period from 1986 through 1995-96 (see Figure 3 and Appendix A). During one year a station may be persistently or intermittently high, the next several years it will be low. However, in 1996 and to a greater extent in 1997 and 1998, summer bacteria levels at most stations seemed to be consistently lower than in previous years. The primary exception to this is Two Bar Creek, which has had very high bacteria levels since 1994, and which also seems to impact water quality in the River as far south as Boulder Creek. This creek is under further investigation, but continues to have intermittently high bacteria levels.

Urban Runoff and Health Risk Investigations

During 1995 and 1996, Environmental Health conducted an investigation of bacterial levels and urban runoff constituents in the River, focusing on the urban area in Santa Cruz. This study also included a health risk survey to gauge actual incidence of disease in people swimming in River water at various bacterial concentrations. Although the lower River in Santa Cruz typically exceeds standards for safe body contact, little illness was reported by those in the water during the summer (0.6%). Primary sources of high bacteria levels appear to be birds, with additional contribution from storm drain discharge. Except during storm periods, bacteria levels in the River as it enters Santa Cruz are well below standards, indicating little or no contribution from upstream septic systems to the high levels found in the lower River.

Findings Regarding Nitrate

Nitrate levels in the San Lorenzo River are approximately seven times greater than estimated natural predevelopment levels. Although nitrate is well below drinking water standards, the elevated nitrate may adversely effect drinking water and recreation by stimulating growth of microscopic algae and other organisms, which can increase organic load and summer turbidity, and impart taste and odor to the water. Studies conducted as a part of the San Lorenzo Nitrate Management Plan have indicated that

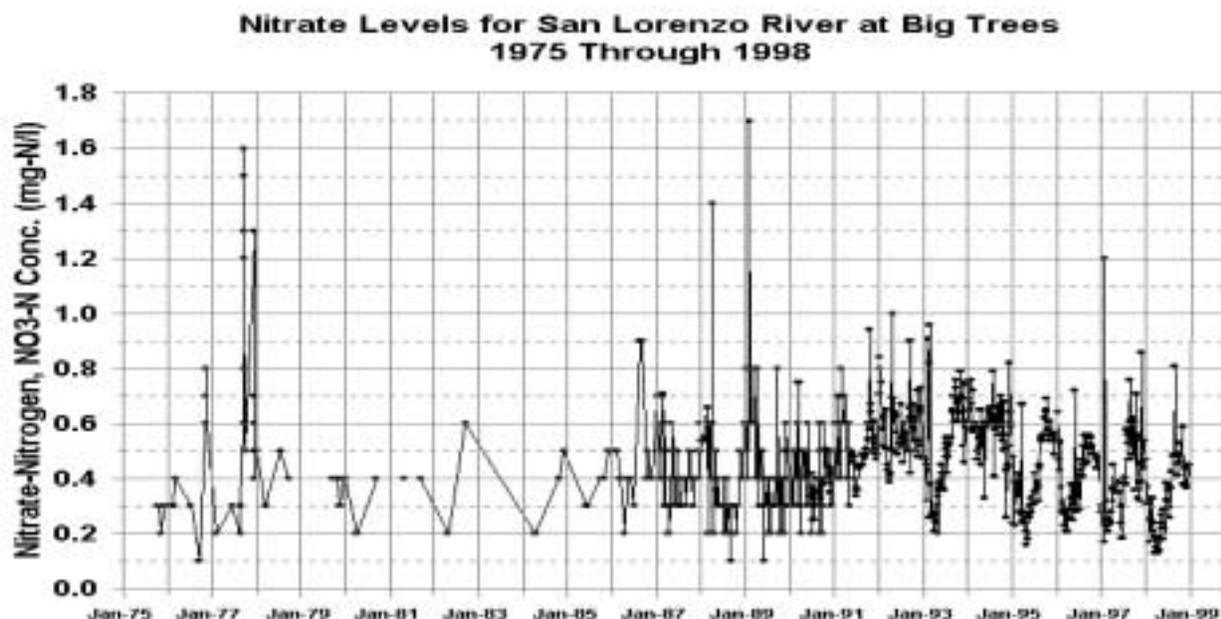
the increased nitrate levels probably have little effect on growth of the larger filamentous algae that is readily visible at times.

Septic systems contribute an estimated 57% of the current summer nitrate load in the River, with other contributions from community sewage disposal systems, groundwater from the Scotts Valley area, livestock operations, and natural sources. The monitoring program has been useful to monitor long term nitrate levels in the River and water supply aquifers and to identify source areas of nitrate. Additional testing is being done to evaluate the effectiveness of specific measures to reduce nitrate discharge from septic systems and stables.

The findings of nitrate monitoring through 1993 were presented in the Nitrate Management Plan. Monitoring results for the last five years is generally consistent with the findings of that Plan, although nitrate levels are lower at most stations than they were in the early 1990's when the Nitrate Plan was prepared. A summary of the long term data for primary stations is contained in Appendix A. Figures 2, 4, 5, and 6 also summarize trends. Some of the key findings are as follows:

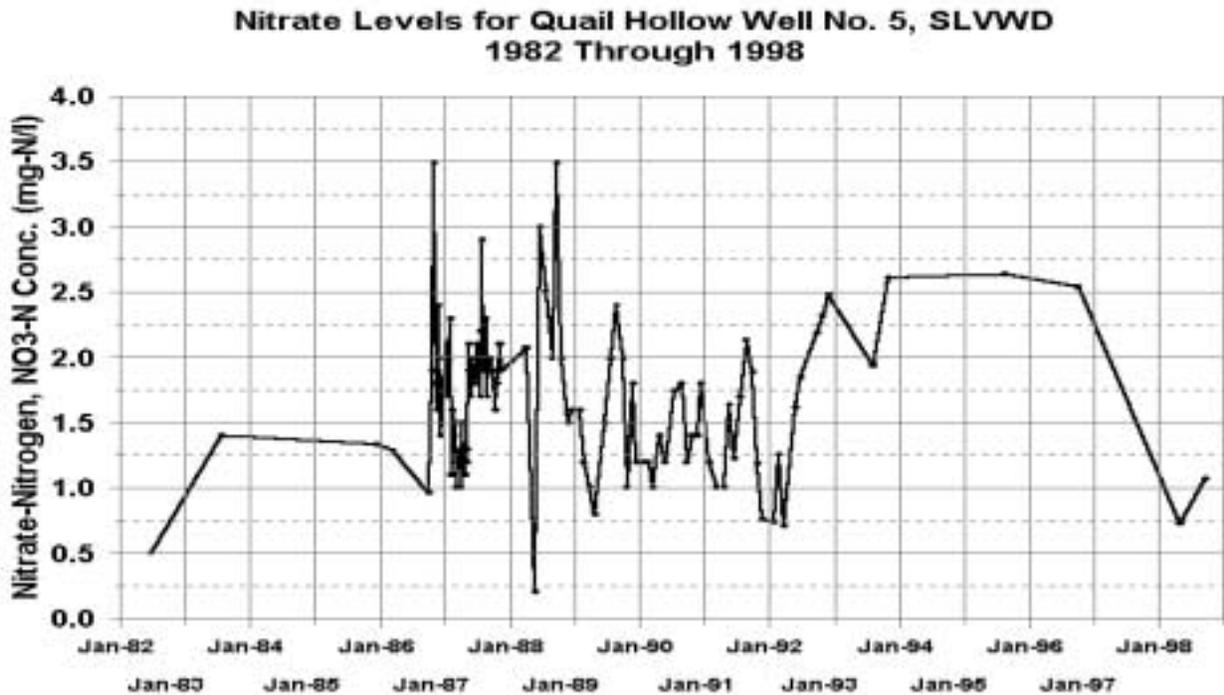
- Nitrate levels in the San Lorenzo River at Big Trees, the primary monitoring location, have generally maintained the same average level over the past 13 years (approximately 0.45 mg-N/l) (Figure 4). Levels do vary significantly from year to year, apparently due to differential rainfall, which affects both the amount of flushing of nitrate and dilution. Levels at Big Trees were lower in 1995 than they were in 1986, both comparably wet years. Mean levels dropped to 0.35 mg-N/l in 1998, the lowest they have been since regular monitoring started in 1986.

Figure 4: Nitrate Levels, San Lorenzo River at Big Trees, 1975-1998



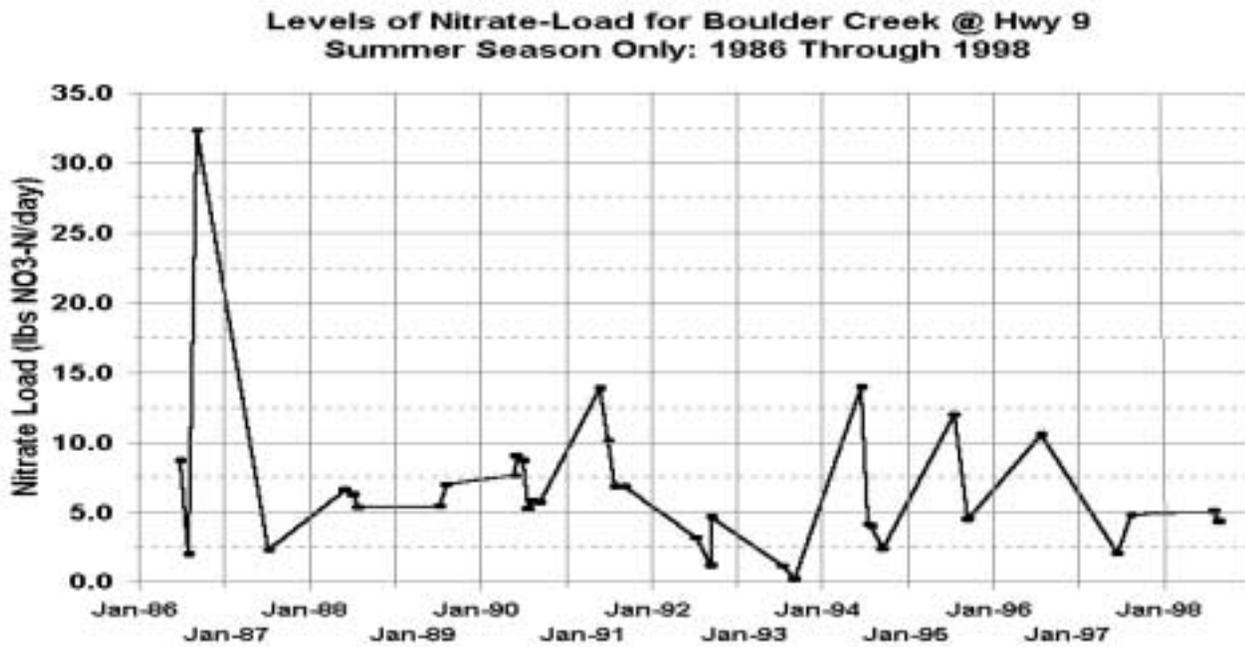
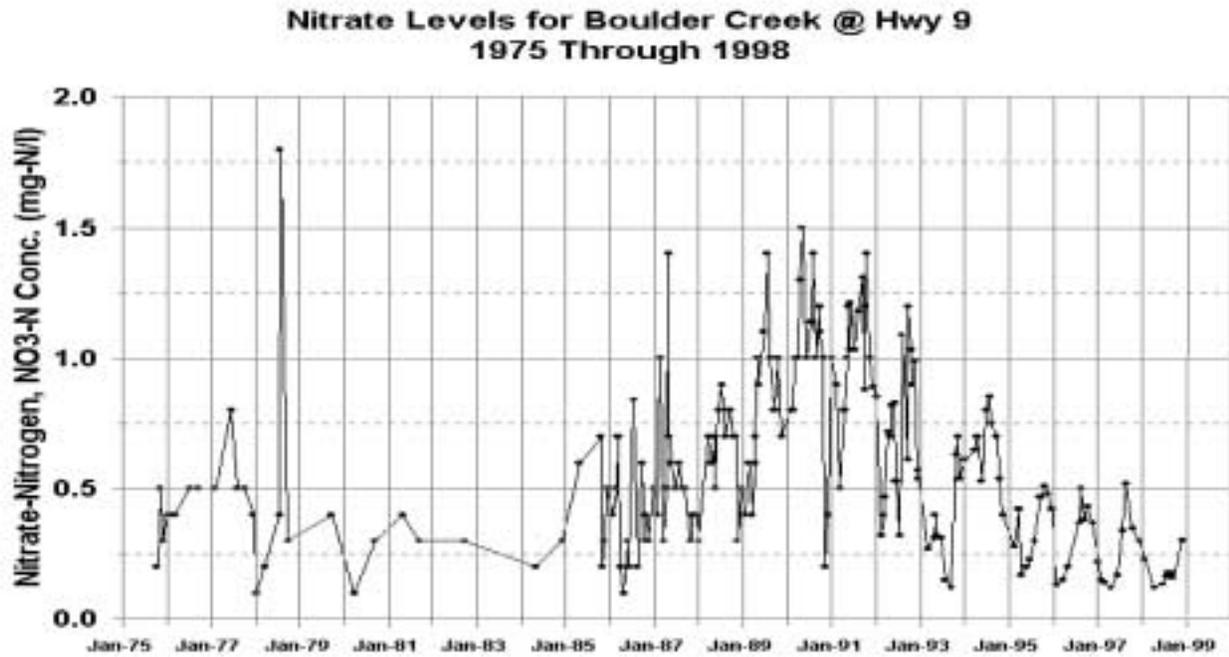
- Nitrate has only been found to exceed drinking water standards of 10 mg-N/l occasionally at two shallow groundwater monitoring wells in Boulder Creek (Figure 2).
- Although there is limited data, nitrate levels in some of the Quail Hollow wells were somewhat higher (2.6-2.9 mg-N/l) in 1994 and 1995 as compared to previous years (Figure 5). However, nitrate levels appear to have dropped in 1998. It will be important to better maintain a quarterly monitoring frequency.

Figure 5: Nitrate Levels in Quail Hollow Well No. 5, SLVWD



- Nitrate levels in groundwater coming from the Scotts Valley area continue to be elevated. They declined in the Kaiser well No. 3, but increased in the Scotts Valley Hatchery well located by Bean Creek. They have remained relatively consistent in Dufour Spring near the junction of Mt Hermon Road and Lockhart Gulch Rd.
- Nitrate concentrations and loads have declined in Boulder Creek (from over 1 mg-N/l in 1990 to 0.2 mg-N/l in 1998) and to a lesser extent in the River downstream from Boulder Creek (from 0.4 to 0.23 mg-N/l in the same time period). This is probably related to improvements in the treatment plant at the Boulder Creek Country Club to reduce nitrogen discharge and promote wastewater reclamation. The improvements were completed in 1998, although changes in operation of the plant had begun to be implemented several years prior to that date. These improvements correspond to an apparent reduction in nitrate load in Boulder Creek. Earlier reductions in nitrate concentration appear to be related to the dilution of higher flows after the drought. (See Figure 6 and Appendix A)

Figure 6 Nitrate Concentrations and Loads in Boulder Creek



Program Administration

The San Lorenzo Wastewater Management Program is conducted by Santa Cruz County's Environmental Health Service, a division of the Health Services Agency. Within Environmental Health, work is performed by the Water Quality Program and supported by the Land Use Program, which has responsibility for permitting and inspection of individual sewage disposal system installations and repairs. The Water Quality Program also has responsibility for countywide wastewater management activities, such as information management and funding of septage disposal facilities, which directly contribute to the San Lorenzo Wastewater Management programs. Other Water Quality Program efforts include monitoring of ocean and freshwater bathing areas, general water quality investigations, urban runoff surveillance, development of livestock management efforts to protect water quality, watershed management, water resource investigations, and broad water quality planning.

Financing of wastewater management efforts has come from a variety of sources: service charges from County Service Area No. 12, permit fees, County General Fund, and grants from state and local agencies. Financing of individual system improvements is done by private property owners. A low interest loan program using State Revolving Funds has been established to provide assistance to property owners in making system upgrades, particularly those using alternative technologies.

The number of positions dedicated to the water quality management effort has increased from 1 position in 1985 to approximately 7 positions in 1998, with about 3.5 full time equivalent positions (FTE) devoted to San Lorenzo Wastewater Management and 1.3 FTE devoted to countywide wastewater management. This does not include clerical support, two Land Use district specialists, and an alternative systems specialist on the Land Use Team who handle permit review, installation inspections, and some complaint enforcement in the San Lorenzo Watershed area. However, the budget shown below for 1997-98, includes reimbursement for time spent by the alternative systems specialist (\$31,000) and district specialists (\$14,000) that is not covered by permit fees. In 1997-98, an additional two year limited term position was added to complete more survey inspections in the San Lorenzo Watershed. This position was not filled until January 1999.

The approximate budgets for septic system maintenance and management activities for the last eight years are shown in the following table:

Table 6: Budget for San Lorenzo Wastewater Management, 1990-98

Fiscal Year	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Countywide Septic Maintenance, CSA-12 (excluding septage)	\$ 42,650	73,000	111,500	118,800	93,000	131,000	107,450	102,500	88,1120
CSA 12 Septage Disposal		57,000	95,000	113,300	137,000	170,000	227,000	244,150	243,000
San Lorenzo Basic Mgt. Activities (CSA 12A)	126,270	184,000	184,800	166,500	169,300	190,000	209,170	234,130	239,070
San Lorenzo Projects and Studies (primarily Grants)	57,940	51,150	72,000	54,830	8,700	0	49,800	3,560	0

The basic activities are funded primarily by service charges collected on the tax bills of residents of County Service Area 12 (CSA 12). This includes all developed parcels outside of sewer areas in the County. Zone A of CSA 12 (CSA 12A) encompasses the San Lorenzo Watershed, and includes an additional service charge for implementation of the San Lorenzo Wastewater Management Plan. The annual service charge for CSA 12 is \$6.90, and for CSA 12A it is \$18.54. Any future increase in the amounts of the service charges would require an election with approval of a majority of the affected property owners. For alternative systems and other nonstandard septic systems, an additional service charge of \$80- \$502 (1998 charges, depending on the type of system) is collected to fund annual inspections and oversight of those systems. These charges do increase annually. Of the septage disposal charges, \$42,000 comes from property owner service charges and the remainder comes from charges to the septic tank pumpers. Since 1995, there have been no County General Fund contributions to these septic system maintenance and management programs.

Implementation Schedule

Following is a summary of the work completed since 1988, and the work that is proposed to be performed:

1989 - Survey of parcels performed in Ben Lomond (100 parcels) and El Solyo Heights (50 parcels in North Felton).

- Additional survey work was limited by dry weather.
- Evaluation and system upgrades in Ben Lomond and El Solyo Heights
- Board of Supervisors establishes County Service Area No. 12 for improved wastewater management in unsewered areas.

Publications:

- San Lorenzo Wastewater Management Program, Status Report 1987-88
- S Preliminary Report, An Evaluation of Wastewater Disposal and Water Quality in the San Lorenzo River Watershed

1990 - Preliminary survey in Glen Arbor and Ben Lomond, but completion was deferred due to dry conditions.

- S Commencement of Nitrate Management Study, funded by State Water Resources Control Board with 205j funds.
- Board of Supervisors approves collection of first annual CSA 12 Service charges and implementation of augmented wastewater management programs for the San Lorenzo Watershed in fiscal year 1990-91.

1991 - Survey of parcels performed in Ben Lomond (350 parcels), Glen Arbor (420 parcels), Felton (650 parcels), Forest Lakes (520 parcels), and Mount Hermon (60 parcels).

- Recheck of past problem parcels in Boulder Creek and Kings Creek
- Community evaluation of Boulder Creek, Kings Creek, Felton, Glen Arbor, Ben Lomond, Brook Lomond, and Forest Lakes done.
- Feasibility Study of community disposal alternatives for downtown Boulder Creek completed.

- Septic System Permit Processing and Information Management System developed and implemented on County mainframe computer, including conversion of data from the pre-existing system on microcomputer

Publications:

- San Lorenzo Wastewater Management Plan (preliminary draft)
- San Lorenzo Nitrate Management Study, Phase 1 Interim Report (draft)

- 1992 - Survey of parcels in Felton, Forest Lakes, Ben Lomond, Boulder Creek, Mt. Hermon, and Boulder Creek Corridor completed
- Recheck of parcels subject to high winter water table in Felton Glen Arbor, Ben Lomond, Boulder Creek, and Kings Creek.
 - Feasibility Study of long term disposal needs and potential community disposal initiated for Glen Arbor, Felton, Brook Lomond and portion of Ben Lomond.

Publications:

- San Lorenzo Wastewater Management Plan (revised drafts)
- San Lorenzo Nitrate Management Study, Phase 1 Interim Report (final)
- New forms and procedures for amended Sewage Disposal Ordinance

- 1993 - Survey and Evaluation of parcels in Upper San Lorenzo, Pasatiempo and Brookdale area.
- Wet Year Recheck of parcels subject to high winter water table Felton, Glen Arbor, Ben Lomond, Boulder Creek, and Kings Creek.
 - Development of funding options for Community Disposal Projects
 - Revision of Nonstandard System Policies and Procedures
 - Revision of Data Management System

Publications:

- San Lorenzo Wastewater Management Plan (public draft)

- 1994 - Survey and Evaluation of parcels in Lompico, Lower Zayante, Paradise Park
- Preliminary acceptance of San Lorenzo Wastewater Management Plan
 - Completion of Computerized Septic System Database.
 - Completion of San Lorenzo Valley Community Wastewater Disposal Feasibility Study

- 1995 - Survey and Evaluation of parcels in Lompico, Upper Zayante.
- Initiate Feasibility Study of community wastewater disposal for Pasatiempo
 - Complete Nitrate Management Plan
 - San Lorenzo Wastewater Management Plan (final)
 - Pursuit of state loan to develop local revolving fund for low cost loans for enhanced individual system improvements.
 - Amend Septic System Ordinance for implementation of Management Plan

- 1996 - Complete Survey of parcels in Lompico
- Continue reinspection of parcels areas already inspected.
 - Complete San Lorenzo Wastewater Management Program, 1989-95 Status Report
 - Review of Management Plan efforts.
 - Develop procedures for state loan program for low cost loans for enhanced individual system improvements.
 - Increase staffing for implementation of Management Plan
 - Develop improved programs for management of livestock operations to protect water quality.
- 1997 - Survey and Evaluation of parcels in Quail Hollow, Lower Bean Creek, Lockhart Gulch, Pasatiempo
- Reinspect parcels in Kings Creek Area
 - Complete Feasibility Study of community wastewater disposal for Pasatiempo
 - Begin update of San Lorenzo Watershed Management Plan, including urban runoff and health risk investigations.
- 1998 - Survey and Evaluation of parcels in Quail Hollow, and outlying parcels in Felton, Ben Lomond, Upper Boulder Creek Corridor
- Complete Evaluation of Water Resources Monitoring and Management Activities in Santa Cruz County

Proposed Work:

- 1999 - Survey and Evaluation of parcels in Upper Bean Creek, Upper Zayante, Branciforte Creek, outlying Boulder Creek and Bear Creek Corridor
- Reinspect parcels in downtown Boulder Creek Area
 - Formalize reinspection program of parcels areas already inspected.
 - Establish guidelines for inspection of uninspected parcels in outlying areas.
 - Trial mailing of pumping notices to parcels with no record of pumping in last 10 years.
 - Pursue formation of assessment district for sewerage Pasatiempo area.
 - Prepare sediment TMDL for San Lorenzo River and complete update of the San Lorenzo Watershed Management Plan
- 2000 - Continue Reinspections
- Consider mandatory pumping ordinance

Information Management

The Wastewater Management Program uses three different information management systems to manage and track information.

The County's automated Land Use Information System has a very extensive septic system component that was put into use beginning in July 1991. Older information dating back to 1983 from a PC based system was transferred into the mainframe system. Information is maintained on inspections, permits,

installations, general system characteristics, and tank pumping records. All information is now entered into the system as a routine part of business. Entry of system information is done at the time a permit is finalled, or is done for all parcels on an area basis. Data entry is reviewed for accuracy by several staff members. It is estimated that the error rate of information in the system is 2-10%, depending on the data element. This system can readily be queried and has been used extensively in the preparation of this report.

Separate, but related to the Land Use information system is the County's geographic information system (GIS). This system is used to capture geographic information such as soils or proximity to a stream or watershed boundary, and add it to the site specific system information that is already in the Land Use System. The GIS is also used to plot and display information from the Land Use System such as system failures, winter groundwater levels, use of seepage pits, etc. In 1998 the County added a pc-based GIS using Arcview software. This is much more flexible and is been used extensively to display and manipulate wastewater management information which has been extracted from the mainframe system.

Water quality data is maintained in several different databases. In 1996, most of the data was converted to RBASE. However, Symphony (Lotus) continued to be used for graphics and reports, with SPSS used for statistical analysis. In late 1998, the data was moved over to Paradox and Quattro Pro. These newer systems were used in the preparation of this report. Data is available to other interested parties in both hard copy and electronic format.

Implementation of Nitrate Management Plan

The San Lorenzo Nitrate Management Plan was adopted by the State and County as a part of the Wastewater Management Plan. The Nitrate Plan includes provisions for reducing nitrate discharge from wastewater disposal as well as other sources. The Regional Board's Resolution 95-04 calls for an annual status report on implementation of the San Lorenzo Nitrate Management Plan as a part of the report on the Wastewater Plan. The Resolution calls for reporting on progress of the each of thirteen recommendations of the Plan.

Recommendations 1, 2, 4, 9, and 10 call for maintenance of existing efforts:

1. Maintain the current requirement of a one acre minimum parcel size for new development, regardless of the date of lot creation.
 2. Implement the San Lorenzo Wastewater Management Plan.
 4. Maintain policies for shallow leachfields (4-6.5 ft., depending on soil percolation rate) to provide for improved nitrate removal in the soil.
 9. Maintain policies for minimizing density of new land divisions (10 acre minimum) in groundwater recharge areas, and various other existing policies for protecting groundwater recharge areas.
 10. Maintain current regulations on erosion control, land clearing, and riparian corridor protection.
- All of these policies and programs have been maintained and remain unchanged, although some limited and mitigated modification of the one acre minimum size for commercial uses is under consideration.

The status of other recommendations is as follows:

3. Upgrade Boulder Creek Country Club Treatment Plant for Nitrate Reduction - Construction was mostly completed by 1997. The treatment process was then refined and fully operational by May 1998. The improvements provide for wastewater reclamation on the golf course much of the year, with treatment for nitrogen removal at other times. These improvements should ultimately reduce the amount of nitrate in Boulder Creek and in the River between Boulder Creek and Ben Lomond by about 75%. Reductions beginning in 1998 appear to be substantial.

- 5,6 Require Enhanced Treatment Technologies for Large Systems and Systems in Sandy Soils - The County's sewage disposal ordinance was amended in 1995 to require enhanced treatment for large disposal systems (more than 2000 gallons per day) and for new or expanded systems in sandy soils with percolation rates faster than 6 minutes per inch. Guidelines have been put in place to implement these requirements. Some concern has been expressed regarding the cost and effectiveness of currently available enhanced treatment technologies. County staff share some of these concerns and are working to explore more cost-effective options. The current objective is to utilize technologies that reduce nitrogen by about 75%, producing an effluent that has less than 10 mg-N/l. Sand filters generally have not achieved these goals and have proven to be much more expensive than anticipated. However, a number of proprietary systems provide for good nitrogen removal at a more reasonable price. Several of these have been installed and are being monitored for effectiveness. The requirements for enhanced treatment are currently waived for system repairs where there is no expansion of use.

7. Include Nitrogen Control in Waste Discharge Requirements - County staff has worked with staff at the Regional Board to include nitrogen reduction requirements in new or amended waste discharge permits. This was included in the permits for expansion of the Mount Hermon Association system, the Boulder Creek Country Club system, and the San Lorenzo Valley High School system.

8. Implement Nitrogen Control for Livestock Operations - County staff held meetings with a group of stable owners, livestock interests, and horse association members to develop recommendations for improved management of livestock to reduce nitrate discharge and provide other protection of water quality. The stakeholders expressed a desire to implement this through education and self-policing. County staff have been amenable to considering this concept and a draft brochure has been prepared. However, staff shortages have precluded completing this effort. Efforts are again increasing and a grant funded education effort is scheduled for fall of 2000.

11. Require Nitrogen Reduction for all New Land Use Proposals - Development proposals are being evaluated by County staff to ensure that measures for nitrate reduction are included in the projects, if there is a potential for new nitrogen discharge. This is done for new livestock facilities and other uses, including the Quail Hollow Ranch County Park Master Plan (with possible fertilized playing fields, equestrian activities and onsite sewage disposal) and a proposed 60 lot subdivision and equestrian facility on Graham Hill Road (Graham Hill Estates). County staff also worked with the Scotts Valley Water District to include a denitrification process in the tertiary treatment process for wastewater reclamation.

- 12,13. Continue Water Quality Monitoring - Monitoring of nitrate levels, including the Scotts Valley plume is continuing, as discussed in a previous section under the Wastewater Management Plan.

Appendix A - Water Quality Summary by Water Year for Primary Stations, 1985-1998