Draft II

Santa Rosa Creek
Bacterial Contamination Investigation Report

Prepared by

City of Santa Rosa, Sonoma County Environmental Health Department, and North Coast Regional Water Quality Control Board

December 2001

Background

Santa Rosa Creek is a 22-mile long tributary to the Laguna de Santa Rosa which flows into the Russian River, located in Sonoma County, California. Santa Rosa Creek historically supported an abundant steelhead run as well as coho salmon. In the downtown area, Santa Rosa Creek was channelized for flood control purposes. Riparian vegetation was removed and the creek was converted into a trapezoidal channel lined with grouted rock rip-rap. The problems facing steelhead through the downtown reach include a lack of variable habitat and high summertime temperatures caused by the grouted rock rip-rap bottom and lack of streamline vegetation.

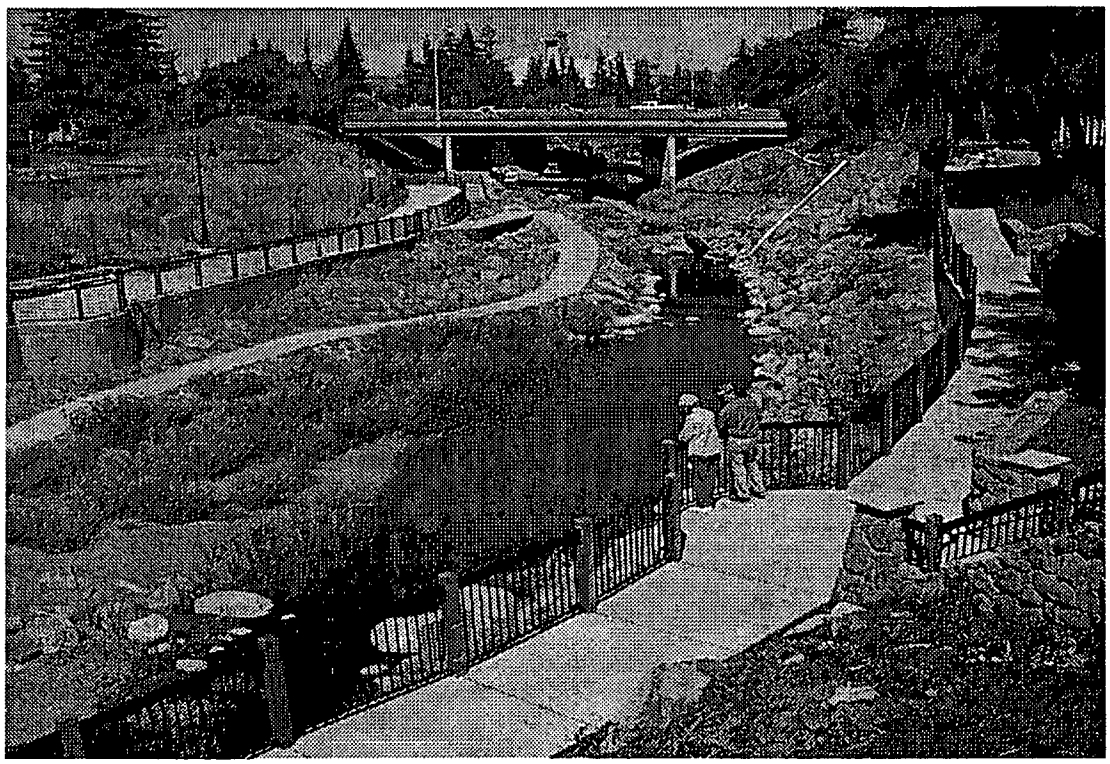


Figure 1. Prince Memorial Greenway looking upstream to Highway 101

During the summer of 2000, Phase 1 of the Prince Memorial Greenway Project (Greenway) was implemented on a reach of Santa Rosa Creek that runs through downtown from Highway 101 west to Railroad Street (see Figure 1). The Greenway was designed to restore steelhead habitat in Santa Rosa Creek through downtown by creating a defined low flow channel, installing rock wing deflectors and boulder weirs to create pools, riffles and glides, and revegetating the channel bottom and banks. The restoration was consistent with the techniques set forth in the California Department of Fish and Game California Salmonid Stream Habitat Restoration Manual.

The Greenway is a community-based project that incorporates a multi-goal approach. The goals of this project include but are not limited to: enhancing creek access, maintaining hydraulic capacity, conserving and restoring natural habitats, providing recreational opportunities, providing educational opportunities, and establishing an alternative transportation mode of

bikeways and pathways. Channel capacity was enlarged by removing the grouted rip-rap and replacing the southern bank with a steeper engineered crib wall system. The north bank is stepped with a series of retaining walls which allow for hard and soft multiple-use pedestrian and maintenance paths. A naturalized creek bottom has been vegetated with native riparian grasses, sedges and shrubs and a low water crossing has been installed adjacent to a sandy beach area at the waterline.

The Greenway was implemented as a result of the Santa Rosa Creek Master Plan. The Master Plan was adopted unanimously in 1993 by the Santa Rosa City Council and by the Sonoma County Board of Supervisors/Sonoma County Water Agency (SCWA) Board of Directors. The Master Plan is the result of extensive public participation.

The Bacterial Contamination Issue

As Phase 1 of the Greenway was completed and opened to the public in Spring 2001, concern was raised about children playing in the water and the presence of bacterial contamination. The Sonoma County Environmental Health Department (Health Department) initiated water quality testing in the Greenway. Samples were taken by the Health Department from three locations in the Greenway on June 28, 2001 (see Figure 2), after a summer storm event on the previous day. Rainfall amounts recorded on June 27, 2001 were 0.63" at Bennett Valley, 0.51" at Oakmont, and 0.08" at the Laguna de Santa Rosa.

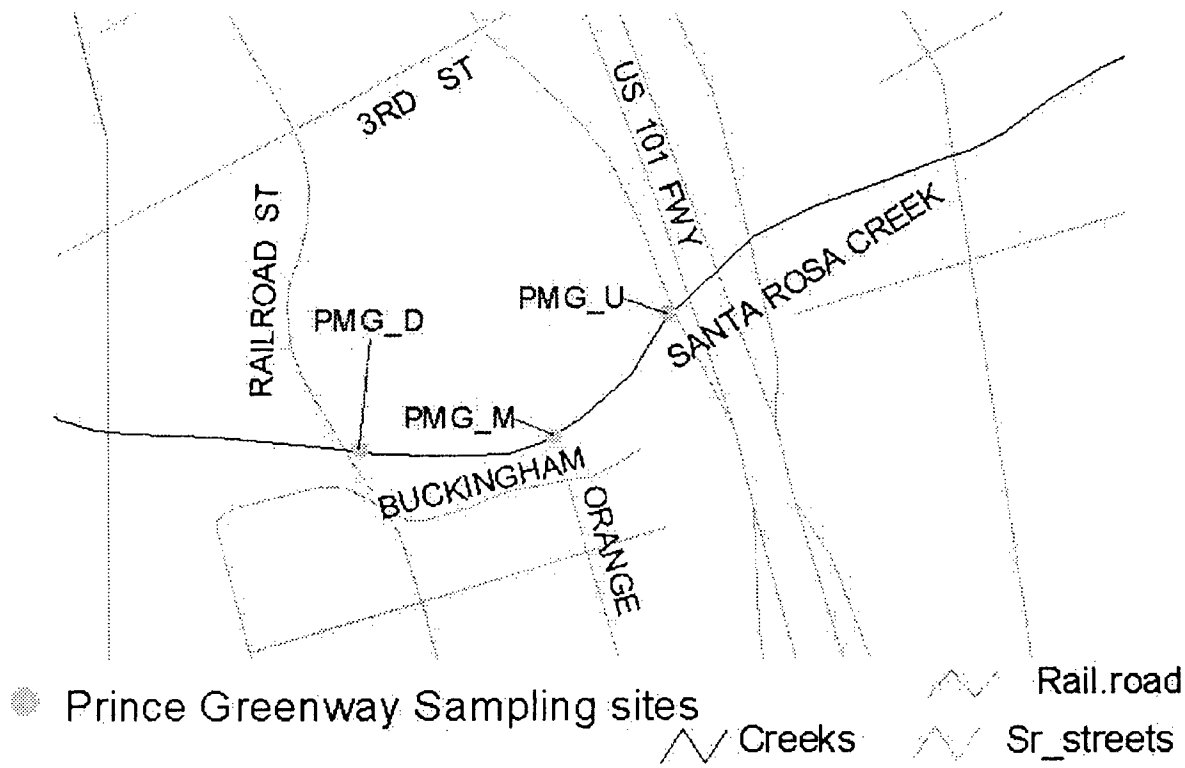


Figure 2. Water quality test sites in the Prince Memorial Greenway

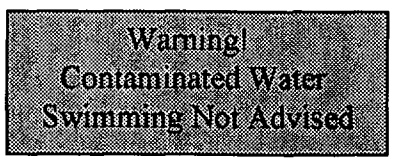
Test results showed that indicator bacteria levels were elevated (see Table 1). Indicator bacteria levels found during the testing were compared with the California Department of Health Services "draft Guidance for Fresh Water Beaches." The draft guidelines recommend posting warning signs when organisms exceed the following levels at a designated beach area:

Total Coliform:	10,000 per 100 ml
Fecal Coliform:	400 per 100 ml
Enterococcus:	61 per 100 ml
E. coli:	235 per 100 ml

According to the Water Quality Control Plan for the North Coast Region "In waters designated for contact recreation (REC-1), the median fecal coliform concentration based on a 30-day period shall not exceed 50/100ml, nor shall more than ten percent of total samples during any 30-day period exceed 400/100ml (State Department of Health Services)."

The City of Santa Rosa's Public Works Department conducted follow-up water quality testing from the same three sites in the Greenway on July 3 and July 5. Results from these tests continued to reveal elevated bacteria levels (see Table 1).

Based on these results, the City of Santa Rosa issued a press release on July 9 (see Appendix A) to inform the community about the high bacteria levels, about the signs that were being installed, and about the investigation and monitoring that is under way. On July 10 the City posted warning signs along the Greenway that indicate:



The signs are posted in English and Spanish and are in the immediate vicinity of the Greenway. They also provide a phone number for people to obtain additional information. A supplemental press release was issued on August 1 to further inform the community about the high bacterial levels in the creek and provide information as to how each person can reduce their detrimental impacts to the creeks (see Appendix A).

In an effort to determine the possible sources of contamination the City held several meetings which included staff from the Public Works Department and the Utilities Department. The Utilities Department dye tested all sewer crossings under Santa Rosa Creek and sewer lines near the Greenway to check for cross-contamination. Test results did not indicate any cross-contamination. The Utilities Department also reported two sewage overflow events in February 2001 that flowed into Santa Rosa Creek. In both cases heavy rains washed away most of the overflow (see Appendix B).

To begin tracking the sources of bacterial contamination, the City tested a total of 12 sites on Santa Rosa, Brush, Matanzas, and Spring Creeks on July 10. Some of the test sites were chosen because

Table 1. Water Quality Data

Site	Date	Total Coli.	Fecal Coli.	E. Coli	Entero.
EPA Guidelines		**10,000**	**400**	**235**	**61**
Upstream end of Greenway (#1)	6/28/01**	>24,192	NR	>24,192	7,270
" " "	7/3/01	22,000	2,300	NR	NR
" " "	7/5/01	>24,192	NR	1,430	1,210
Midpoint of the Greenway (#2)	6/28/01**	>24,192	NR	19,863	8,164
" " "	7/3/01	30,000	5,000	NR	NR
" " "	7/5/01	24,192	NR	1,680	630
" " "	7/10/01***	111,990	NR	410	1,610
" " "	9/13/01***	3,880	400	310	119
" " "	9/27/01****	13,540	5,000	2,260	146
" " "	10/11/01	4,870	800	1,480	181
" " "	10/25/01	6,440	NR	630	109
Downstream end of Greenway (#3)	6/28/01**	>24,192	NR	>24,192	12,033
" " "	7/3/01	24,000	2,300	NR	NR
" " "	7/5/01	64,800	NR	630	980
CSR 01 SR CK w/o Santa Rosa Ave.	7/10/01***	8,820	NR	620	980
CSR 02 Matanzas Ck @ E St	7/10/01	23,100	NR	410	860
CSR 03 SR CK @ E St	7/10/01	5,040	NR	>100	>100
CSR 04 Matanzas CK @ Doyle Park	7/10/01	15,000	NR	>100	200
CSR 05 Spring CK @ Doyle Park	7/10/01	19,890	NR	410	410
CSR 06 SR CK @ Alderbrook Ave.	7/10/01	5,760	NR	100	300
CSR 07 SR CK just upstream of Brush CK	7/10/01	8,570	NR	2,750	1,000
CSR 08 Brush Ck just upstream of SR CK	7/10/01	15,650	NR	100	100
CSR 13 SR CK s/o Melita, e/o Los Alamos	7/10/01	15,760	NR	>100	100
CSR 14 SR CK n/o Melita, e/o L. Alamos	7/10/01	3,230	NR	520	200
CSR 15 SR CK @ Mission Blvd.	7/10/01	13,130	NR	100	630
SR CK, A St Outflow Pipe (#1,48")	7/24/01	860	200	520	448
" " " " "	8/23/01	740	<200	<100	52
SR CK, A St Outflow Pipe (#2, 66")	7/24/01	11,370	400	<100	158
" " " " "	8/23/01	32,550	1700	850	281
SR CK, SR Ave. Outflow Pipe (#3,48")*	7/24/01	64,880	<200	<100	52
3rd St depression	8/23/01	410	<200	<100	52
SR CK 50 yds upstream of Farmers (#1)	7/27/01	9,300	200	100	86
SR CK mid reach below bathroom area (#2)	7/27/01	7,500	200	200	200
SRCK 120yds dnstrm of end of rt bank bike	7/27/01	5,000	400	200	230
SR CK Shadow Cr Apts, 24"	8/23/01	<100	<200	<100	<10
SRCK Downstream Outflow Pipe (#1) *	8/8/01	2,650	200	<100	52
SRCK Culvert Ground Seepage (#2) *	8/8/01	<100	200	<100	<100
Millington Creek in Hood Mtn. Park (Mil01)	9/27/01	1,480	NR	<100	41
SRCK in Hood Mtn. Park (srck99)	9/27/01	2,010	200	<100	31
SRCK upstream of Melita Rd. (srck98)	9/27/01	860	200	100	216
SRCK behind Shadow Creek Apts.	9/27/01	10,500	400	410	288
Matanzas Cr./High School Bioasses. Site	10/11/01	5,040	<200	310	86

* It is possible the sample is contaminated due to contact of the sampling bottle to the substrate

** A summer storm event on this day may have caused elevated results

*** The site is in the vicinity of a temporary flashboard dam & may give distorted results

****Results may be distorted due to the breaching of a temporary dam in a construction area directly upstream

they were situated directly upstream of a confluence to Santa Rosa Creek. Other sites were chosen due to their proximity to a possible contamination site i.e. homeless encampments. Test results indicated elevated bacteria levels at some sites (see Table 1).

On July 25, staff from the City of Santa Rosa Public Works Department, Utilities Department and Police Department met with staff from the County of Sonoma Health Department and the North Coast Regional Water Quality Control Board (NCRWQCB) to determine further action to be taken. As a result of this meeting a joint field investigation was initiated on Santa Rosa Creek to help determine point sources of bacterial contamination.

Field Investigation

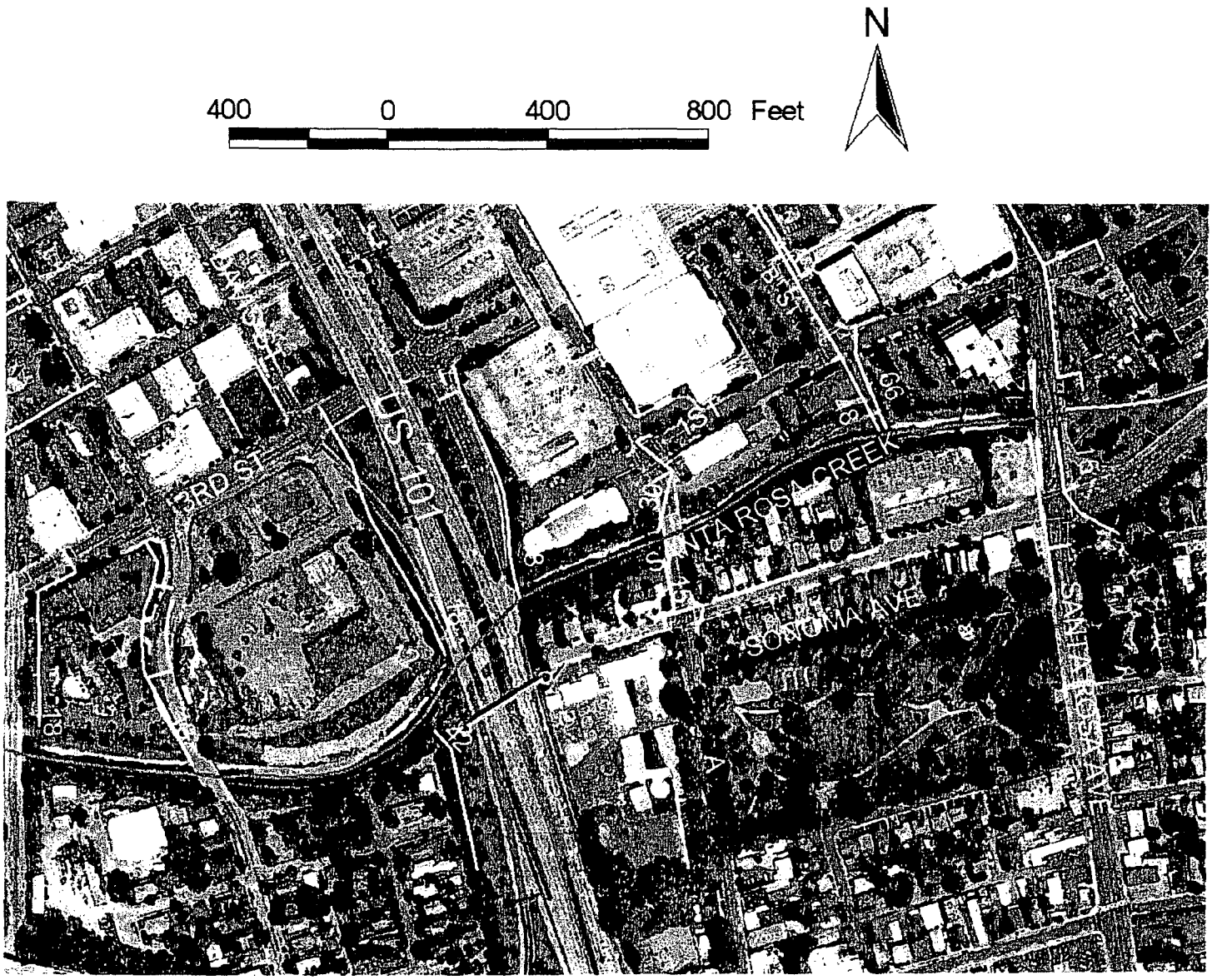
Five stream reaches were chosen as sites for the field investigation. Reach 1 is on Santa Rosa Creek from the downstream end of the Greenway (Railroad Street) to Santa Rosa Avenue. Reach 2 is on Matanzas Creek from the upstream end of the box culvert ("E" Street) to the upstream end of Doyle Park, and reach 3 is on Spring Creek from the confluence of Matanzas Creek to the upstream end of Doyle Park. Reach 4 is on Santa Rosa Creek from Farmers Lane to Mission Boulevard. Reach 5 includes the three underground box culverts which contain Santa Rosa Creek and Matanzas Creek. The reaches for the field investigation were chosen based on test results that indicated high levels of bacterial contamination and based on their proximity to homeless encampments. Field investigation notes for all reaches are included in Appendix C.

The field investigation was conducted on most reaches by Lisa Gonzales, a biologist from the City of Santa Rosa, Dave Mesagno, an Environmental Health Specialist III from the Health Department and Paul Keiran, a Water Resources Control Engineer from the NCRWQCB who were accompanied by police officers from the City of Santa Rosa Police Department. Investigators were looking for evidence of bacterial contamination sources such as: active outfall pipes, fecal matter (human and animal), homeless encampments, algal masses, seepage from banks, wildlife concentrations, and sediment discoloration.

Reach 1

Santa Rosa Creek from the downstream end of the Greenway (Railroad Street) to Santa Rosa Avenue was investigated on July 24 by Lisa Gonzales and City biologist Alistair Bleifuss (See Figure 3). Three samples were taken from three active outfall pipes in this reach. Two of the outfalls run parallel to B Street and are 48" and 66" in diameter (Structures 85, 174, and 242 on City Storm Drain Map II-28-17). The third outfall runs parallel to Santa Rosa Avenue and is 48" in diameter. The samples showed elevated bacteria levels but they were not higher than those found in the Greenway (see Table 1).

All other outfall pipes in this reach were dry. On August 23 the two outfalls parallel to B Street were sampled again (see Table 1). In addition, a sample was taken from the sump in the 3rd Street depression under Santa Rosa Mall. Spring water is pumped out of the depression and enters Santa Rosa Creek via Structure 174, the 48" outfall. The samples met all the criteria except for enterococcus during this sampling event.



Creeks

SD lines

SANTA ROSA CREEK
Railroad Street to Santa Rosa Avenue

(Figure 3)

Reaches 2 and 3

The field investigation for Matanzas Creek and Spring Creek from "E" Street to the upstream end of Doyle Park was conducted on July 31 (see Figure 4). The significant sources of bacterial contamination that were found included five incidences of animal fecal matter and two incidences of human fecal matter.

On August 14, several catch basins that drain into Matanzas and Spring Creeks were inspected by Alistair Bleifuss and Zephan Fischl. All catch basins inspected were either dry or had some moisture in them but none of them had flowing water.

Reach 4

On July 27, Alistair Bleifuss, accompanied by Mark Mahre from the City of Santa Rosa Police Department, took water samples from Santa Rosa Creek above Farmers Lane (see Figure 5). Several homeless encampments are situated along this reach. Earlier that morning the City and County had conducted outreach to residents of encampments along this stretch of creek. Sampling was conducted upstream and downstream of the encampment area, with a third sample taken from mid-reach in an area identified by Mahre as the "bathroom area". The samples in this reach did not show elevated bacteria levels for any of the parameters tested except for enterococcus. The results, were lowest downstream of the encampment area and were lower than those found in the Greenway (see Table 1).

The actual field investigation for Santa Rosa Creek from Farmers Lane to Mission Boulevard was conducted on August 7. There were several incidences of toilet paper on the bank and a fecal odor was persistent in the "bathroom area" situated mid-reach. Conventional water quality constituents (pH, temperature, dissolved oxygen, and specific conductivity) were recorded at various sites and are included in the field notes. The investigation was called off approximately 1000' west of Mission Blvd. due to an injury incurred by one of the police escorts.

Since most of the outfall pipes in reach 4 were difficult to locate from the active channel, an additional investigation was conducted from the top of bank on August 13 by City employees Alistair Bleifuss and Zephan Fischl. They found that only one out of twenty-five outfall pipes had water flowing from it. On August 23 the City sampled this outfall which was a 24" storm drain line behind the Shadow Creek Apartments (Structure 35, City Storm Drain Map II-29-07). Bacteria levels were below California Department of Health Services guidance levels (See Table 1.)

The remainder of the Reach 4 investigation took place on September 24. There were several encampments situated along the remainder of this reach. The encampment underneath the Mission Blvd. bridge was rather elaborate with a garden area, shower, and a plastic bucket containing human waste. There was also an area nearby with some dense foam floating on the surface of the water that seemed to be unnatural. Water quality parameters were taken at this and other sites along the reach and are included in the field notes. On September 27 the City sampled the area with the dense foam and found that it exceeded some of the applicable standards but not to a large

600 0 600 Feet

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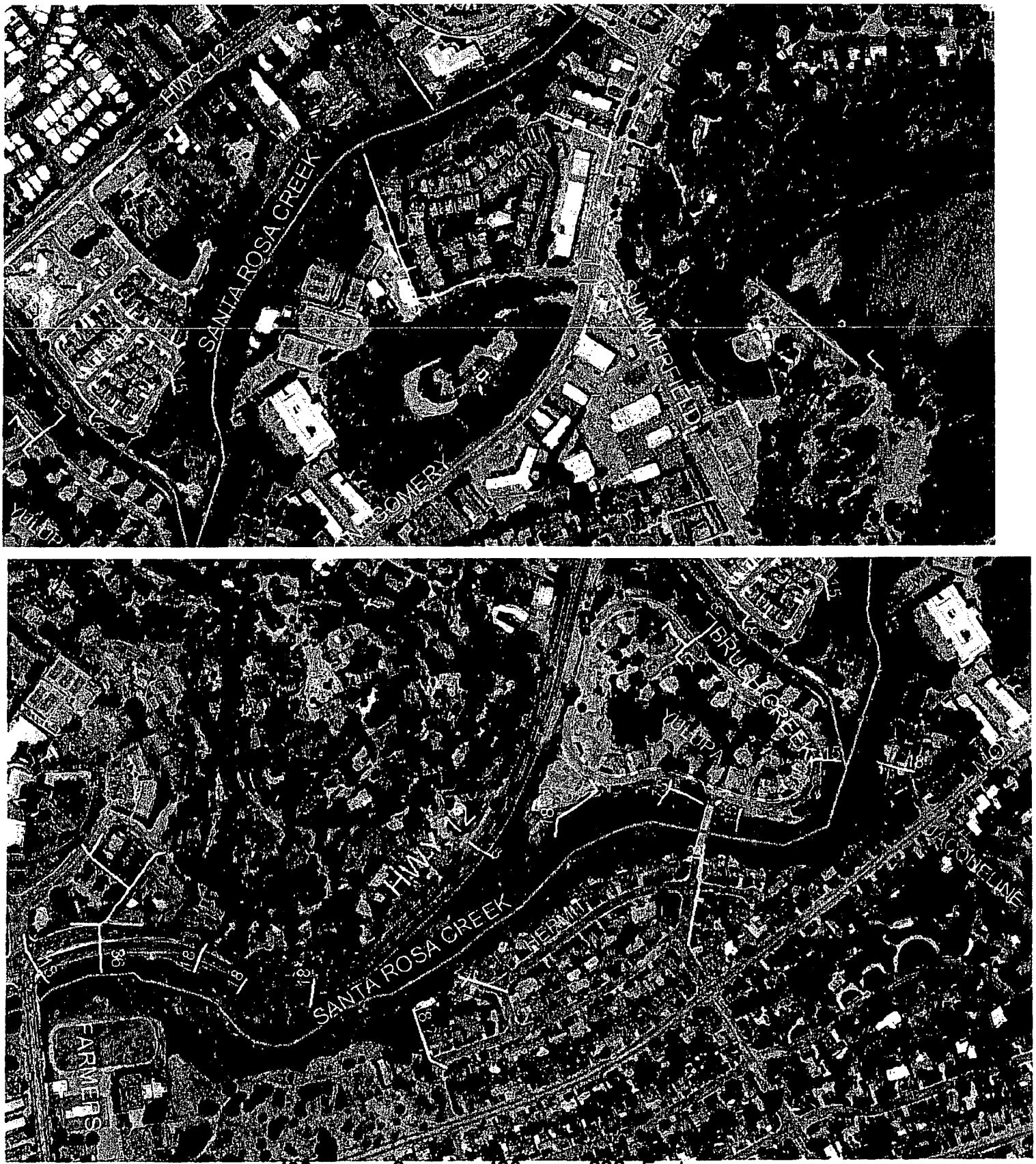
MATANZAS CREEK
"E" Street to Hoen Avenue

Creeks

SD lines

(Figure 4)



SANTA ROSA CREEK
Farmers Lane to Mission Blvd.
(Figure 5)

degree (See Table 1).
On September 24, the 24"storm drain behind Shadow Creek Apartments was found to still be flowing at approximately 5 gallons/minute. After a thorough investigation, the City of Santa Rosa's Water Conservation Department found an irrigation leak at the Shadow Creek apartments and, by working with the apartment supervisor, was able to eliminate this significant discharge from the 24" storm drain.

Reach 5

On August 8, staff from the Sonoma County Water Agency led City and County staff on a tour of the underground box culverts on Santa Rosa Creek and Matanzas Creek from Santa Rosa Avenue to "E" Street. The only obvious source of bacterial contamination was from one incidence of human fecal matter. Water samples were taken from one accessible flowing outfall pipe and one area where groundwater was seeping through the culvert foundation. These samples came back fairly clean (see Table 1).

On August 18 the City Utilities Department videotaped the western B St. storm drain line. Dripping connections were viewed along Ross Street. The western B St. line was receiving discharge from the 3rd St depression. Approximately 200' of corrugated pipe that comprises the downstream end and outfall of the western line was not videotaped.

Septic Investigation

All agencies involved have agreed that the next step to track the source of bacterial coliforms is to survey properties adjacent to Santa Rosa Creek for failing septic systems and illicit grey water discharge pipes. The City has located and mapped 91 sites adjacent to Santa Rosa Creek that are in need of a septic investigation (See Appendix D). The following criteria was used to determine which sites are in need of a septic inspection: identify all parcels directly adjacent to Santa Rosa Creek and the tributaries that drain into it that do not have a sewer line and are not vacant land or a parking lot. The Sonoma County Permit and Resource Management Department has staff with expertise in septic surveys and will take the lead in this investigation when a funding source has been located.

Homeless Encampments

A great effort has been made by the Mayor of Santa Rosa to relocate homeless people who are living on Santa Rosa Creek. The National Guard Armory, a winter shelter for the homeless was opened on November 14th. The Armory is a 190 bed facility that is almost full to capacity. There is another shelter in Santa Rosa and one in Petaluma which makes a total of 364 available winter-time beds. The site for a new shelter in Santa Rosa has been determined but the opening date has not been set as of yet.

It was decided by the Santa Rosa City Council that the homeless people on Santa Rosa Creek are a detriment and should be relocated once the shelters were opened. After appropriate notification, the Police Department began cleaning up homeless camps on Monday, November 26. The

progression on Santa Rosa Creek was as follows: Farmers Lane upstream to Mission Boulevard, behind the Municipal Service Center (downstream of Stony Point Road), and Pierson Street to Farmers Lane.

Ongoing Sampling

Ongoing sampling in the middle of Prince Memorial Greenway will continue through the dry seasons of 2002. The City samples twice a month from April to October and tests for total and fecal coliforms and e. coli.

If a representative month can be found, the City will also sample for a 30-day average by collecting 5 equally spaced samples in a 30-day period. The City also plans to take several samples from the same station 2 minutes apart to determine the variability in the test results. This sampling won't proceed in 2001 because of the irregularities created by the Prince Memorial Greenway Phase 2 construction project.

Public Outreach

Public outreach is an invaluable method of educating the community about their role in protecting water quality. Agencies involved in this project decided that public outreach regarding livestock, pet, and yard waste be conducted for Santa Rosa residents.

The County of Sonoma Department of Health Services identified twenty-one properties along or near Santa Rosa and Matanzas Creeks as having horse care facilities. A letter was sent to the property owners as an educational outreach effort to assist them with horse manure management and stream protection. Along with the letter was enclosed a guide, "Horse Owner's Guide to Water Quality Protection." The letter and guide are included in Appendix E.

The City is taking the lead in the implementation of public outreach regarding pet waste. An Environmental Specialist from the City met with the Sonoma County Water Agency (SCWA) to discuss and design pet waste signs for SCWA maintained channels with public pathways and possibly other city and county areas. SCWA and the City are currently working together on a final design for the signs.

There has also been discussion about placing dispensers with plastic bags at the entrance of SCWA and City maintained channels with public pathways. There is ample opposition towards the availability of the plastic bags. In the past, bag dispensers have been placed in the city but have become a litter problem due to vandalism. It is the general feeling that responsible pet owners will bring their own bags and irresponsible pet owners will not use the bags even if you provide them. The City is considering a pilot site for dispensers in a high profile area but, as of yet, the City does not have funds appropriated for the widespread distribution and collection of pet waste receptacles.

SCWA was contacted to ensure that pet waste was covered as part of their on-going water education program that reaches hundreds of school-age children each year. There is a pollution prevention facet to their water education program in place which includes non-point source

pollution such as toxic and animal waste.

Annadel State Park in Santa Rosa, which has tributaries that flow into Santa Rosa Creek, was contacted for information regarding their policy for horse waste in the park. According to the park ranger, the state park policy requires equestrians with horse trailers to remove their own waste. Although most equestrians clean up after their horses, not all horse owners do an adequate job and the park is considering putting receptacles in the parking areas for horse waste. As for horse waste on the trails in the park, it is the park staff's general feeling that the waste breaks down and enters the soil profile, not the water. Dogs are not allowed on back country trails in State Parks.

The City of Santa Rosa has designed outreach material for radio advertisements and movie theater previews regarding pet waste and yard waste. The radio advertisements regarding pet waste aired four to five times a week from September through November on 92.9 (KFGY), 95.9 (KSXY), and 1460am (KRRS) (See Appendix). The movie theater preview slides are being displayed on eight screens at the Airport Cinema in Santa Rosa from November through January. The slides are also being displayed at the Roxy Theater in Santa Rosa on seven screens from October through December. The slides address pet waste and yard waste issues (See Appendix E).

The City also designed a flyer addressing the recycling of autumn leaves. It was distributed in one of last years' utility bills and was posted this year on the City's web site which can be found at: http://ci.santa-rosa.ca.us/pworks/StormWater/autumn_leaves.asp . A utility bill insert distributed in fall 2001 encouraged visits to the City's storm water web site.

Discussion of Indicator Bacteria

Coliforms are bacteria found in the intestinal tract of humans and animals therefore their presence in ambient water indicates fecal pollution and the potential presence of pathogens. Indicator bacteria has been used for decades to determine the risk of illness associated with water contact recreation. However, there has been ample debate over the efficacy of this method.

The total coliforms test indicates several genera of bacteria, some of which occur in the intestinal tracts of animals and humans, and some of which occur naturally in soil and in fresh waters. Although the total coliforms test was essentially a surrogate for *E. coli*, it is the false positives from this traditional water quality test which have prompted the adoption of more definitive indicators of water pollution by fecal matter (Joyce). Also, the bacteria count in soil can be 100 times greater than those found in the water column. It is possible that the construction activities in Phase II of the Greenway could have disrupted sediments and re-suspended the bacteria into the water column.

Beginning in 1976, the EPA recommended fecal coliforms to the regulatory community as indicator organisms for the presence of pathogens in recreational waters. Fecal coliforms, a subgroup of total coliforms, include several species that commonly occur in the feces of warm-blooded animals. The use of the term "fecal coliforms" has proven to be a poor choice, however, because it implies that all microorganisms responding to the test come from fecal matter, which is an incorrect assumption. Also, the fecal coliform method does not differentiate between fecal organisms of human or animal origin (Joyce).

In 1986, based on new research data, the EPA recommended new monitoring guidelines, including

the use of Escherichia coli (E. coli) and enterococci as indicators to replace fecal coliforms. Escherichia coli indicates fecal contamination since it is one of the ubiquitous coliform members of the intestinal microflora of warm-blooded animals. E. coli has been found to be universally present in the fecal matter of warm-blooded animals and comprises nearly 95 percent of the coliform in feces. This indicates that E. coli would always be present in fecal contamination incidents whereas the other members of the coliform group may or may not be present, even though known sewage contamination was present (Joyce).

Enterococci are bacteria that live in the intestinal tract of humans and animals. The two main species that are detected from this test are more human-specific than other members of this group (Joyce). Of particular note is recent information relayed to Nevada County by William A. Yanko, former head of the Los Angeles County Sanitation District's Microbiology Lab, questioning the accuracy of enterococci testing. According to Mr. Yanko, analyses using an Idexx Quantitray system with Enterolert has produced false positives when compared to "Standard Methods" for the same samples. The Sonoma County Public Health Laboratory where the City of Santa Rosa's samples have been tested uses Enterolert.

The presence of these bacteria in recreational waters correlates with swimming-associated gastrointestinal disease better than a total coliform count. About one-third of all states have adopted either E. coli or enterococci for monitoring fresh and marine waters. However, other states have continued to use total coliforms to indicate water quality.

References:

1. Action Plan for Beaches and Recreational Waters EPA/600/R-98/079.
2. "Draft Implementation Guidance for *Ambient Water Quality Criteria for Bacteria* – 1986", EPA-823-D-00-001.
3. Joyce, Jake. US Environmental Protection Agency, Region 7.

Bacterial Contamination in Other Communities

San Luis Obispo

High bacteria counts discovered in the fall of 2000 in San Luis Obispo (SLO) Creek prompted a study to identify and mitigate the sources. Previous creek restoration work by the City of San Luis Obispo had provided public access to the creek. Due to the public access the City posted the creek with "No swimming" signs similar to those posted by the City of Santa Rosa.

In March of 2001, Chris Rose of the Central Coast Regional Water Quality Control Board began extensive testing for total coliform and fecal coliform in San Luis Obispo Creek and its tributaries. Sampling for bacteria occurred in July and August but the results are not yet available. Sampling will continue throughout the winter to get data over a full year.

46 sites were tested along San Luis Obispo Creek and its tributaries above, in, and below the City.

24 of the sites had fecal coliform results that at least once exceeded 300 MPN/100mg. Results of the water quality testing study show that:

Of	169	total	tests	for	fecal	coliform	97	had	levels	above	200 MPN/100mg.
"	"	"	"	"	"	"	82	"	"	"	300 MPN/100mg
"	"	"	"	"	"	"	54	"	"	"	400 MPN/100mg
"	"	"	"	"	"	"	23	"	"	"	1,000 MPN/100mg

There was not significant rainfall before the collection. There was, however, one small (~1 inch) rain event in March, which did seem to affect bacteria numbers across all sites.

Rose notes that "finding the source of the problem is of course a different matter [than just obtaining sampling results.] Much research and energy is being expended to find sources of coliform. At this point, the verdict is still out on which way to go. Simply put, I am narrowing down the sources through extensive sampling up and down stream of suspected sources. When high counts are found, I am narrowing the sampling down. This method has brought some progress, particularly in the area of storm drains. The city is then helping using dye to narrow the sources into the drains."

The highest bacteria counts were found near a 6" pipe located 15' up the wall of a "main" tunnel that discharged slowly into SLO Creek (sample site SLOCK10.89). The discharge smelled of sewage. According to Rose "the 6 inch pipe was a small storm water pipe draining sidewalk water. The drain was frequently used by an outdoor flower shop. What is very interesting is that earthworms seemed to have colonized the drain area of the pipe, and significantly increased the fecal coliform count. When the water was allowed to cascade over rock, then into the stream, worms colonized the rocks, and the coliform count went very high. Samples collected before the cascading over the rocks were not as high. I think this source was truly from earthworms and perhaps soil bacteria, and not human."

High readings were found in 2 of the 3 watersheds that form the headwaters of SLO Creek. All drainage from California Polytechnic University (Cal Poly) occurs through Briziolari and Stenner Creeks which flow into SLO Creek. Rose reported that "Briziolari Creek, drains Cal Poly Land that is used for intense feeding areas for cattle. Stenner [Creek] also drains Cal Poly land where wash-off from cattle barns is allowed to settle in a pond, then is irrigated over a field. Some of the water is apparently making its way to the adjacent Stenner Creek." The third headwater tributary is the main branch of SLO Creek. Rose stated that "the sample point SLOCK12.5 had lower bacteria levels and is the most upstream sample point, beyond which almost no human activity occurs, including grazing. On that note, grazing does not seem to be a problem unless the cattle are allowed in the stream." In support of this conclusion about grazing, another high reading was recorded along Highway 101 where cattle are allowed to graze in the riparian corridor.

Fecal coliform levels in SLO Creek generally decreased downstream of the City. However, high bacteria counts were discovered near Sycamore Hot Springs, a hotel/resort where natural hot springs are piped in to rooms with hot tubs. The hot tubs use the mineral laden water, then they drain into a culvert that empties into SLO Creek. Rose said that "this discovery is new, and in the

process of being investigated thoroughly."

The City of SLO feels that most of the bacteria is due to animals at Cal Poly. Michael Clarke, City Biologist, reported that Cal Poly has been slow to make any changes but Clarke feels that eventually they will "get on board" once more test results are in. Dye tests of sewer lines have uncovered no leaks. Pets and homeless people living along the creeks have been identified as possible contributing factors. Dave Mesagno said that he has heard about septic system issues in the SLO Creek watershed.

South Yuba River

"The Nevada County Departments of Environmental Health and Community Health issued a joint Health Advisory for avoiding water contact in a portion of the South Yuba River on August 1, 2001. The initial Advisory noted that the area known to some as the "China Dam", contains high levels of the Enterococcus bacteria. The Advisory recommended that NO water contact occur in that area, including pets."

A water sample taken on June 24, 2001 from China Dam showed an elevated level of Enterococcus bacteria (225 MPN/100 ml). As a result of the elevated level, two re-samples were taken from the same area on July 3. The results of these samples were even higher, at 381 and 960 MPN/100 ml. Other samples taken from the South Yuba River on June 24 had acceptable levels of bacteria. A news release on August 9 listed other sites where high Enterococcus levels had been discovered.

Subsequent and expanded testing on August 2 has confirmed that the high Enterococcus levels found in the China Dam area are on-going, and have even risen to higher levels. Samples taken several hundred yards upstream and downstream from the China Dam are all high, with numbers ranging from 1,553 to greater than 2,419 MPN/100 ml (the maximum number detectable by the type of test).

Meetings and discussion between the various involved agencies have heightened the level of concern for water quality throughout the South Yuba River length frequented by the public. It was determined that expanded testing is needed for areas of high public contact to ensure that safe levels of bacteria are found in these locations. At this point, the possible source of the elevated bacterial levels has not been determined.

The California State Department of Parks and Recreation, Federal Bureau of Land Management and the United States Forest Service have been monitoring water together on the South Yuba River since July 2000. The recent high bacteria levels initiated participation by other agencies and organizations in a multi-jurisdictional problem solving approach. Along with the services of the Nevada County Environmental Health, Community Health, and Geographical Information Service Departments, the State Department of Parks and Recreation is conducting water quality testing; the State Department of Health Services has offered its lab services, an inspector, and equipment; a State epidemiologist will assist in data evaluation; the State Water Resources Control Board, Regional Water Quality Control Board, Army Corps of Engineers, Placer County Health

Department, and South Yuba River Citizens League are also providing assistance in tracking down the bacteria source(s). General public questions can be directed to Peggy Zarriello at (530) 265-1787.

Sources:
1. County of Nevada News Release-8 August 2001, "Health Advisory Update #1 for Portion of South Yuba River." Available at http://www.syrcl.org/janet2.htm.
2. Personal conversation with Peggy Zarriello, Nevada County employee
3. Email from Mr. William A. Yanko to Dr. Charles Johnson, Nevada County
4. Updates are available at: http://docs.co.nevada.ca.us/dscgi/ds.py/View/Collection-2596

Orange County

- The Regional Water Board for the Santa Ana Region (Region 8) developed a TMDL for the Upper Newport Bay Ecological Reserve, which outlines a phased approach for the control of bacterial quality. The approach is designed to combat difficulties in identifying pollution sources and control strategies by allowing time for further evaluation, monitoring, and the revision of the TMDL as needed. Counties and designated agricultural operators in the Newport Bay will collect at minimum, five samples in 30-days at specified stations, as well as develop a plan for identifying and characterizing the source(s) of contamination. Beneficial uses will undergo assessment to determine prioritized areas within Newport Bay.

- Region 4 is currently in the process of developing TMDLs. As a consequence of the large number of high priority creeks listed, the Region was unable to provide any specific information at this time.

- Due to the high number of impaired bodies within California and the highly difficult process of preparing and approving TMDLs and implementation plans, few pathogen/bacteria TMDLs are currently available for review.

- The Orange County Department of Environmental Health stated that there are no comparable freshwater areas for bathing in Orange County. At times they have found that the freshwater draining from the creeks into the ocean have total fecal coliforms in the tens of thousands, fecal coliforms in the thousands, e. coli in the thousands, and enterococcus in the hundreds or the thousands.

Appendix A

Press Releases

Media Release

FOR IMMEDIATE RELEASE

CONTACT: Colleen Ferguson, City of Santa Rosa Public Works Department
(707)- 543-3852

The City of Santa Rosa recently tested bacteria levels in Santa Rosa Creek between Railroad Street and Highway 101. Test results received on June 29 and July 6, 2001, showed that bacteria levels are high enough that water contact recreation (swimming, wading, splashing) should be avoided. Water samples were taken at three locations: Railroad Street, Highway 101 and in the Prince Memorial Greenway between Railroad Street and Highway 101.

After comparing indicator bacteria levels found during testing performed in Santa Rosa Creek with the California Department of Health Services "draft Guidance for Fresh Water Beaches", the City of Santa Rosa will install signs stating "Contaminated Water - Swimming Not Advised". The signs, in English and Spanish, will be posted in the immediate vicinity of the Prince Memorial Greenway.

The City is implementing a monitoring program in the Santa Rosa Creek system upstream of the Greenway to identify the extent and possible sources of bacteria contamination. Bacteria are present in natural creeks, usually due to wildlife near the creek. Therefore, it is not appropriate to eliminate all bacteria. Efforts to decrease sources of bacteria contamination in the creek will focus on identifying possible unnatural sources and eliminating them to the extent possible.

Media Release

FOR IMMEDIATE RELEASE

CONTACT: Colleen Ferguson, City of Santa Rosa Public Works Department
(707)- 543-3852

The City of Santa Rosa previously tested bacteria levels in Santa Rosa Creek between Railroad Street and Highway 101. Test results received on June 29 and July 6, 2001 showed elevated bacteria levels. Additional tests in the upstream Santa Rosa Creek watershed showed that fecal bacteria levels throughout the urban area are above those listed in California Department of Health Services "draft Guidance for Fresh Water Beaches". Water contact recreation (swimming, wading, splashing) should be avoided. Test results and locations are attached for reference.

Beginning on July 31, 2001, the Regional Water Quality Control Board, County Department of Health Services and City of Santa Rosa are conducting a field investigation in the Santa Rosa Creek system to identify the extent and possible sources of fecal bacteria contamination. Homeless encampments along the creek are likely contributing to the problem. Other unnatural contributing sources may include pet and livestock waste, septic systems, illicit connections and illegal dumping. Bacteria are present in natural creeks, usually due to wildlife near the creek. Therefore, it is not possible to eliminate all bacteria. Efforts to decrease sources of bacteria contamination in the creek will focus on identifying possible unnatural sources and eliminating them to the extent possible.

The City inspected and tested the public sanitary sewer system at all crossings of Santa Rosa Creek. The sewer crossings were found to be leak-free.

Some sources of bacterial contamination that can be fairly easily controlled include pet waste, livestock waste and poorly maintained septic systems. Community members can help reduce bacteria levels in local creeks by:

- cleaning up after their dogs, particularly when walking dogs along creekside paths
- properly disposing of cat litter and backyard pet waste in the garbage
- controlling livestock waste so that it doesn't flow to streams or storm drains
- maintaining septic systems to prevent seepage through creek banks and system overflows
- reporting incidents of dumping human or other waste into streams. Incidents within the city limits of Santa Rosa should be reported to the Public Works Department at 543-3881.

Appendix B

Sewage Overflow Events

Utilities Department Sewage Overflow Report

City of Santa Rosa Utilities Department sewage overflow reports from January 1 to August 24, 2001 reveal that two sewage overflows entered storm drains that discharge into or upstream of the reaches of creeks identified through testing as having high bacteria counts. On February 19, a sewer main backed up and 50 gallons of sewage entered a storm drain that flows into Austin Creek, a tributary of Brush Creek. "Due to the high volume of rain water in storm drain we [Utilities] were unable to recover wastewater" (Work Order SPLC 263714). On February 20, a resident near Farmers Lane removed a clean out cap releasing 150 gallons of sewage. "Heavy rain washed away all but 25 gals of raw sewage" (Work Order SPLP 263767). 125 gallons flowed into Santa Rosa Creek. All other overflows were contained and cleaned up. The Regional Water Board was informed of both overflows.

Appendix C

Field Investigation Notes

Matanzas Creek Field Investigation: "E" St. - Doyle Park (Reach 2) July 31, 2001:

Photos:
36 = Mat 02 : 6" pipe, dry
35 = Mat 01: 12" pipe, trickling
34 = Mat 03: 12" pipe, dry
33 = Mat 04: 18" pipe, dry
32 = Mat 05: Anaerobic odor & black sediment
31 = Brookwood Bridge, trash, human waste
30 = Brookwood Bridge, human waste

GPS:
MAT 01: 12" pipe, trickling (not on map)
MAT 02: 6" pipe, dry (not on map)
MAT 03: 12" pipe, dry (not on map)
MAT 04: 18" pipe, dry (not on map)
MAT 05: Anaerobic odor & black sediment
MAT 06: Algal mass in backwater area

Fecal Sites:
01: Near Mat 05, (animal, probably fox)
02, 03: Near Mat 05 (animal, probably fox)
04, 05: 100 yd. East of 30" drain (animal)
06: Under Brookwood Bridge (human)
07 :Under Brookwood Bridge (human)
08: Under Brookwood Bridge (animal)
09: Between Brookwood & Doyle Park (animal)

Notes:
- 30" Drain on Matanzas is causing scour hole and needs rip rap
- Brookwood Bridge is a homeless encampment
- Retaining wall at 142 Gray Ct. is in serious need of repair
- Fair Began on 24th - Trailers could affect creeks
- ~ 1' steelhead ~ 60 yds E. of Brookwood in deep pool

Spring Creek Field Investigation - from Matanzas creek confluence to Doyle Park (Reach 3) July 31, 2001

- No apparent sources of contamination found.

Santa Rosa Creek Field Investigation: Farmers Ln. - Mission (Reach 4)
August 7, 2001:

SRCK01: Under Farmers Ln. Bridge. Algal biomass along waterline.
Temp: 17.37 c (63.2 f)
SpCond.: .4372
DO: 5.74 mg/l
pH: 7.38
Turbidity: 0

SRCK02: Encampment, L bank. Rock dam needs to be removed.

SRCK03: Encampment, L bank Toilet paper on L. Bank. Soap bars for bathing.
Temp: 17.6 c
SpCond.: .4348
DO: 6.11 mg/l
pH: 7.51
Turbidity: 14.1

SRCK04: Encampment, R. bank. Major toilet area directly adjacent on L bank. Dense algal biomass along waterline. Families live from about here down. Urine scent in creek. Cooking/washing area in creek.
Temp: 17.58 c
SpCond.: .4324
DO: 5.8 mg/l
pH: 7.62
Turbidity: 0

SRCK05: Encampment, L bank. Top of Bank.

SRCK 06: Encampment, R bank. Toilet paper on bank. Fecal odor. Detergent for washing clothes on bank, high density area.

SRCK07: Encampment, L bank. Top of bank. Detergent for clothes on bank. Two resident chickens. High density area.

SRCK08: Took water quality in shallow run above high density area.
Temp: 18.86 c
SpCond.: .4176
DO: 4.62 mg/l
pH: 7.48
Turbidity: 0

SRCK09: Took water quality.
Temp: 17.47 c
SpCond.: .4784
DO: 7.07 mg/l
pH: 7.5
Turbidity: 1.7

SRCK10: Encampment. Bathing area. Above Brush Cr. confluence.

SRCK11: Took water quality.
Temp: 19.87 c
SpCond.: .4608

DO: 6.7 mg/l
pH: 7.61
Turbidity: 1.9

SRCK12: Encampment, L bank
SRCK13: 24" pipe. Flowing @ ~ 5 gal./min.

Notes:
- 4 ducks

Santa Rosa Creek Field Investigation: Farmers Ln. - Mission (Reach 4)
Continued on September 24, 2001:

SRCK13: 24" pipe. Still Flowing @ ~ 5 gal./min.

SRCK14: Two homeless encampments, 1 on each bank. Took water quality right below this site at 24" pipe.

Temp: 14.53 c
SpCond.: .4506
DO: 7.69 mg/l
pH: 7.83
Turbidity: 0

SRCK15: Dense brownish foam that didn't break up when touched, no iridescent sheen, water was moving slowly in this area.

Temp: 14.53 c
SpCond.: .4488
DO: 7.08 mg/l
pH: 7.88
Turbidity: 0

SRCK16: Two encampments
Under Mission Blvd. Bridge: Elaborate homeless encampment. Garden, Shower, Honey Bucket.

Box Culvert Investigation: Santa Rosa Ave.- "E" St. (Reach 5)
August 8, 2001:

Photos:
36: weep hole
35: sample site 2
34: ceiling dripping
33: Matanzas pipe within a pipe

Sample Sites:
#1: Northern box, 30 - 36" outfall near entrance. Sample bottle touched substrate.
#2: Northern box, ~ 100 yds up from downstream entrance. Water seeping up through joint in concrete slab and flowing into fish ladder. Shuttled sample from one bottle to the next due to

lack of gradient.

Notes:

- 3" weep holes on 10' centers all along north box and south box outer walls with a few on the inside walls. Most holes had an abundance of organic or mineral deposits oozing from them.
- Fish ladder in north box was clogged with debris near the upper end causing stagnation.
- In Southern box (Matanzas), there was an odd looking 2" pipe within a 15" drain that had water trickling from it. Too high to sample.
- Northern box had one incidence of human fecal matter.
- Center box was dry with no outfalls.
- Matanzas had ~ 3" of water throughout it.
- Several occurrences of ceiling drip throughout boxes.
- 4 ducks and 1 egret prior to entering boxes
- raccoon footprints in Matanzas box
- 1 bird nest at upstream end of Matanzas box

Appendix D

Septic Investigation Information

Septic Inspection Sites

City Limit Status	Street number	Street name
In County island	285	BREY RD
In County island	289	BREY RD
In County island	5900	CHANNEL DR
In County island	5910	CHANNEL DR
In County island	5914	CHANNEL DR
In County island	5920	CHANNEL DR
In County island	6044	CHANNEL DR
In County island	6200	CHANNEL DR
In County island	6300	CHANNEL DR
In County island	6350	CHANNEL DR
In County island	234	MARIA WAY
In County island	240	MARIA WAY
In County island	246	MARIA WAY
In County island	248	MARIA WAY
In County island	254	MARIA WAY
In County island	5640	MELITA RD
In County island	5658	MELITA RD
In County island	5664	MELITA RD
In County island	5668	MELITA RD
In County island	5690	MELITA RD
In County island	5704	MELITA RD
In County island	5712	MELITA RD
In County island	5715	MELITA RD
In County island	5756	MELITA RD
In County island	5765	MELITA RD
In County island	5773	MELITA RD
In County island	5880	MELITA RD
In County island	6010	MELITA RD
In County island	6020	MELITA RD
In County island	6064	MELITA RD
In County island	6066	MELITA RD
In County island	6070	MELITA RD
In County island	5155	MONTGOMERY DR
In County island	5205	MONTGOMERY DR
In County island	5225	MONTGOMERY DR
In County island	1546	RONNE DR
In County island	1560	RONNE DR
In County island	1596	RONNE DR
In County island	4224	SONOMA HWY
In County island	5670	SONOMA HWY
Not in island	5858	CHANNEL DR
Not in island	125	ELAINE DR

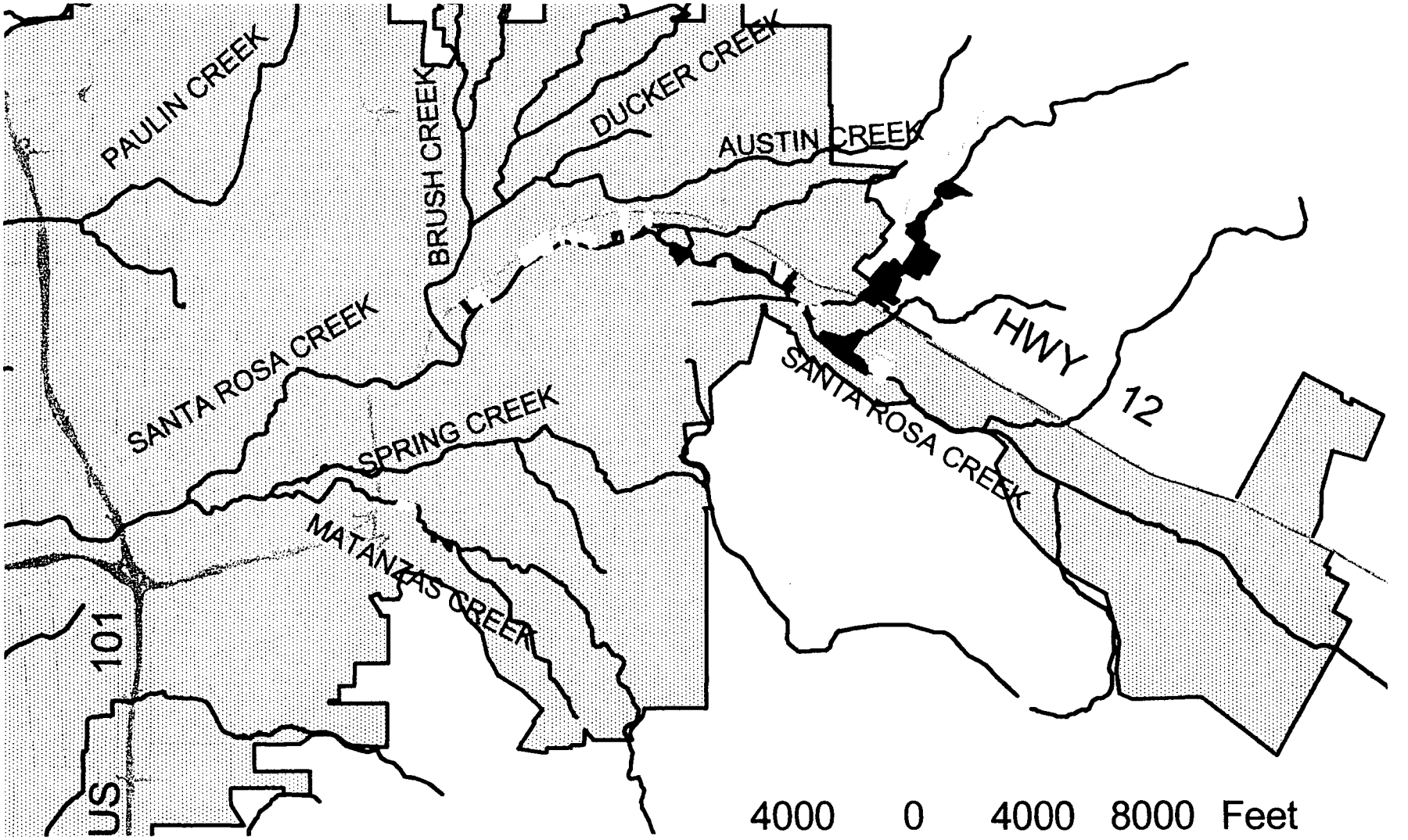
12/6/2001

Septic Inspection Sites

City Limit Status	Street number	Street name
Not in island	130	ELAINE DR
Not in island	150	ELAINE DR
Not in island	155	ELAINE DR
Not in island	200	ELAINE DR
Not in island	202	ELAINE DR
Not in island	415	ELNOKA LN
Not in island	425	ELNOKA LN
Not in island	5737	MELITA RD
Not in island	5743	MELITA RD
Not in island	5877	MELITA RD
Not in island	1423	MONTEREY DR
Not in island	1434	MONTEREY DR
Not in island	4358	SONOMA HWY
Not in island	4374	SONOMA HWY
Not in island	4420	SONOMA HWY
Not in island	4680	SONOMA HWY
Not in island	4712	SONOMA HWY
Not in island	4744	SONOMA HWY
Not in island	4770	SONOMA HWY
Not in island	4820	SONOMA HWY
Not in island	4914	SONOMA HWY
Not in island	4914	SONOMA HWY
Not in island	4914	SONOMA HWY
Not in island	5080	SONOMA HWY
Not in island	5160	SONOMA HWY
OUTSIDE	545	LOS ALAMOS RD
OUTSIDE	545	LOS ALAMOS RD
OUTSIDE	575	LOS ALAMOS RD
OUTSIDE	595	LOS ALAMOS RD
OUTSIDE	599	LOS ALAMOS RD
OUTSIDE	6231	MELITA RD
OUTSIDE	6255	MELITA RD
OUTSIDE	6260	MELITA RD
OUTSIDE	6265	MELITA RD
OUTSIDE	6271	MELITA RD
OUTSIDE	5817	SONOMA HWY
OUTSIDE	5823	SONOMA HWY
OUTSIDE	5833	SONOMA HWY
OUTSIDE	5745	WILDWOOD MTN RD
OUTSIDE	857	WILDWOOD TRL
OUTSIDE	858	WILDWOOD TRL
OUTSIDE	860	WILDWOOD TRL

Septic Inspection Sites

City Limit Status	Street number	Street name
OUTSIDE	862	WILDWOOD TRL
OUTSIDE	864	WILDWOOD TRL
OUTSIDE	868	WILDWOOD TRL
OUTSIDE	872	WILDWOOD TRL
OUTSIDE	878	WILDWOOD TRL
OUTSIDE	884	WILDWOOD TRL
OUTSIDE	900	WILDWOOD TRL



PMG Inspection Sites
- County island (40)
- Inside City Limits (27)
- Outside City Limits (24)
- Creeks

Streets
- Highway
- MAJOR

City_limits
- CITY_BDY may-2001

Prince Memorial Greenway
Sites for Septic Inspection
September 14, 2001

Appendix E

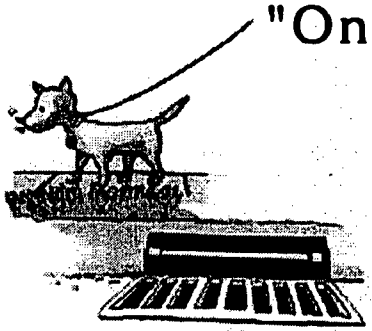
Public Outreach Materials

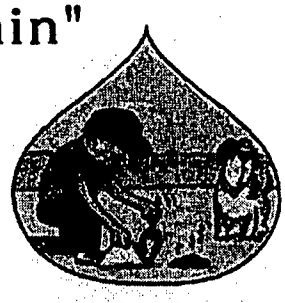
Radio Commercial

Meet Bear and Tigger (SFX: Dog Barking/Cat Meowing) Just like about any other household pets, they love to romp around in the backyard, chasing squirrel's and the occasional bird that wanders in the yard. (SFX: Bird Chirping) Now being animals, Bear and Tigger naturally take care of their number 2 business in the yard, or when they take their owner for a walk. Basically they go when the spirit moves them, if you know what I mean. Bear and Tigger's number 2 problem could become our number 1 concern. Because when it rains or when you water, pet waste becomes part of the runoff into the Storm Drain System and that water is not treated. It flows right into our lakes, rivers and ocean. (SFX: Dog Whines/Cat hisses) Did you know...Waste from only five dogs is enough to substantially increase bacteria levels in creeks? So don't give your pet a bad name. Make sure their number 2 business is scooped up and disposed of properly. Put it in the trash or flush it down the toilet. For more helpful tips call the City of Santa Rosa Public Works Department at 543-3467. Brought to you by the City of Santa Rosa Public Works Department.

Theater Preview Slide

"Only Rain Down The Storm Drain"

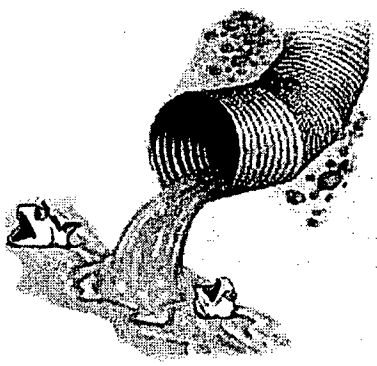




<u>Did You Know...</u>

Pet waste left on the ground can wash into storm drains and pollute our creeks and waterways.

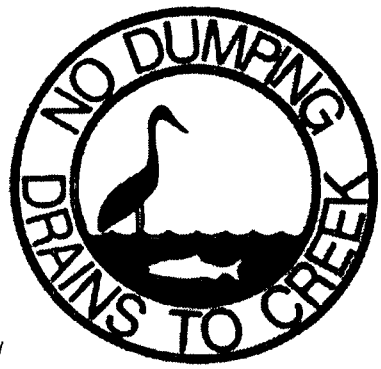
Please clean up your pet's waste.

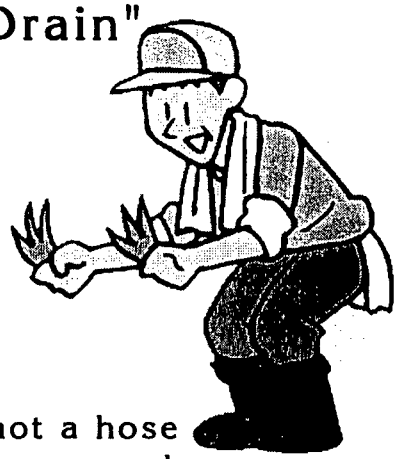


City of Santa Rosa
Public Works Department
Phone: 543-3467
Visit our website under Storm Water

Theater Preview Slide

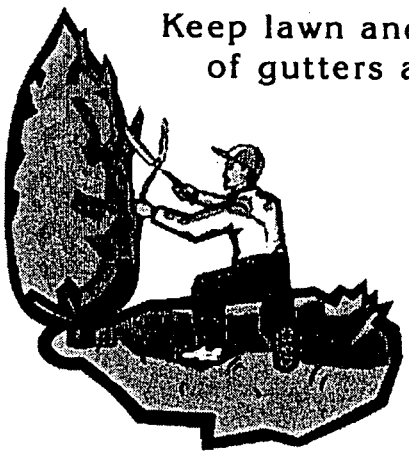
"Only Rain Down The Storm Drain"





Use a broom, not a hose
to clean the driveway or yard area.

Keep lawn and yard clippings out
of gutters and storm drains.



City of Santa Rosa
Public Works Department
Phone: 543-3467
Visit our website under Storm Water

1015-26.

COUNTY of SONOMA
DEPARTMENT OF HEALTH SERVICES
Mark A. Kostielney - Director

Environmental Health Division
Jonathan J. Krug - Director

MEMO

Date: November 7, 2001

To: Colleen Ferguson

From: Jeff Lewin

Re: Survey of horse facilities along Santa Rosa Creek

Twenty-one (21) properties were identified having horse facilities located along or near Santa Rosa Creek and Matanzas Creek. A letter was sent to the property owners as an educational outreach effort to assist them with horse manure management and stream protection. Along with the letter was enclosed a guide, "Horse Owner's Guide to Water Quality Protection."

A copy of the letter and guide are attached.

JL/

Enclosures

3273 Airway Dr., Ste. D, Santa Rosa, CA 95403-2097 • *phone* (707) 565-6565 • *fax* (707) 565-6525 • www.sonoma-county.org

COUNTY of SONOMA
DEPARTMENT OF HEALTH SERVICES
Mark A. Kostielney - Director

Environmental Health Division
Jonathan J. Krug - Director

November 6, 2001

Re: Horse Owner's Guide to Water Quality Protection

Dear :

Enclosed please find the pamphlet titled, "Horse Owner's Guide to Water Quality Protection." (Guide) Our office is providing this Guide for property owners with horses that are located along or near Santa Rosa Creek and Matanzas Creek.

A number of agencies are conducting a pollution study of Santa Rosa Creek due to recent measurements of fecal bacteria contamination. Horse facilities located near a creek have the potential to generate sediment from soil erosion, organic matter, ammonia and nutrients.

As the Guide mentions, ***"Bacteria and viruses in horse manure rarely cause health problems for people. The potential for spread of disease to other horses, or susceptible wildlife species may be of concern."***

We hope this Guide will be of assistance to you as an educational tool with horse manure management and stream protection efforts. After reviewing this Guide if you have any questions, please call me at 565-6560.

Sincerely,

Jeff Lewin, R.E.H.S.
Supervising Environmental Health Specialist

JL/

Enclosure

3273 Airway Dr., Ste. D, Santa Rosa, CA 95403-2097 • *phone* (707) 565-6565 • *fax* (707) 565-6525 • www.sonoma-county.org

With an expanding urban environment, horse owners must diligently protect water quality and present a good image to their neighbors.

What is voluntary compliance?

Both State and Federal laws set standards for handling of animal waste to provide protection of surface and underground water resources. Currently, regulatory and enforcement agencies encourage owners and managers of animal feeding or confinement operations, as well as individual horse owners, to follow a program of "voluntary compliance" to achieve these "clean water" standards without more formal regulatory action.

Voluntary compliance *means voluntarily undertaking the necessary and appropriate management practices to minimize the release of pollutants into local waters without the necessity of obtaining site-specific waste discharge requirements.* Horse owners and facility managers should evaluate the effectiveness of their existing erosion control, stormwater management, and waste management practices to minimize transport of pollutants. Voluntary compliance allows the horse community the opportunity to demonstrate responsible stewardship of natural resources while avoiding stricter enforcement of regulations. Voluntary compliance does not mean that water quality concerns can be ignored.

Council of Bay Area
Resource Conservation Districts
1301 Redwood Way, Suite 170
Petaluma, CA 94954
(707) 794-1242 X 123

Working with horse owners to protect natural resources.

Horse owners can eliminate the need for any further regulation by taking responsibility to manage horse waste, limit erosion, control stormwater runoff and protect aquatic habitat.

For more information contact:

Local Resource Conservation District (RCD):
- Alameda County RCD (925) 371-0154
- Contra Costa RCD (925) 672-6522
- Dixon RCD (707) 678-1655
- Guadalupe-Coyote RCD (408) 288-5888
- Loma Prieta RCD (408) 847-4171
- Marin County RCD (415) 663-1170
- Napa County RCD (707) 252-4189
- San Mateo County RCD (650) 712-8938
- Southern Sonoma County RCD (707) 794-1242

Local USDA Natural Resources Conservation Service Office (707) 794-1242

Local U.C. Cooperative Extension office

CA Dept. of Fish and Game (707) 944-5500

S.F. Regional Water Quality Control Board (510) 622-2300

Funding for this publication has been provided by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service in California through the Environmental Quality Incentives Program. The USDA is an equal opportunity provider and employer. Resource Conservation Districts (RCD) are non-regulatory, special districts governed by a volunteer board of directors. In addition to educational programs, RCDs provide landowners and the public with technical assistance in natural resource management.

Horse Owners Guide to Water Quality Protection

Conservation practices that protect water quality at horse facilities add to a horse property's value, promote horse health, build good relations between neighbors, and discourage further regulation.

While horses contribute only a small fraction of the total pollutants entering local waterways, horse owners and facility managers bear the responsibility to minimize water pollution through:

1. Facility design and siting
2. Horse waste management
3. Stormwater runoff management
4. Pasture and paddock care
5. Protection of waterbodies

Implementation of conservation practices does not need to be costly. Often a slight change in operations will achieve the desired result. How can horse waste and erosion affect water quality? How well are you as a horse owner protecting water quality? What more can you do?

Horses in the wild may roam up to twenty-five miles a day for food, water and shelter. Their continual movement disperses manure and urine and allows for regrowth of vegetation. However, with domestic horses, thoughtful owners provide food and shelter, and, consequently, relatively large numbers of horses can be kept in a small area. If not carefully managed, horse waste and sediment from horse facilities could enter waterways or infiltrate ground water to create conditions detrimental to drinking water supplies, recreational activities, and the environment.

What can horse owners do to minimize adverse water quality impacts?

Be informed and proactive. Analyze possible water quality impacts of your operations before and during rains. Learn how to perform simple water quality monitoring tests. Implement conservation practices if necessary. Carefully consider potential water quality problems before expanding your facility. Schedule a workday at your stables to install roof gutters, improve drainage channels, set up a new manure storage system, or revegetate a creek. Volunteer to maintain public trails. Encourage your friends and horse clubs to do the same.

Remember, any complaint about horses reflects on all horse owners. Realize that not everyone loves horses. Consider yourself an ambassador for horses by good stewardship of land and water resources. Care of natural resources in your local area will initiate an expanding ripple.

How can horse waste impair water quality?

Although horse wastes (manure, urine and soiled bedding) are organic, biodegradable materials, many of their biological and chemical properties can be detrimental to fish, insects, and other aquatic life if those wastes get into local waterbodies.

All aquatic life depends on the small amount of **dissolved oxygen** that naturally exists in water. The atmosphere contains 20% oxygen, but water saturated with oxygen contains only 11 parts per million (ppm) at 50°F, and even less, 9 ppm, at 70°F. The addition of any decomposable organic material to water stimulates the growth of aerobic bacteria that break down, or consume the organic matter. The respiratory demand of the resultant bacterial population can become large enough to overwhelm the water's oxygen dynamics, leaving little or no dissolved oxygen for other aquatic life.

Many of the **nutrients** ingested by animals, not just horses, return to the environment in feces and urine. On land, moisture and atmospheric oxygen support the bacterial conversion of these wastes to nutrients available for plants. However, when carried by stormwater runoff to streams and lakes, excessive amounts of these same nutrients can stimulate unwanted **algae blooms**. Algae produce oxygen by photosynthesis, but only during sunny times of the day do they produce more oxygen than they consume. Thus, algal respiration, like the bacterial decomposition of organic material, uses up dissolved oxygen in water.

Ammonia is an intermediate byproduct of bacterial conversion of urea, a principal constituent of urine and other nitrogenous materials excreted by animals. A very small amount of ammonia dissolved in water can kill fish. State, Federal, and international criteria recognize that waters which support a balanced population of fish and aquatic life have an almost undetectable un-ionized ammonia concentration of 0.025 parts per million or less.

Salts contained in all animal waste do not breakdown, and can be carried by rain runoff into local surface and ground waters. The presence of salts in soils of animal confinement areas can increase the salt load to local streams, limiting the species of fish, amphibians, and invertebrate life.

Bacteria and viruses in horse manure rarely cause health problems for people. The potential for spread of disease to other horses, or susceptible wildlife species may be of concern.

How does erosion affect water quality?

Activities, such as heavy grazing or trampling, that remove the soil's vegetative cover and thus expose the soil surface to the energy of raindrops, water runoff, and wind, accelerate the natural process of erosion. Once mobilized into a stream, excessive sediment can fill pools, smother fish spawning beds, cover or obscure food supplies, reduce the amount of sunlight reaching aquatic plants, increase water temperature, and clog fish gills. In addition, heavy metals and other toxic contaminants can temporarily bind to sediments and be carried along into water.

CONSERVATION PRACTICES FOR HORSE OWNERS

A conservation practice *is any activity that improves, protects or restores a natural resource.*

To implement conservation practices that protect water quality:

1. Identify the source of pollution

2. Determine how pollutants reach the water

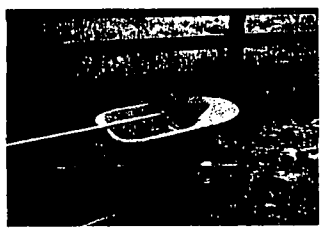
3. Select a conservation practice, or a combination of practices, to cost effectively reduce the adverse impact to water quality

4. Monitor and evaluate its effectiveness in achieving the desired result

5. Make any necessary changes based on the evaluation

Horse owners should consider the following points to protect water quality:

Horse Waste Management



Clean up manure and soiled bedding on a regular basis, especially during wet weather, to limit seepage of salts and nutrients into ground water or runoff of manure into waterbodies.

After clean up, during the arid summer, use a bucket, hose or sprinkler to water areas where horses frequently deposit manure. Watering maintains the moist environment bacteria need to decompose residual waste.

Store horse waste on an impervious surface (a concrete pad or plastic tarp) and under cover (a roof or tarp) during rains to prevent leaching or runoff of contaminants. Locate storage areas away from waterways so that floods or runoff will not wash away waste. Do not dump horse waste on the edge or directly into stream channels.

Disposal fees are expensive. Manure composts into an excellent soil amendment. Perhaps neighbors or local gardeners will want your raw material. Keep compost piles moist and well aerated to aid in conversion of urea and ammonia compounds to more useable, and less toxic nitrates. Be innovative and establish a disposal solution rather than create a disposal problem.

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Management

• Keep "clean water clean." Use grassed ditches, berms, or subsurface drains to divert "clean" runoff around barns, manure storage areas, and paddocks.

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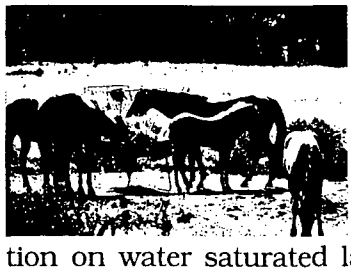
Pasture and Paddock Care

Vegetation protects water quality by slowing the rate of stormwater runoff, which increases absorption into soil, increases bacterial conversion of toxic or consumptive constituents, and lessens the risk that soil and manure solids will be carried into streams.

Grazing Management - Maintain pasture productivity by controlling the number of horses and the amount of time they spend on a pasture. In most cases, pastures provide an exercise area and not the primary food source. For this reason, pasture management should focus on protecting the pasture's soil and vegetative cover. Prevent bare areas from forming. Allow grass time for regrowth. Cross fence to divide pastures into smaller areas, which can be grazed in rotation. Inexpensive and moveable, electric fencing works well to define grazing areas. During the growing season, graze grass to a height of 3-4 inches and allow regrowth to 6-8 inches before returning horses to the pasture. Manage grazing so that a cover of dry residual vegetation protects soil from the first rains.

Soil Compaction - A porous soil improves plant vigor by allowing the infiltration of water, air, and nutrients. Hoof impact and machinery operation on water saturated land compact soil particles and cause loss of porosity.



Paddocks as a Sacrifice Area - Use turnout paddocks as "sacrifice areas" to preserve pastures. This strategy reduces churning and compaction of wet soils, and overgrazing when pastures require rest. If possible, locate paddocks back from waterways; and avoid swales where overland flows can wash away bare soil or manure. Maintain a vegetated border around paddocks to help filter contaminants. Be sure paddocks provide horses with adequate exercise room.

Protection of Waterbodies

Riparian Buffer Strips - Protect or restore a vegetated riparian (streamside) corridor with grass, trees, shrubs and/or groundcover to filter sediments and horse waste, stabilize streambanks, reduce solar heating of the water, and enhance aquatic habitat.

Limit Horses Access to Waterways - Provide other sources of water and shade. The direct deposit of manure into water can harm aquatic life. Trampling physically breaks down streambanks and destroys vegetative cover, which can increase sedimentation. The loss of streamside vegetation may also result in excessive solar heating of the water, which can harm cold water fish. Design stream crossings to minimize erosion. Exclusionary fencing and seasonal grazing of riparian corridors are possible management choices.

Protect Small Tributaries - Ditches and drainage swales carry a large amount of rain runoff. These tributaries also require vegetation to filter sediment and reduce the erosive energy of water. Fencing may be necessary to exclude horses from these smaller waterways.

Wetlands naturally filter contaminants from water and provide excellent wildlife habitat. Protect wetlands from grazing and trampling during the rainy season.

Chemicals in horse grooming and health products, detergents, disinfectants, herbicides, and pesticides can harm aquatic life. Follow instructions for correct application. Minimize use whenever possible. Be careful to avoid direct application or airborne transport of sprays to waterbodies. Do not let horse wash water drain directly into waterways.