TOWN OF PARADISE
WASTEWATER MANAGEMENT STUDY
SUPPLEMENTARY PHASE I REPORT

PREPARED FOR

TOWN OF PARADISE
PARADISE, CALIFORNIA

BY

GEORGE TCHOBANOGLOUS
CONSULTANT
DAVIS, CALIFORNIA
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PARADISE COMMUNITY PROFILE
(As of October 1, 1983)

LOCATION

The community of Paradise is located east of Chico, California along Eden Ridge.

HISTORICAL DEVELOPMENT

Developed primarily during the 1930's through the 1960's, the area has been urbanized for several decades.

DEMOGRAPHIC INFORMATION

Total persons: 24,000
Number of households: 10,000
Number of occupied rentals: 2,277
Median family income: $14,765

PHYSICAL CHARACTERISTICS

Topography: Rolling terrain
Number of lots: 11,200
Number of onsite systems: 10,000
Median lot size: 1.0 acres
Land area: 11,500 acres

WATER SUPPLY

Potable water: The community of Paradise is served by the Paradise Irrigation District (PID).

Other: Some 300 residences use individual wells to replace or supplement PID service.

WASTEWATER DISPOSAL

Individual onsite wastewater disposal systems.

CURRENT WASTEWATER MANAGEMENT SITUATION

No serious problems throughout the community with residential onsite systems. Occassional problems with failing individual onsite systems. Older septic tanks that are not water tight and do not function properly need to be replaced. Some deterioration of water quality in the streams along the central Skyway area due to heavy commercial development and limited depth of soil cover. To protect water quality from the impact of future growth and development, a new Sewage Disposal Ordinance has been adopted.

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TABLES

FIGURES

1. INTRODUCTION

The Water Quality Management Plan (208 Report) for Paradise and Magalia was completed in January 1979 (1). In that report, it was concluded that much of Paradise was suitable for the continued use of onsite wastewater disposal systems and that centralized wastewater management facilities should be constructed to serve the central Skyway area. It was also noted that additional water quality data should be collected to assess fully the operation of the onsite systems in Pardise.

To perform the recommended water quality monitoring and to evaluate the operation of the onsite systems more fully, the Town of Paradise initiated the facilities planning process by requesting a grant from the State of California. Financial assistance for a facilities planning study was received under the Federal Clean Water Grant Program administered in California by the State Water Resources Control Board. The firm of James M. Montgomery, Consulting Engineers, Inc., was selected to do the Step I Facilities Planning Study and a contract was signed on September 15, 1980.

To complete the assessment of the operation of onsite systems in the Town of Paradise, the consultant defined five major tasks, including the "Monitoring of bacterial and chemical indicators of water quality at selected stations during both dry weather and wet weather conditions " (2). The data collected as part of this monitoring program were to be used to document the need for centralized wastewater management facilities for the central Skyway area. The final facilities

planning report was submitted to the Town of Paradise by the consultant on May 3, 1983 (2).

In the report submitted by the consultant, the results of bacterial measurements made at some 34 sampling stations are reported along with the results of measurements of two inorganic constituents, chloride and nitrate, at selected stations (2). The bacterial measurements included total coliform, fecal coliform, and fecal streptococcus. The fecal coliform to fecal streptococcus ratio is also reported. Test results are reported for the period from July 8, 1981 through September 1, 1982. Based on their analysis of the bacteriological data and other supporting information, one of the recommendations made by the consultant was that centralized wastewater management facilities should be considered for selected areas along the Skyway.

Based on an independent analysis of the data contained in the report, it was concluded by the staff of the Regional Water Quality Control Board that the bacterial data presented were insufficient to justify the need for centralized wastewater management facilities to serve portions of the central Skyway area. Because the bacteriological data were inconclusive, it was jointly agreed by the Town of Paradise and the Regional Water Quality Control Board that additional bacteriological tests should be conducted during May, June, and July, 1983 (a wet period) and during September and early October, 1983 (a dry period). To help in the conduct of the additional studies and in the analysis of the data, Professor George Tchobanoglous was retained by the Town of Paradise.

The results of the additional sampling program and an analysis of these data are presented in this report.

OBJECTIVES

The principal objective of this study was to document the need for centralized wastewater management facilities. Specific subobjectives included:

1. The collection of surface water samples for bacteriological analysis from selected stream locations near the central Skyway area.
2. An analysis of the continued use of onsite systems in the Town of Paradise and, more specifically, in the central Skyway area.
3. Recommendations for the completion of the Phase II of the Step 1 Clean Water Grant.

SCOPE AND CONDUCT OF STUDY

The scope of this study included the collection of field samples; reconnaissance surveys of several streams in the critical central Skyway area; selected borings to trace qualitatively groundwater levels; and an analysis of past reports.

Cited reports, studies, and other pertinent literature have been arranged alphabetically and numbered sequentially and may be found at the end of this report. Where reference is made to this material in the text, the appropriate number or numbers are enclosed in paranthesis.

The study was conducted by Mr. Joseph J. Henao and

Dr. George Tchobanoglous.

ACKNOWLEDGEMENTS

The completion of this investigation would not have been possible without the cooperation and assistance of numerous individuals. The author is particularly indebted to Mr. Joseph J. Henao of the Regional Water Quality Control Board, Central Valley Region; Messers George F. Irving, Stephen J. Smith and Jon A. Lander of the Town of Paradise; Messers Lynn Vanhart and Henry Martin of the Butte County Health Department.

2. BACTERIAL SAMPLING STATIONS

To gather additional data on the bacterial levels in the more heavily populated drainage basins within the boundaries of the Town of Paradise, a total of eight surface water sampling stations were selected. The location and characteristics of these sampling stations are discussed below.

LOCATION OF BACTERIAL SAMPLING STATIONS

The location of the sampling stations was based on an analysis of the findings presented in the Montgomery report (2) and the guidance of the Town of Paradise engineering and planning staffs. The location of each sampling station is described in Table 1 and shown graphically in Figure 1. As shown, most of the sampling stations are located in the Middle Honey Run Basin.

CHARACTERISTICS OF SAMPLING STATIONS

The characteristis of each sampling station are considered with respect to the potential for contamination by sources other than effluent from failing septic tanks and leach fields. Photographs taken at sampling stations 1 through 7 are presented in Figures 2 through 7. These photographs are an aid in visualizing the following word descriptions of the individual sampling stations.

Station 1 (see Figure 2)

Located in a wooded area 200 feet upstream from the

Table 1

LOCATION OF BACTERIAL SAMPLING STATIONS

Station no.	Location
1	Northern tributary to Honey Run Creek 200 feet upstream of culvert under Bowles Blvd.
2	Northern tributary to Honey Run Creek at entrance to culvert under Bowles Blvd.
3	South eastern tributary to Honey run Creek in backyard of residence at the end of Tanglewood Drive.
4	Culvert discharging into Honey Run Creek at entrance to culvert under Oakmore Drive at Oakmore Drive and Valstream Drive.
5	Honey Run Creek 25 feet upstream from entrance to culvert under Oakmore Drive at Oakmore Drive and Valstream Drive.
6	Neal Basin Creek 400 feet downstream from culvert exit on Sunburst Drive near intersection of Filbert Street and Sunburst Drive.
7	Neal Basin Creek at entrance to culvert at intersection of Filbert Street and Sunburst Drive.
8	Catch basin sump on Skyway in front of Apple Ridge restaurant.

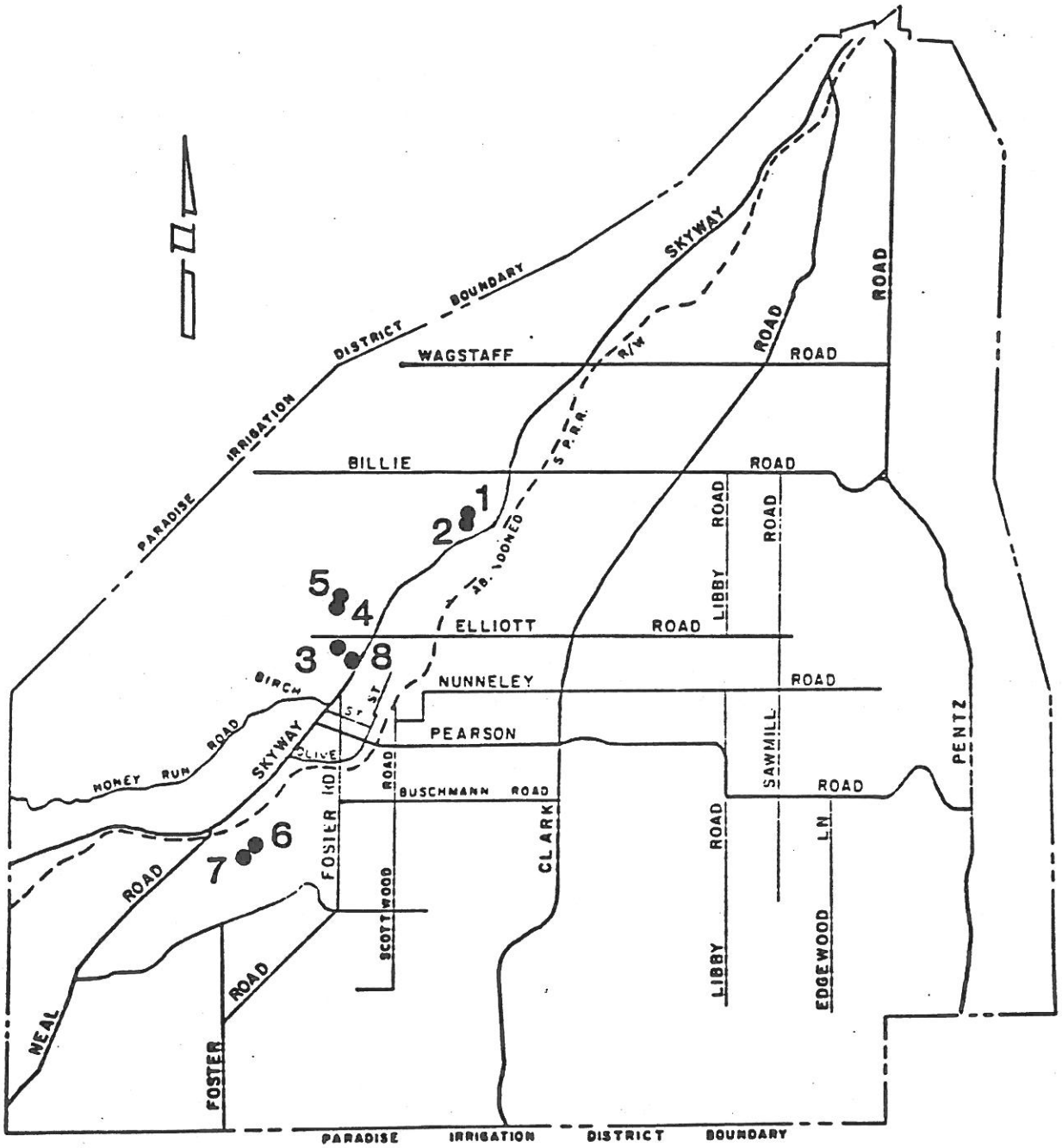

Figure 1 LOCATION OF SURFACE WATER BACTERIOLOGICAL SAMPLING STATIONS

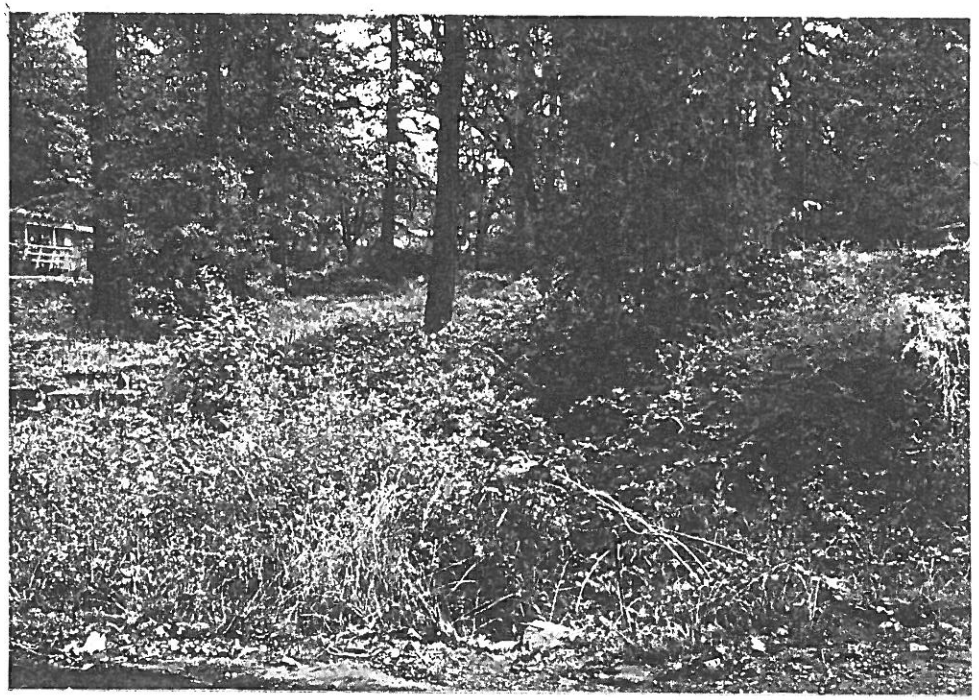

Figure 2 PHOTOGRAPHS TAKEN AT SAMPLING STATIONS 1 AND 2

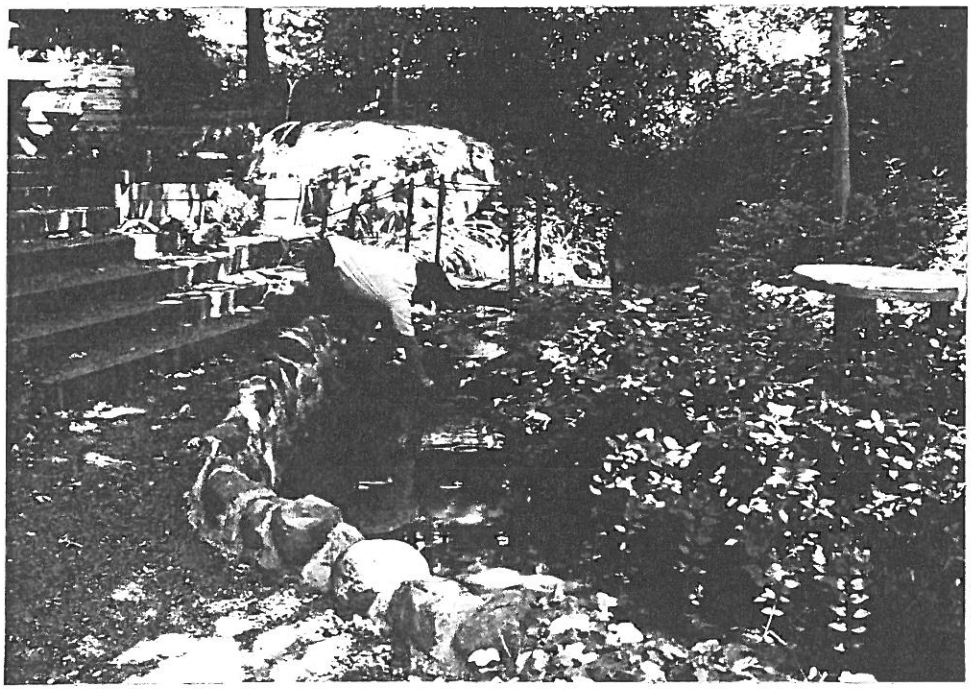

Figure 3 PHOTOGRAPHS TAKEN AT SAMPLING STATION 3

Figure 4 PHOTOGRAPHS TAKEN AT SAMPLING STATION 4 a) DURING DRY PERIOD, b) AFTER FIRST INTENSE RAIN OF FALL SEASON

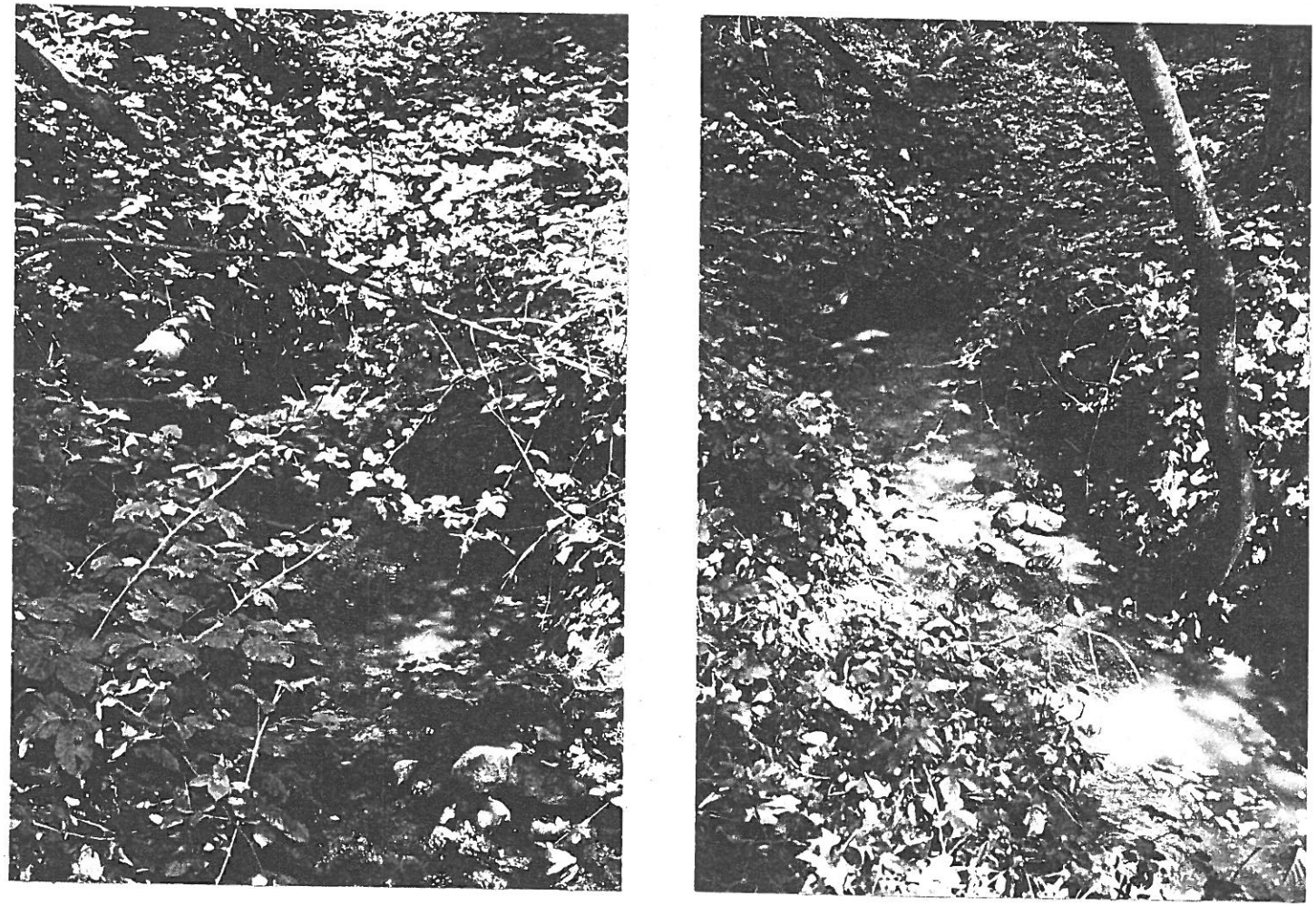

Figure 5 PHOTOGRAPHS TAKEN AT SAMPLING STATION 5 a)DURING DRY PERIOD, b) AFTER FIRST INTENSE RAIN OF FALL SEASON

Figure 6 PHOTOGRAPHS TAKEN AT SAMPLING STATION 6

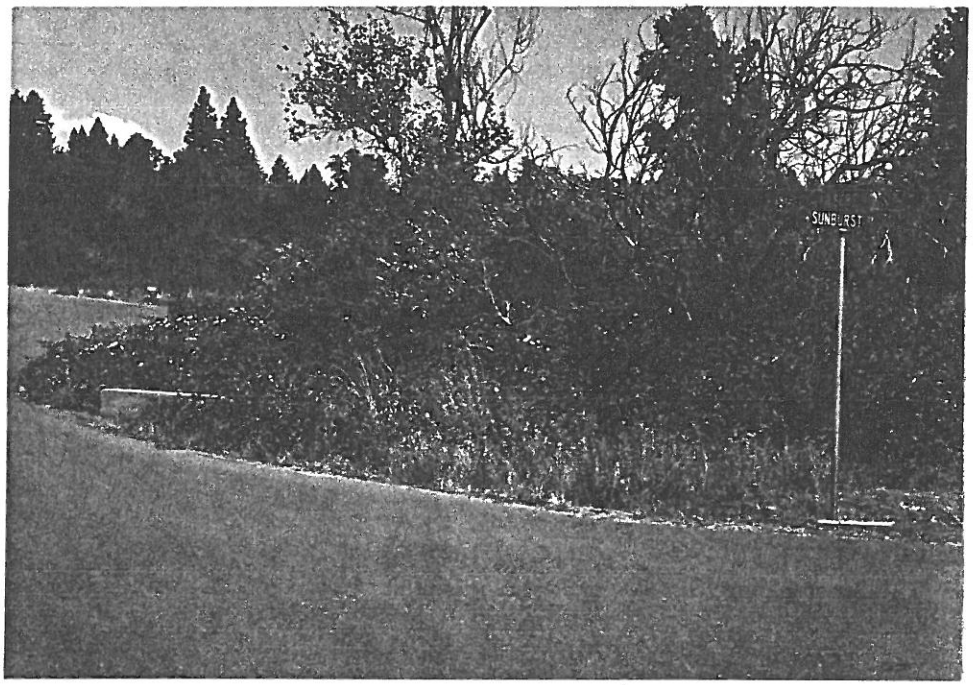

Figure 7 PHOTOGRAPHS TAKEN AT SAMPLING STATION 7

culvert under Bowles Blvd, the station is subject to both animal and human traffic. Honey Run Creek goes underground upstream from this location during the middle of the summer.

Station 2 (see Figure 2)

The entrance to the culvert on Bowles Blvd is subject to extensive animal and human traffic during all times of the year. Residences are located upstream on either side of this sampling station.

Station 3 (see Figure 3)

Located in the backyard of a residence at the end of Tanglewood Drive, this station is exposed to both animal and limited human traffic. The leachfield of the residence is located about 100 feet upslope from the creek. Occasionally, petroleum type odors could be detected at this sampling location.

About 250 feet upstream from sampling station 3, the tributary stream exists from a buried culvert. Petroleum based odors were always noted at the culvert outlet. At times, the odors were quite noticable inthe general area of the culvert. During the summer, a rust colored material of apparent biological origin covered the bottom of the stream from the outlet of the culvert to some 500 feet downstream.

Station 4 (see Figure 4)

The upstream area contributing to the culvert discharging into Honey Run Creek at the entrance to the culvert under Oakmore Drive at Oakmore Drive and Valstream Drive, is open

and is subject to both animal and human traffic.

Station 5 (see Figure 5)

The immediate section of Honey Run Creek upstream of the culvert under Oakmore Drive at Oakmore Drive and Valstream Drive, is subject primarily to animal traffic.

Station 6 (see Figure 6)

Located on Neal Basin Creek 400 feet downstream from the culvert exit on Sunburst Drive, Sampling Station 6 is open to both animal and human traffic. Because this location is used as a play site by the neighborhood children, wooden planks and boards are placed across the stream.

Station 7 (see Figure 7)

The immediate area located upstream of Station 7 at the entrance to the culvert at the intersection of Filbert Street and Sunburst Drive, is heavily wooded and not subject to human traffic. In the immediate vicinity of the sampling station, the culvert is open to both animal and human traffic.

Station 8

The catch basin sump on Skyway in front of the Apple Ridge restaurant. This screened drainage inlet is essentially open to animal traffic. Also, this station is located in one of the busiest sections along Skyway with extensive vehicular and pedestrian traffic.

3. RESULTS OF BACTERIAL SAMPLING PROGRAM

Weekly bacterial samples were collected at each sampling station during two time periods. The first sampling period started with the week of May 16, 1983 and continued through the week of July 11, 1983. The second sampling period started with the week of September 5, 1983 and ended with the week of October 3, 1983.

SAMPLING PROGRAM

The sampling program encompassed the collection and analysis of the samples. The specific tests conducted depended on the laboratory carrying out the analyses.

Sample Collection and Analysis

Samples were collected by the staff of the RWQCB and the County Health Department (CHD). The samples collected by the staff of the RWQCB were analyzed by Anlab Analytical Laboratory, a commercial laboratory located in Sacramento, California. The samples collected by the staff of the CHD were analyzed at the County Health Department laboratory in Chico, California. In all cases, the samples were iced and delivered to the respective laboratories in a time period equal to less than three hours after they were collected.

Sample Analyses

The first weekly sample processed by Anlab(A) included analyses for total and fecal coliform and fecal streptococcus. In the subsequent samples processed by Anlab, only fecal

coliform and fecal streptococcus were measured. Samples collected on September 22, 1983, were also analyzed for MBAS (methylene blue active substances) and ammonia.

The samples processed by the CHD through September were only analyzed for total and fecal coliform organisms. In the last two samples processed by the CHD, fecal streptococcus were also evaluated. Fecal streptococcus were not analyzed previously because the CHD did not have the necessary test facilities to do this test.

BACTERIOLOGICAL TEST RESULTS

The bacterial test results obtained from the two sampling periods have been summarized by station and are reported in Tables 2 through 9. As shown in these tables, total coliform, fecal coliform, and fecal streptococcus are reported in columns 2, 3, and 4, respectively. The fecal coliform to fecal streptococcus ratio (FC/FS) is reported in column 5. The laboratory at which the samples were analyzed is given in column 6. Test data on MBAS and ammonia are reported in Table 10.

Fecal coliform and fecal streptococcus are present in the feces of man and warm-blooded animals. The fecal coliform (FC)/fecal streptococcus (FS) ratio is used to assess whether the contamination is of human or animal origin. The FC/FS ratio for domestic animals is less than 1.0, whereas the ratio for human beings is more than 4.0. If ratios are obtained in the range from 1 to 2, interpretation is uncertain (3). It should be noted that the use of the FC/FS ratio is

Table 2

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 1 LOCATED ON NORTHERN TRIBUTARY TO HONEY RUN CREEK 200 FEET UPSTREAM OF CULVERT UNDER BOWLES BLVD.

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	540	49	4	12.25	A
5/26/83	240	93			CHD
6/07/83		33	33	1.00	A
6/13/83		8	13	0.62	A
6/20/83	240	23			CHD
6/28/83		33	110	0.30	A
7/ 5/83		5	130	0.04	A
7/12/83		9200	1300	7.08	A
9/ 6/83		D	D	D	
9/16/83		D	D	D	
9/22/83		D	D	D	
9/29/83		D	D	D	
10/5/83		D	D	D	

Table 3

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 2 LOCATED ON NORTHERN TRIBUTARY TO HONEY RUN CREEK AT ENTRANCE TO CULVERT UNDER BOWLES BLVD.

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	33	23	<2	>11.5	A
5/26/83	1100	240			CHD
6/ 7/83		13	5	2.60	A
6/13/83		13	49	0.27	A
6/20/83	93	25			CHD
6/28/83		13	23	0.57	A
7/ 5/83		79	49	1.61	A
7/12/83		1700	<20	>85.0	A
9/ 6/83		8	49	0.16	A
9/16/83		5	79	0.06	A
9/22/83		9200	5400	1.70	A
9/29/83	460	11	93	0.12	CHD
10/5/83	150	11	150	0.07	CHD

Table 4

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 3 LOCATED ON SOUTH EASTERN TRIBUTARY TO HONEY RUN CREEK IN BACKYARD OF RESIDENCE AT THE END OF TANGLEWOOD DRIVE

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	≥2400	≥2400	170	≥14.11	A
5/26/83	750	750			CHD
6/ 7/83		≥2400	130	≥18.46	A
6/13/83		≥2400	130	≥18.46	A
6/20/83	11,000	11,000			CHD
6/28/83		≥2400	≥2400	1.00	A
7/ 5/83		350	350	1.00	A
7/12/83		330	210	1.57	A
9/ 6/83		350	2400	0.15	A
9/16/83		350	350	1.00	A
9/22/83		5400	340	15.88	A
9/29/83	2400	460	1100	0.42	CHD
10/5/83	46,000	15	93	0.16	CHD

Table 5

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 4
LOCATED AT CULVERT DISCHARGING INTO HONEY RUN CREEK
AT ENTRANCE TO CULVERT UNDER OAKMORE DRIVE
AT OAKMORE DRIVE AND VALSTREAM DRIVE

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	920	540	27	20.00	A
5/26/83	1100	460			CHD
6/ 7/83		240	920	0.26	A
6/13/83		240	920	0.26	A
6/20/83	11,000	240			CHD
6/28/83		≥2400	≥2400	1.00	A
7/ 5/83		240	240	1.00	A
7/12/83		700	2200	0.32	A
9/ 6/83		240	≥2400	<0.10	A
9/16/83		700	920	0.76	A
9/22/83		D	D		
9/29/83		D	D		
10/5/83	4600	460	2400	0.19	CHD

Table 6

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 5 LOCATED AT HONEY RUN CREEK 25 FEET UPSTREAM FROM ENTRANCE TO CULVERT UNDER OAKMORE DRIVE AT OAKMORE DRIVE AND VALSTREAM DRIVE

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	130	79	23	3.43	A
5/26/83	93	43			CHD
6/ 7/83		540	≥2400	<0.23	A
6/13/83		130	≥2400	0.05	A
6/20/83	4600	2400			CHD
6/28/83		130	1600	0.08	A
7/ 5/83		1600	≥2400	0.67	A
7/12/83		490	2400	0.20	A
9/ 6/83		920	≥2400	0.38	A
9/16/83		110	920	0.12	A
9/22/83		3500	1200	2.92	A
9/29/83					
10/5/83	1500	93	460	0.20	CHD

Table 7

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 6 AT NEAL BASIN CREEK 400 FEET DOWNSTREAM FROM CULVERT EXIT ON SUNBURST DRIVE NEAR INTERSECTION OF FILBERT STREET AND SUNBURST DRIVE

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	540	240	23	10.43	A
5/26/83	1100	750			CHD
6/ 7/83		170	540	0.31	A
6/13/83		920	≥2400	<0.38	A
6/20/83	2100	150			CHD
6/28/83		540	350	1.54	A
7/ 5/83		≥2400	≥2400	1.00	A
7/12/83		490	790	0.62	A
9/ 6/83		920	920	1.00	A
9/16/83		220	540	0.41	A
9/22/83		7000	4000	1.75	A
9/29/83	11,000	460	1100	0.42	CHD
10/5/83	4600	150	4600	0.03	CHD

Table 8

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 7 LOCATED AT NEAL BASIN CREEK AT ENTRANCE TO CULVERT AT INTERSECTION FILBERT STREET AND SUNBURST DRIVE

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83	240	130	33	3.94	A
5/26/83	1100	43			CHD
6/ 7/83		540	540	1.00	A
6/13/83		220	79	2.78	A
6/20/83	460	460			CHD
6/28/83		240	350	0.69	
7/ 5/83		920	≥2400	0.38	A
7/12/83		330	330	1.00	A
9/ 6/83		350	≥2400	0.15	A
9/16/83		540	460	1.17	A
9/22/83		3500	35,000	0.10	A
9/29/83	1100	240	1100	0.22	CHD
10/5/83	11,000	150	11,000	0.01	CHD

Table 9

RESULTS OF BACTERIAL TESTING PROGRAM AT STATION 8
LOCATED AT CATCH BASIN SUMP ON SKYWAY
IN FRONT OF APPLE RIDGE RESTAURANT

Date	Bacterial count, MPN/100 ml			FC/FS ratio	Lab
	Total coli.	Fecal coli.	Fecal strep.		
5/20/83					
5/26/83					
6/ 7/83		33	49	0.42	A
6/13/83		<2	79	<0.03	A
6/20/83	1100	93			CHD
6/28/83		D	D		
7/ 5/83		≥2400	≥2400	1.00	A
7/12/83		<20	1300	<0.02	A
9/ 6/83		D	D		
9/16/83		D	D		
9/22/83		D	D		
9/29/83		D	D		
10/5/83		D	D		

controversial because of the many variables that can affect the test results. In the discussion of the test results that follows, the FC/FS ratio is used only as one added bit of evidence.

CHEMICAL TEST RESULTS

The results of the MBAS and ammonia tests for the samples taken on September 22, 1983, for Stations 2, 3, 5, 6, and 7 are reported in Table 10.

DISCUSSION OF BACTERIOLOGICAL TEST RESULTS

The bacteriological test results are considered in the following discussion.

Stations 1 and 2

The general bacteriological quality of the surface water at these stations is adequate. High fecal coliform MPN values (greater than 1,000/100 mL) were only recorded once at Station 1 and twice at Station 2. Based on the FC/FS ratio, it appears that an intermittant source of human pollution may be present. If a constant source of pollution were present, it would be anticipated that high values would be recorded in successive weeks. Successive high values were not measured.

Station 3

The highest fecal coliform MPN values were recorded at this station. The high fecal coliform MPN values recorded during the wet sampling period may have resulted from one or more failing onsite systems and from bacterial accumulations in the upstream culvert. With the exception of the sample

Table 10

RESULTS OF MBAS AND AMMONIA ANALYSES FOR SAMPLES TAKEN ON SEPTEMBER 22, 1983[a]

Station no.	MBAS, as LAS, mg/L	Ammonia as N, mg/L
2	0.05	<0.1
3	0.06	0.2
5	0.04	0.7
6	<0.01	<0.1
7	<0.01	<0.1

[a]Samples were collected after heavy rainfall (the first significant rainfall of the season).

taken on September 22, 1983, high fecal coliform MPN values were not recorded during the second dry weather sampling period.

To establish whether the high fecal coliform MPN values are due to failing onsite systems or a combination of failing systems and failing (broken) drainage culverts that allow improperly treated leachate to enter and mix with surface runoff, bacteriological samples should be taken at the outlet of the culvert and at one or more upstream locations. Based on a limited reconnaissance survey conducted with the staff of the Town of Paradise and the County Health Department, surfacing effluent was not observed upstream from the sampling station.

Sampling Stations 4 and 5

In general, the bacterial quality of the surface water at these two locations is adequate. While there are some high fecal coliform MPN values at these stations, they do not persist in successive sampling periods. Based on the FC/FS ratio, it appears that the major source of the fecal coliform organisms is from the resident animal population in the area. Also, it has been observed that many residents walk their dogs along the side of the road that is tributary to the culvert discharge.

Sampling Stations 6 and 7

With the exception of two high fecal coliform MPN values at Station 6 and one at Station 7, the bacteriological quality

of the surface water at this station is adequate. Most of the high fecal coliform values appear to be of animal origin. However, because of the high groundwater in much of this general area, failing onsite systems connot be eliminated as a source of contamination.

Sample Station 8

With the exception of one value, all of the fecal coliform MPN values are quite low. Based on the FC/FS ratio, it appears that most of the organisms present at this sampling station are of animal origin.

Conclusions From Bacteriological Test Results

Based on the bacteriological test results obtained during the two sampling periods, it can be concluded that, at present, a serious pollution problem does not exist in most of the streams in the general vicinity of the central Skyway area. However, there is evidence of localized deterioration in water quality in at least one of the streams sampled (e.g., Sampling Station 3.) It is also important to note that the area along skyway near Sampling Station 3 is highly developed. It should be noted that even though Station 8 leads directly to Station 3, the contamination noted at Station 3 does not appear to be coming from Station 8. The impact of future development is considered in the following chapter.

4. WASTEWATER MANAGEMENT IN TOWN OF PARADISE

Based on an analysis of the water quality data collected as part of this study and the water quality data, soil characteristics, groundwater hydrology, topography, and onsite system performance, data contained in the Montgomery report (2), it can be concluded that the provision of centralized wastewater management facilities are not warranted at this time. However, as the Town of Paradise continues to develop, centralized facilities will be needed along portions of the central Skyway area. As will be discussed later, centralized facilities will be needed because of hydrogeological limitations. Further, it can also be concluded that the level of wastewater treatment provided by **well managed and controlled** onsite systems in the residential areas of the Town of Paradise will be adequate to protect the environment.

There are, however, concerns and problems that must be addressed if the continued use of onsite systems is to remain a viable option, and if the continued development of the central Skyway area is to procede in an orderly manner. The purpose of this section is to consider short-term and long-term needs with respect to wastewater management in the Town of Paradise.

SHORT-TERM NEEDS

Wastewater management problems that must be addressed in the immediate future include the development of 1) regulations for new construction with respect to the use of onsite waste-

water disposal systems, 2) regulations for the commercial development along the central Skyway area, and 3) regulations for the containment and disposal of hazardous wastes from commercial activities. The first of these problems has been addressed with the new Sewage Disposal Ordinance finalized since the inception of this study.

Adoption of Sewage Disposal Ordinance

Until adoption of Sewage Disposal Ordinance 103, the Town of Paradise used the regulations of the Butte County Department of Health for the installation of onsite wastewater disposal systems. The current ordinance was developed jointly by the staff of the Town of Paradise and the staff of the County Health Department in conjunction with the staff of the Regional Water Quality Control Board. The final version of the current ordinance was adopted by the Town Council in January, 1984.

One of the key features of the Sewage Disposal Ordinance is that the area requirements for development are based on an analysis of existing loading rates in the Town of Paradise and in other communities (2). The limiting loading rate is 900 gal/acre·d. With the rigorous implementation of this ordinance, the impact of future residential development on water quality in the Town of Paradise should be minimized.

Regulations For Development Along Skyway

In some sections along the central Skyway area, most of the available lots have been developed. In those locations

where the general direction of the groundwater flow is towards the stream, problems with surfacing effluent can be expected to develop from time to time. To understand how surfacing effluent problems can develop, it will be helpful to review Figures 8 and 9. As shown in Figure 8, when the direction of the flow is towards the creek, the series of leach lines shown in Figure 8a can be replaced, for the purposes of hydraulic analysis, with the single leachline shown in Figure 8b. Referring to Figure 9, it can be seen that all of the wastewater applied must be transported to the stream through a thin layer of soil. If the amount of wastewater applied exceeds the hydraulic transfer capacity of the soil, surfacing of effluent can be expected. The problem of surfacing will become serious as more of the lots become developed as there will be no opportunity for the applied wastewater to spread in the lateral direction.

To control the surfacing of effluent in the short run, it will be necessary to limit the amount of wastewater discharged from each lot. It should be noted that adding additional leach lines will not help in solving the surfacing effluent problem. The use of water conservation fixtures should be a requirement for any future development in the central Skyway area. Owners of existing onsite systems along Skyway could be advised that the installation of water conservation fixtures would extend the useful life of their systems.

Without control measures to limit the volume of wastewater, centralized wastewater management facilities will be

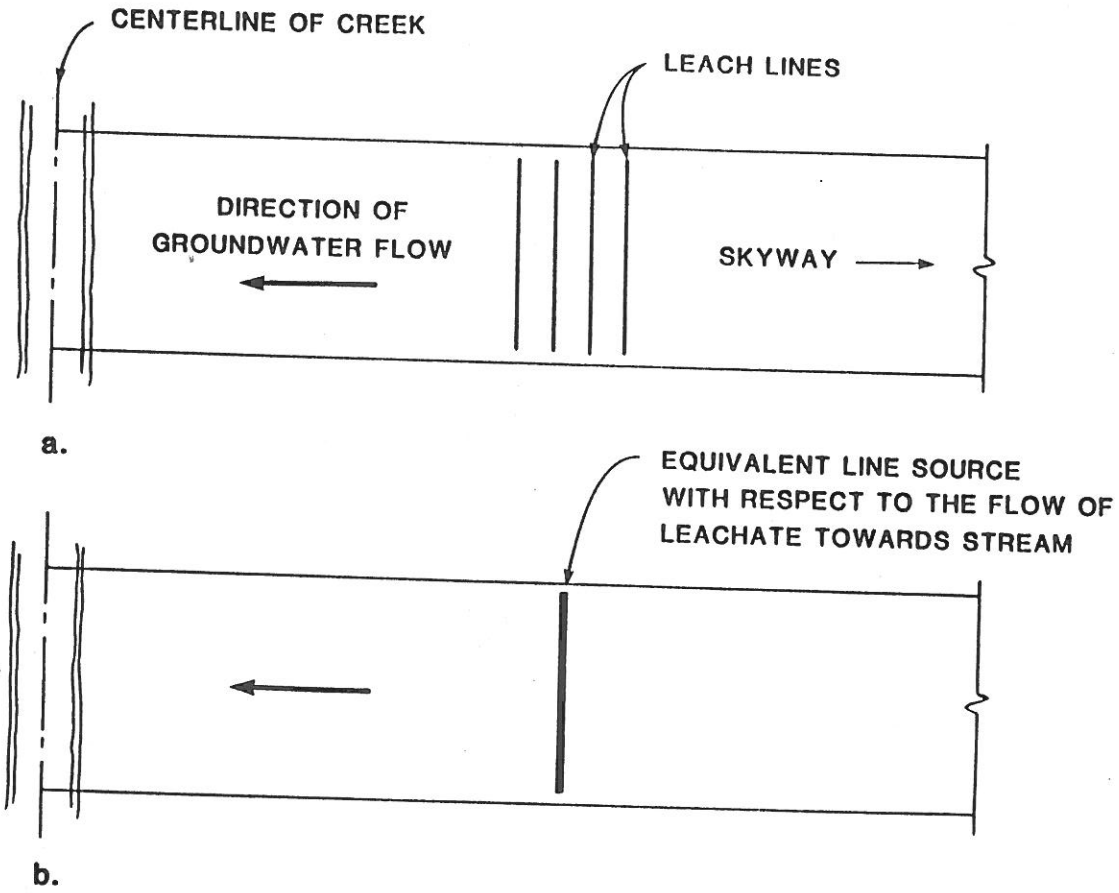

Figure 8 SCHEMATIC REPRESENTATION OF a) CONVENTIONAL LEACHFIELD SYSTEM AND b) HYDRAULIC EQUIVALENT FOR ONSITE SYSTEMS LOCATED IN THE MIDDLE HONEY RUN BASIN

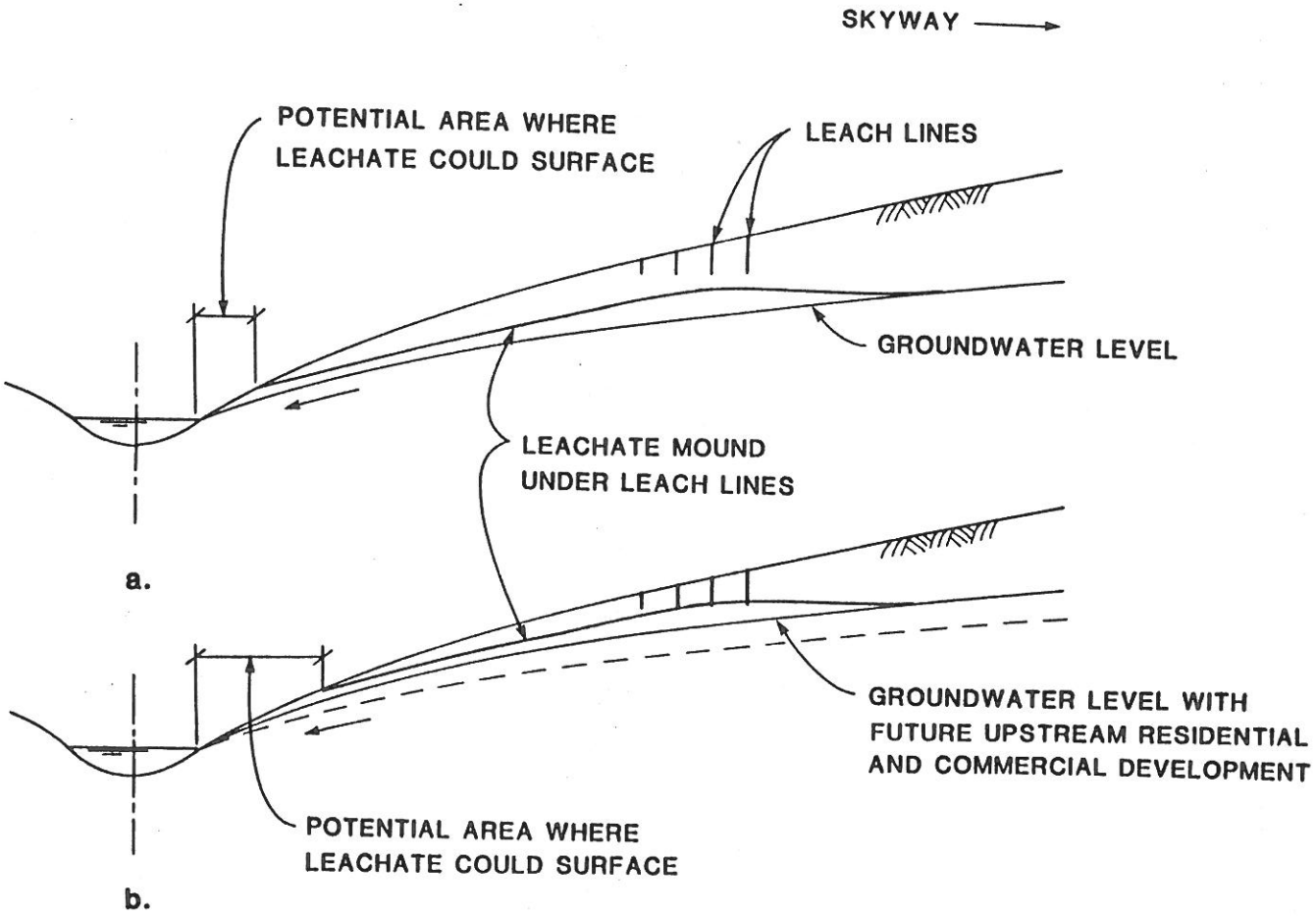

Figure 9 SCHEMATIC REPRESENTATION OF FLOW FROM SEPTIC TANK EFFLUENT LEACHFIELDS LOCATED IN THE MIDDLE HONEY RUN BASIN a)UNDER CURRENT CONDITIONS AND b)WITH FUTURE UPSTREAM RESIDENTIAL AND COMMERCIAL DEVELOPMENT

needed at several locations along the central Skyway area. As the tributary residential and commercial lots are developed, it is anticipated that centralized facilities will be required at specific locations along Skyway regard less of any control measures due to the large volume of effluent that must be transported to the streams. This subject is considered further under the heading, Long-Term Needs.

Waste Ordinance For Commercial Activities

One of the problems that the Town of Paradise must address in the near future is the disposal of wastes from the many service stations in town and from other commercial activities where potentially hazardous materials are used. A typical Example of the problem is illustrated in Figure 10. The contents of radiators that are flushed at one of the local service stations are allowed to run down the street essentially unmanaged. Many of the antifreeze solutions now in use contain compounds that would be classified as hazardous wastes.

Based on the persistent petroleum odors noted at the culvert outlet upstream of Station 3, it would appear that at one time or another, petroleum wastes must have been discharged somewhere in the community, and that these wastes entered the culvert system. To avoid such problems in the future, an ordinance should be enacted for the control of industrial and hazardous wastes. To eliminate the existing odors, the culvert should be cleaned and flushed under the direction of the town engineer.

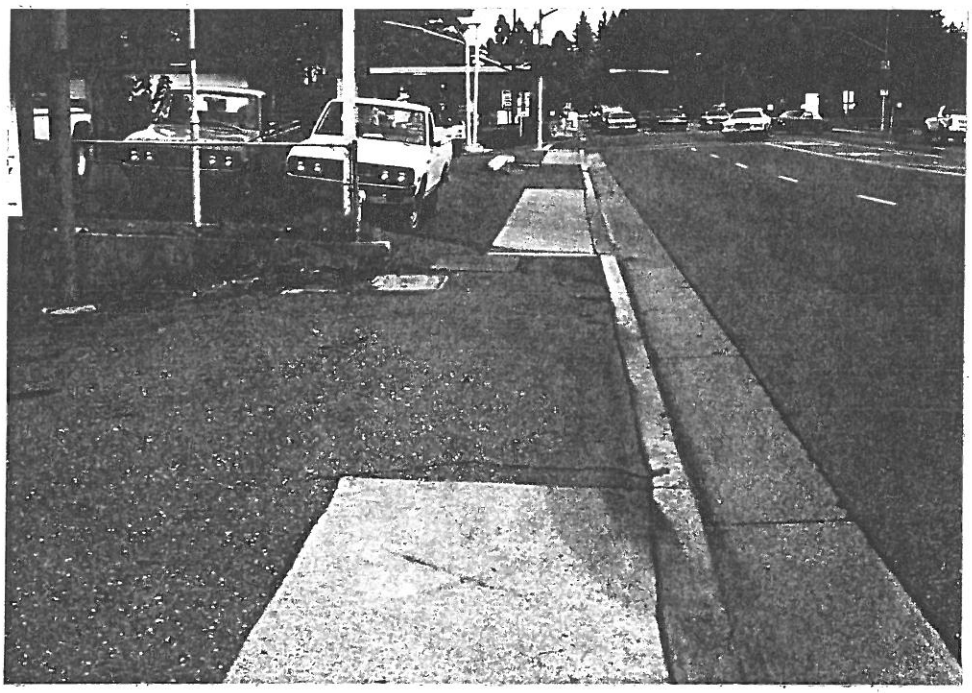

Figure 10 WASTEWATER FROM LOCAL SERVICE STATION DISCHARGED TO GUTTER ALONG SKYWAY

LONG-TERM NEEDS

The long-term wastewater management needs in the Town of Paradise include the development of 1) an onsite wastewater management district, 2) an ongoing public education program, 3) long range plans for the possible sewerage of selected locations along the central Skyway area, and 4) long range plans for the disposal of septage.

Onsite Wastewater Management District

To insure the continued successful operation of onsite systems, an Onsite Wastewater Management District should be established 1) to approve plans for new onsite systems, 2) to inspect newseptic tank and leachfield installations, 3)to perform periodic inspections of onsite systems, 4) to ensure that septic tanks are pumped at proper intervals, 5) to insure that failing onsite systems are repaired, and 6) to conduct a limited water quality monitoring program. The above tasks to be performed by the District could be done by personnel employed by the District or by an outside agency or by a combination of agencies.

Public Education Program

To encourage proper use and maintenance of onsite systems, a public education program should be undertaken by the staff of the Town of Paradise. As an example, information could be mailed periodically with each homeowner's utility bill. Further, a file of current reference material should be maintained by the town engineer to provide interested homeowners with additional information about wastewater

management. Such information should include the names and/or suppliers of low-flush toilets, septic tanks, dosing siphons, leachfield diversion valves, etc.

Planning For Limited Sewerage Facilities

Because the future is difficult to predict, it is both prudent and mandatory for the Town of Paradise to develop a long-range plan for providing centralized wastewater management facilities in the central Skyway area. In some locations along the central Skyway area, it may not be possible to accomodate future commercial development unless plans are available for limited centralized wastewater management facilities. Before all of the available residential and commercial building sites are developed, it is estimated that the amount of wastewater to be disposed of will exceed the hydraulic capacity of the soil system tributary to many of the streams in the area. When the capacity of the soil system is exceeded, continuous surfacing of partially treated wastewater will result as illustrated in Figure 9. Centralized facilities would also be needed if local weather conditions should change over an extended period of time, thereby altering groundwater levels in the area.

The long range planning effort for sewerage facilities should include 1) an analysis of alternative collection systems suitable for use in the central Skyway area, 2) the identification of potential wastewater treatment sites, effluent disposal options, and sludge treatment and disposal options, and 3) the staging of such facilities. In addition,

the possible methods and means of financing such faciltites should be examined.

It is anticipated that several smaller centralized wastewater management facilities will be needed as opposedto one single system. Initially, several commercial activities and residences might be combined and the wastewater pumped to a community septic tank and leachfield. As the town continues to grow, it may ultimately be appropriate to combine one or more of the smaller sewerage systems to provide treatment at a centralized facility.

Disposal of Septage

For onsite wastewater management facilities to operate properly, the septic tank should be pumped on a regular schedule. Although the disposal of septage does not appear to be a problem at the present time, it may become a problem in the future, especially if fuel prices increase significantly. Also, the available septage disposal sites may, in the future, no longer be able to accept septage directly as it is pumped from septic tanks. Further, if it is necessary to use black-water holding tanks for selected residences, the availability of a septage management facility would make the use of such facilities feasible. Septage processing should also be considered in the long range plans for providing centralized wastewater treatment facilities.

The key elements of a typical separate septage management facility are illustrated in Figure 11. As shown, septage is discharged from pumper trucks at a receiving platform. The

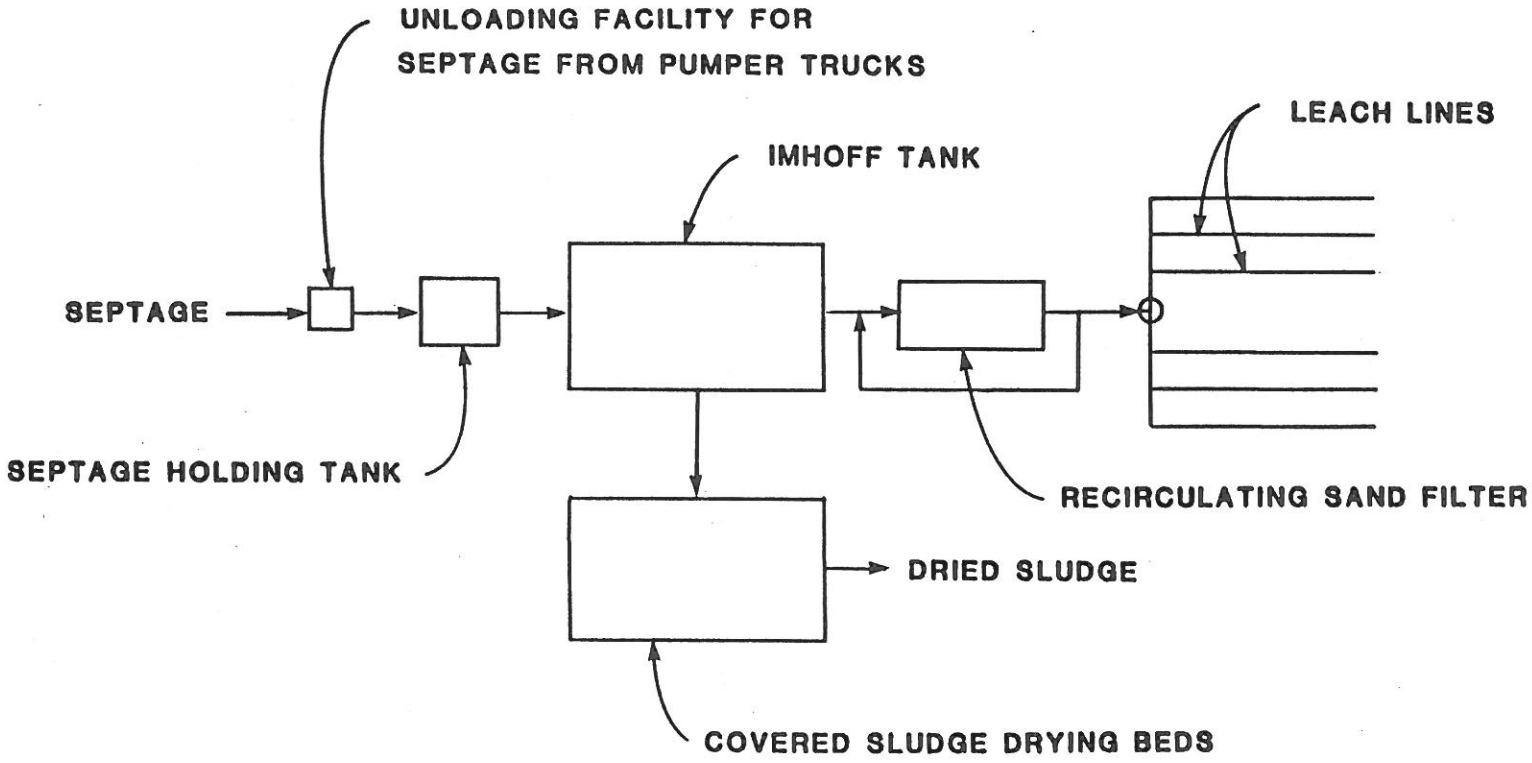

Figure 11 TYPICAL SEPTAGE MANAGEMENT FACILITY

septage is discharged to a holding tank. From the holding tank, the septage could be pumped or could flow by gravity to an Imhoff tank. The settled liquid would be treated in a recirculating sand filter before being discharged to a soil adsorption system. The digested sludge could be dewatered in glass covered drying beds or on vacuum drying beds. The partially dewatered sludge could be composted, if desired. Dry sludge would be disposed of in a landfill.

5. SUMMARY

Based on an analysis of current water quality data and other pertinent information, the provision of centralized wastewater management facilities for the central Skyway area is not warranted at this time. However, there are localized water quality problems in the central Skyway area. The basic problem along the central Skyway area is the shallow depth of the soil mantel. As residential and commercial lots are developed, a point will be reached where the amount of wastewater applied will exceed the hydraulic capacity of the soil system, and continuous surfacing of partially treated effluent will occur. When problems with surfacing effluent occur, further development will not be possible. To accomodate future development, plans should be available for centralized wastewater management facilities for selected locations along the central Skyway area.

With the adoption of the Sewage Disposal Ordinance 103, the Town of Paradise has taken a major step to limit the impact of future development on water quality. However, as discussed previously in Chapter 4, much remains to be done to insure that the progress made to date with respect to wastewater management continues. Because the staff of the Town of Paradise is limited, it is recommended that an outside consultant be retained to complete Phase II of the Step I Facilities Planning Grant to develop the needed information 1) to implement an onsite wastewater management program, 2) to develop long-range plans for centralized wastewater management

facilities, and 3) to develop a long-range plan for septage management. Specifically, the consultant should:

1. Define the charge (duties and responsibilities), the staffing requirements, and the operating budget of an Onsite Wastewater Management District.

2. Develop an operating framework for an Onsite Wastewater Management District including rules and regulations, operating procedures, water quality monitoring programs, reporting forms, and revenue plans. A time schedule must also be developed for the implementation of the Onsite Wastewater Management District.

3. Develop a long-range plan for centralized wastewater management facilities for the central Skyway area. The plan should include an evaluation of alternative types of collection systems and the identification of potential treatment sites, treatment methods and effluent disposal options. The plan should be staged and the elements of each stage clearly identified, including funding sources.

4. Develop a long-range plan for septage management by the Town of Paradise. The plan for septage management should include the identification of potential treatment and disposal sites, including financing. Septage treatment and disposal facilities may be an integral part of the centralized wastewater management facilities.

REFERENCES

1. James M. Montgomery, Consulting Engineers, Inc., **Water Quality Management Plan For Paradise and Magalia**, Walnut Creek, CA, January, 1979.

2. James M. Montgomery, Consulting Engineers, Inc., **Town of Paradise Wastewater Management Study Phase I Report**, Walnut Creek, CA, May, 1983.

3. Mara, D.D., **Bacteriology For Sanitary Engineers**, Churchill Livingston, Edinburgh, 1974.

APPENDIX A

LABORATORY DATA

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

MAY 25, 1983
DATE SAMPLE REC'D: 5-20-83
REPORT #: 243382

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	TOTAL COLIFORM MPN/100ML	FECAL COLIFORM MPN/100ML	FECAL STREP MPN/100ML
'1', 82-2433-1	540	49	4
'2', 82-2433-2	33	23	< 2
'3', 82-2433-3	≥2400	≥2400	170
'4', 82-2433-4	920	540	27
'5', 82-2433-5	130	79	23
'6', 82-2433-6	540	240	23
'7', 82-2433-7	240	130	33

DATA CERTIFIED BY Ken Nanka
REPORT APPROVED BY Roger Elliott
ANLAB/T. IKESAKI

SS

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JUNE 16, 1983
DATE SAMPLE REC'D: 6-7-83
REPORT #: 251182

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML
#1, 82-2511-1	33	33
#2, 82-2511-2	13	5
#3, 82-2511-3	≥2400	130
#4, 82-2511-4	240	920
#5, 82-2511-5	540	≥2400
#6, 82-2511-6	170	540
#7, 82-2511-7	540	540
#8, 82-2511-8	33	49

DATA CERTIFIED BY Ken Namba

REPORT APPROVED BY Roger Elliott

ANLAB/T. IKESAKI

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Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JUNE 20, 1983
DATE SAMPLE REC'D: 6-13-83
REPORT #: 256182

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML
#1, 82-2561-1	8	33
#2, 82-2561-2	13	49
#3, 82-2561-3	≥2400	130
#4, 82-2561-4	240	920
#5, 82-2561-5	130	≥2400
#6, 82-2561-6	920	≥2400
#7, 82-2561-7	220	79
#8, 82-2561-8	< 2	79

DATA CERTIFIED BY Ken Namba

REPORT APPROVED BY Rogers Elliott

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A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JULY 5, 1983
DATE SAMPLES REC'D: 6-28-83
REPORT #: 262982

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML
'1', 82-2629-1	33	110
'2', 82-2629-2	13	23
'3', 82-2629-3	≥2400	≥2400
'4', 82-2629-4	≥2400	≥2400
'5', 82-2629-5	130	1600
'6', 82-2629-6	540	350
'7', 82-2629-7	240	350

DATA CERTIFIED BY Ken Nanka

REPORT APPROVED BY Roger Elliott

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ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JULY 13, 1983
DATE SAMPLES REC'D: 7-5-83
REPORT #: 265882

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
3201 S STREET
SACRAMENTO, CALIFORNIA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION	ANLAB I.D.#	FECAL COLIFORM, MPN/100ML	FECAL STREP., MPN/100ML
SAMPLE #1	82-2658-1	5	130
SAMPLE #2	82-2658-2	79	49
SAMPLE #3	82-2658-3	350	350
SAMPLE #4	82-2658-4	240	240
SAMPLE #5	82-2658-5	1600	≥2400
SAMPLE #6	82-2658-6	≥2400	≥2400
SAMPLE #7	82-2658-7	920	≥2400
SAMPLE #8	82-2658-8	≥2400	≥2400

DATE CERTIFIED BY Ken Nanka
REPORT APPROVED BY Roger Elliott
ANLAB/ T. IKESAKI

SB

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JULY 18, 1983
DATE SAMPLES REC'D: 7-12-83
REPORT #: 270882

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPM/100ML	FECAL STREP. MPN/100ML
'1', 82-2708-1	9200	1300
'2', 82-2708-2	1700	< 20
'3', 82-2708-3	330	210
'4', 82-2708-4	700	2200
'5', 82-2708-5	490	2400
'6', 82-2708-6	490	790
'7', 82-2708-7	330	330
'8', 82-2708-8	< 20	1300

DATA CERTIFIED BY Ken Namba

REPORT APPROVED BY Roger Elliott

ANLAB/T. IKESAKI

SS

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

SEPTEMBER 13, 1983
DATE SAMPLE REC'D: 9-6-83
REPORT #: 100278

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML
#2, 100278-1	8	49
#3, 100278-2	350	2400
#4, 100278-3	240	≥2400
#5, 100278-4	920	≥2400
#6, 100278-5	920	920
#7, 100278-6	350	≥2400

DATA CERTIFIED BY Ken Namba

REPORT APPROVED BY Sue Littlefield

ANLAB/T. IKESAKI

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Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

SEPTEMBER 23, 1983
DATE SAMPLES REC'D: 9-16-83
REPORT #: 100360

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML
SAMPLE #2, 100360-1	5	79
SAMPLE #3, 100360-2	350	350
SAMPLE #4, 100360-3	700	920
SAMPLE #5, 100360-4	110	920
SAMPLE #6, 100360-5	220	540
SAMPLE #7, 100360-6	540	460

DATA CERTIFIED BY Ken Nanlz

REPORT APPROVED BY Sue Littlefield

ANLAB/T. IKESAKI

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Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

OCTOBER 14, 1983
DATE SAMPLES REC'D: 9-22-83
REPORT #: 100393

STATE OF CALIFORNIA
REGIONAL WATER QUALITY
CONTROL BOARD
3201 S STREET
SACRAMENTO, CA 95816

ATTN: JOSEPH HENAO

SAMPLE DESCRIPTION/ ANLAB ID #	FECAL COLIFORM MPN/100ML	FECAL STREP. MPN/100ML	MBAS MG/L AS LAS	AMMONIA MG/L AS N	OIL & GREASE MG/L
#2, 100393-1	9200	5400			
#3, 100393-2	5400	340			
#5, 100393-3	3500	1200			
#6, 100393-4	7000	4000			
#7, 100393-5	3500	35000			
#9, 100393-6	20	< 20			
#2A, 100393-7			0.05	<0.1	
#3A, 100393-8			0.06	0.2	
#5A, 100393-9			0.04	0.7	
#6A, 100393-10			<0.01	<0.1	
#7A, 100393-11			<0.01	<0.1	
#9A, 100393-12			<0.01	<0.1	
#3B, 100393-13					< 1

DATA CERTIFIED BY Kim Namba

REPORT APPROVED BY Sue Littlefield

ANLAB/T. IKESAKI

SS

1983 DATE			TOTAL COLIFORM	FECAL COLIFORM	FECAL STREP
	Station #2				
5/26	Bowles Blvd.	(upstream)	240	93	
6/20	Bowles Blvd.	(by trees)	240	23	
5/26	Bowles Blvd.	(culvert)	1,100	240	
6/20	Bowles Blvd.	(by culvert)	93	25	
9/29	Bowles Blvd.	(by culvert)	460	11	93
10/5	Bowles Blvd.	(by culvert)	150	11	150
	Station #3				
5/26	Tanglewood		750	750	
6/20	In draining pipe on skyway		1,100	93	
6/20	Tanglewood		11,000	11,000	
9/29	Tanglewood		2,400	460	1,100
10/5	Tanglewood		46,000	15	93
	Station #5				
5/26	Oakmore & Valstream	(upstream)	93	43	
6/20	Oakmore & Valstream	(upstream)	4,600	2,400	
10/5	Oakmore & Valstream	(upstream)	1,500	93	460
5/26	Oakmore & Valstream	(by culvert)	1,100	460	
6/20	Oakmore & Valstream	(by culvert)	11,000	240	
10/5	Oakmore & Valstream	(by culvert)	4,600	460	2,400
	Station #7				
5/26	Sunburst	(by culvert)	1,100	43	
5/26	Sunburst & Filbert	(fence)	1,100	750	
6/20	Sunburst & Filbert	(by fence)	2,100	150	
6/20	Sunburst	(by culvert)	460	460	
9/29	Sunburst	(culvert)	1,100	240	1,100
9/29	Sunburst & Filbert	(fence)	11,000	460	1,100
10/5	Sunburst	(by culvert)	11,000	150	11,000
10/5	Sunburst & Filbert	(by fence)	4,600	150	4,600

Typed: 10/13/83