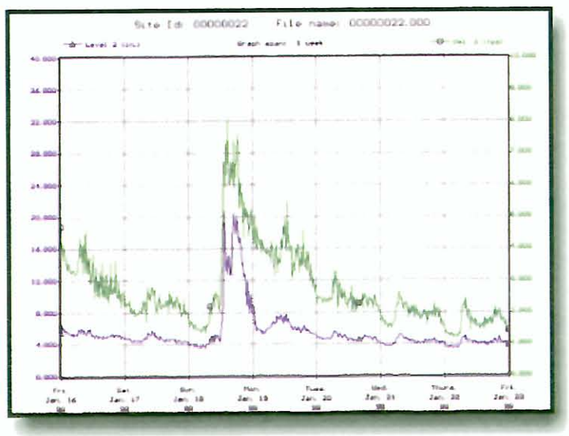
MASTER PLAN

County of San Mateo

September 2000

Fair Oaks Sewer Master Plan



Final Report

BROWN AND CALDWELL

COUNTY OF SAN MATEO

Fair Oaks

Sewer Maintenance District

SEWER MASTER PLAN

Prepared by:
Brown and Caldwell
September 2000

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BROWN AND CALDWELL
Environmental Engineering & Consulting

September 28, 2000

Mr. Walt Callahan
County of San Mateo
Department of Public Works
555 County Center, 5th Floor
Redwood City, California 94063-1665

11-14692-001/5

Subject: Fair Oaks Sewer Maintenance District Sewer Master Plan

Dear Mr. Callahan:

In completion of your December 1996 authorization, Brown and Caldwell is pleased to submit 10 copies of the subject final report. This report summarizes the field work and analysis performed on the Fair Oaks Sewer Maintenance District collection system. This report also presents the recommended capital improvement program.

We appreciate the opportunity to work with the County on this project and look forward to working with you on future projects.

Please call Mr. Brian Hammer at (925) 210-2346, or me at (925) 210-2509 with any questions.

Very truly yours,

Charles W. Joyce, P.E.
Project Manager

Brian E. Hammer
Project Engineer

CWJ:BEH:ka
Enclosures

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*Foldout figure follows page number indicated.

EXECUTIVE SUMMARY

In December 1996, the County of San Mateo engaged Brown and Caldwell to prepare a sewer system master plan for the Fair Oaks Sewer Maintenance District (FOSMD). This executive summary presents the findings, conclusion, and recommendations regarding this system. It also proposes a capital improvement plan (CIP) and summarizes recommended rates and a revenue plan to finance proposed improvements.

Background

The overall master planning process used for the sewer system master plan consisted of identifying capacity limitations along with structural deficiencies of the sewer system and developing an ongoing improvement program to correct the limitations. Part of the overall improvement program is the consideration for changing current maintenance activities to more appropriately match the needs of the sewer system. The improvement plan's goal is to develop a balance between capital projects and system maintenance to achieve a highly reliable collection system for the lowest overall cost.

A series of field inspections were performed to collect information on the collection system. Limited source detection methods (including smoke testing, manhole inspections, maintenance calls, television inspection and topographic surveying) were used to identify collection system structural deficiencies. Wet weather flow monitoring and hydraulic modeling were performed to develop a listing of hydraulic deficiencies. Projects were developed and prioritized based on the deficiencies and capital costs that were prepared. Methods for financing the recommended improvements are also included in the study.

Findings

Review of known problem areas and interviews with County maintenance crews were used to prioritize field inspections in the FOSMD. Flow monitoring was also performed to evaluate the amount of remaining capacity in the wastewater collection system. This section presents the results of the field inspection and capacity analysis.

A manhole inspection program was performed in the winter and spring of 1997. Field crews documented the condition of 204 manholes. No serious defects were noted during the inspection. Results of the inspections were used to prioritize the television inspection program.

The smoke testing program was conducted during the summer of 1998. Areas with suspected high inflow/infiltration (I/I) were scheduled for testing. Field crews tested approximately 27,500 linear feet of sewer lines. A total of 59 collection system defects were documented during the program. No serious defects were noted.

The television inspection program was conducted during the winter of 1999. A total of 15,000 feet of the collection system was inspected. Over 658 structural defects were documented during the inspection. Results of the television inspection program were used to develop the CIP.

Flow monitoring was performed during the winters of 1997 and 1998. The purpose of the flow monitoring was to develop peak wastewater flow rates for use in the hydraulic model of the collection system. The capacity of the major trunk sewer in the FOSMD was evaluated for this study. Results of the analysis indicate that approximately 25,800 linear feet of the trunk sewer has inadequate capacity.

Recommendations

A CIP was developed based on the results of the field work and capacity analysis. A total of 25 capital improvement projects were developed for the FOSMD. Eleven of the projects are recommended to repair structural deficiencies. Fourteen projects are recommended to provide additional hydraulic capacity to the FOSMD trunk sewer. Estimated total construction costs for the projects range between $7,115,000 and $7,532,000, depending on the selected alternative improvement. The location of the improvement projects are listed below:

1. Bay Road #4
2. Oakside/Barron Avenue
3. Selby Lane #3
4. Berkshire Avenue
5. Selby Lane #2
6. Bay Road #2
7. Selby Lane #1
8. Nimitz Avenue between Selby Lane and Himmel Street
9. Bay Road #1
10. 12th Avenue
11. Woodside Road
12. Santiago Avenue
13. El Camino Real #2
14. Milton/Hull Avenue
15. Eleanor Drive
16. Melanie Lane
17. Middlefield Road
18. Polhemus Avenue
19. Page Street
20. Stockbridge Avenue
21. 6th Avenue
22. Bay Road #3
23. El Camino Real #1
24. Hillside Drive
25. Glenwood Avenue

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SECTION 1

INTRODUCTION

This chapter introduces the sewer master planning process for the Fair Oaks Sewer Maintenance District (FOSMD) of San Mateo County (County), including background, authorization, scope of work and report organization.

Background and Purpose of Work

The overall master planning process used for the sewer system master plan consisted of identifying capacity limitations along with structural deficiencies of the sewer system and developing an ongoing improvement program to correct the limitations. Part of the overall improvement program is the consideration for changing current maintenance activities to more appropriately match the needs of the sewer system. The improvement plan's goal is to develop a balance between capital projects and system maintenance to achieve a highly reliable collection system for the lowest overall cost.

A series of field inspections were performed to collect information on the collection system. Limited source detection methods (including smoke testing, manhole inspections, maintenance calls, television inspection and topographic surveying) were used to identify collection system structural deficiencies. Wet weather flow monitoring and hydraulic modeling were performed to develop a listing of hydraulic deficiencies. Projects were developed and prioritized based on the deficiencies and capital costs that were prepared. Methods for financing the recommended improvements are also included in the study.

The County maintains and operates nine noncontiguous sewer districts containing approximately 130 miles of sewer mains. The sewer districts are:

1. Burlingame Hills Sewer Maintenance District
2. Crystal Springs County Sanitation District
3. Devonshire County Sanitation District
4. Emerald Lake Heights Sewer Maintenance District
5. Fair Oaks Sewer Maintenance District
6. Harbor Industrial Sewer Maintenance District
7. Kensington Square Sewer Maintenance District
8. Oak Knoll Sewer Maintenance District
9. Scenic Heights County Sanitation District

The FOSMD is located on the San Francisco Peninsula in the area roughly bounded by Canada Road in the south, Charter Street and Shelby Lane in the west, the San Francisco Bay in the north and Atherton Avenue and Marsh Court in the east.

Though the County has maintained and upgraded the collection system in the past, this work has been done without the benefit of master planning. This report provides a prioritized capital

improvement program along with recommended follow-up field investigations and potential funding mechanisms.

Authorization

The County authorized this work through an agreement with Brown and Caldwell dated December 17, 1996.

Scope of Work

The scope of work includes the following activities:

Assessment of Existing Sewer Systems. To develop a meaningful capital improvement program, it was necessary to determine the structural and hydraulic condition of the FOSMD collection system. Methods used to complete the evaluation included reviewing existing maps and records drawings, interviewing County maintenance workers and checking maintenance records, manhole inspections, wet weather flow monitoring, smoke testing and television inspection. Results from the flow monitoring program were used to develop wet weather hydrographs for use in the hydraulic model and determine which areas in the system had the highest infiltration/inflow rates.

Development of Sewer System Capital Improvement Plans. A listing of sewer system deficiencies were developed based on the sewer system assessment task. Capital projects were developed to correct each identified system deficiency. Capital projects were prioritized and estimated capital costs for each project were determined. Project priorities were reviewed with County staff and an annual schedule of required capital improvements were developed. A financial plan was developed to support the recommended projects. The financial plan includes financial alternatives and recommended sewer charges and revised connection fees, if any.

Data Management. Data generated during the study was entered into a series of Access databases for future use by the County. The databases will be submitted under separate cover to the County with the Master Plans.

Master Plan Report. Prepare a sewer system master plan report for the Fair Oaks District. The master plan report is supported by a series of technical memoranda prepared as part of the previous tasks. The master plan provides completed documentation of the recommended capital improvement projects as well as financing alternatives.

Report Format

This Master Plan report has been organized as a reference report, to the extent possible. Each section in the report consists of one to two pages of descriptive text followed by a data table, graphical figure, or both. This report has 15 sections roughly divided as follows:

- Sections 1 through 3 describe the current County system and operating procedures.
- Sections 4 through 9 describe the field work programs.
- Sections 10 and 11 summarize the hydraulic modeling work.
- Sections 12 through 15 describe the capital improvement program and funding mechanisms.

Technical memoranda and backup material are also provided in the appendices following the main body of the report as identified in the Table of Contents.

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SECTION 2

EXISTING SEWERS

The general physical characteristics of the Fair Oaks Sewer Maintenance District (FOSMD) sewer collection system are described in this section. These characteristics provide the basis for physical evaluation of the collection system and determine the system's ability to convey current and projected wastewater flows.

Description of Existing Facilities

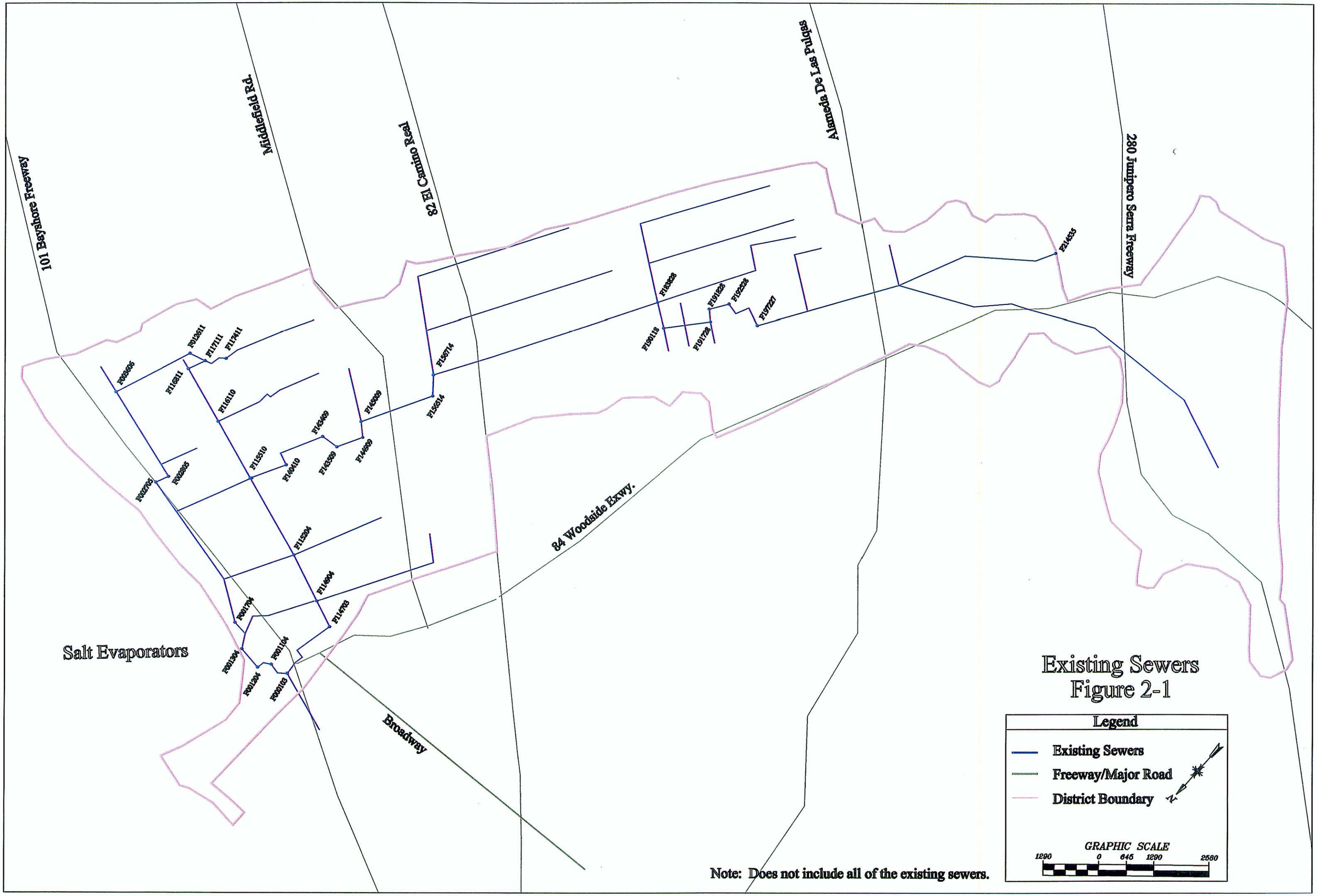
The FOSMD's sewer collection system is characterized as a gravity system. Sewage pumping stations are not required due to the topography in the service area. The collection system consists of approximately 54 miles of 6-inch to 33-inch-diameter vitrified clay and reinforced concrete pipeline. Most of the collection system has been constructed between the post World War II period and the present.

The primary trunk sewer in the FOSMD is a 10-inch to 33-inch-diameter sewer originating at the intersection of the Alameda De Las Pulgas and Woodside Road (Highway 84). The trunk sewer drains toward the San Francisco Bay along Woodside Road, Selby Lane, Berkshire Avenue, Oakside Avenue, Barron Avenue, Bay Road and terminates at the South Bayside Sewage Authority pumping station in Redwood City.

Manhole Number System

A manhole numbering scheme was developed to aid in data management. The manhole numbering system consists of an eight-digit alphanumeric code. The first letter identifies the District within the County (F for FOSMD). The next four numbers identify the manhole within the FOSMD. A single letter code follows and is used for manholes with duplicate numbers (typically infill manholes constructed by the County). The last two numbers in the code describe the County map number.

In 1996, a 10-inch-diameter relief was constructed near the intersection of Nimitz Avenue and Selby Lane. Brown and Caldwell field crews inspected the alignment of the new relief sewer. This information was used to update the system maps and was included in the development of the subsequent field inspection programs.



Existing Sewers
Figure 2-1

Legend

- Existing Sewers
- Freeway/Major Road
- District Boundary

GRAPHIC SCALE

1290 0 645 1290 2580

Note: Does not include all of the existing sewers.

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SECTION 3

SEWER OPERATION AND MAINTENANCE

Prior to beginning the physical inspection of the Fair Oaks Sewer Maintenance District (FOSMD), the current operation and maintenance procedures were reviewed. This section documents the results of that review.

Known Problem Areas

Areas of known problems within the sewer collection system were identified through discussions with County personnel and review of the FOSMD maintenance records. Problem areas were identified by line blockages from roots and grease accumulations or sewer sags. The collection systems are on a cleaning frequency of once per year minimum and can range up to four times per year based on collection system call outs. Problems associated with flat sewers are not found in the FOSMD due to the relatively steep topography in the service area. There are no known manholes or pipelines with hydrogen sulfide corrosion problems.

Several approaches are available for addressing sewer maintenance problems. Grease problems are addressed by controlling grease discharges from commercial establishments by requiring grease traps and having an enforcement program to ensure that they function properly. Grease can accumulate at sags, areas with flat slopes, roots, and offset joints in sewers. Grease problems in residential areas are addressed by increased maintenance (hydroflushing of the sewer to flush the grease accumulation downstream).

Root problems are typically addressed by using an undersized root cutter, typically a 4-inch-diameter cutter for a 6-inch sewer. The County maintenance crews prefer to use an undersized cutter to prevent damage to the pipeline. Roots can also be addressed by chemical foam application to kill the roots. Application and reapplication is typically required on a 1- to 3-year cycle. The County has recently started using chemical root treatment in the Burlingame Hills Sewer Maintenance District.

Accumulations of rocks and gravel in the sewer line can be an indicator of broken pipe in the system. Television inspection should be performed in these areas to look for pipes in bad condition. A listing of the maintenance "hot-spots" for sewer laterals in the system requiring callouts more than twice a year is provided in Table 3-1. Sewer mains requiring two or more callouts per year are summarized in Table 3-2. A description of the problem is also provided. This listing was used to develop the collection system physical inspection programs described in the following sections.

Table 3-1. Callout Summary for Sewer Laterals

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
288	01st Ave	1991	xx				
341	01st Ave	1985				x	Permit 0687
462	01st Ave	1997					No cleanout
202	02nd Ave	1993			x		4-apt. complex w/3 downstairs
308	02nd Ave	1996					Connection completed, but never inspected.
412	02nd Ave	1994	xx				
491	02nd Ave	1993					"T"-cleanout
623	02nd Ave	1977					Lateral replaced
642	02nd Ave	1985			xx		Off-set
677	02nd Ave	1986					Mud; Flat line (on County side)
681	02nd Ave	1993					Bad spot, needs repair; Permit 2291
780	02nd Ave	1986				x	Cleanout OK
837	02nd Ave	1992	x				Cleanout too far back of P/L
901	02nd Ave	1994					No cleanout
349	03rd Ave	1978					Lateral OK
364	03rd Ave	1985	xx				
393	03rd Ave	1984					Mud
441	03rd Ave	1987					No cleanout
481	03rd Ave	1994		x			Permit 2414
500	03rd Ave	1984					"T"-cleanout
605	03rd Ave	1978					No cleanout, Lateral OK
686	03rd Ave	1985	xxx				
687	03rd Ave	1988	x		x		
724	03rd Ave	1978					No cleanout, Lateral OK
747	03rd Ave	1980					No cleanout
902	03rd Ave	1990	x				Wire/plastic sticks in lateral
936	03rd Ave	1980					No cleanout
977	03rd Ave	1986					No cleanout
200	04th Ave	1980			xx		Lateral OK
217	04th Ave	1976					No cleanout
248	04th Ave	1984					Permit 0508
327	04th Ave	1995					No cleanout
390	04th Ave	1994					No cleanout
410	04th Ave	1986					"T"-cleanout
435	04th Ave	1985					No cleanout
451	04th Ave	1995					No cleanout
493	04th Ave	1985					Lateral OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
556	04th Ave	1985					No cleanout
611	04th Ave	1980	x				Lateral OK
911	04th Ave	1985	x				Cleanout OK
956	04th Ave	1979	x				Lateral OK
971	04th Ave	1984					Lateral OK
55	05th Ave	1986					Permit 1294
234	05th Ave	1979					Permit 0201
356	05th Ave	1985			x		Lateral OK
421	05th Ave	1991	x		x		
435	05th Ave	1995					Permit 2583
452	05th Ave	1978	xx				
491	05th Ave	1985			x		Lateral OK
598	05th Ave	1977	x				Lateral OK
916	05th Ave	1980					Lateral OK
1004	05th Ave	1994	x	x			Non-std. 3" cleanout; Permit 2436
1012	05th Ave	1984	xx				
1018	05th Ave	1993	xx				
1091	05th Ave	1995					Permit 2610
413	06th Ave	1992	xx				
422	06th Ave	1993	x		x		
434	06th Ave	1984	xx				
467	06th Ave	1995	xx				Lateral OK
500	06th Ave	1984	xxx				
501	06th Ave	1995	xx				Off-set wye
507	06th Ave	1992	x				Lateral roots
545	06th Ave	1992					No cleanout
553	06th Ave	1979	x		x		Lateral OK
573	06th Ave	1979					Permit 0221
585	06th Ave	1996	xx				
737	06th Ave	1979					Lateral OK
797	06th Ave	1992					No cleanout
816	06th Ave	1992	x				Lateral OK
828	06th Ave	1986	x				No cleanout
832	06th Ave	1980	x				Lateral OK
957	06th Ave	1976	x		x		
958	06th Ave	1985	x				Broken lateral
406	07th Ave	1992					Permit 2294
411	07th Ave	1987	xx		x		
435	07th Ave	1993	xx				Lateral OK
466	07th Ave	1996					No cleanout
524	07th Ave	1995	xx				
545	07th Ave	1988					Cleanout OK
560	07th Ave	1985	xx		xx		
580	07th Ave	1992	x		x		
700	07th Ave	1978			x		Permit 0121
726	07th Ave	1987	x				Cleanout OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
797	07th Ave	1979					
835	07th Ave	1978	x				Lateral OK
908	07th Ave	1993	x				"T"-cleanout
911	07th Ave	1995			x		Off-set
919	07th Ave	1984					
943	07th Ave	1980					Lateral OK
951	07th Ave	1992			x		Lateral OK
958	07th Ave	1992					No cleanout
959	07th Ave	1991					"T"-C/O under fence
410	08th Ave	1979			x		Broken lateral
412	08th Ave	1995	x				Off-set
433	08th Ave	1987			x		Lateral OK
475	08th Ave	1996					No cleanout
479	08th Ave	1977	xx				
483	08th Ave	1996					No cleanout
543	08th Ave	1979					No cleanout
717	08th Ave	1978					No cleanout, Cat droppings
816	08th Ave	1992					Permit 2199
903	08th Ave	1986	x		x		Off-set
907	08th Ave	1993	x		xx		
911	08th Ave	1991	x		x		
915	08th Ave	1993					"T"-cleanout
933	08th Ave	1984			xx		
962	08th Ave	1978					Lateral OK
975	08th Ave	1996					No cleanout
1000	08th Ave	1996			x		Mud; Broken pipe (Needs repair)
1012	08th Ave	1986	x		x		
1016	08th Ave	1987	x		x		
1020	08th Ave	1992	xx				
1049	08th Ave	1986	x				Lateral OK
407	09th Ave	1992	xx				
409	09th Ave	1990	x		x		
417	09th Ave	1993	x				Lateral OK
436	09th Ave	1986	x		x		
444	09th Ave	1992	x		x		
454	09th Ave	1980				x	Permit 0231
458	09th Ave	1980				x	Permit 0256
481	09th Ave	1988				xx	
485	09th Ave	1986				x	Permit 1282
492	09th Ave	1994	x				Permit 2411 & 2502
515	09th Ave	1996	xx		x		
525	09th Ave	1991			xx		Lateral OK
569	09th Ave	1978	x				No cleanout
583	09th Ave	1994					No cleanout
655	09th Ave	1996	x				

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
679	09th Ave	1995					No cleanout
775	09th Ave	1994					No cleanout
815	09th Ave	1980				x	No cleanout
824	09th Ave	1992	x				Lateral OK
506	10th Ave	1992	x		x		
658	10th Ave	1987	xx				
840	10th Ave	1987					No cleanout
904	10th Ave	1987	xxx				Lateral OK
958	10th Ave	1985	xx		x		
1006	10th Ave	1985	x		x		
1016	10th Ave	1995					No cleanout
1028	10th Ave	1987	x		xxx		
1032	10th Ave	1986					"T"-cleanout
1044	10th Ave	1994	xx				
1057	10th Ave	1994					Permit 2462
1074	10th Ave	1995	xx		x		
1075	10th Ave	1996	x		x		
1081	10th Ave	1987	xx				
1096	10th Ave	1975					No cleanout, Lateral OK
1098	10th Ave	1980	x	x			Lateral OK
624	11th Ave	1991	x		x		
658	11th Ave	1996	xx		x		
666	11th Ave	1988	x				Cleanout OK
674	11th Ave	1995	xx				Lateral roots
742	11th Ave	1993	x				Lateral OK
650	12th Ave	1980	x				Cleanout OK
668	12th Ave	1993					Permit 2324
725	12th Ave	1981	xxx				
803	12th Ave	1992	xx				Lateral OK
609	14th Ave	1994					"T"-cleanout
635	14th Ave	1991	x		x		
731	14th Ave	1994					"T"-cleanout
820	14th Ave	1984	xx				Roots
822	14th Ave	1991					Permit 2054
823	14th Ave	1990	xxx				Lateral & main OK
827	14th Ave	1991					No cleanout
832	14th Ave	1991	x				
836	14th Ave	1994	x				"T"-cleanout
839	14th Ave	1992	x		x		Lateral OK
843	14th Ave	1991	x				"T" cleanout
848	14th Ave	1995	xx		x		
856	14th Ave	1978			xx		
863	14th Ave	1996	xx				
484	15th Ave	1977					Lateral OK
604	15th Ave	1991					No cleanout
722	15th Ave	1987					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
755	15th Ave	1980					No cleanout
803	15th Ave	1979					Permit 0248
811	15th Ave	1991					No cleanout
832	15th Ave	1991					
843	15th Ave	1994					Permit 2426
883	15th Ave	1993					Permit 2361
888	15th Ave	1991					No cleanout
912	15th Ave	1991					Cleanout beyond P/L
915	15th Ave	1991					No cleanout; tied to manhole
948	15th Ave	1992	x		x		
973	15th Ave	1993	x		x		Needs repair
1004	15th Ave	1984	x			x	
1028	15th Ave	1996			xx		
1031	15th Ave	1979					Broken lateral
1040	15th Ave	1986					Flat line
1044	15th Ave	1980	x				No cleanout
662	16th Ave	1978	xx				
682	16th Ave	1979	xx				
731	16th Ave	1992	xx				
739	16th Ave	1986	xx				
771	16th Ave	1979	xx				
807	16th Ave	1992					Permit 2288
812	16th Ave	1986					Cleanout OK
1009	16th Ave	1978					Cleanout repaired
1014	16th Ave	1992	xx		x		
1020	16th Ave	1985	x			xx	
1021	16th Ave	1987	xx				
1024	16th Ave	1991	x		x		
1026	16th Ave	1992	x				Broken pipe; needs repair
1027	16th Ave	1979					Lateral OK
1031	16th Ave	1980	xx		x		
1038	16th Ave	1996	x				Lateral OK
669	17th Ave	1993					No cleanout
691	17th Ave	1980	xx				
754	17th Ave	1987					No cleanout
789	17th Ave	1991	x				
803	17th Ave	1987			xx		Lateral OK
824	17th Ave	1996	x				Lateral OK
1022	17th Ave	1994	xx				
1025	17th Ave	1994					C/O too far into property
1027	17th Ave	1977			x		No cleanout
1034	17th Ave	1991	x		x		
1049	17th Ave	1978	x				Lateral OK
1061	17th Ave	1992	x				Permit 2300

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
1066	17th Ave	1993					Permit 2303
1081	17th Ave	1994			xx		Permit 2430
1107	17th Ave	1995	xx				
1108	17th Ave	1986	xx				Off-set
1111	17th Ave	1991	x		xx		
1115	17th Ave	1991			x		Lateral "combo"
1116	17th Ave	1995	xx				
1119	17th Ave	1979	x				Lateral OK
1123	17th Ave	1988	xx				
1124	17th Ave	1993	xx		x		
1128	17th Ave	1994	xx				
1135	17th Ave	1994	xx				
1136	17th Ave	1985					No cleanout
1139	17th Ave	1980			x	x	Permit 0267
1140	17th Ave	1978	xx				
1143	17th Ave	1986		x	x		Off-set
1144	17th Ave	1975	x				Lateral OK
1148	17th Ave	1996	xx				
1151	17th Ave	1995	xx				
1152	17th Ave	1995	xx		x		
1156	17th Ave	1994	xx				
1159	17th Ave	1985	xx				Off-set
1160	17th Ave	1992	xx				
1163	17th Ave	1994	x		x		Offset
832	18th Ave	1993					Permit 2350
838	18th Ave	1991	x				
1125	18th Ave	1979					"T"-cleanout
1132	18th Ave	1996					"T"-cleanout. Letter sent.
1185	18th Ave	1993					Permit 2352
24	Adam Wy	1977					No cleanout
57	Adam Wy	1980					Lateral OK
76	Adam Wy	1984	x				Lateral OK
81	Adam Wy	1980					No cleanout
2187	Alameda de las Pulgas	1979					Permit 0207
107	Alexander Ave	1978	x				Lateral OK
127	Alexander Ave	1984			x		Lateral OK
162	Alexander Ave	1986			xxxx		
171	Alexander Ave	1980					Lateral OK
185	Alexander Ave	1978	xx		x		Lateral OK
202	Alexander Ave	1980		x		x	Permit 0301
203	Alexander Ave	1996	xx				
211	Alexander Ave	1993	x				No box & may need to extend riser 3-4'. Letter sent.
270	Alexander Ave	1991	xxx				
301	Alexander Ave	1990	xx				

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
308	Alexander Ave	1996	xx				
309	Alexander Ave	1986	x				No cleanout
316	Alexander Ave	1990	x				Lateral & main OK
324	Alexander Ave	1992	xxx				
330	Alexander Ave	1996	xx				
331	Alexander Ave	1990	xx				
335	Alexander Ave	1992	x		x		
340	Alexander Ave	1996	xx		x		Offset
341	Alexander Ave	1987			xx		Cleanout OK
346	Alexander Ave	1992	xx		x		
347	Alexander Ave	1984	x				Lateral OK
350	Alexander Ave	1993	x				3" PVC riser & no box
356	Alexander Ave	1996	x		x		Lateral OK
363	Alexander Ave	1985	xx				Cleanout OK
370	Alexander Ave	1994	xx		x		Offset
57	Almendral Ave	1984	x				Lateral OK
75	Almendral Ave	1978					No cleanout
90	Almendral Ave	1976	x				Lateral OK
162	Almendral Ave	1984	x				Lateral OK
160	Alta Mesa Rd	1985	xx				
188	Alta Mesa Rd	1988					Cleanout OK
36	Amador Ave	1994	x				
43	Amador Ave	1979					Permit 0228
41	Amherst Ave	1985	xx				
1205	Annette Ave	1993	x	x			Unable to open cleanout
115	Arbor Ct	1992	x		x		Lateral OK
21	Arrowhead Ln	1980	x				Also 23 Arrowhead Ln; No cleanout
36	Arrowhead Ln	1991	xx		xx		
40	Arrowhead Ln	1994					No cleanout
64	Arrowhead Ln	1978			x		No cleanout
4	Arthur Ln	1991					No cleanout
7	Athlone Ct	1991	x				Combo
8	Athlone Ct	1996					Lateral OK
11	Athlone Ct	1995	x				Permit 2603
58	Austin Ave	1978	xx				No cleanout
249	Austin Ave	1980	x				Lateral OK
1855	Barton St	1993	xx				
1862	Barton St	1985	x				Lateral OK
2440	Bay Rd	1978					No cleanout
3091	Bay Rd	1994					Non-std. Cleanout
3411	Bay Rd	1980	xx		x		
3420	Bay Rd	1991	xxx				Combo cleanout
3437	Bay Rd	1978	x	x			Lateral OK, Flat slope

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
3445	Bay Rd	1996					Broken pipe
3451	Bay Rd	1996			xx		
3561	Bay Rd	1991					No cleanout; main OK
3569	Bay Rd	1977					No cleanout
123	Belmont Ave	1987	xx				
131	Belmont Ave	1988			x		Off-set; Permit 1674
231	Belmont Ave	1991	xxx				
275	Belmont Ave	1979			xx		
329	Belmont Ave	1992	x		x		Lateral OK
331	Belmont Ave	1987	xx				
389	Belmont Ave	1995					No cleanout
391	Belmont Ave	1984			xx		Lateral OK
138	Beresford Ave	1991	xx				
153	Beresford Ave	1980					Permit 0269
155	Beresford Ave	1987	x		x		
222	Beresford Ave	1980	xx				
234	Beresford Ave	1990	x				Lateral OK
237	Beresford Ave	1993					Permit 2348
238	Beresford Ave	1977	x				Lateral OK
262	Beresford Ave	1990	xx				
306	Beresford Ave	1980					Lateral OK
381	Beresford Ave	1979	xx				
415	Beresford Ave	1978	x	x	x		
560	Beresford Ave	1995					No cleanout
57	Berkshire Ave	1978					Permit 0082
304	Berkshire Ave	1993	x				Lateral OK
2707	Blenheim Ave	1978					No cleanout
2740	Blenheim Ave	1993					"T"-cleanout. Letter sent.
2789	Blenheim Ave	1984	x		x		
2799	Blenheim Ave	1991	xx				
2872	Blenheim Ave	1980			xx		
2877	Blenheim Ave	1987	x				Permit 1367
28	Broadway	1975					No cleanout
43	Broadway	1985			x	x	
57	Broadway	1979			x	x	Also 59 Broadway; broken lateral
118	Broadway	1979					Also 120 Broadway; laterals OK
132	Broadway	1993					No cleanout
134	Broadway	1994					No cleanout
595	Broadway	1979					Permit 0242
899	Broadway	1984			x		"T"-cleanout
939	Broadway	1985			xx		
1185	Broadway	1986				x	Permit 1040
95	Buckingham Ave	1985			xx		Off-set

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
130	Buckingham Ave	1991					Lateral & main OK
180	Buckingham Ave	1985	x		xx		Lateral repair
197	Buckingham Ave	1991	x				Permit 1756
401	Buena Vista Ave	1985			x		No cleanout
430	Buena Vista Ave	1984			x		Lateral OK
439	Buena Vista Ave	1977	x				Wrong cleanout
454	Buena Vista Ave	1986	x				Cleanout OK (needs box)
486	Buena Vista Ave	1990	xx				
532	Buena Vista Ave	1991			xx		
34	Burbank Ave	1996	xx		x		
1105	Canada Rd	1984				x	Permit 0477
1107	Canada Rd	1984				xx	Permit 0455
2	Carolina Ln	1992	xx				
94	Cebalo Ln	1993	x				Cleanout installed w/out permit
97	Cebalo Ln	1996	x				No cleanout (Connected to manhole)
150	Cerrito Ave	1977	x				Lateral OK
166	Cerrito Ave	1984				x	Permit 0459
263	Cerrito Ave	1978	x				
624	Charter St	1984	xxx				
628	Charter St	1986	xx				
708	Charter St	1992	x		x		
712	Charter St	1992	xx				
732	Charter St	1977	x				Lateral OK
934	Charter St	1985					No Cleanout
60	Churchill Ave	1984					Broken lateral
37	Columbia Ave	1979	x		x		
132	Columbia Ave	1978	xx				
146	Columbia Ave	1994	x				Lateral OK
190	Columbia Ave	1986					Permit 1423
197	Columbia Ave	1993					No cleanout
2820	Crocker Ave	1977			xx		Wax
2825	Crocker Ave	1984				x	Permit 0484
121	Croydon Wy	1995					Permit 2516
2819	Curtis Ave	1990					No cleanout
2	Delmar Ct	1991	x				Permit 2158
3	Delmar Ct	1993					No cleanout
5	Delmar Ct	1980	x				No cleanout
2795	Devonshire Ave	1991					No cleanout
30	Dexter Ave	1978	xx	x	x		No cleanout
33	Dexter Ave	1976	xx				No cleanout
111	Dexter Ave	1992					No cleanout
144	Dexter Ave	1991	xx				
1036	Dodge Dr	1984					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
1044	Dodge Dr	1992	xx				
1062	Dodge Dr	1992					Off-set
424	Douglas Ave	1992	x	x			
505	Douglas Ave	1994	xx				
511	Douglas Ave	1990	xx				
527	Douglas Ave	1979	x				Lateral OK
528	Douglas Ave	1990	x				
533	Douglas Ave	1986	x				Cleanout OK
536	Douglas Ave	1995	x	x			
538	Douglas Ave	1994					No cleanout
565	Douglas Ave	1995	xx		x		
570	Douglas Ave	1986					Lateral OK
575	Douglas Ave	1988	x				Needs repair
587	Douglas Ave	1977			x		Lateral OK
609	Douglas Ave	1979			x		"T"-cleanout
616	Douglas Ave	1985					No cleanout
632	Douglas Ave	1988	x		x		
676	Douglas Ave	1979	x				Cleanout cemented
817	Douglas Ave	1992			xx		
1325	Douglas Ave	1987	x		x		Lateral OK
110	Dumbarton Ave	1996					No cleanout
111	Dumbarton Ave	1987	x				Cleanout OK
166	Dumbarton Ave	1994	xx				3" Tee-cleanout too far into property
186	Dumbarton Ave	1986	x				Cleanout OK
205	Dumbarton Ave	1985			xx		
224	Dumbarton Ave	1991	x		x		Improper cleanout
228	Dumbarton Ave	1985		x			Lateral OK
239	Dumbarton Ave	1985		x	xx		
305	Dumbarton Ave	1992			x		No cleanout
325	Dumbarton Ave	1985	x		x		
339	Dumbarton Ave	1980			x		"T"-cleanout
348	Dumbarton Ave	1984					No Cleanout
450	Dumbarton Ave	1980		x			Lateral OK
1709	E Bayshore Rd	1987				xxx	
1715	E Bayshore Rd	1984				x	Permit 0487
1903	E Bayshore Rd	1977	xx				
2003	E Bayshore Rd	1984				xx	
3274	Edison Wy	1987	xx		x		
3475	Edison Wy	1991			x		Permit 2058
330	El Camino Real	1978				x	Permit 0190
2857	El Camino Real	1995					No cleanout
139	Eleanor Dr	1995	x				Lateral OK
140	Eleanor Dr	1995	x				Lateral OK
169	Eleanor Dr	1987	xx				Lateral OK
380	Eleanor Dr	1992	xx				
418	Eleanor Dr	1985	x				Cleanout OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
485	Eleanor Dr	1994	x				"T"-cleanout; Permit 2478
54	Encina Ave	1992	x				No cleanout
431	Encina Ave	1978	x				No cleanout
544	Encina Ave	1985				x	Permit 0524
25	Euclid	1996	xx				
1	Euclid Ave	1986	x				Cleanout OK
2	Euclid Ave	1985	x			x	Permit 0973
25	Euclid Ave	1980	x				Lateral OK
53	Euclid Ave	1975	x				Lateral OK
68	Euclid Ave	1985	x				Permit 0528
29	Eugenia Ln	1977					No cleanout
2961	Fair Oaks Ave	1991					Permit 2160
2969	Fair Oaks Ave	1986	xx				
3637	Fair Oaks Ave	1975					Lateral OK
3915	Fair Oaks Ave	1986	xx				
4104	Fair Oaks Ave	1990					No cleanout
4112	Fair Oaks Ave	1988			x		Cleanout OK
4120	Fair Oaks Ave	1980	x				Lateral OK
4123	Fair Oaks Ave	1984	xx				Lateral OK
4201	Fair Oaks Ave	1975					Lateral OK
4205	Fair Oaks Ave	1993					No cleanout
2	Fleur Pl	1993	x		x		Mud; to be televised
3703	Florence	1996	x	x			Offset at ML
3609	Florence St	1978					No cleanout
3615	Florence St	1992					Permit 2238
3703	Florence St	1987		x	x		Flat line
3719	Florence St	1978			xx		
511	Flynn Ave	1988					No cleanout
518	Flynn Ave	1975	x				Lateral OK
530	Flynn Ave	1992					Permit 2211
536	Flynn Ave	1984	xxx				No cleanout
539	Flynn Ave	1979	x				No cleanout
547	Flynn Ave	1991	x				No cleanout
548	Flynn Ave	1979	x				Lateral OK
551	Flynn Ave	1987	xx				
559	Flynn Ave	1984	x				Lateral OK
606	Flynn Ave	1984	x				Lateral repair
618	Flynn Ave	1975					No cleanout
627	Flynn Ave	1990	xx				
635	Flynn Ave	1991	x				No cleanout
1	Friendly Ct	1986					No cleanout
4	Friendly Ct	1978					No cleanout
7	Friendly Ct	1993					Permit 2320
2945	Glendale Ave	1996					"T"-cleanout
2951	Glendale Ave	1995					Permit 2565 & 2609
3031	Glendale Ave	1996					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
3250	Glendale Ave	1987					Permit 1385
3350	Glendale Ave	1977				x	Permit 0087
3391	Glendale Ave	1977				x	Permit 0086
232	Glenwood Ave	1992					Permit 2280
2145	Greenways Dr	1994					Permit 2412
2170	Greenways Dr	1986	xxx				
2185	Greenways Dr	1993	xx				
8	Greenwood Ln	1992	x				No cleanout
22	Greenwood Ln	1979					No cleanout
26	Greenwood Ln	1987	x				Lateral OK
28	Greenwood Ln	1985	xx				
34	Greenwood Ln	1980	x				No cleanout
80	Gresham Ln	1986					Cleanout OK
97	Gresham Ln	1985	xx				
2825	Halsey Ave	1985				x	Lateral OK
2835	Halsey Ave	1985					Permit 0456
653	Hampshire Ave	1980				x	Permit 0262
677	Hampshire Ave	1991					Lateral OK
919	Haven Ave	1985	xx				Off-set
925	Haven Ave	1987	x				Cleanout OK
930	Haven Ave	1980			xx		
947	Haven Ave	1985	x				Flooded
955	Haven Ave	1986					Cleanout OK
959	Haven ave	1996					Mud; Offset, Needs repairs
960	Haven Ave	1987	x				Lateral OK
961	Haven Ave	1981					Lateral OK
972	Haven Ave	1990					Lateral OK
1020	Haven Ave	1979	x				Lateral OK
1049	Haven Ave	1988					No cleanout
1055	Haven Ave	1979	x				Lateral OK
1056	Haven Ave	1991	xxx				
1076	Haven Ave	1996	x				Non-standard P/L C/O
1079	Haven Ave	1987	x		x		
1087	Haven Ave	1980	x				Lateral OK
1093	Haven Ave	1995			xx		
1115	Haven Ave	1979	xx				
2040	Helena Wy	1986	xx				
2050	Helena Wy	1992					No cleanout
2065	Helena Wy	1986					Lateral OK
15	Hillary Ln	1996					No cleanout
116	Hillside Dr	1991	x				No cleanout; main OK
120	Hillside Dr	1986	xx				
428	Hillside Dr	1992	x				Lateral OK
515	Hillside Dr	1992					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
1202	Himmel Ave	1992	x				Lateral OK
3017	Hoover St	1975					No cleanout, Lateral OK
3058	Hoover St	1987					No cleanout
3065	Hoover St	1994	xx				
3109	Hoover St	1985			x		Broken lateral
3117	Hoover St	1987					
3212	Hoover St	1994					"T"-cleanout
3230	Hoover St	1993					No cleanout
3238	Hoover St	1979					No cleanout
3255	Hoover St	1994	x				"T"-cleanout
3324	Hoover St	1986	x		x		
3413	Hoover St	1985				x	No cleanout
3443	Hoover St	1994					No cleanout
3449	Hoover St	1992			xxx		
3462	Hoover St	1991	xx		x		
3491	Hoover St	1985			x		Lateral OK
3497	Hoover St	1986	xx				Mud & needs repair
3507	Hoover St	1986	x				No cleanout
3530	Hoover St	1992	xx				
3597	Hoover St	1984			x		Lateral OK
3736	Hoover St	1990					Flat line
1753	Hull Ave	1980					No cleanout
1872	Hull Ave	1990	x		x		Mud (Needs repair)
1879	Hull Ave	1990	x				Lateral OK
1931	Hull Ave	1991	xx				
2030	Hull Ave	1995					Permit 2490
2830	Huntington Ave	1985			x		Cleanout OK
2843	Huntington Ave	1993					No cleanout
421	Hurlingame Ave	1986				xx	Inspection OK (needs box)
444	Hurlingame Ave	1979					Rocks, Broken lateral
500	Hurlingame Ave	1980	x		x		Replaced cleanout
528	Hurlingame Ave	1979	xx				
586	Hurlingame Ave	1979	xx				
610	Hurlingame Ave	1991	xx				Bad spot in line
644	Hurlingame Ave	1975				x	
660	Hurlingame Ave	1995	xx		x		
668	Hurlingame Ave	1984					Permit 0450
744	Hurlingame Ave	1990	xx				
750	Hurlingame Ave	1975		x			"T" cleanout
31	Inyo Pl	1980	x				Lateral OK
70	Inyo Pl	1980		x			No cleanout
1029	Jones Ct	1993					No cleanout
1050	Jones Ct	1987					Lateral OK
1063	Jones Ct	1986					No cleanout
870	Kaynyne Ave	1984			xx		No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
11	Kramer Ln	1994	x				Private main.
301	Lacour Wy	1985			x		Permit 0780
22	Lloyden Dr	1994					No cleanout
34	Lloyden Dr	1992	x				Lateral OK
53	Lloyden Dr	1977	x				No cleanout
69	Lloyden Dr	1991			xx		
17	Loyola Ave	1995					"T"-cleanout & too far back
21	Loyola Ave	1986				x	Permit 0925 & 0749
81	Loyola Ave	1978					No cleanout
120	Loyola Ave	1991					No cleanout
141	Loyola Ave	1979				x	No cleanout
150	Loyola Ave	1994	x				Lateral roots
430	MacArthur Ave	1987				x	Permit 1441
521	MacArthur Ave	1992	xx				
601	MacArthur Ave	1978					Lateral OK
661	MacArthur Ave	1991			x		Combo cleanout
666	MacArthur Ave	1995	x				Lateral OK
667	MacArthur Ave	1994					Combo cleanout. Letter sent.
678	MacArthur Ave	1987	xxx				
5	Malory Ct	1979				x	
139	Markham Ave	1994	x	x	x		Offset
161	Markham Ave	1991			xx		
2600	Marlborough Ave	1994			xx		
2625	Marlborough Ave	1978			xx		
44	Marymont Ave	1995					Lateral OK (Water problem)
56	Marymont Ave	1993	xx		x		Lateral OK
67	Marymont Ave	1992	xx		x		Lateral holds water; needs repair
70	Marymont Ave	1992	x				No cleanout
83	Marymont Ave	1992	x				Permit 2295
96	Marymont Ave	1977	x				Broken lateral
6	Meadow Ln	1993	x		x		Non-std. C/O (no riser & box)
7	Meadow Ln	1992					Permit 2204
12	Meadow Ln	1994	x		xx		
16	Meadow Ln	1995					Main & lateral OK
19	Meadow Ln	1991	xxx		x		Lateral & main OK
26	Meadow Ln	1990					Non-std. cleanout
38	Meadow Ln	1985	x		x		
76	Melanie Ln	1990	xx				Bad bend
3480	Michael Dr	1985	x				Lateral OK
2480	Middlefield Rd	1985				x	Permit 0555
2601	Middlefield Rd	1984					Lateral OK
2615	Middlefield Rd	1985					Mud, Lateral repair
3006	Middlefield Rd	1979					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
3017	Middlefield Rd	1978		x	x		Lateral OK
3041	Middlefield Rd	1985				x	Permit 0607
3102	Middlefield Rd	1980			xx		
3143	Middlefield Rd	1992		xxx			
3176	Middlefield Rd	1987		x	xx		
3200	Middlefield Rd	1991	x	x	xx		
3201	Middlefield Rd	1994					Permit 2481
3250	Middlefield Rd	1985				x	Permit 0493
3301	Middlefield Rd	1987		xx			
1090	Mills Wy	1986					Cleanout OK
1607	Montgomery Ave	1990					No cleanout
400	Montwood Cir	1984					Lateral OK
51	Mt Vernon Ln	1977					Lateral OK
2040	Nassau Dr	1979	xx				Lateral OK
2055	Nassau Dr	1979	xx				
45	Neuman Ln	1992					Lateral OK (repair on owner's portion)
5	Nimitz Ave	1987			xx		
110	Nimitz Ave	1985	xx		x		
114	Nimitz Ave	1985	xx				
115	Nimitz Ave	1978	x		x		
141	Nimitz Ave	1979	x		x		
146	Nimitz Ave	1991			xx		
171	Nimitz Ave	1990	xx				
179	Nimitz Ave	1979	x				Lateral OK
196	Nimitz Ave	1986	xx				
201	Nimitz Ave	1990	xx				
205	Nimitz Ave	1995	x				Lateral OK
210	Nimitz Ave	1977	xx				
231	Nimitz Ave	1979					Lateral OK
234	Nimitz Ave	1985	x				Lateral OK
235	Nimitz Ave	1986	xx				
255	Nimitz Ave	1994	xx				Combo
271	Nimitz Ave	1991	x				Lateral & main OK
301	Nimitz Ave	1995	x				Lateral OK
312	Nimitz Ave	1994	xx				
320	Nimitz Ave	1978	x				Lateral OK
334	Nimitz Ave	1987	xxx				
343	Nimitz Ave	1994					No cleanout
350	Nimitz Ave	1980	xx		x		
351	Nimitz Ave	1980	x				Lateral OK
362	Nimitz Ave	1980	xx				
363	Nimitz Ave	1985	xxx				
368	Nimitz ave	1979	x				Lateral OK
412	Nimitz Ave	1991					No cleanout
540	Nimitz Ave	1980	x				Lateral OK
541	Nimitz Ave	1987	xx				

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
1	Nora Wy	1980					Lateral OK
87	Nora Wy	1979					No cleanout
47	Normandy Ln	1984					No cleanout
128	Northgate	1996					No cleanout
20	Northumberland Ave	1993					No cleanout
190	Northumberland Ave	1984	x				Lateral OK
171	Nottingham Ave	1986	xxx				No cleanout
196	Nottingham Ave	1986	xx				
3504	Oak Dr	1993	x				No cleanout
3518	Oak Dr	1978	xx		x		
3527	Oak Dr	1990	xx				
3538	Oak Dr	1993					No cleanout
3701	Oak Dr	1985	xx				
81	Oakhaven Wy	1978	xx				
9	Odessa Ct	1990	x		xx		
150	Otis Ave	1993	x				Lateral OK
211	Pacific Ave	1984	x				Permit 0457
3006	Page St	1984	x				Lateral OK
3008	Page St	1978	x				No cleanout
3064	Page St	1986					Permit 1236
3100	Page St	1984	x		x		
3125	Page St	1980			xx		
3227	Page St	1975	x		x		
3308	Page St	1979	x				Lateral OK
3316	Page St	1986					No cleanout
3321	Page St	1976	x				Lateral OK
3342	Page St	1995	x		x		Bad wye
3346	Page St	1996	x				Lateral OK
3361	Page St	1979	x				Lateral OK
3416	Page St	1991	xx				
3435	Page St	1986	xxx				
3439	Page St	1996					No cleanout
3443	Page St	1990	x				No cleanout
3446	Page St	1990	x		xx		
3498	Page St	1993	xx				Can't open cleanout
3521	Page St	1987	xx				No cleanout
3523	Page St	1984				x	Lateral OK
3526	Page St	1977				x	
3533	Page St	1984	xx				
3603	Page St	1984	xx				
3703	Page St	1977	x				Lateral OK
3706	Page St	1980			x		Lateral OK
3716	Page St	1978	x		x		
3722	Page St	1987	xx				
3723	Page St	1980	x		x		Lateral OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
17	Parker Ave	1979	x				Lateral OK
28	Parker Ave	1984	x				Lateral OK
49	Parker Ave	1993	x		x		No cleanout
71	Parker Ave	1980	x				Lateral OK
79	Parker Ave	1977	x				Lateral OK
92	Patricia Dr	1980					Lateral OK
61	Placitas Ave	1995	x				Lateral OK
64	Placitas Ave	1984	x				Lateral OK
97	Placitas Ave	1984	xx				
98	Placitas Ave	1995	xx				
602	Placitas Ave	1992					Permit 2179
238	Polhemus Ave	1979	x		x		
243	Polhemus Ave	1985	x				Lateral OK
244	Polhemus Ave	1987	xx				
5	Quail Meadows Ct	1993					Lateral & main OK
23	Ralston Rd	1978					Lateral OK
67	Redwood Way	1996	x				
260	Ridgeway Rd	1980				x	Permit 0294
275	Ridgeway Rd	1985				x	Permit 0850
285	Ridgeway Rd	1984				x	Permit 0460
295	Ridgeway Rd	1980				x	Permit 0275
350	Ridgeway Rd	1979				x	Permit 0245
3048	Rolison Rd	1985					No cleanout
3272	Rolison Rd	1993					No cleanout
3592	Rolison Rd	1975		x			No cleanout
940	Rose Ave	1985					Cleanout OK
131	Rutherford Ave	1994					No cleanout
140	Rutherford Ave	1987	x		x		
174	Rutherford Ave	1991	xx				
182	Rutherford Ave	1986	xx				Cleanout OK
211	Rutherford Ave	1979	x				Lateral OK
218	Rutherford Ave	1994					Non-std. cleanout
219	Rutherford Ave	1995	xxx				
235	Rutherford Ave	1980	x				Lateral OK
241	Rutherford Ave	1991					Lateral OK
245	Rutherford Ave	1979					Cleanout OK
263	Rutherford Ave	1996					Permit 2662
270	Rutherford Ave	1994					"T"-cleanout
279	Rutherford Ave	1990					No cleanout
305	Rutherford Ave	1987	x		x		
306	Rutherford Ave	1981	x				No cleanout
308	Rutherford Ave	1985	x		x		
311	Rutherford Ave	1978	x		x		
317	Rutherford Ave	1985	xx				
318	Rutherford Ave	1985				x	Cleanout OK
321	Rutherford Ave	1990	x				
333	Rutherford Ave	1978	x				Lateral OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
335	Rutherford Ave	1986	x				Lateral OK
338	Rutherford Ave	1991	x	x	x		
341	Rutherford Ave	1991	x				Lateral & main OK
347	Rutherford Ave	1984	xxxx				
357	Rutherford Ave	1986	x				Cleanout OK
371	Rutherford Ave	1992	x		xx		
430	Rutherford Ave	1978					Lateral OK
450	Rutherford Ave	1978	x				Lateral OK
460	Rutherford Ave	1993					No cleanout
464	Rutherford Ave	1985	xx				
482	Rutherford Ave	1987	xx				
500	Rutherford Ave	1986					Cleanout OK
515	Rutherford Ave	1986					Cleanout OK
552	Rutherford Ave	1991	x				Lateral OK
550	San Benito Ave	1995					"T"-cleanout
612	San Benito Ave	1996					Permit 2668
680	San Benito Ave	1978	xx				
727	San Benito Ave	1980	xx				
731	San Benito Ave	1995					Permit 2574
739	San Benito Ave	1980					No cleanout
760	San Benito Ave	1991					Permit 2120
780	San Benito Ave	1991	x				Lateral roots
793	San Benito Ave	1994	xx				
138	San Carlos Ave	1993					Permit 2309
155	San Carlos Ave	1980					
359	San Carlos Ave	1984			x		Broken lateral
130	Santa Clara Ave	1984					Lateral OK
163	Santa Clara Ave	1979	x				Lateral OK
205	Santa Clara Ave	1981					Lateral OK
260	Santa Clara Ave	1993					No cleanout
276	Santa Clara Ave	1991					No cleanout
147	Santiago Ave	1976					No cleanout
162	Santiago Ave	1980	xx				
178	Santiago Ave	1978	xx				
235	Santiago Ave	1992			xx		
247	Santiago Ave	1975					Replaced lateral
255	Santiago Ave	1980	xx				
270	Santiago Ave	1992	x		xx		
278	Santiago Ave	1994	x				Ties to 270 Santiago
515	Scott Ave	1986	x				Lateral OK
535	Scott Ave	1991	xx				
566	Scott Ave	1994	x				No cleanout
606	Scott Ave	1986	x			x	
611	Scott Ave	1977	x				Cleanout repaired
647	Scott Ave	1991					Cannot service
702	Scott Ave	1980	x				No cleanout
43	Selby Ln	1979	x				Lateral OK

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
58	Selby Ln	1984	x		x		
132	Selby Ln	1996	x				
198	Selby Ln	1987	x				Cleanout OK
226	Selby Ln	1990	x		xx		
260	Selby Ln	1987					Cleanout OK
228	Semicircular Rd	1985					No cleanout
308	SEMICIRCULAR RD	1996	x				Mud
6	Sequoia Ave	1995			x		Broken at wye
206	Sequoia Ave	1995	xx		x		
259	Sequoia Ave	1996					No cleanout
265	Sequoia Ave	1993			xxx		Needs repair
283	Sequoia Ave	1986	x				No cleanout
286	Sequoia Ave	1985				xx	
301	Sequoia Ave	1979				xx	
311	Sequoia Ave	1994	x				Box too small
319	Sequoia Ave	1979	x				Roots
339	Sequoia Ave	1985	x		xx		"T"-cleanout
364	Sequoia Ave	1978					"T"-cleanout
388	Sequoia Ave	1984	xx				
391	Sequoia Ave	1979	xxx				
392	Sequoia Ave	1994	xx				
398	Sequoia Ave	1984			xx		
415	Sequoia Ave	1991	xx		xx		
445	Sequoia Ave	1995					Private sewer line.
463	Sequoia Ave	1987	xx				
475	Sequoia Ave	1979	xxx				
495	Sequoia Ave	1987	xx		x		
515	Sequoia Ave	1987			x		Lateral OK
575	Sequoia Ave	1980	x		x		
39	Shearer Dr	1984					Broken lateral
60	Shearer Dr	1977	xx				Lateral OK, but with roots
11	South Gate	1993					No cleanout
2412	Spring St	1978				x	Broken lateral
2428	Spring St	1996					No cleanout
2487	Spring St	1984				x	Permit 0443
2528	Spring St	1980	x		x		
2661	Spring St	1988					Permit 1710
2851	Spring St	1986			xxx		
3243	Spring St	1977	xx				
3244	Spring St	1978					No cleanout
3311	Spring St	1995	x		xx		Needs TV
3315	Spring St	1995					Lateral broken; "T"-cleanout
3340	Spring St	1991					Permit 2137
3348	Spring St	1996					No cleanout

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
3356	Spring St	1991					Permit 2151
3404	Spring St	1978					Lateral OK
3424	Spring St	1991					No cleanout
3511	Spring St	1993					Permit 2345
3552	Spring St	1991					Permit 2176
24	St Mary's Pl	1991					
30	St Mary's Pl	1987	x				No cleanout
36	St Mary's Pl	1991					Lateral OK
42	St Mary's Pl	1996	x				No cleanout
48	St Mary's Pl	1996					Holds water; needs TV
60	St Mary's Pl	1978	x		x		
501	Stanford Ave	1980	xx		x		
517	Stanford Ave	1987	x				Flat line
523	Stanford Ave	1991	xx				Mud
550	Stanford Ave	1986	xx				
565	Stanford Ave	1992	xx		x		
570	Stanford Ave	1987	xxx		xxxxxxx		Lateral OK
575	Stanford Ave	1993					Non-std. Cleanout
612	Stanford Ave	1978	x		x		No cleanout
625	Stanford Ave	1975					Lateral OK
71	Stockbridge Ave	1987	xx				
99	Stockbridge Ave	1980	x				No cleanout
269	Stockbridge Ave	1978	x				No cleanout
283	Stockbridge Ave	1979	x				No cleanout
1250	Stockbridge Ave	1986					Cleanout OK
1520	Stockbridge Ave	1980	x				Lateral OK
1540	Stockbridge Ave	1995	xx				
1690	Stockbridge Ave	1991	x		x		
1946	Stockbridge Ave	1994	x		x		
2010	Stockbridge Ave	1978					Lateral OK
2124	Stockbridge Ave	1990	xx				
2154	Stockbridge Ave	1986	xx				
2280	Stockbridge Ave	1994	xx				
820	Sweeney Ave	1987				x	Permit 1400
128	Toyon Ct	1986	x				Cleanout OK
42	Tuscaloosa Ave	1994					Permit 2408 & 2416
116	Tuscaloosa Ave	1992	x				Cleanout OK
142	Tuscaloosa Ave	1978	x				Lateral OK
153	Tuscaloosa Ave	1979	x	x			
196	Tuscaloosa Ave	1979	x				Lateral OK
1218	W Selby Ln	1980					Permit 0280
1330	W Selby Ln	1995	xx		x		Lateral offset
1414	W Selby Ln	1993	x				Homeowner problem
1514	W Selby Ln	1991	x				Permit 2123
1615	W Selby Ln	1978	x				Lateral OK
1645	W Selby Ln	1988					Permit 1653

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
1655	W Selby Ln	1991	xx				
1764	W Selby Ln	1987			xx		
2125	Ward Wy	1993					No cleanout
2135	Ward Wy	1975	x				Broken lateral
512	Warrington Ave	1980			xx		
536	Warrington Ave	1985	x		x		
537	Warrington Ave	1984					Lateral OK
583	Warrington Ave	1980			xx		
660	Warrington Ave	1980	x				Repair lateral
670	Warrington Ave	1991			xx		
697	Warrington Ave	1994			x		Cleanout too far back
757	Warrington Ave	1986			x		Cleanout OK
15	Wayne Ct	1987					Combo cleanout
23	Wayne Ct	1995					No cleanout
2776	Westmoreland Ave	1978				x	No cleanout
91	Wilburn Ave	1987	x				Cleanout OK
3041	William Ave	1978	xx				
3071	William Ave	1987			x		Off-set
3150	William Ave	1993					Lateral OK
820	Willow St	1984					Permit 0499
1235	Woodside Rd	1993	x				No cleanout
2105	Woodside Rd	1992	x		xx		
2155	Woodside Rd	1979					Repair (lateral damaged by PG&E)
2165	Woodside Rd	1987	x				Mud
1	Yarnall Ct	1996	x				
10	Yarnall Pl	1979					No cleanout
20	Yarnall Pl	1985	x		x		
24	Yarnall Pl	1990	x				Lateral OK
28	Yarnall Pl	1978	xx		x		Lateral OK

Table 3-2. Callout Summary for Sewer Mains

Street Number	Street Name	Year	Reason for Callout				
			Roots	Grease	Paper	Inspection	Comment
902	03rd Ave	1986	xx				
389	04th Ave	1985		xxx			
1076	08th Ave	1993		x	x		
615	11th Ave	1979	xx				
819	15th Ave	1987	xx				
98	Cebalo Ln	1991	xx				
193	Dumbarton Ave	1986		x			Sticks
305	Dumbarton Ave	1990		xx			
3515	Edison Wy	1985				xx	
2671	El Camino Real	1993					Plugged & Mud and bad spot
2907	El Camino Real	1978		xxx			
2907	El Camino Real	1985		x	x		
231	Glenwood Ave	1985					Broken main (by contractor) & Main repair
3491	Hoover St	1986	xx				Flooding
3748	Hoover St	1993	x	x			
5	Light Wy	1994	x	x			
2933	Middlefield Rd	1992		xx			
3101	Middlefield Rd	1987		xx			
3176	Middlefield Rd	1978		xx			
6	Montego Ln	1995	x				
2055	Nassau Dr	1986	xx				
8	Selby Ln	1993	xx				
150	Todo El Mundo	1996	xx				
2772	Westmoreland Ave	1978		xx			

Insert “4” Tab Here

SECTION 4

MANHOLE INSPECTION

The manhole inspection program was conducted during the winter and spring of 1997. Field crews documented the condition of 204 manholes in the Fair Oaks Sewer Maintenance District (FOSMD). This section presents the results of the manhole inspection program.

Purpose and Objective

Manhole inspection was performed to evaluate manholes as potential infiltration/inflow (I/I) sources and document their physical condition. Additionally, the manhole inspection results were used to prioritize the smoke testing and television inspection programs. The manhole inspection program did not include all the manholes in the FOSMD. Manholes were selected for inspection to provide a representative sample of the manholes in the FOSMD.

During the inspection, the general condition of the manhole and incoming/outgoing pipelines was determined. Photographs of the incoming/outgoing pipelines were taken to determine their condition. The following conditions were documented during the inspection:

- Manhole bench/channel condition
- Roots in the manhole or pipeline
- Grease in the manhole or pipeline
- Manhole frame/cover condition
- Presence of I/I in the manhole or pipeline
- Major debris in the manhole or pipeline
- General physical condition of the pipeline.

Findings

The major manhole defects noted during the manhole inspection program are listed in Table 4-1. The major pipeline defects observed from the photographs are listed in Table 4-2. A technical memorandum, dated October 12, 1998, describing the manhole inspection in more detail is provided in Appendix A. Manhole inspection forms and photographs are provided under separate cover in a series of three-ring binders.

Table 4-1. Manhole Defects

Defect type	Number
Bench/Channel Defects	22
Roots	7
Grease	82
Frame and Cover Problems	2
Active or signs of Infiltration/Inflow	6
Major Debris in Channel	46
Manholes Inspected	204

Table 4-2. Pipeline Defects Noted from Manhole Inspection Program

Pipes with separated joints greater than moderate and deflections greater than 1 inch	15
Pipes with greater than minor corrosion	10
Pipes with infiltration/inflow	0
Pipes with greater than light grease	24
Pipes with greater than light roots	39
Pipes with roots and grease	1
Pipes with cracks and fractures	16
Pipes with plugs and obstructions	3

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SECTION 5

FLOW MONITORING PROGRAM

A flow monitoring program was implemented to measure flow rates during dry weather and discrete rainfall events. This section describes the flow monitoring program. Flows and flow rates developed from the flow monitoring efforts are described in Sections 8 and 9.

Wastewater flows were divided into base sanitary flow (BSF) and wet weather infiltration/inflow (I/I) components for this study. Base sanitary flow factors are based on dry weather flow monitoring performed during the winter of 1997. Due to limited rainfall during the winter of 1997, additional wet weather flow monitoring was performed during the following season. El Niño effects resulted in extensive rainfall during the months of January and February of 1998. Wet weather flow projections are based on flow monitoring results from the second flow monitoring program in 1998. Results of the 1997 flow monitoring program are provided in Appendix B. Results of the 1997-1998 flow monitoring program are provided in the County of San Mateo 1997-1998 flow monitoring program dated January 14, 1998, and March 4, 1998.

Purpose and Objective

The purpose of the flow monitoring program was to measure the existing collection system flows at various locations in the Fair Oaks Sewer Maintenance District (FOSMD). Wet weather and dry weather flow rates were measured to develop design flows for use in a hydraulic model of the collection system. Additionally, a rain gauge was installed at Fire Station #11, located at the intersection of Bay Road and Second Street, to determine how collection system flows reacted to various rainfall events.

Flow in the new 10-inch-diameter sewer located near the intersection of Nimitz Avenue and Selby Lane was inspected and considered negligible. Therefore, it was not included in the flow monitoring program.

Table 5-1 summarizes the measured flow rates for each monitoring station in the FOSMD for the 1997/1998 flow monitoring period. The location of the flow monitors and rain gauges is shown on Figures 5-1, 5-1a, and 5-1b. The technical memorandum describing the 1997 flow monitoring program is provided in Appendix B. Attachments A and B for the technical memorandum were provided in the original submittal. This memorandum describes the location of the flow monitors and rain gauges, and the complete results of the flow monitoring program.

**NOTE: There was a question if the relief line along Nimitz Avenue should be shown in Figure 5-1. It should not have been shown because it did not affect the flow much and the flow meter was not on the relief line.

Table 5-1. Flow Monitoring Results, million gallons per day 1997/1998

Flow monitoring site	Minimum dry weather flow	Average dry weather flow	Peak wet weather flow
51	0.29	0.66	1.72
52	0.41	1.79	7.21
53	0.41	1.20	4.04
54	0.19	0.41	1.77
55	0.00	0.22	1.04
56	0.13	0.44	1.91
57	0.27	0.89	3.06

101 Bayshore Freeway

Middlefield Rd.

82 El Camino Real

Match Line

Alameda De Las Pulgas

Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Selby Ln.

Nimitz Ave.

Bay Rd.

84 Woodside Exwy.

Broadway

Salt Evaporators

280 Junipero Serra Freeway

Flow Monitor Locations
Figure 5-1

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor

GRAPHIC SCALE

1290 0 645 1290 2580

Flow Monitor Locations
Figure 5-1a

Middlefield Rd.
Stockbridge Ave.
Selby Ln.
Bay Rd.
Nimitz Ave.
El Camino Real
82
84 Woodside Exwy.
101 Bayshore Freeway
Broadway
Salt Evaporators
Match Line
Figure 5-1b

F012611
F120311
F115710
56
F141610
53
F143309
F157A1A
F1717A19
57
F190018
54
51
F002605
F114804
52
F260308

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor

N

GRAPHIC SCALE
600 0 300 600 1200

Figure 5-1a
Match Line

Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Alameda De Las Pulgas

F214535

F198536

55

F192528

F193228

F191828

F193028

F183828

F180018

54

F190118

57

F1717A19

Selby Ln.

Nimitz Ave.

84 Woodside Exwy.

Figure 5-1a
Match Line

280 Junipero Serra Freeway

Flow Meter Locations
Figure 5-1b

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor

N

GRAPHIC SCALE

600 0 300 600 1200

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SECTION 6

SMOKE TESTING PROGRAM

The smoke testing program was conducted during the summer of 1998. Field crews tested approximately 27,500 linear feet of sewer lines in the Fair Oaks Sewer Maintenance District (FOSMD). This section presents the results of the smoke testing program.

Purpose and Objective

Smoke testing is a quick and effective method for identifying many types of wastewater collection system deficiencies. Typical defects encountered during a smoke testing program include the following:

1. Broken or deteriorated building laterals.
2. Improperly capped cleanouts.
3. Broken or deteriorated sewer mains in unpaved areas.
4. Unsealed or damaged manholes.
5. Sags and/or obstructions in the mains.
6. Direct and indirect connections between storm and sanitary sewer systems.
7. Untrapped or improper building plumbing.
8. Illegal sewer connections from/to storm drain systems

Although smoke testing is an efficient method of identifying collection system inadequacies, certain conditions affect the interpretation and effectiveness of the test. One factor that affects smoke testing results is the extent and porosity of the cover over the sewer main or service lateral. For instance, pilot studies have indicated that only one-third or less of lateral defects are detected by smoke testing.

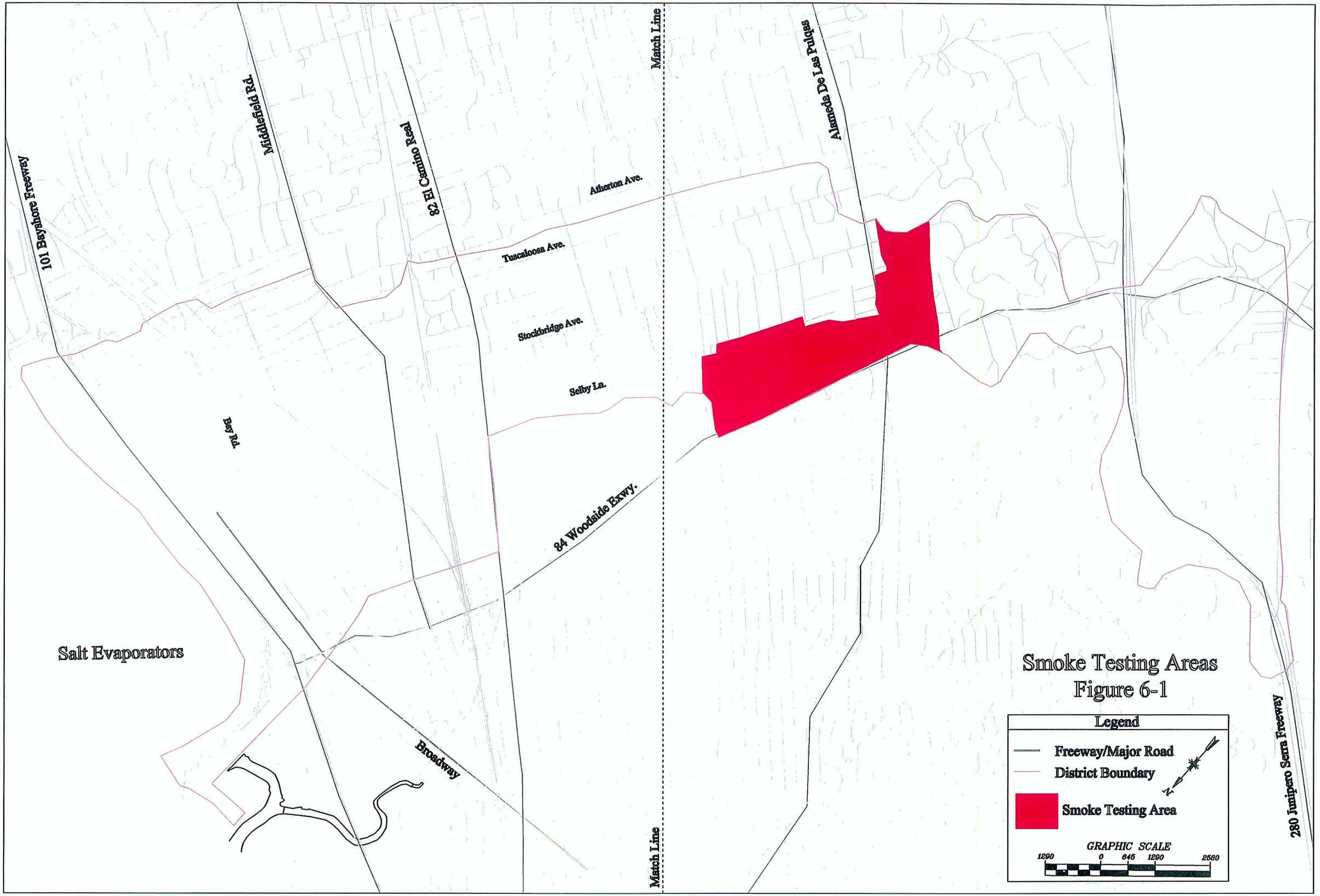
Smoke Testing Results

Smoke testing was performed during the dry months of August and September 1998 to ensure that smoke was not trapped in high groundwater. The areas tested in the FOSMD area are shown on Figure 6-1. Smoke testing areas were selected based on the results of the flow monitoring program. Areas with suspected high I/I rates were selected for smoke testing. Other factors affecting the selection of areas to perform smoke testing include traffic and disruption to local businesses. Approximately 12 percent of the total area was smoke tested.

No major defects were noted during the smoke testing program. A total of 59 defects were located and documented during the program. The most prevalent defect was missing or damaged cleanout covers. The majority of these defects are located on the private side of the property line. A summary of the smoke testing defects is provided in Table 6-1. A technical memorandum, dated October 13, 1998, describing the smoke testing program in more detail is provided in Appendix C. Smoke testing reports and photographs are also provided in Appendix C.

Table 6-1. Smoke Testing Defect Summary

Defect type	Number of defects
Cleanout	45
Lateral	4
Illegal drain	4
Storm drain cross connection	1
Manhole leaks	3
Pavement cracks	1
Other	1
Total footage tested: 27,501	


101 Bayshore Freeway
Middlefield Rd.
82 El Camino Real
Match Line
Alameda De Las Pulgas
Atherton Ave.
Tuscaloosa Ave.
Stockbridge Ave.
Selby Ln.
Bay Rd.
84 Woodside Exwy.
Salt Evaporators
Broadway
Match Line
280 Junipero Serra Freeway
Smoke Testing Areas
Figure 6-1
Legend
Freeway/Major Road
District Boundary
Smoke Testing Area
GRAPHIC SCALE
1290 0 645 1290 2580

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SECTION 7

TELEVISION INSPECTION PROGRAM

The television inspection program was conducted during the winter of 1999. Field crews inspected approximately 15,000 linear feet of sewer lines in the Fair Oaks Sewer Maintenance District (FOSMD). This section presents the results of the television inspection program.

Purpose and Objective

The purpose of the television inspection program of mainline sewers was to observe and document the internal condition of the pipeline in reference to infiltration/inflow (I/I) and structural deterioration. Results of the television inspection were then used to develop capital improvement programs described in Sections 13 and 14. The following conditions were observed and documented:

1. Structural Integrity— the number, type and extent of cracks and/or broken, crushed, shattered or collapsed pipe.

2. Root Intrusion— the amount and severity of the roots were documented.

3. I/I— the location of I/I sources were documented.

4. Protruding Laterals— a lateral's protrusion into the pipeline was estimated to judge if it will interfere with rehabilitation or routine maintenance.

5. Defective lateral connections— defective lateral connections such as broken pipe at the connections, broken saddles, cracks and the connections, pieces missing from the connection, and structural defects in the lateral were documented.

6. Offset or Open Joints— offset or open joints were visually estimated from the inspection to determine if they would require spot repairs prior to rehabilitation.

7. Pipe Sags— the extent of sags or misalignment was judged to help determine the structural integrity of the pipeline and their suitability for rehabilitation.

8. Corrosion— hydrogen sulfide corrosion of concrete sewers was identified and documented.

Television Inspection Results

The areas scheduled for television inspection in the FOSMD area are shown on Figures 7-1a and 7-1b. Sewers were selected for television inspection if they met one of the following four criteria:

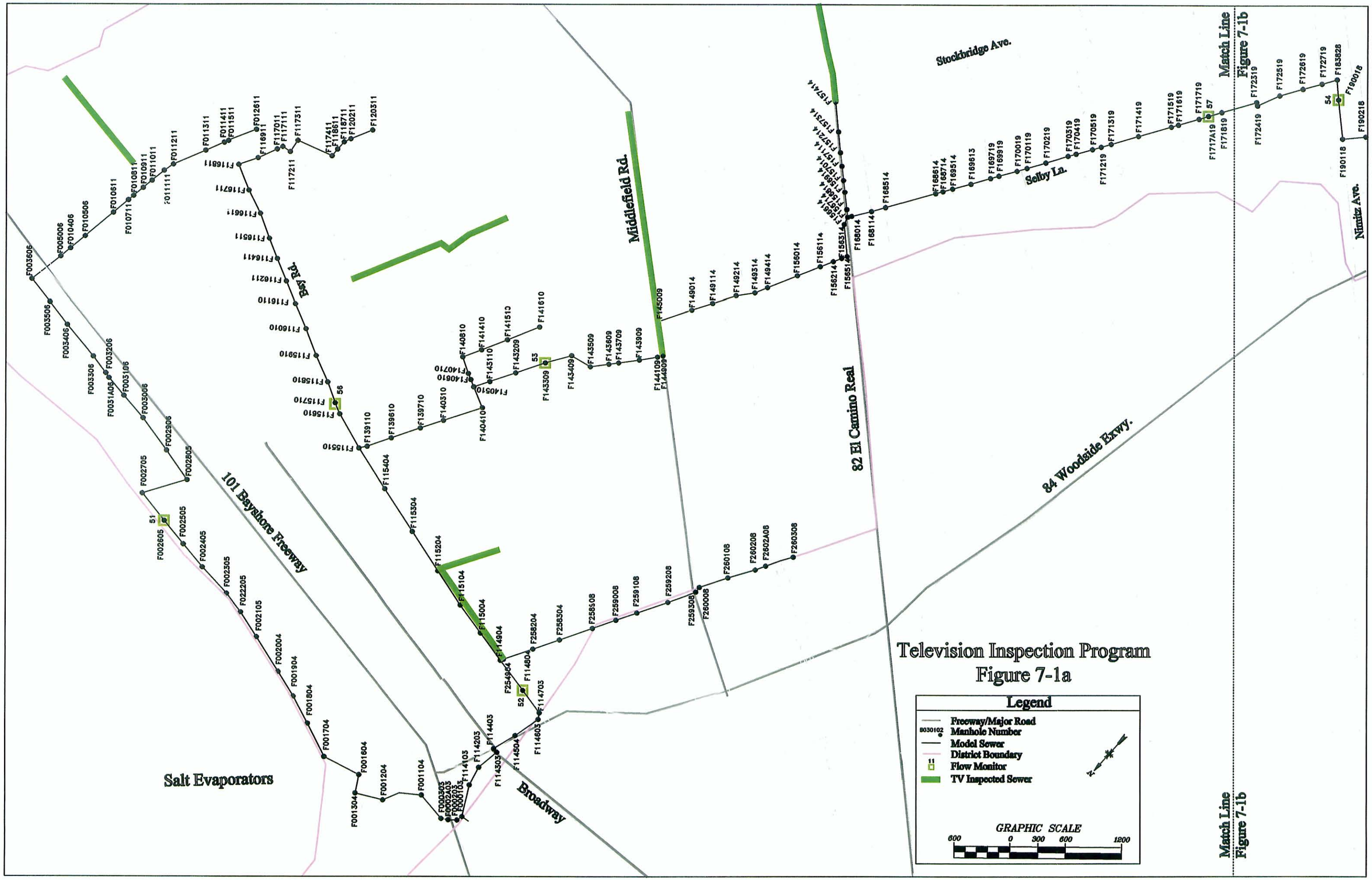
- Excessive maintenance callouts
- Manhole inspection program noted a pipeline defect
- Special request from the County maintenance personnel
- A mainline defect was noted during the smoke testing program.

Sewers scheduled for television inspection were cleaned or flushed prior to inspection to allow for a better structural inspection. Approximately 700 linear feet of mainline sewer could not be inspected due to severe defects in the line, which blocked the path of the camera, or lack of access to the sewer. When a severe defect was encountered, the camera setup was reversed to attempt an inspection of the sewer whenever possible. Approximately 5.3 percent of the sewers in the Fair Oaks District were inspected. Results of the television inspection program are summarized in Table 7-1. Complete results of the program are provided in Appendix D.

Table 7-1. Television Inspection Summary

Description	Total
Footage Attempted	15,707
Footage Completed	15,025
Cracks	
Radial	330
Longitudinal	1
Joints	
Minor Offset Joint	12
Major Offset Joint	0
Laterals	
Protruding Lateral	0
Defect at Connection	0
Dead Connection	47
Roots	
Roots at Joint	167
Roots at Lateral	15
Infiltration/Inflow	
At Joint	0
At Crack	0
At Roots	0
At Inside Lateral	0
At Lateral Connection	1
At Inside Lateral and at Connection	0
Alignment	
Sag in Line	25
Pipe Out of Round	0
Structural	
Piece Missing	31
Shattered/Broken	28
Crushed or Collapsed	1
Mineral Stains	
At Joint	0
At Cracks	0
Sulfide Corrosion	
Minor	0
Severe	0

Television Inspection Program
Figure 7-1a



Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Figure 7-1a
Match Line

Alameda De Las Pulgas

Selby Ln.

Nimitz Ave.

84 Woodside Exwy.

Figure 7-1a
Match Line

280 Junipero Serra Freeway

F170219 F170319 F170419 F170519 F171219 F171319 F171419 F171519 F171619 F171719 57 F1717A19 F171819 F172319 F172419 F172519 F172619 F172719 54 F183828 F190018 F190118 F190218 F190528 F190828 F191128 F191428 F191728 F191828 F192028 F192228 F192428 F192528 F193028 F193128 F193228 F197127 F197227 F197327 F197427 F197727 F197827 F198027 F198127 F198227 F198336 F198436 55 F198536 F198636 F213236 F213336 F213436 F213535 F213635 F2136A35 F213735 F213835 F2138A35 F213935 F214035 F214135 F214235 F214335 F214435 F214535

Television Inspection Program
Figure 7-1b

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor
- TV Inspected Sewer

GRAPHIC SCALE

600 0 300 600 1200

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SECTION 8

BASE SANITARY FLOWS

The results of the flow monitoring program described in Section 5 were used to establish base sanitary flow (BSF) rates. Base sanitary flow rates are used with wet weather flow rates and the hydraulic model to determine the amount of available capacity in the collection system. Wet weather flow rates and the hydraulic modeling are discussed in subsequent sections of the report. This section describes the methodology used to develop base sanitary flow rates for the Fair Oaks Sewer Maintenance District (FOSMD).

Dry Weather Flow

BSF is wastewater contributed by residential, commercial, industrial and public users. Base flow is directly related to land use and varies throughout the day and between weekdays and weekends. BSF from residential areas has a typical diurnal pattern with peak flows occurring in the morning after 7:00 a.m. and a second smaller peak occurring in the evening. A typical dry weather hydrograph is shown on Figure 8-1.

BSF flow contributions to the hydraulic model are based on the flow monitoring data collected during dry weather periods. Actual dry weather flow hydrographs were extracted from the flow monitoring data and used in the model. Peaking factors normally estimated for subsequent use in the hydraulic analysis were not needed since the actual diurnal flow pattern from the flow monitoring could be used directly in the hydraulic model.

Dry weather periods were used to minimize the amount of groundwater infiltration (GWI) included in the calculation. GWI occurs when groundwater levels are above the sewer pipes and the pipes have defects that allow infiltration. Some groundwater infiltration is undoubtedly included in the BSF rates. However, extensive review of accurate water use data in each District would be needed to determine the amount of groundwater infiltration in each area. Based on our review of the flow monitoring, GWI is not a significant factor in the total wastewater flow in the FOSMD area.

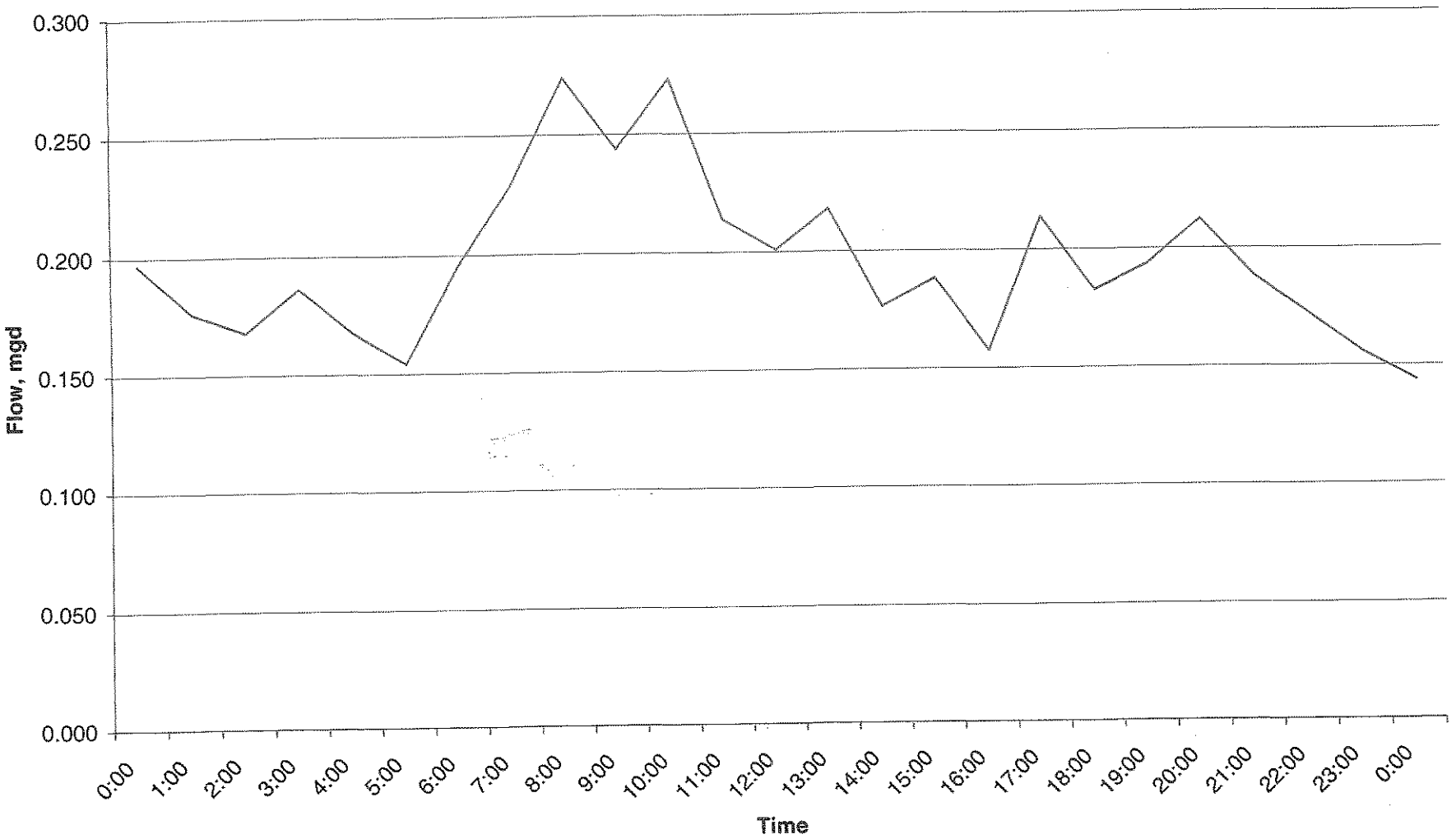
BSF projections were not prepared for future land use conditions. Land use planners for the County and affected City agencies indicated that growth or significant infilling were not expected in the future.

BSF rates used for the service area for each of the flow monitoring sites are presented in Table 8-1. A complete description of the flow monitoring program is given in Appendix B. Additionally, the technical memorandum describing the flow projections and hydraulic modeling in more detail is provided in Appendix E.

Table 8-1. Base Sanitary Flow Rates

Flow monitor	Base sanitary flow, mgd
51	0.756
52	0.678
53	0.242
54	0.469
55	0.171
56	0.375
57	0.234

Typical Dry Weather Hydrograph
Figure 8-1



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SECTION 9

INFLOW/INFILTRATION RATES

The flow monitoring program described in Section 5 was performed to establish inflow/infiltration (I/I) rates. I/I rates are used in conjunction with base sanitary flow (BSF) rates (established in Section 8) and the hydraulic model to determine the amount of available capacity in the collection system. This section describes the methodology used to develop I/I rates for the Fair Oaks Sewer Maintenance District (FOSMD).

Wet Weather Flow

I/I consists of direct inflow of storm water runoff and rainfall-induced infiltration of storm water percolating through the soil into the collection system. Inflow occurs when storm water enters the collection system through illegally connected catch basins, area drains or home roof gutter downspouts, or through manhole covers of cleanout lids. Inflow can become severe if surface flooding occurs and manholes and cleanouts are submerged or used to drain low-lying areas.

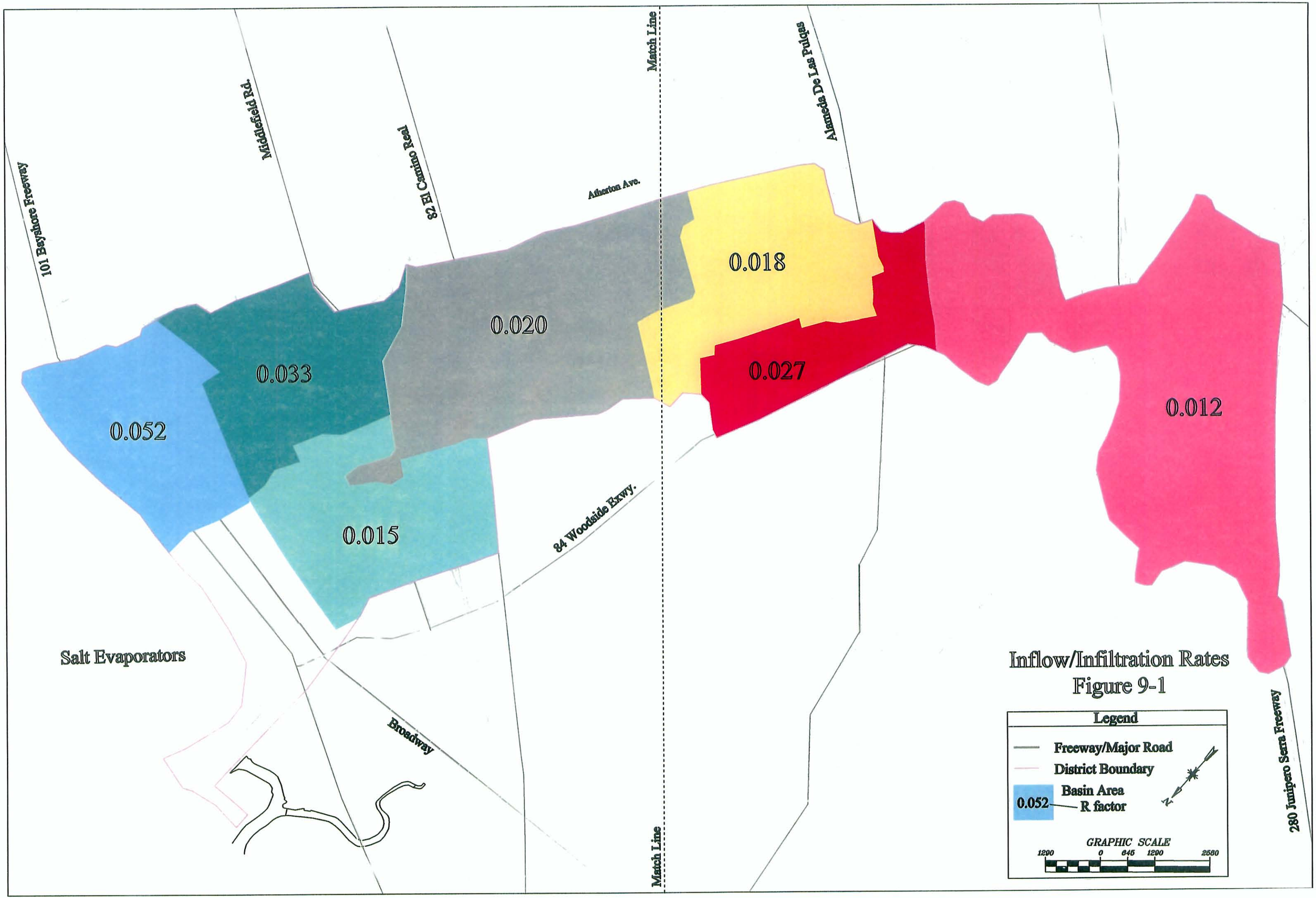
I/I accounts for the large increase in peak flows that occur during rainfall events. In areas with older sewers, I/I is typically the largest component of the total wastewater flow. I/I was evaluated by calculating the "R" factor for each of the monitored basins for each storm. An "R" factor is the percentage of rainfall volume falling on an area that enters the collection system as I/I. The composite minimum and maximum "R" factor, based on the flow monitoring data, for each flow monitoring location is listed in Table 9-1. The flow monitors service areas and R factor used for the wet weather flow projections are shown on Figure 9-1.

A wet weather design storm was developed to determine the effects of I/I on the capacity of the wastewater conveyance system. The January 18, 1998, rainfall event was very similar to a 5-year design storm in terms of intensity, duration, and volume. Therefore, this storm was selected as the design event. Minor adjustments were made to the rainfall hydrograph to account for differences in the volume between the actual storm and the 5-year design rainfall.

Unit hydrographs were developed for each basin to develop wet weather hydrographs for use in the model. Unit hydrographs are based on the "R" factor and the individual runoff characteristics for each basin. Synthetic hydrographs were added to the base flow hydrographs and the total flow hydrograph was then input to the hydraulic model. A typical wet weather synthetic hydrograph is shown on Figure 9-2. A complete description of the I/I flow projections is provided in the Technical Memorandum provided in Appendix E.

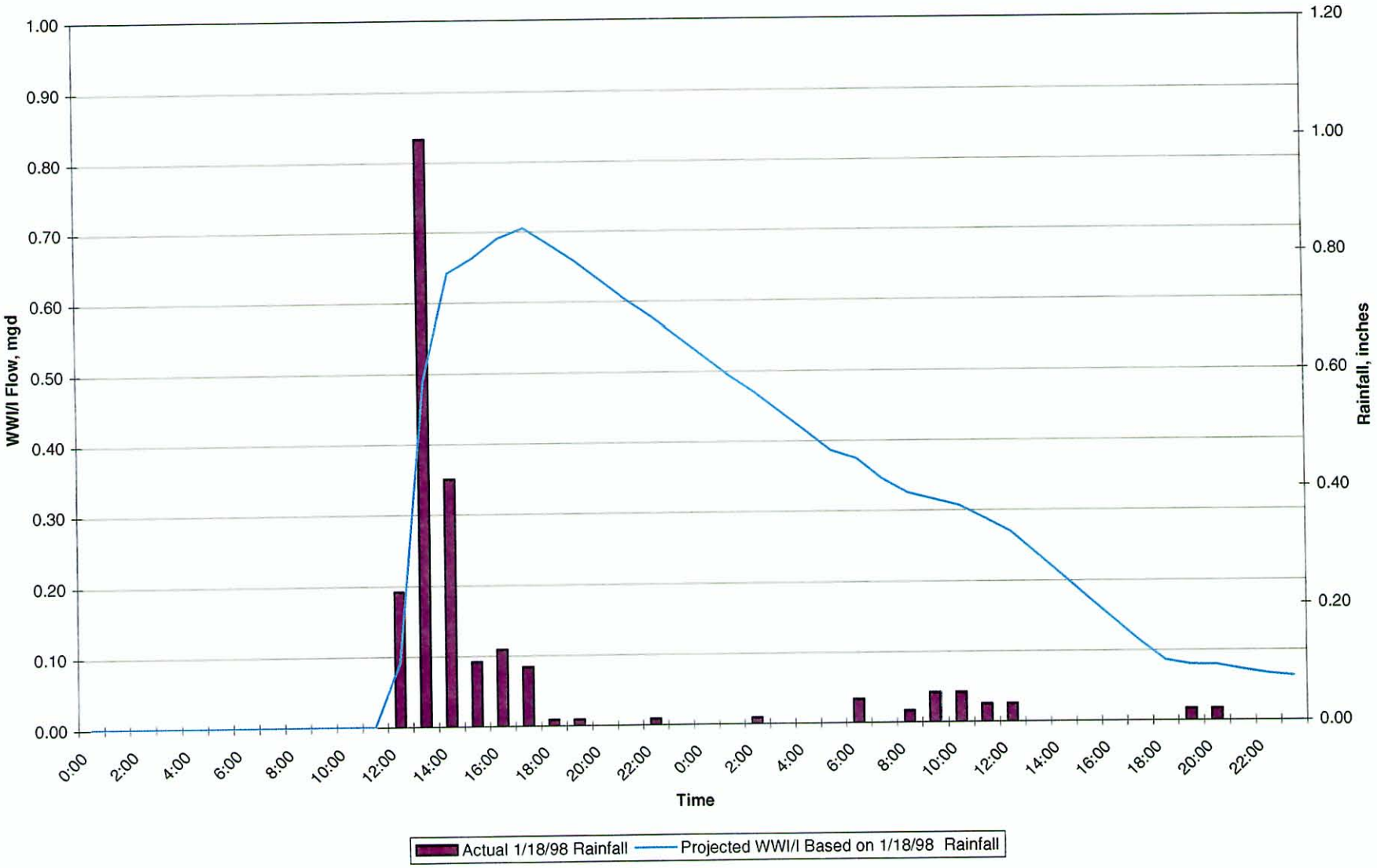
Table 9-1. R Factors

Flow monitoring site	Minimum	Maximum
51	0.038	0.111
52	0.015	0.037
53	0.02	0.053
54	0.027	0.027
55	0.012	0.046
56	0.028	0.033
57	0.018	0.046



Inflow/Infiltration Rates
Figure 9-1

Typical Wet Weather Hydrograph
Figure 9-2



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SECTION 10

HYDRAULIC MODEL DESCRIPTION

A hydraulic model was prepared of the Fair Oaks Sewer Maintenance District's (FOSMD) wastewater collection system trunk sewer. The model was used to evaluate the capacity of the pipelines to carry existing peak wet weather flows. This section presents a description of the model and the model development.

Computer Model

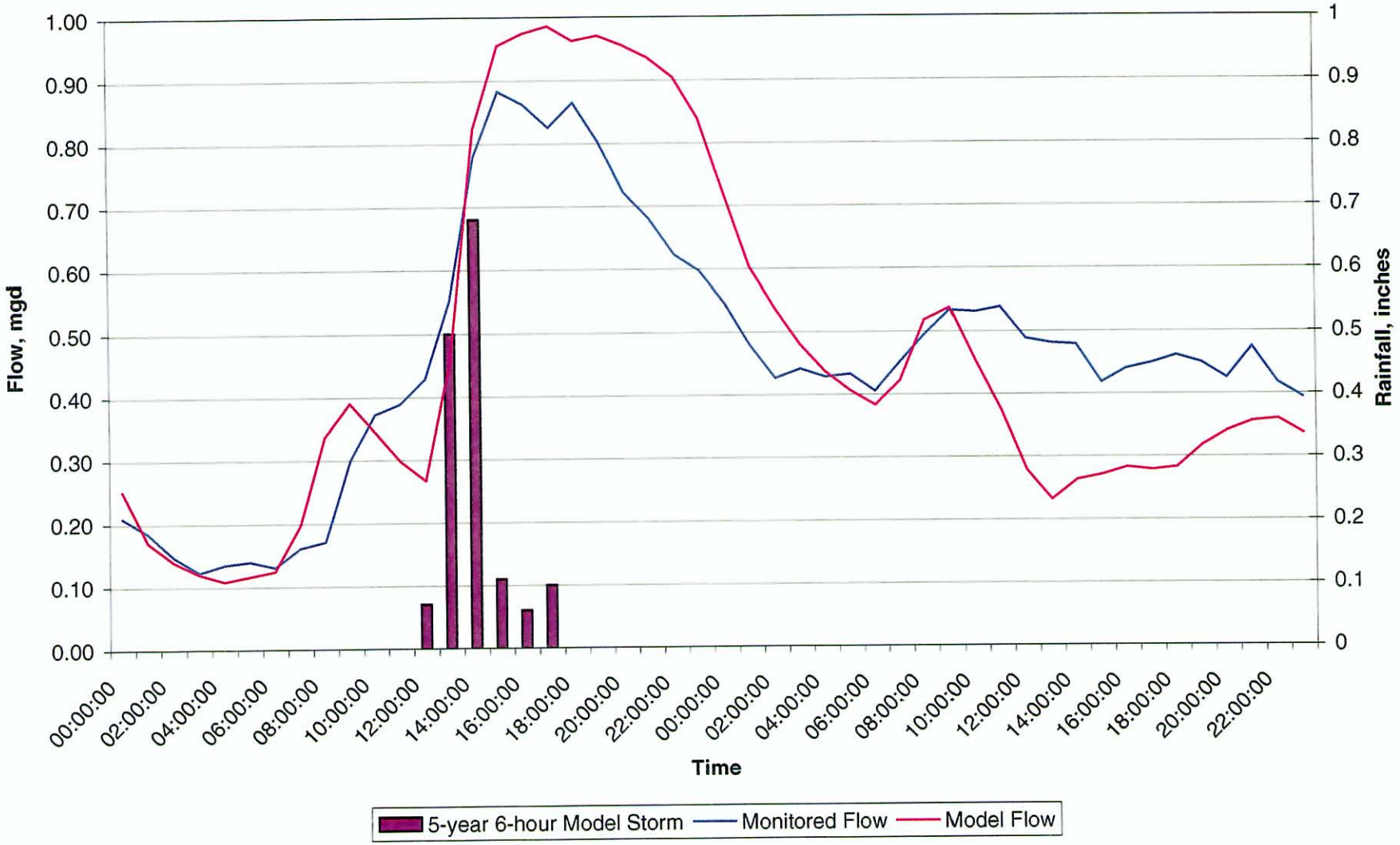
Major trunk sewers in each of the sewer Districts were modeled to determine where capacity deficiencies exist. The HYDRA model developed by PIZER, Inc., was used to simulate wastewater flows in the each of the Districts collection systems. HYDRA routes flow hydrographs (developed in Section 9) through the collection system and accounts for the time delays of peak flow from various tributary areas as the flows move downstream.

For the FOSMD, the main trunk sewers system was modeled. These sewers includes nearly all the pipelines 10 inches in diameter or larger in the FOSMD.

Most of the pipeline data used in the model was taken from the existing County collection system maps. Pipeline data required by the model includes upstream and downstream inverts and pipeline length and diameter. Surveying was completed to fill in gaps in the data or questionable data.

Modeled flow is compared to the theoretical capacity of each pipe segment. The capacity of each pipeline is a function of the pipeline slope and diameter. If capacity deficiencies were detected, then the program was used to size the appropriate relief and/or replacement sewer size. A typical example hydrograph comparing the model hydrograph to actual flow monitoring is shown on Figure 10-1. The technical memorandum describing the flow development and modeling is provided in Appendix E.

Typical Monitored to Model Flow Calibration
Figure 10-1



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SECTION 11

MODEL RESULTS

An evaluation of the pipeline capacities was performed using the flows developed in Sections 8 and 9 and the hydraulic model described in Section 10. This section describes the results of the capacity evaluation developed for the Fair Oaks Sewer Maintenance District (FOSMD).

Capacity Analysis

The capacity of the existing system was evaluated using peak wet weather flows. This flow condition is generated by existing development in the service area (Section 8) under design storm conditions (Section 9).

The model routes the flow through the pipe network, calculates the capacities of the pipes, and compares the routed flows to the pipe capacities to identify inadequate pipes. The pipe capacity calculations are based on a Manning's roughness coefficient of 0.013. Pipes were defined to be hydraulically inadequate if the depth of flow is 100 percent or greater of the pipe diameter. The model sized relief and replacement sewer sizes for all inadequate sewers.

The results of the model indicate nearly five miles of sewer pipelines with insufficient capacity to convey peak wet weather flow without surcharging. Peak wet weather flow in the trunk sewers along Selby Lane and Nimitz Avenue are at nearly 300 percent of the pipeline capacity. Model results are shown on Figures 11-1a and 11-1b. The technical memorandum describing the flow development and modeling is provided in Appendix E. Additionally, the complete HYDRA modeling results are provided in Appendix E.

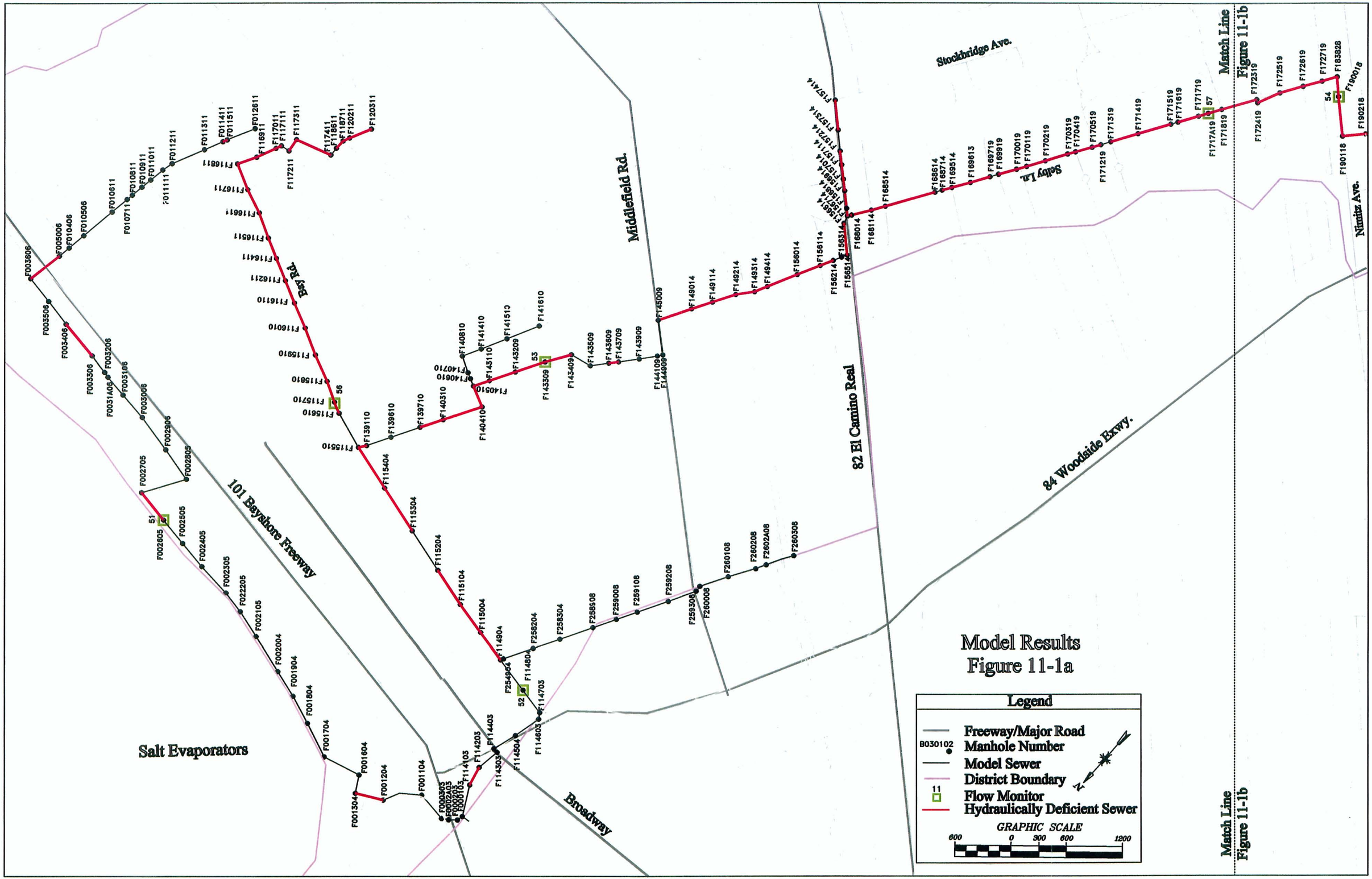
Middlefield Rd.
82 El Camino Real
101 Bayshore Freeway
84 Woodside Exwy.
Broadway
Stockbridge Ave.
Sally La.
Nimitz Ave.
Bay Rd.
Salt Evaporators
Match Line
Figure 11-1b
Match Line
Figure 11-1b
Model Results
Figure 11-1a
Legend
Freeway/Major Road
B030102 Manhole Number
Model Sewer
District Boundary
11 Flow Monitor
Hydraulically Deficient Sewer
GRAPHIC SCALE
600 0 300 600 1200

Figure 11-1a
Match Line

Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Alameda De Las Pulgas

F170219 F170319 F170419 F170519 F171219 F171319 F171419 F171519 F171619 F171719 57 F171819 F172519 F172519 F172619 F172719 F183828 54 F190018 F190118 F190218 F190528 F190828 F191128 F191428 F191728 F191828 F192028 F192228 F192428 F192528 F193128 F193228 F197127 F197227 F197327 F197427 F197727 F197827 F198027 F198127 F198227 F198336 F198436 55 F198536 F198636 F213236 F213336 F213436 F213535 F213635 F213735 F213835 F213935 F214035 F214135 F214235 F214335 F214435 F214535

Selby Ln.

Nimitz Ave.

84 Woodside Exwy.

Figure 11-1a
Match Line

280 Junipero Serra Freeway

Model Results
Figure 11-1b

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor
- Hydraulically Deficient Sewer

GRAPHIC SCALE
600 0 300 600 1200

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SECTION 12

UNIT COSTS

This section presents the basis for the estimated unit costs that were developed for estimating the construction costs and the capital costs of recommended capital improvements. The cost index and the development of the capital costs of gravity sewer pipeline construction and rehabilitation are presented.

Capital Costs

The total capital investment necessary to complete a project consists of expenditures for construction, engineering services, contingencies, and such overhead items as legal and administrative services and financing. The various components of capital costs are described below. Unit construction costs were developed for the following construction and rehabilitation methods:

- Remove and Replace— recommended for pipelines with serious structural or hydraulic capacity deficiencies where trenchless construction is typically more expensive or not practical.
- Sliplining— recommended for pipelines with minor structural deficiencies or root intrusion and minimal sags.
- Pipe Bursting— recommended method for increasing capacity of structurally deficient 6-inch-diameter lines to 8-inch-diameter lines and provides minimal disruption to the community.
- Chemical Root Treatment— recommended for lines with root intrusion.
- Do Nothing— no capital project is recommended for lines with minor structural deficiencies and light root intrusion. For this option, television re-inspection in a maximum of 10 years is recommended.
- Increase O & M— recommended for lines with minor root intrusion and grease buildup.
- Spot Repair— recommended for lines with severe defects that create maintenance problems or where required prior to implementing other rehabilitation methods.

Cost Index. A good indicator of changes over time in construction costs is the Engineering News Record (ENR) 20-city Construction Cost Index (CCI), which is computed from prices of construction materials and labor, and based on a value of 100 in 1913. Cost data in this report are based on an ENR CCI of 6000, representing costs in March 1999.

Construction Costs. Construction costs presented in the master plan represent preliminary cost estimates of the materials, labor and services necessary to build the proposed projects. The cost estimates are prepared to be indicative of the cost of construction in the study area. In considering cost estimates, it is important to realize that changes during final design, as well as future changes in

the cost of material, labor and equipment, will cause comparable changes in the estimated costs. Unit costs used in this study were obtained from a review of pertinent sources of reliable construction cost information. Construction cost data given in this report are not intended to represent the lowest prices that can be achieved for each type of work, but rather are intended to represent planning-level estimates for budgeting purposes. The following assumptions were made in the development of the unit costs:

- Remove and Replace— Costs include excavation, backfill, compaction, haul off and asphalt repair. Material costs for 8-inch- to 21-inch-diameter sewers are for PVC or VCP. Material costs for 24-inch-diameter or larger sewers are for RCP. Replacement costs for 6-inch-diameter lines include cost for 8-inch-diameter replacement materials. The costs have been developed based on a maximum trench depth of 15 feet.
- Sliplining— Costs include the use of HDPE as the liner material, construction of access pits and an average service lateral reconnection fee. Sewage bypass pumping is only needed on a localized basis and, therefore, is not included in the costs.
- Pipe Bursting— Costs include the use of HDPE as the liner material, construction of access pits and an average service lateral reconnection fee. Costs include the bypassing of sewage.
- Chemical Root Treatment— Costs include application and removal with hydroflush equipment. Costs also include reapplication every 2 years.
- Do nothing— Costs for this option are for television re-inspection in 10 years at a rate of $1.50/foot for the data collection and data review.
- Spot Repair— A cost of $800 has been included in the estimates for each spot repair occurrence.

Table 12-1 presents the unit construction costs for construction and rehabilitation of gravity sewer pipelines.

Contingencies, Engineering, and Overhead

Construction contingencies, engineering and overhead are assumed to be 40 percent of the construction cost. It is appropriate to allow for the uncertainties unavoidably associated with planning-level layout of projects. Such factors as unexpected geotechnical conditions, extraordinary utility relocation and alignment changes are a few of the items that can increase project cost for which it is wise to make allowance in preliminary estimates.

Engineering services associated with projects include preliminary investigations and reports, site and route surveys, geotechnical explorations, preparation of drawings and specifications, construction services, surveying and staking, and sampling and testing of materials. Overhead charges cover such items as legal fees, financing expenses, administrative costs, and interest during construction.

Table 12-1. Gravity Sewer Pipe Unit Construction Costs

Pipe diameter, inches	Relief and replacement sewer cost, dollars/foot	Sliplining, dollars/foot	Root treatment, dollars/foot	Pipe Bursting, l.f.
6	85	n/a	3	90
8	85	55	3	90
10	100	70	4	115
12	110	90	5	145
15	120	110	6	175
18	140	n/a	n/a	n/a
21	180	n/a	n/a	n/a
24	195	n/a	n/a	n/a
27	220	n/a	n/a	n/a
30	230	n/a	n/a	n/a
33	255	n/a	n/a	n/a
36	285	n/a	n/a	n/a
42	305	n/a	n/a	n/a
48	355	n/a	n/a	n/a

Other Costs:

$800/spot repair

Reinspect in 10 years = $1.50/foot

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SECTION 13

RECOMMENDED COLLECTION SYSTEM IMPROVEMENTS

Improvements will be necessary to the Fair Oaks Sewer Maintenance District (FOSMD) collection system to adequately convey peak wet weather flows. This section presents the recommended improvements for correcting the hydraulic capacity problems identified in Section 11. Capital improvement projects for correcting structural deficiencies as well as the hydraulic deficiencies are provided in Section 14.

Relief/Replacement Sewer Sizing

The improvements recommended for correcting the hydraulic capacity problems are based on the model results for peak wet weather flow. The model selects pipe sizes for parallel relief and replacement pipes. The hydraulic analysis provides for trunk size reduction based on the slope of the existing sewer. For this report, alternatives and costs have been developed assuming the existing sewer will be replaced by a larger sewer. The main drawback to a relief sewer is the increased amount of sewer pipe in the ground for the maintenance crews. However, the County will have to decide on a case-by-case basis during the design of each project as to whether to construct replacement or parallel relief sewers.

Sewer sizes developed by the computer model were verified and modified where necessary to reduce potential maintenance problems. Maintenance problems can arise when a larger sewer discharges into a smaller sewer. The diameters of the smaller sewers are modified to be no smaller than the upstream pipe. In some cases, a sewer is extended for several reaches to connect two portions of the collection system with hydraulic problems.

Short lengths and isolated reaches of over-capacity pipe (less than six percent of deficient pipe) have not been included with the recommended relief/replacement sewer program. These reaches are not considered significant hydraulic problems because resulting backwater would be minor.

Nearly 25,800 linear feet of the trunk sewers were identified as hydraulically deficient. Replacement sewers are recommended to relieve the existing trunk sewer. The location of the recommended replacement sewers is shown on Figures 13-1a and 13-1b. Table 13-1 summarizes the modeling results.

Infiltration/Inflow Reduction

The use of collection system rehabilitation to reduce the overall PWWF within the basin was considered as an option prior to developing the recommendations listed in Table 13-1 for pipe replacement. Collection system rehabilitation is used to accomplish two main objectives:

Table 13-1. Recommended Replacement Sewers

Upstream manhole	Downstream manhole	Existing diameter, inches	Length, ft	Recommended replacement sewer sizes, inches
F115510	F114904	30	2833	48
F143709	F139110	21	3394	24
F183828	F170419	18	3033	36
F156614	F145009	15	256	33
		18	500	
		21	1633	
F170419	F169919	15	144	30
		18	767	
F116211	F115610	12	589	24
		18	1144	
F169919	F168014	15	1667	24
F190528	F183828	12	222	21
		15	989	
F117211	F116211	10	644	21
		12	1411	
F120311	F117211	10	956	18
F198636	F198227	10	1167	12
F197727	F193228	10	1367	12
F157414	F156714	10	1289	18
F193228	F191828	8	639	15
		10	1189	
TOTAL			25,833	

1. Provide a continuing level of service with regard to the structural integrity of the collection system.

2. Reduce the overall level of I/I entering the collection system for either peak flow rates or for total I/I flow into the system.

I/I studies nationwide have demonstrated that effective removal of I/I from the collection system requires a comprehensive implementation of collection system rehabilitation of both the sanitary sewer and the private building lateral. Agencies, such as East Bay Municipal Utilities District Vallejo Sanitation and Flood Control District, and the City and County of Honolulu have performed pilot rehabilitation programs demonstrating the need for comprehensive rehabilitation for effective I/I removal. The effective amount of I/I reduction possible, even with comprehensive rehabilitation, is a subject of some debate within the sewer industry. Claims range from over 90 percent removal to less than 40 percent removal of the I/I from the collection system. Many things impact the ability of the rehabilitation effectiveness in removing I/I for a long period of time (50 years is considered a reasonable time measure for effectiveness of rehabilitation program). An average long-term effectiveness of 75 percent was assumed for I/I removal from the collection system for this study, based on the results of similar work in the Bay Area.

This type of area-wide rehabilitation approach is critical for collection systems where field data from condition assessment programs show no one area of the collection system as having a significantly higher level of sewer defects that contribute to I/I in the collection system. The Crystal Springs County Sanitation District condition assessment data indicates that the entire district will require comprehensive rehabilitation to provide the required reduction in I/I related flows to avoid the capacity limitations within the existing collection system configuration.

A 6.35-mgd reduction in the projected PWWF of 11.3 mgd as shown in Appendix E will be required to eliminate surcharging in the FOSMD trunk sewer system. Effectively, 56 percent of the PWWF will need to be eliminated from the system through a comprehensive rehabilitation program of the district. Using the 75 percent effectiveness criteria, which could be considered optimistic, then the entire collection system in the district will require comprehensive rehabilitation.

The cost associated with complete collection system rehabilitation, using the unit costs provided in Table 12-1, equals $21.38 million for the 54 miles of collection system approximated as 8-inch rehabilitated sewer at $75/lf (assumes approximately a 50/50 split between slip lining and pipe bursting of equivalent 8-inch-diameter pipe). The rehabilitation of the sewer laterals will cost approximately $50/ft when considering landscaping replacement or the use of trenchless construction methods. The estimated total length of sewer laterals in the district is about 41.5 miles. Therefore, the estimated construction cost for lateral rehabilitation is $11.0 million. The total estimated construction cost for a rehabilitation program that is effective enough to eliminate the requirement for a new larger capacity sewer is approximately $32.35 million. The estimated replacement construction cost for the increased capacity of sewer in the FOSMD is $5.41 million as shown for the projects listed in Table 14-1. Compare $5.41 million replacement construction cost with the costs listed on the other pages.

Wastewater Cost of Treatment

The cost of treating the increased PWWF will have to be borne by the rate payers of the district. A typical cost of wastewater treatment is approximately $0.00125/gallon treated. Using this rate the cost of treating the PWWF storm event total flow of approximately 7.8 million gallons equals $9,750 per peak flow event. Given that this is a once in five-year condition, the overall cost impact to eliminate the wet weather flows is not practical based on the cost analysis shown above.

The County needs to carefully review the terms of the operating agreements for accommodating wastewater flow with each of these agencies to determine who is responsible for the cost of any potential downstream improvements required as the result of construction of a new larger capacity sewer for the district. The operating agreements should provide a basis of negotiation and planning for developing the recommended projects so that no agency is overly burdened with the cost of the new facilities and that the potential for overflows is prevented.

Replace with 18-inch diameter sewer

Replace with 21-inch diameter sewer

Replace with 24-inch diameter sewer

Replace with 24-inch diameter sewer

Replace with 18-inch diameter sewer

Replace with 33-inch diameter sewer

Replace with 24-inch diameter sewer

Replace with 30-inch diameter sewer

Replace with 36-inch diameter sewer

Replace with 48-inch diameter sewer

Bay Rd.

Middlefield Rd.

El Camino Real

Stockbridge Ave.

Selby Ln.

Nimitz Ave.

101 Bayshore Freeway

82 El Camino Real

84 Woodside Exwy.

Broadway

Salt Evaporators

Match Line Figure 6b

Match Line Figure 6b

Recommended Replacement Sewers
Figure 13-1a

Legend

- Freeway/Major Road
- 8030102 Manhole Number
- Model Sewer
- District Boundary
- 51 Flow Monitor
- Recommended Replacement Sewer

GRAPHIC SCALE

600 0 300 600 1200

Match Line

Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Alameda De Las Pulgas

Replace with 12-inch diameter sewer

F214535 F214435 F214335 F214235 F214135 F214035 F213935 F213835 F213735 F2136A35 F2136535 F2135535 F213436 F213336 F213236 F198636 55 F198536 F198436 F198336 F198227 F198127 F198027 F197827 F197727 F197427 F197327 F197227 F197127 F193228 F193128 F193028 F192528 F192428 F192228 F192028 F191828 F191728 F191428 F191128 F190828 F190528 F190218 F190118 54 F190018 F183828 F172719 F172619 F172519 F172419 F172319 57 F171819 F171719 F171619 F171519 F171419 F171319 F171219 F170519 F170419 F170319 F170219

Replace with 36-inch diameter sewer

Selby Ln.

Replace with 21-inch diameter sewer

Nimitz Ave.

Replace with 15-inch diameter sewer

Replace with 12-inch diameter sewer

84 Woodside Exwy.

Match Line

280 Junipero Serra Freeway

Recommended Replacement Sewers
Figure 13-1b

Legend

- Freeway/Major Road
- 8030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor
- Recommended Replacement Sewer

GRAPHIC SCALE

600 0 300 600 1200

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SECTION 14

CAPITAL IMPROVEMENT PROGRAM

Capital improvement program (CIP) projects in the Fair Oaks Sewer Maintenance District (FOSMD) are necessary to correct identified hydraulic and structural deficiencies. This section presents the recommended improvement for correction the hydraulic deficiencies presented in Section 13 and the structural problems identified in Section 7.

Capital Projects

A total of 25 capital improvement projects were developed for the Fair Oaks District. Projects 1 through 14 were developed to provide increased hydraulic capacity to the FOSMD trunk sewer. Projects 15 through 25 are required to correct structural deficiencies that create increased maintenance costs or where the sewer is deteriorated to the point where failure may occur in the near future. Alternatives have been developed for the following projects in the Fair Oaks District:

1. Bay Road #4
2. Oakside/Barron Avenue
3. Selby Lane #3
4. Berkshire Avenue
5. Selby Lane #2
6. Bay Road #2
7. Selby Lane #1
8. Nimitz Avenue
9. Bay Road #1
10. 12th Avenue
11. Woodside Road
12. Santiago Avenue
13. El Camino Real #2
14. Milton/Hull Avenue
15. Eleanor Drive
16. Melanie Lane
17. Middlefield Road
18. Polhemus Avenue
19. Page Street
20. Stockbridge Avenue
21. 6th Avenue
22. Bay Road #3
23. El Camino Real #1
24. Hillside Drive
25. Glenwood Avenue

A priority ranking of 1 to 3 was applied to each of the projects to aid in the scheduling of the recommended CIP projects. The ranking was done according to the following:

- Priority 1— Required to correct hydraulic deficiencies. The only mitigation alternative available for this option is construction of relief or replacement sewers.
- Priority 2— Sewer lines with excessive maintenance requirements. Improvements to Priority 2 lines are required to prevent dry weather overflows that may be associated with blockages created by roots or other structural problems.
- Priority 3— Sewer lines with minor to major structural deficiencies. Corrective action may or may not be required on these lines depending on the severity of defects.

Table 14-1 presents the recommended projects, priority rating and minimum and maximum mitigation construction costs. Each of the recommended projects is shown on Figures 14-1a and 14-1b. A project summary sheet is provided for each project in Appendix F. The summary sheet describes the project location, description of the deficiency, the three corrective alternatives, estimated construction costs for each alternative and any specific project concerns (i.e., easement work, coordination with neighboring cities, etc.).

Estimated construction costs for the projects range from $7,115,200 to $7,531,200 depending on the selected alternative. The FOSMD trunk sewer replacement projects may require coordination with the South Bayside Sewage Authority (SBSA). Currently, the FOSMD trunk sewer conveys flow to the SBSA pumping station in Redwood City. Operating procedures at the pumping station cause flow to back up and surcharge in the FOSMD trunk sewer along Bay Road. Correcting the capacity limitations along the FOSMD trunk sewer may cause more severe surcharging problems in near the pumping station.

Operation and Maintenance Program

A crucial part of the successful ongoing performance of the collection system is the operation and maintenance (O&M) program used by the agency. Current maintenance guidelines for the collection system are to clean all sewers in easements annually, and all sewers in roadways every 6 months. In addition some sewers are cleaned more frequently where they have been identified as being prone to blockages. The purpose of this section is to provide an overview of an O&M approach for the district. It is beyond the scope of work for this project to develop a reach by reach O&M program for the district.

County staff provided a long-term history of emergency call outs to respond to potential spills and blockages. Analysis of these data confirmed that some portions of the system require more frequent cleaning than other segments, which is typical of all collection systems. Also typical cleaning practice is to clean enough material from the pipe to keep the flow moving, rather than completely clean the pipe. An example of this practice is the use of a 4-inch root cutter head to open the flow on the 6-inch diameter sewer. This cleaning method provides only 44 percent of the available pipe cross sectional area to convey sewer flows. Cleaning to the full diameter of the sewer (use of a 6-inch root cutter in a 6-inch sewer, etc.) and removing the debris from the immediate downstream manhole, while more time consuming, will provide the maximum available sewer system capacity without pipe replacement. The priority of the field crew should be placed on providing a clean sewer rather than the more typical production rate performance criteria.

Table 14-1. Recommend Capital Improvement Program

Project Description	Priority	Minimum construction cost, dollars	Maximum construction cost, dollars
Bay Rd. #4	1	1,005,700	1,005,700
Oakside/Barron Ave	1	661,800	661,800
Selby Ln #3	1	864,400	864,400
Berkshire Ave	1	609,200	609,200
Selby Ln #2	1	209,500	209,500
Bay Rd. #2	1	337,900	337,900
Selby Ln #1	1	325,000	325,000
Nimitz Ave	1	218,000	218,000
Bay Rd. #1	1	369,900	369,900
12th Ave	1	133,800	133,800
Woodside Rd.	1	128,400	128,400
Santiago Ave	1	150,400	150,400
El Camino Real #2	1	180,500	180,500
Milton St/Hull Ave	1	219,400	219,400
Eleanor Dr	3	149,260	240,500
Melanie Ln	3	150,195	161,300
Middlefield Rd	3	108,715	137,500
Polhemus Ave	3	293,760	367,200
Page St	3	107,935	114,120
Stockbridge Ave	3	234,260	248,040
6th Ave	3	97,480	146,470
Bay Rd. #3	3	185,900	223,020
El Camino Real #1	3	133,770	191,100
Hillside Dr	3	124,200	149,040
Glenwood Ave	3	115,800	138,960
Totals		7,115,200	7,531,200

Overall collection system maintenance should be on a regular schedule that balances the need to provide maximum available sewer capacity with the cost of maintenance. Typical cleaning frequencies in other agencies in the Bay Area range from once every 6 to 10 years, with segments of sewer cleaned more frequently (up to monthly) where needed. Adopting a program with a fixed cleaning frequency should be instituted for the district. The County has maintenance management software that is capable of establishing schedules for the maintenance crews. Initial cleaning frequencies should be extended to once every 2 years (except for known trouble spots) and then to longer return periods as the condition of the collection system relative to debris, grease, and roots build up is determined throughout the collection system. Known trouble spots that require more frequent maintenance should be placed on a two month cleaning schedule or more frequent if warranted and tracked to determine whether the cleaning frequency can be increased.

Establishing a cleaning program that relies on continuous schedule/frequency refinement will provide the district with an optimum cleaning program that provides a high level of service and reliability to the community. An added benefit to a responsive cleaning program is the ability of the maintenance crews to shift their focus to accommodate changes in the collection system as changes occur.

When the cleaning of the collection system is performed by a maintenance crew that has other assigned duties in addition to O&M on the collection system, it becomes very important to prioritize with justification, the time requirements of the maintenance crews. Other collection system activities, such as spot repairs, main line rehabilitation, manhole rehabilitation/reconstruction, and lateral rehabilitation could all be added to the duties of the maintenance crew. The impact of this type of increased work load would likely require the maintenance crews to become completely assigned to collection system O&M. This approach would allow the County to maintain the structural integrity of the collection system with a minimum amount of outside construction contracting. Larger projects where several sewers are rehabilitated at the same time should be constructed with a contractor that specializes in the rehabilitation method being used for that portion of the collection system.

The upcoming EPA regulations on sanitary sewer overflows (SSO) will likely require that each district within the County apply for and secure a National Pollutant Discharge Elimination System (NPDES) permit for the operation of the collection system. One of the key aspects proposed for the SSO regulations is the tracking and elimination of dry weather overflows. The SSO regulations will likely allow for limited overflows to occur that are related to acts of nature (severe wet weather events) and for acts of vandalism (illegal dumping of debris into a manhole). It will not allow for repeat overflow locations and will require a database/geographic information system to track the operation and maintenance and the performance of the collection system.

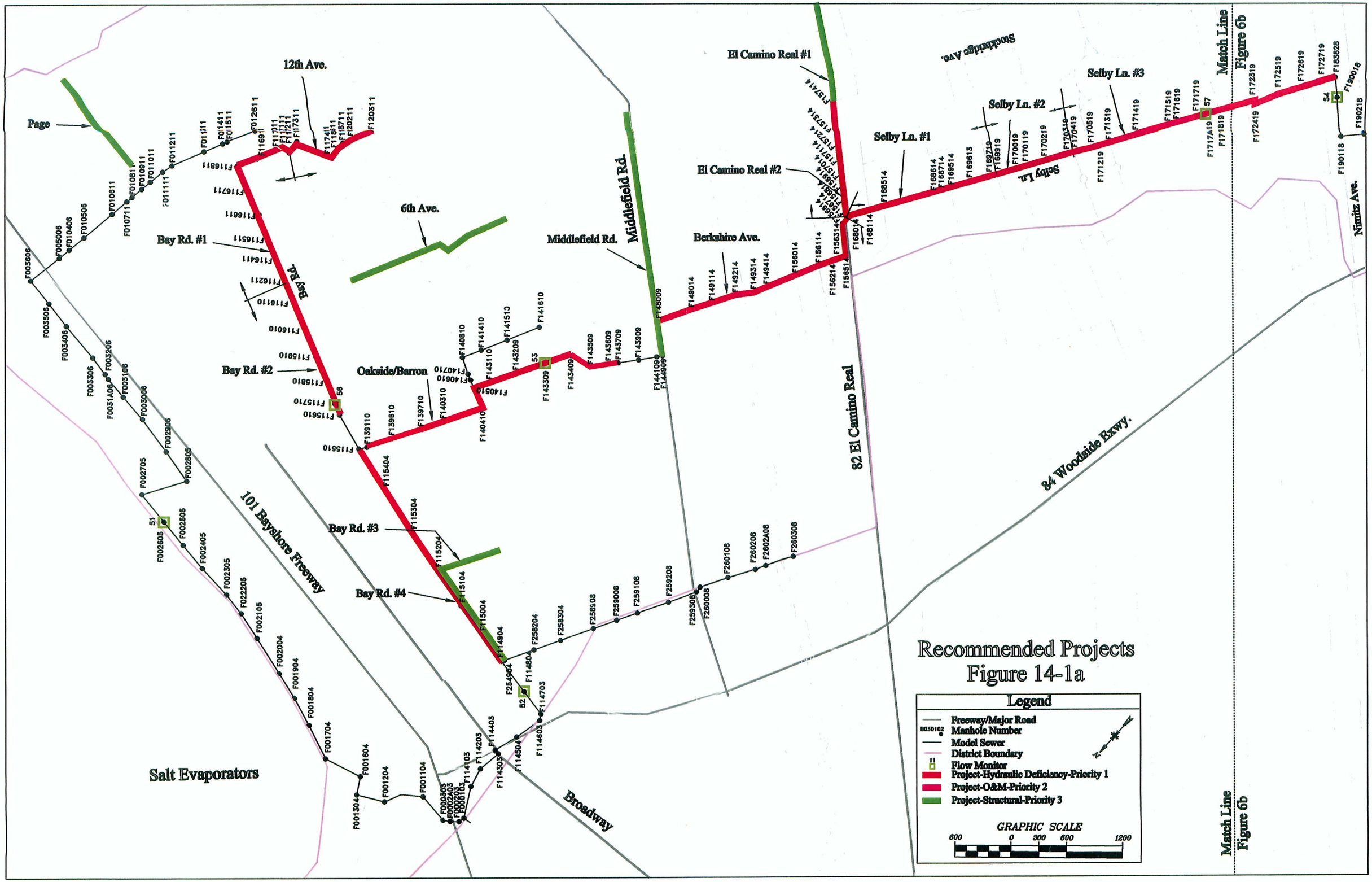
The mission of proactive collection system maintenance is to provide the longest possible life to the sewers without having to replace them with costly construction projects. The primary goal of providing the maximum capacity of the existing collection system network is what the maintenance program should achieve. Unfortunately, an aggressive O&M program will not have any effect on the amount of I/I that enters the collection system as the repairs that are completed by the maintenance crews are selective, structurally oriented, and spread over the entire collection system, rather than a comprehensive focused rehabilitation program.

Other Collection System Options

The County could consider the impacts/benefits of other collection system options, in addition to construction and modifications of the O&M program recommendations made from this study. Two main options are presented below:

1. Require lateral inspection testing and repair as a condition of ownership transfer of a sewered parcel. The benefit is that the new property owner will acquire the property with a sound sewer lateral and the County will, over a long time period, have the sewer lateral located on the private property rehabilitated at no direct cost to the County. Statistically home ownership changes an average of every 7 to 10 years. A downside to this approach is that many properties do not change ownership in this time frame and consequently the County will end up with a mix of tested and untested laterals within a neighborhood, thereby limiting the effectiveness of the rehabilitation for reducing the I/I contribution to PWWF. This type of inspection has been implemented in several communities in California and in all cases meet with considerable political resistance for impacted jurisdictions and the local real estate organizations. Where implemented the program is now considered a minor cost of doing business within the community.

2. Begin a long-term sewer replacement program of the collection system. At this time the cost of a cyclic replacement program based on the design life of the collection system is both impractical and cost prohibitive. The cost comparison of providing system capacity versus total system rehabilitation (see Section 13) to reduce I/I contribution demonstrates the economic burden on the rate payer. A key benefit of a scheduled cyclic replacement program would be establishing a reasonable expected cap to I/I related flows by establishing a schedule of replacement combined with ongoing O&M to effectively limit the amount of I/I entering the collection system.


Page
12th Ave.
6th Ave.
Bay Rd. #1
Bay Rd. #2
Bay Rd. #3
Bay Rd. #4
Bay Rd.
Middlefield Rd.
Middlefield Rd.
Oakside/Barron
El Camino Real #1
El Camino Real #2
Berkshire Ave.
Selby Ln. #1
Selby Ln. #2
Selby Ln. #3
Selby Ln.
Scottridge Ave.
Match Line
Figure 6b
Ninnitz Ave.
82 El Camino Real
84 Woodside Expwy.
101 Bayshore Freeway
Broadway
Salt Evaporators
Recommended Projects
Figure 14-1a
Legend
Freeway/Major Road
B030102 Manhole Number
Model Sewer
District Boundary
11 Flow Monitor
Project-Hydraulic Deficiency-Priority 1
Project-O&M-Priority 2
Project-Structural-Priority 3
GRAPHIC SCALE
600 0 300 600 1200
Match Line
Figure 6b

Match Line

Atherton Ave.

Tuscaloosa Ave.

Stockbridge Ave.

Polhemus Rd.

Stockbridge

Alameda De Las Pulgas

Melanie Ln.

Eleanor Dr.

Selby Ln. #3

Selby Ln.

Nimitz Ave.

Nimitz Ave.

Milton/Hull

Santiago

Woodside Rd.

84 Woodside Exwy.

Match Line

280 Junipero Serra Freeway

F170219 F170319 F170419 F170519 F171219 F171319 F171419 F171519 F171619 F171719 57 F171819 F1717A19 F172319 F172419 F172519 F172619 F172719 F183828 54 F190018 F190118 F190218 F190528 F190828 F191128 F191428 F191728 F191828 F192028 F192228 F192428 F192528 F193028 F193128 F193228 F197127 F197227 F197327 F197427 F197727 F197827 F198027 F198127 F198227 F198336 F198436 55 F198536 F198636 F2132536 F213336 F213436 F213535 F213635 F2136A35 F213735 F213835 F2138A35 F213935 F214035 F214135 F214235 F214335 F214435 F214535

Recommended Projects
Figure 14-1b

Legend

- Freeway/Major Road
- B030102 Manhole Number
- Model Sewer
- District Boundary
- 11 Flow Monitor
- Project-Hydraulic Deficiency-Priority 1
- Project-O&M-Priority 2
- Project-Structural-Priority 3

GRAPHIC SCALE

600 0 300 600 1200

Insert “15” Tab Here

SECTION 15

SANITARY SEWER RATES

The implementation of the capital improvement programs (CIP) developed for Fair Oaks Sewer Maintenance District (FOSMD) in Section 14 will require that the District invest considerably in its sanitary sewer collection system. As a consequence, the District will need to charge higher rates to customers. The impact of the various alternative levels of CIP expenditures on District finances and a projection of this impact on the equivalent single-family residences (SFR) rate is presented in this section. SFRs currently make up approximately 81 percent of all FOSMD residential unit equivalents. The impact of various levels of CIP expenditures on the rates assessed SFRs was determined by (1) determining the various alternative levels of the CIP expenditure considered over a 5-year period, adjusted for inflation, and (2) determining current revenue requirements.

The sanitary sewer rates necessary to pay for the recommended improvements, at each alternative level considered for the 5-year study period FY 1999/00 through 2003/04 were estimated. This section presents the methodology used to determine the likely impacts.

The rates derived assume no use of reserves to lower revenue requirements necessary to be recovered from rates. As such, this section contains guidelines for the County's use in determining an appropriate reserve level for the District. All supporting documentation of the development of revenue requirements and rates is contained in Appendix G.

RATE IMPACTS

Determining the impact of the CIP on the sanitary sewer rates requires that the cost of the CIP be combined with existing annual revenue requirements to estimate the increase in the rates required to meet the new level revenue requirements. Essentially, revenue requirements are developed based on historical expenditures, offsetting revenues and alternative levels of CIP related expenditures for each fiscal year in the study period. This total net revenue requirement is divided by the total number of equivalent residential connections (ERC) in the District to obtain the rate per ERC.

Development of CIP

The three priority levels of capital improvements currently under consideration are discussed in detail in Section 14. The recommended financing alternative for the District for the CIP developed is pay-as-you-go financing. Although debt (e.g., Certificates of Participation [COPs] or revenue bonds) could possibly be issued by combining projects from several

Districts to create a larger single issue, pay-as-you-go financing is the recommended alternative at this time.

Development of Annual Revenue Requirements

Revenue requirements for the FOSMD system were estimated from accounting information provided by County staff. For each alternative, historical and projected revenue requirements were developed. Projected expenses were developed by inflating the FY 1997/98 expenses by 3 percent per year. The capital projects expenditures (CIP) in any given year is the level of CIP divided by 5 years (assuming the projects will be paid evenly over the 5-year period) and inflated by 3 percent in each subsequent year. Offsetting revenue in the form of secure property taxes was also inflated by 3 percent per year. Other projected offsetting revenues were based on historical levels of receipts and were not inflated. It was assumed that the District does not plan to either add to or subtract from their existing reserve fund balance. This assumption may change if the County conducts a reserve study, the results of which may indicate that the reserve balance can either be used or added to. Tables 15-1, 15-2 and 15-3 contain a summary of the revenue requirements and rate development.

Impact of Revised Revenue Requirements

The impact on rates of the proposed CIP is significant regardless of what level of capital projects FOSMD chooses. Current rates are $174/residential unit equivalent. Alternative 1 sees a maximum rate increase of 84 percent to $321/residential unit equivalent in FY 2003/04. Alternative 2 sees a maximum rate increase of 72 percent to $299/residential unit equivalent in FY 2003/04. Alternative 3 sees a maximum rate increase of 72 percent to $300/residential unit equivalent in FY 2003/04. This analysis assumes that the increased costs, both as a result of the CIP and increases in general expenses, are absorbed equally by all customers. The tables provided in Appendix G summarize the revenue requirements including CIP levels for each alternative along with the calculated rates. As no significant growth is expected in FOSMD, the number of equivalent residential units used to calculate the rates is 11,556. The full development of the rates for the three alternatives and the average of the three alternatives is contained in Appendix G. Tables 15-1, 15-2 and 15-3 also contain a summary of the rate development.

Table 15-1. Fair Oaks Alternative 1 Summary Rate Development

Item	Projected, dollars				
	1999/00	2000/01	2001/02	2002/03	2003/04
Gross expenses	3,659,557	3,769,344	3,882,424	3,998,897	4,118,864
Total offsetting revenue	397,126	400,834	404,653	408,587	412,639
Use of fund balance	-	-	-	-	-
Net revenue requirements	3,262,431	3,368,510	3,477,771	3,590,310	3,706,225
Annual rate assuming 11,556 connections	282	291	301	311	321

Table 15-2. Fair Oaks Alternative 2 Summary Rate Development

Item	Projected, dollars				
	1999/00	2000/01	2001/02	2002/03	2003/04
Gross expenses	3,438,629	3,541,788	3,648,042	3,757,483	3,870,207
Total offsetting revenue	397,126	400,834	404,653	408,587	412,639
Use of fund balance	-	-	-	-	-
Net revenue requirements	3,041,503	3,140,954	3,243,388	3,348,896	3,457,568
Annual rate assuming 11,556 connections	263	272	281	290	299

Table 15-3. Fair Oaks Alternative 3 Summary Rate Development

Item	Projected, dollars				
	1999/00	2000/01	2001/02	2002/03	2003/04
Gross expenses	3,441,964	3,545,223	3,651,580	3,761,127	3,873,961
Total offsetting revenue	397,126	400,834	404,653	408,587	412,639
Use of fund balance	-	-	-	-	-
Net revenue requirements	3,044,838	3,144,389	3,246,926	3,352,540	3,461,322
Annual rate assuming 11,556 connections	263	272	281	290	300

RESERVE RECOMMENDATION

The following list of general recommendations are for the County's use in determining the appropriate amount of reserve funds to maintain for the District.

1. **Working Capital Reserve**— This generally constitutes 1/6 to 1/12 (as appropriate for a utility's billing cycle) of annual operations and maintenance expenses. This is intended to cover the gap created by the need to pay for expenses incurred prior to the receipt of fees for services rendered.

2. **Emergency Repair Reserve**— Between 1 percent and 3 percent of the current replacement value of a system's assets can be held in reserve for use in the case of main breaks or other necessary emergency repairs.

3. **Self Insurance Reserve**— Between 1 percent and 3 percent of the current replacement value of a system's assets can be held in reserve as self insurance in the case of damages a system might sustain from natural or other disaster.

4. **Debt Service Reserve**— Generally, debt holders require that a utility maintain a minimum reserve equal to 1 year's debt service payments.

It is recommended that, at a minimum, the County maintain 10 percent of annual operating and maintenance costs as working capital reserves or about $330,000 in the case of Fair Oaks along with emergency repair reserves. Assuming FOSMD has approximately 285,000 feet of equivalent 10-inch-diameter pipe (assuming 57,000 feet modeled length represents 20 percent of the system) and assuming $120/foot replacement cost yields an estimated minimum system replacement value of $34,000,000. Using the guideline above the County should thus maintain between $340,000 and $1,030,000 for emergency reserves. Thus, the total minimum recommended reserves would be between $670,000 and $1,360,000 for FOSMD. It should be noted that this minimum level of reserves is based on the District's current O&M expenses, the above guidelines, and a rough estimate of the value of the District's assets and should be updated if better information becomes available. Current and projected fund balance levels are shown on the tables in Appendix G.

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APPENDIX A

MANHOLE INSPECTION
TECHNICAL MEMORANDUM

MEMORANDUM

To: Mark Welsh
County of San Mateo, DPW

From: Charlie Joyce
Brown & Caldwell

Date: October 12, 1998 File- 4692.01/10

Subject: Sanitary Sewer and Water System Evaluation Study
Manhole Inspection Memorandum of Field Work

INTRODUCTION

This memorandum presents a summary of the field investigations conducted during the winter and spring of 1997 on inspection of manholes in the nine sewer districts maintained by the San Mateo County Department of Public Works. A total of 873 manholes in the nine districts were inspected with the following in each district:

Table 1
Number of Manholes Inspected By District

District	Manholes Inspected
Burlingame Hills Sewer Maintenance District	90
Crystal Springs County Sanitation District	257
Devonshire County Sanitation District	37
Emerald Lake Heights Sewer Maintenance District	233
Fair Oaks Sewer Maintenance District	204
Harbor Industrial Sewer Maintenance District	22
Kensington Square Sewer Maintenance District	6
Oak Knoll Sewer Maintenance District	17
Scenic Heights County Sanitation District	7

The purpose of this memorandum is to provide the background of how the manholes inspections were conducted, manhole numbering, interpretation of the manhole data, how the data will be used for other parts of the sanitary sewer collection system evaluation, and a summary of critical locations in the districts where repair work should take place. The memorandum also includes descriptions on how to locate photographs related to an inspected manhole in the 12 three ring binders provided at the completion of this project.

This memorandum does not provide the condition assessment of the sanitary collection system. That work effort will be completed as part of a later task in the project when the other parts of the field data, namely flow monitoring, television inspection, and smoke testing, are completed.

MANHOLE INSPECTION OVERVIEW

A key part of the data collection consisted of documenting the findings of the inspections for analysis. Two methods of documenting the manhole inspection were used for this project. The first was a field form set up to allow the field crew to collect data in an efficient manner on the condition of the manhole. The second method of documenting the manhole condition was to photograph defects found during the visual inspections. The manhole inspections were top side inspections where the condition of the manhole was observed from the surface.

In order to collect additional data on each manhole location a "Camera on a Stick" (Figure 1) was lowered into the manhole and a photograph of each pipe entering and leaving the manhole was taken. Where infiltration/inflow or other manholes conditions warranted a photograph was also taken from the "Camera on a Stick".

The view in the pipeline using the "Camera on a Stick" is dependent on the flow, debris, and channel benching in the manhole. Where the camera can be placed in the channel with a clear view of the pipeline the photograph typically shows approximately 20 feet of the sewer away from the manhole for an 8-inch diameter sewer. Larger sewer diameters typically show a longer distance and smaller sewer diameters show a shorter distance.

Figure 1

Pipes were photographed in a clockwise direction to avoid confusion and to allow for cataloging the photographs. Pipe A was always the first pipe in the clockwise direction from the primary outlet pipe(s). Drop manholes would have a photograph taken of both the top and bottom of the drop manhole and were noted as such in the comment field of that pipe. Each pipe in the drop manhole pipe was given a separate pipe identifier.

A copy of a blank field form used to document manhole conditions is included as Attachment A. Also in that attachment is a blank form for the pipe condition assessment that was completed for each pipe when the photographs were reviewed.

Manhole numbering modifications to the existing manholes numbering system for each basin were performed so that each manhole in the nine districts has a discrete unique label. The manhole number is an eight character alpha/numeric with the following definition:

B0001A04

B	Burlingame Hills, see Table 2.
0001	Manhole Number with zeros shown for place holders.
A	Several manholes were placed after initial numbering using a letter - A, B, etc. When not needed this part of field is left blank.
04	District Map Number as supplied by County.

Table 2
District Designators

District	Designator
Burlingame Hills Sewer Maintenance District	B
Crystal Springs County Sanitation District	C
Devonshire County Sanitation District	D
Emerald Lake Heights Sewer Maintenance District	E
Fair Oaks Sewer Maintenance District	F
Harbor Industrial Sewer Maintenance District	H
Kensington Square Sewer Maintenance District	K
Oak Knoll Sewer Maintenance District	O
Scenic Heights County Sanitation District	S

The manholes were numbered as the inspections were completed. Each completed form was then entered into a Microsoft Access v2.0 database that was programmed for manhole inspection analysis. Each item on the inspection form was input to the data base. The checks and boxes on the inspection form translate to a yes/no or numerical value in the database for future use in the condition assessment analysis. Data related to the pipe photographs were entered directly into the database after the photographs were developed and reviewed.

Manholes were selected for inspection to provide a representative random sample of the manholes in each of the nine districts. Manholes were identified for inspection from the collection system maps. The manholes selected normally met one of the following criteria:

- Connection of more than two sewers entering the manhole
- One of the sewers entered into or exited from an easement
- The sewer segment appeared typical to the area served
- A special flow connection or cross-connection was shown on the maps
- A manhole with many laterals entering, such as a cul-de-sac.

Manholes located in easements were also inspected, although access to many of these manholes was not possible due to obstructions, locked gates, or the occasional fence built over the manhole. Traffic control measures were used to route vehicles around the field crew and the crew followed safety precautions as outlined in the Field Health and Safety Plan required on all

Brown and Caldwell field related projects.

MANHOLE INSPECTION BINDERS

A series of three-ring binders containing the print outs from the database with the accompanying photographs for each inspected manhole were assembled. The binders are numbered by an alpha/numeric format where the first letter corresponds to the district and the number corresponds to the binder number for that district. This format allows for future manhole inspections to be placed in successive binders. A field was added to the database so that the binder number could be attached to the manhole number.

A summary report is contained at the front of each binder to facilitate the location of a manhole. The summary report is provided in two orientations: 1) by film roll number, and 2) by manhole number. The contents of the binders area are arranged by film roll number for each District, rather than by manhole number.

The photographs for each manhole are arranged so the first photo (normally upper left) is the manhole number followed by the manhole cover, channel, or other defect photographs. The pipe photographs follow using the same convention as identified in the field inspection, beginning with Pipe A and proceeding through to Pipe X.

Locating a manhole in the binders is most easily accomplished by using the database query "BINDER/ROLL/MHID" to identify the binder number and the roll number of the associated photographs and then looking up the database print out and photographs in the appropriate binder.

Of the 873 manholes inspected a total of 2,480 pipes were photographed. The following tables provide summary information related to the manholes and pipes inspected. The tables are arranged by manhole number. Specific database reports for manholes and pipes, Attachments B and C, respectively, follow this memorandum.

Manholes
Manholes with Bench/Channel Defects Worse Than Moderate
Manholes with Roots
Manholes with Grease
Manholes with Frame and Cover Problems
Manholes with Infiltration/Inflow and Flow Caps
Manholes with Major Debris in Channel

Pipes
Pipes with Separated Joints Greater than Moderate and Deflections Greater than One Inch

Pipes with Greater than Minor Corrosion
Pipes with Infiltration/Inflow
Pipes with Greater than Light Grease
Pipes with Greater than Light Roots
Pipes with Roots and Grease
Pipes with Cracks and Fractures
Pipes with Plugs and Obstructions

Insert “B” Tab Here

APPENDIX B

1997 FLOW MONITORING PROGRAM TECHNICAL MEMORANDUM

MEMORANDUM 4692-02

November 19, 1997

TO: MARK WELCH, COUNTY OF SAN MATEO

FROM: BRIAN HAMMER, BROWN AND CALDWELL
CHARLIE JOYCE, BROWN AND CALDWELL

SUBJECT: COUNTY OF SAN MATEO MASTER PLAN
1997 FLOW MONITORING PROGRAM

This memorandum documents the flow monitoring program conducted for the County of San Mateo Master Plan during the winter of 1997. The purpose of the project was to measure the flow rate during dry weather and discrete rainfall events in the San Mateo County area. This memorandum discusses the flow monitoring program and subsequent data analysis. Results of the flow monitoring program are attached.

Flow Monitoring Locations

A flow monitoring plan was developed to determine dry weather flow rates and Inflow/Infiltration (I/I) rates in the County of San Mateo wastewater collection system. As part of the flow monitoring plan, specific locations within the County sanitary collection systems where temporary flow monitors and rain gauges could be installed were identified and evaluated. Potential monitoring site evaluations were conducted the week of January 16, 1997, by Brown and Caldwell staff.

During the field evaluation, manholes were inspected to determine their hydraulic suitability for flow monitoring and accessibility. Special safety considerations were also documented. Fifteen manholes were selected for temporary flow monitoring among the nine sewer district. Additionally, four rain gauge sites in the County collection system were also located and evaluated. The selected flow monitoring sites and rain gauge locations are listed in Table 1 and Table 2, respectively. Flow monitoring site reconnaissance forms for the selected manholes are included in Attachment A. Included in Attachment A are schematic diagrams of each sewer district showing the flow monitor locations.

Table 1 Flow Monitoring Locations

Flow monitor site	Location	Pipe diameter, in.
11	Burlingame Hills - 2815 Adeline near Alvarado	8
12	Burlingame Hills - 2872 Canyon Road	8
21	Crystal Springs - Polhemus Road near Ascension Street	10
22	Crystal Springs - Polhemus Road and Ticonderoga Road	8
31	Devonshire - Devonshire Road and Exeter Street	8
41	Emerald Lake - 1706 Cordilleras Road	8
42	Emerald Lake - Lake Boulevard and Oak Knoll Drive	8
43	Emerald Lake - Glenwood Drive at Garret Park	6
44	Emerald Lake - 1036 Lakeview Drive	6
51	Fair Oaks - Douglas Court. (end)	30
52	Fair Oaks - Bay Road at Willow Street.	30
53	Fair Oaks - 559 Oakside Drive	21
54	Fair Oaks - 343 Nimitz Avenue.	15
55	Fair Oaks - Woodside Road. near Churchhill	10

Table 2 Rain Gauge Locations

Rain gauge no.	Location
1	Burlingame Hills - Hillside at Newton, Fire Station #2
2	Crystal Springs - 2295 Cobble Hill at Ticonderoga Road (private residence)
3	Emerald Lake - California at Jefferson, Fire Station #19
4	Fair Oaks - Bay Road at 2nd Street., Fire Station #11

Flow Monitoring

Montedoro-Whitney WDFM-8 flow monitors were installed at the fifteen selected locations on January 22 and 23, 1997. These monitors are capable of measuring both depth and velocity of flow. The combined depth and velocity measurements make it possible to calculate flow rates for open channel conditions and during surcharge or backwater conditions.

Depth measurements were made by a differential pressure type strain gauge. One side of the sensing element is open to atmospheric pressure. This prevents errors due to changes in barometric pressure. Adjustments for temperature differences are made to further insure the accuracy of the measurements. The depth of flow sensing element is located on the bottom of the monitoring probe, which allows for depth measurements from zero to a maximum of 10 feet when the probe is centered exactly on the bottom of the pipe.

In field conditions, it is very difficult to center the probe exactly on the bottom of the pipe. The resultant difference between actual water surface level and monitored water surface level is called a depth offset. Corrections for the depth offset are discussed later in this memorandum. Depth measurements with these monitors are accurate to 0.01 of a foot under laboratory conditions. Accuracy of depth measurements in the field is dependent on the hydraulic characteristics of the flow stream at the monitoring site, proper installation techniques, and frequent maintenance procedures.

The monitors measure flow velocity using the ultrasonic Doppler shift method. The velocity sensor on the monitor sends an ultrasonic signal into the flow stream and measures velocities based on the Doppler shift. The flow monitoring velocity sensor is located approximately 1.5 inches from the bottom of the sensor and must be completely submerged to obtain accurate velocity measurements.

Velocity measurements are made at the bottom of the pipe near the wall and, therefore, are not actually measuring the average velocity of the flow stream. The difference between the monitored velocity and the average velocity is called a velocity offset and is also discussed later in this memorandum.

Precipitation intensity and duration were measured at four temporary locations in the County service area. The rain gauges were tipping bucket type gauges connected to portable electronic event recorders. The rain gauges are calibrated to tip after 0.01 inches of rainfall is received. The event recorder documents the time of each tip. Rain gauges 1 and 3 were installed on January 24, 1997. Rain gauges 2 and 4 were installed January 23, 1997. The flow monitors and rain gauges were removed on March 18, and March 24, 1997, respectively.

Flow Monitor Calibration

Calibration data was collected to verify both depth and velocity and to develop a depth-to-discharge relationship for the monitoring sites. Calibration data was obtained approximately once a week by manually measuring the depth and velocity of the flow stream with portable equipment. Field staff were responsible for maintaining the flow monitoring equipment and obtaining calibration information. The data was collected at various times in the diurnal cycle including early morning low flow periods and peak flow periods. Attachment B provides a listing of the calibration data for each flow monitoring location.

Data Analysis

Flow monitoring data analysis consisted of developing depth to discharge relationships for calculating flows, and determining depth and velocity offset values for the raw data. These tasks are described in the following paragraphs.

Depth-to-Discharge Relationship. The first step in the data analysis process was to develop a flow depth-to-discharge rating curve for each monitoring site. The rating curve was used to determine flows under open channel conditions. During the monitoring site calibration, the average velocity and corresponding depth of flow were measured approximately twice weekly at each of the flow monitoring sites. Average velocity measurements were made by field crews using portable velocity probes. The portable velocity probe is capable of continuously samples the velocity of the flow stream. Field crews move the portable velocity probe throughout the cross-sectional area of the flow stream for a period of 10 to 40 seconds and the average velocity was calculated automatically by the portable equipment.

These measurements were used to develop depth-to-discharge relationships. Calibration measurements were made at various times of the day and various days of the week to obtain information during the largest range of conditions experienced in the system during the monitoring period.

Actual flow rates were calculated from the calibration data using the continuity equation (flow = area x average velocity). The flow rate was then used to calculate the equivalent hydraulic slope at the site using Mannings equation. The average slope for all the manual measurements was then calculated and flow rates were plotted on a depth-versus-flow graph, and a Mannings curve was "fitted" to the data points. The curve utilizes the standard Mannings equation for open-channel flow, and use a depth-variable roughness coefficient or Mannings "n" value. The curves were then used to convert the flow monitoring depth measurements to flow rates during open channel flow conditions. When surcharging occurs, the depth and velocity measurements were used to calculate the flow rate using the continuity equation.

Offsets. The site calibration measurements were also used to develop depth and velocity offsets for the flow monitoring sites. Depths offsets occur when the flow monitoring probe was not installed exactly in the center of the pipe. Velocity offsets occur because the velocity sensor measures a point velocity near the pipe wall. In addition, each sensor has an inherent electronic offset. Manual calibration data was used to correct the monitored depth measurements and convert the point velocities to an average velocity. For this project, the combined electronic and physical offset remained constant at each of the flow monitoring sites during the flow monitoring period.

Results

Four storm events occurred during the flow monitoring program. The storm dates and their daily rainfall totals are summarized in Table 3.

Table 3 Rain Gauge Results, inches

Date	Rain Gauge 1 Burlingame Hills	Rain Gauge 2 Crystal Springs	Rain Gauge 3 Emerald Lake	Rain Gauge 4 Fair Oaks
01/24/97	0.63	0.56	0.71	0.59
01/25/97	1.20	1.15	1.64	1.02
01/26/97	0.53	0.43	0.52	0.25
02/17/97	0.21	0.13	0.13	0.07
03/02/97	0.23	0.11	0.21	0.02
03/16/97	0.34	0.13	0.40	0.10

The flow monitors at sites 12 and 44 either failed or became clogged with debris, for noted periods of time. For site 44, we do not recommend using the flow data from February 23, 1997, to March 16, 1997, as flow levels were too low to measure accurately. Also, flow monitoring at site 12 failed from February 20, 1997, to February 25, 1997. No additional monitoring problems were noted. Table 4 presents the dry weather and wet weather flow monitoring results of this analysis.

Table 4 Flow Monitoring Results, million gallons per day

Flow Monitoring Site	Minimum Flow	Average Flow	Peak Dry Weather Flow	Peak Wet Weather Flow
11	0.01	0.11	0.27	1.13
12	0.06	0.11	0.17	0.24
21	0.01	0.34	1.12	2.82
22	0.03	0.12	0.37	0.50
31	0.02	0.08	0.20	0.65
41	0.01	0.04	0.07	0.18
42	0.01	0.02	0.04	0.09
43	0.01	0.02	0.03	0.07
44	0.01	0.03	0.10	0.12
51	0.29	0.66	1.31	2.30
52	0.41	1.79	3.22	8.89
53	0.41	1.20	2.26	4.26
54	0.19	0.41	0.80	1.94
55	0.00	0.22	0.48	1.10

Listed below is a summary of the contents of the attachments:

Attachment A Flow Monitoring Site Reconnaissance Forms.

Attachment B. Flow Calibration Data

Attachment C Graphical Flow Summary. Graphical plots of minimum, daily, and peak flow rates.

BH:CJ:jm
Attachments

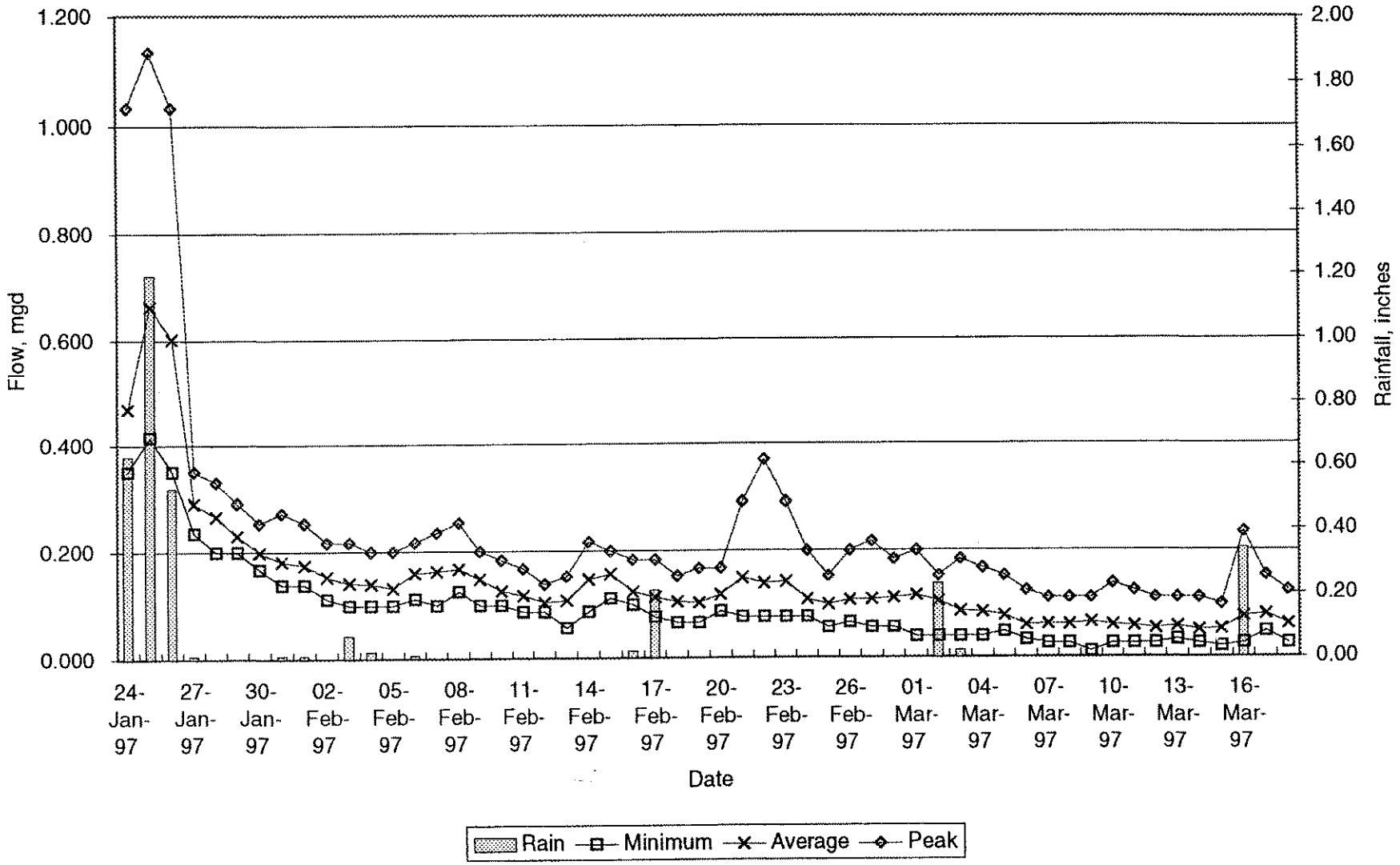
ATTACHMENT A

FLOW MONITORING SITE RECONNAISSANCE FORMS

ATTACHMENT C

GRAPHICAL FLOW SUMMARY
GRAPHICAL PLOTS OF MINIMUM, DAILY, AND PEAK FLOW RATES

County of San Mateo
Daily Flow Rates -- Site 11 -- 2815 Adeline, near Alvarado
8" Diameter



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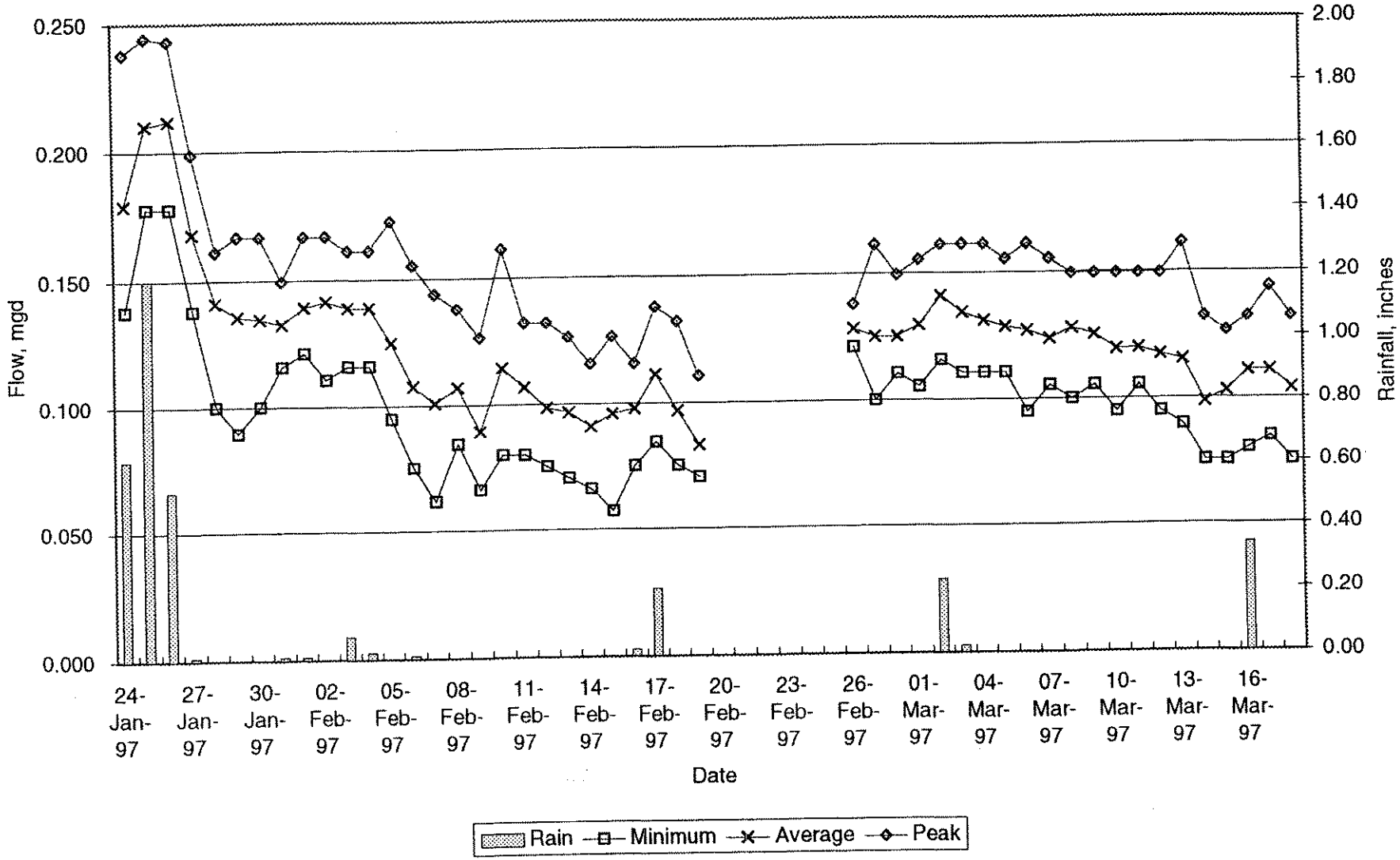
Country of San Mateo
Daily Flow Rates -- Site 12 -- 2872 Canyon Rd.
8" Diameter



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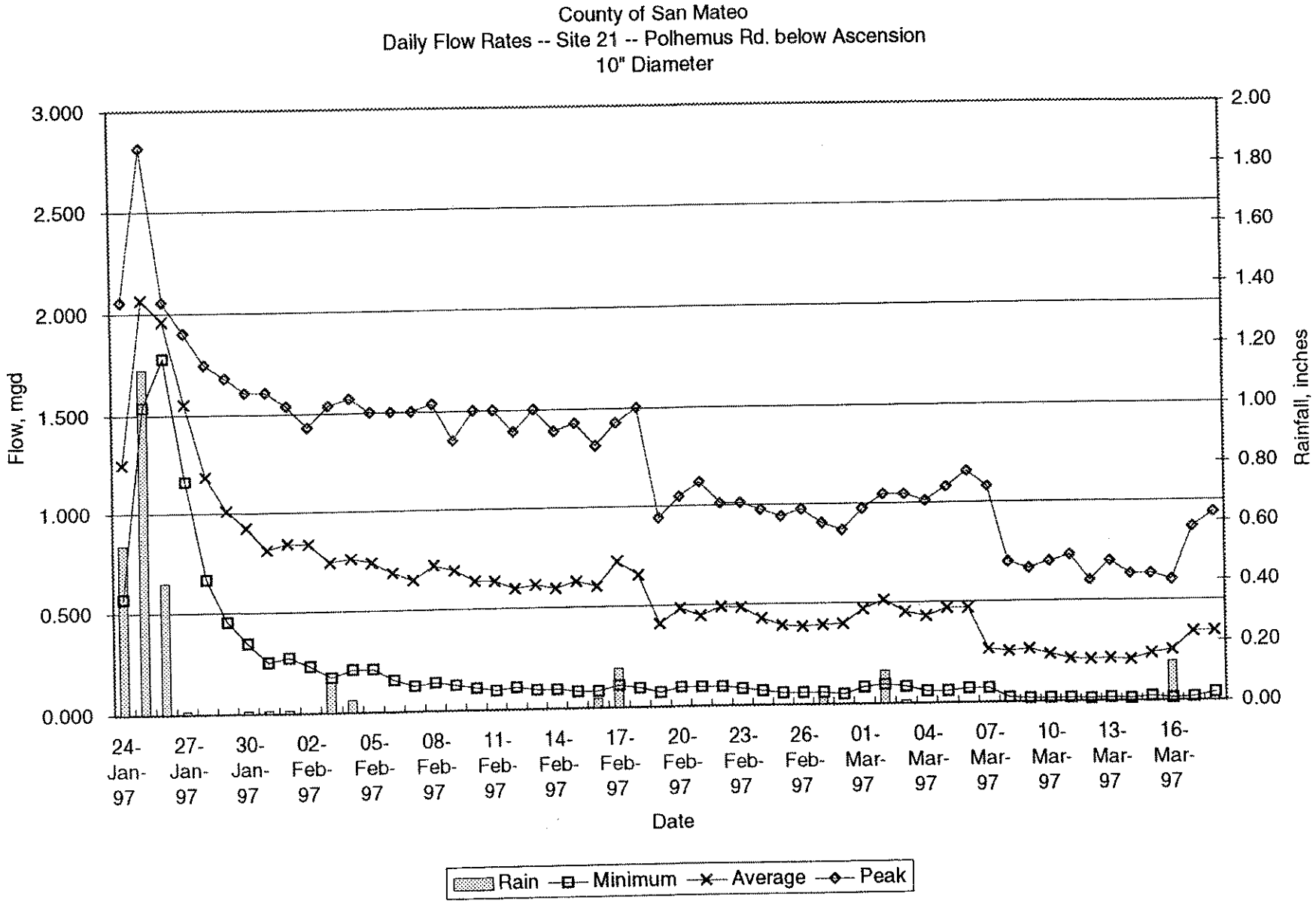

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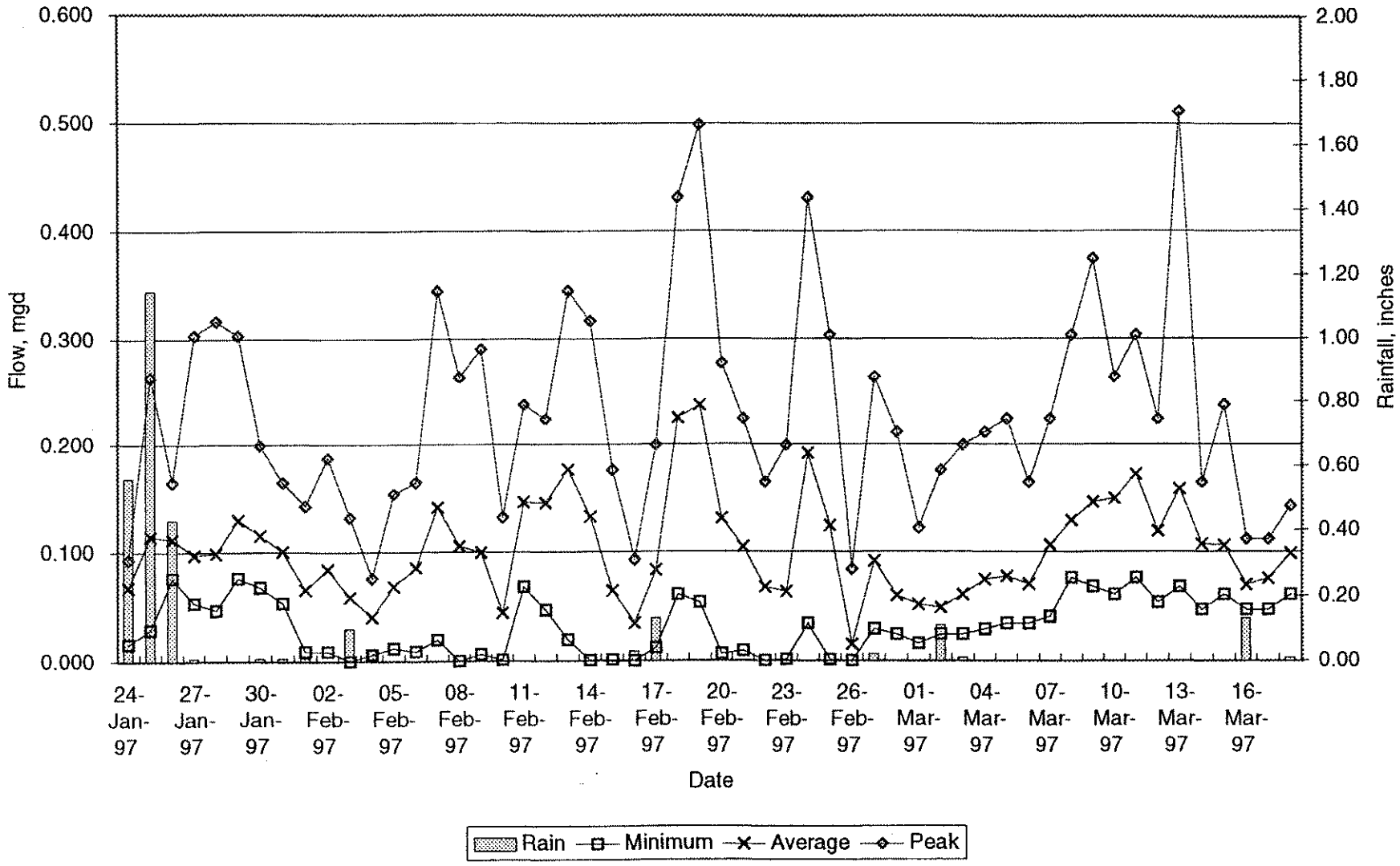
County of San Mateo
Daily Flow Rates -- Site 22 -- Polhemus Rd. at Ticonderoga
8" Diameter



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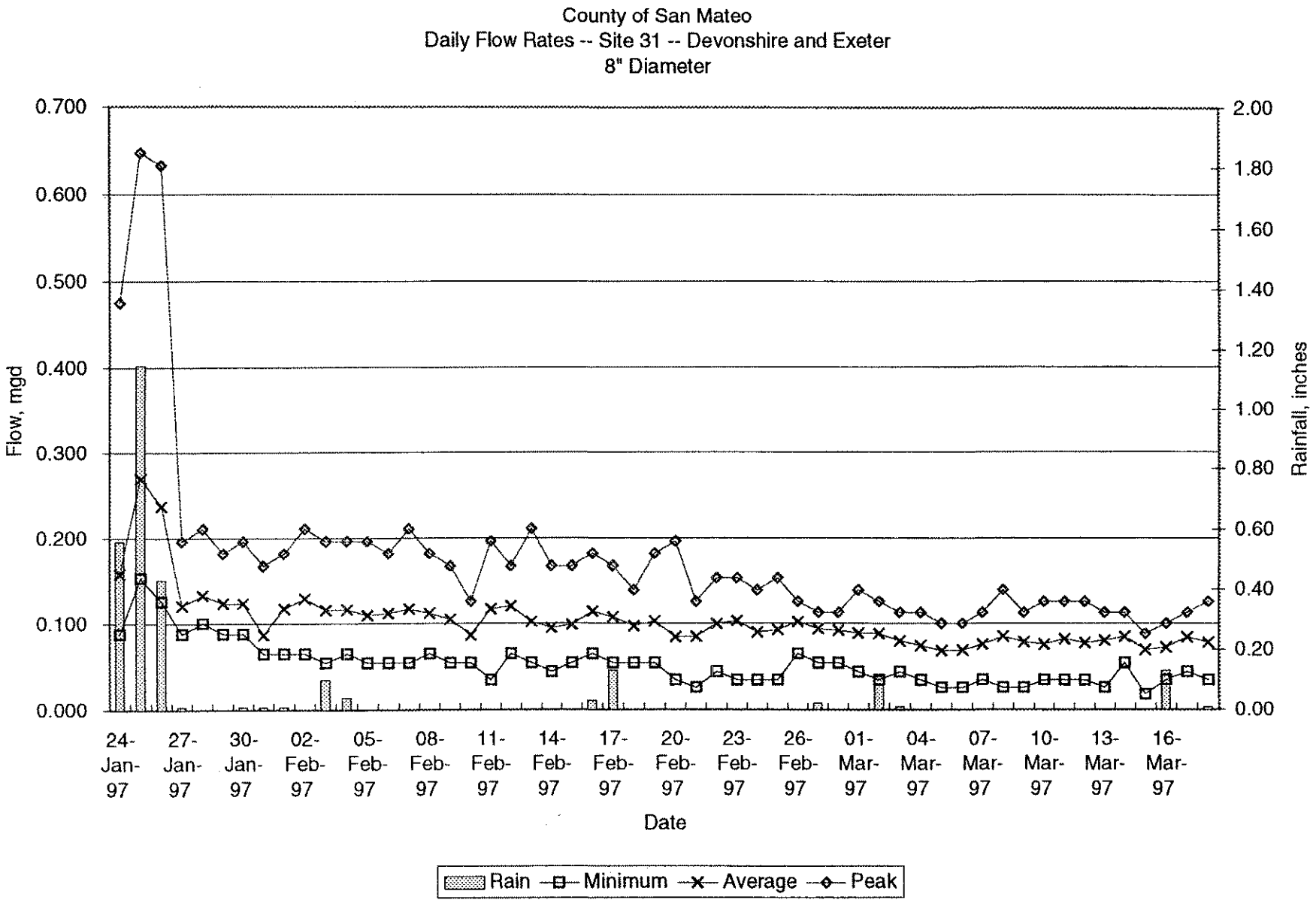
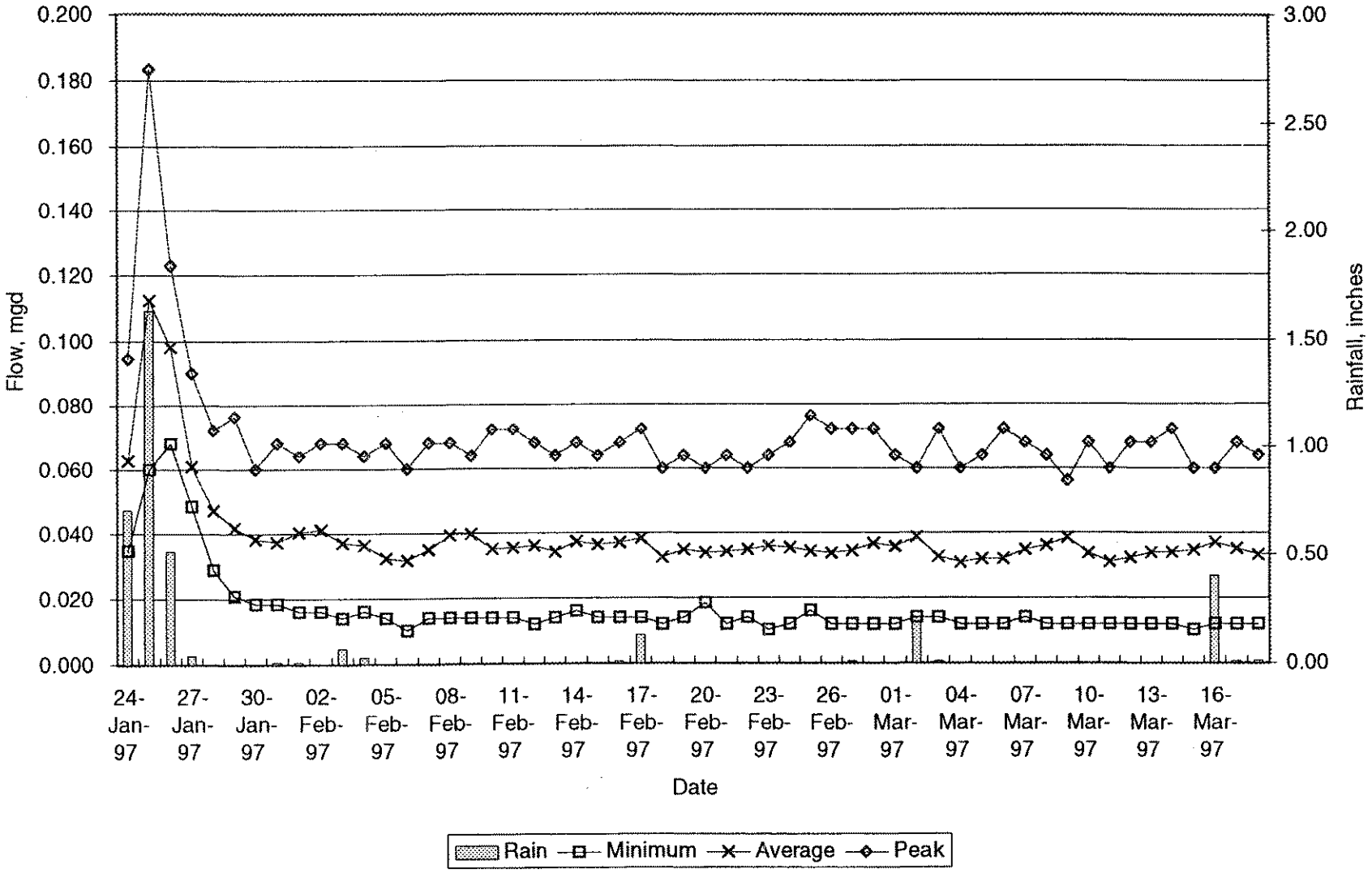

County of San Mateo
Daily Flow Rates -- Site 31 -- Devonshire and Exeter
8" Diameter
Flow, mgd
Rainfall, inches
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
24-Jan-97
27-Jan-97
30-Jan-97
02-Feb-97
05-Feb-97
08-Feb-97
11-Feb-97
14-Feb-97
17-Feb-97
20-Feb-97
23-Feb-97
26-Feb-97
01-Mar-97
04-Mar-97
07-Mar-97
10-Mar-97
13-Mar-97
16-Mar-97
Date
Rain
Minimum
Average
Peak

County of San Mateo
Daily Flow Rates -- Site 41 -- 1706 Cordilleras
8" Diameter



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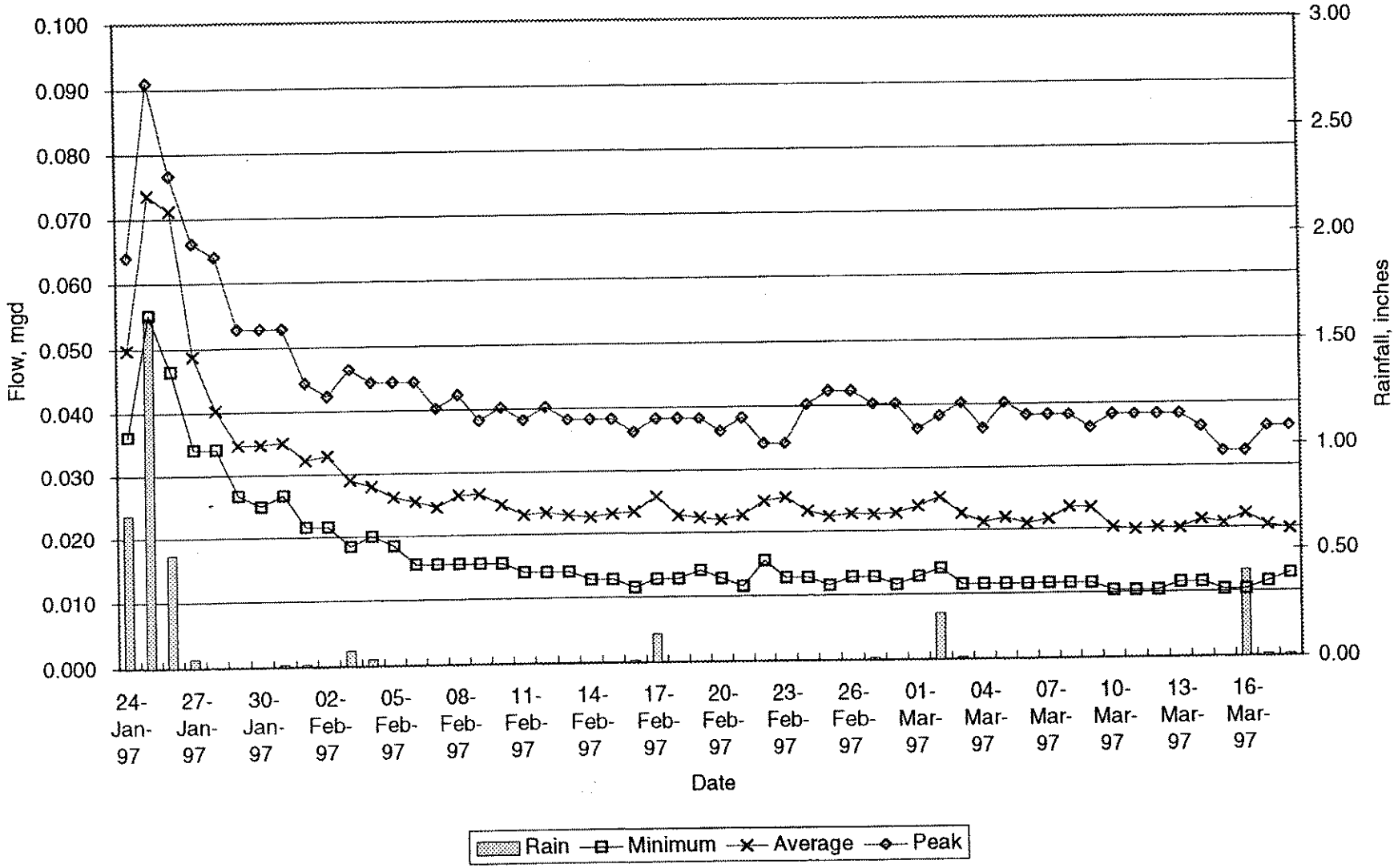
County of San Mateo
Daily Flow Rates -- Site 42 -- Lake Blvd. and Oak Knoll
8" Diameter



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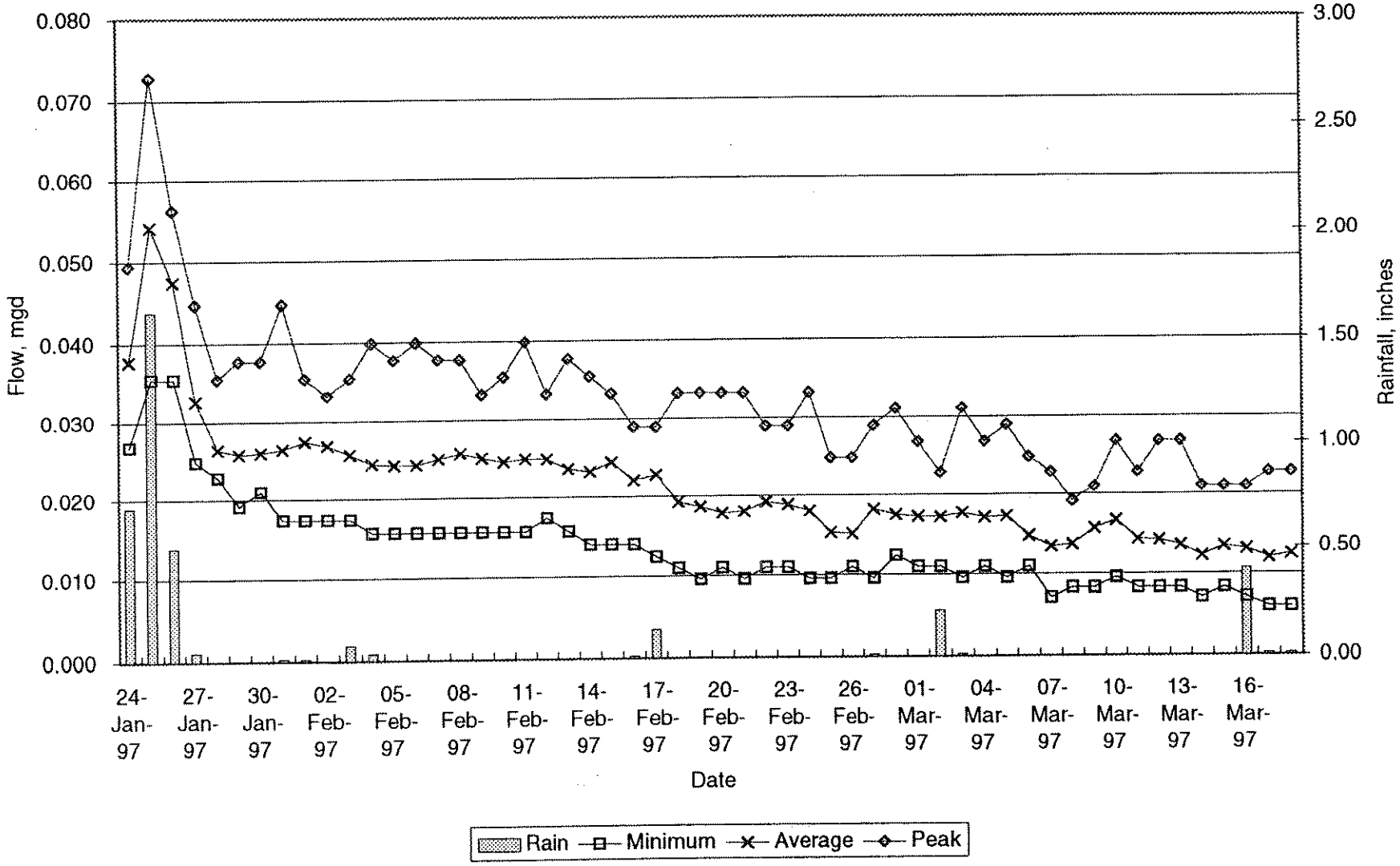
County of San Mateo
Daily Flow Rates -- Site 43 -- Glenwood Drive at Garret Pk.
6" Diameter



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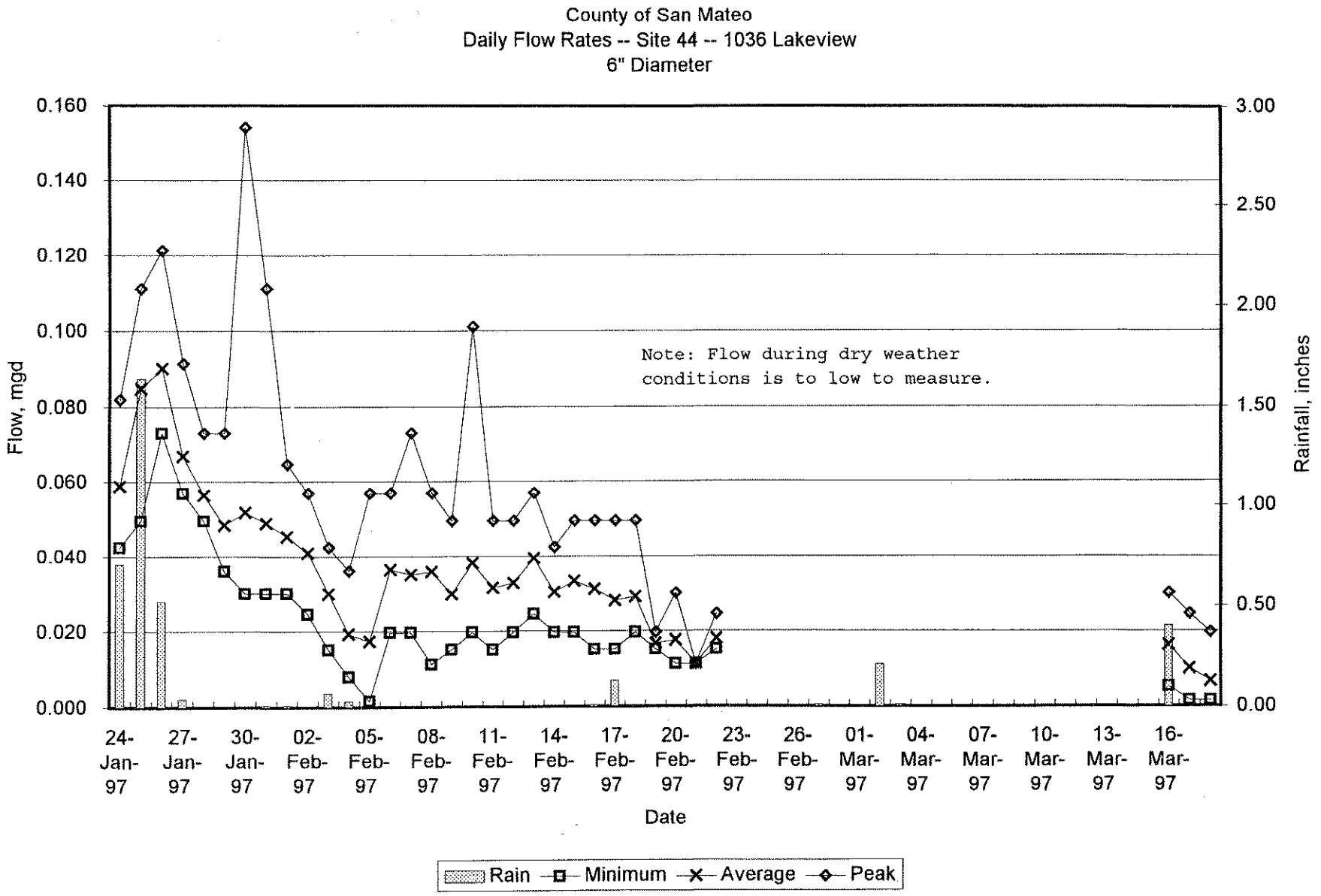

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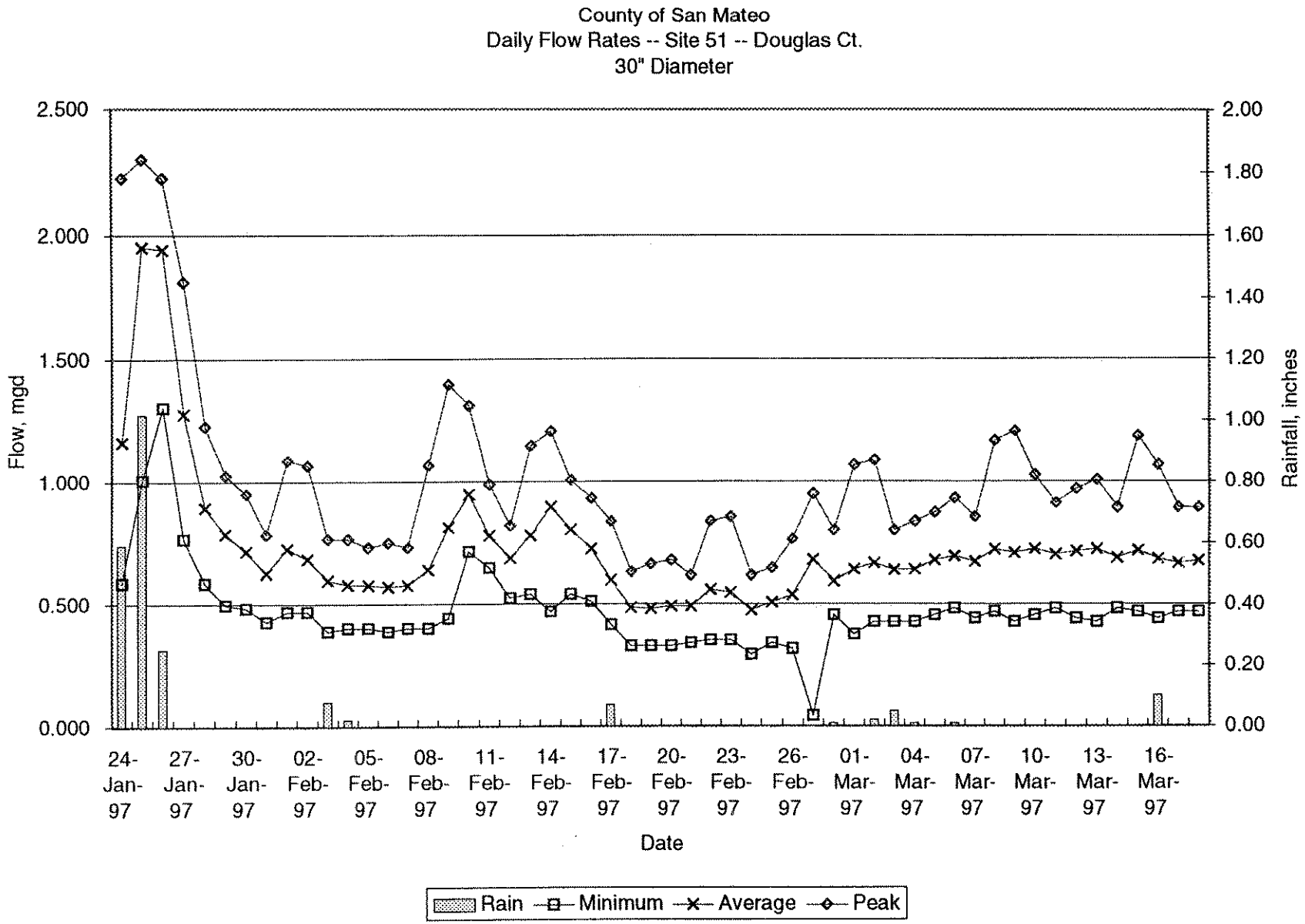

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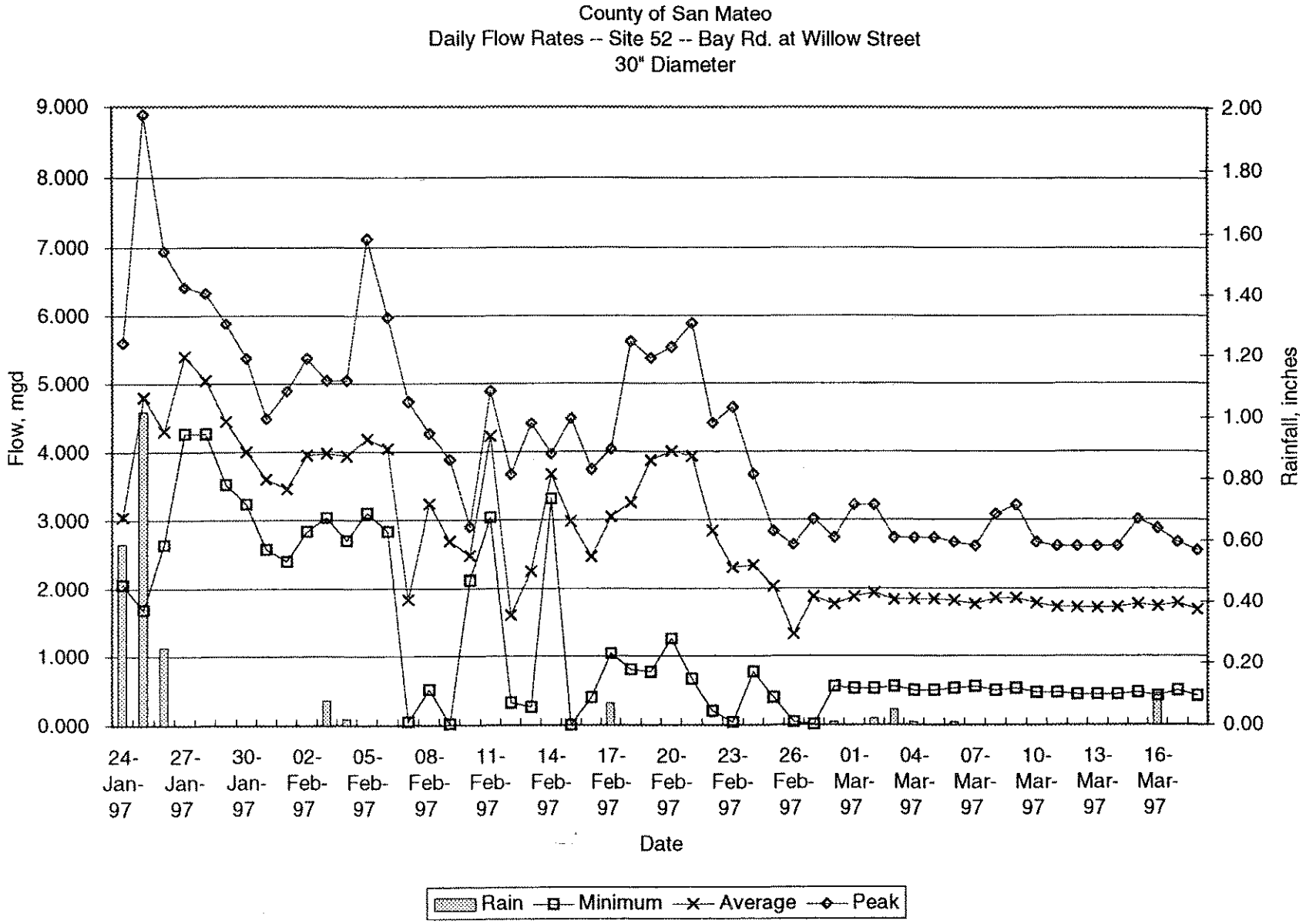

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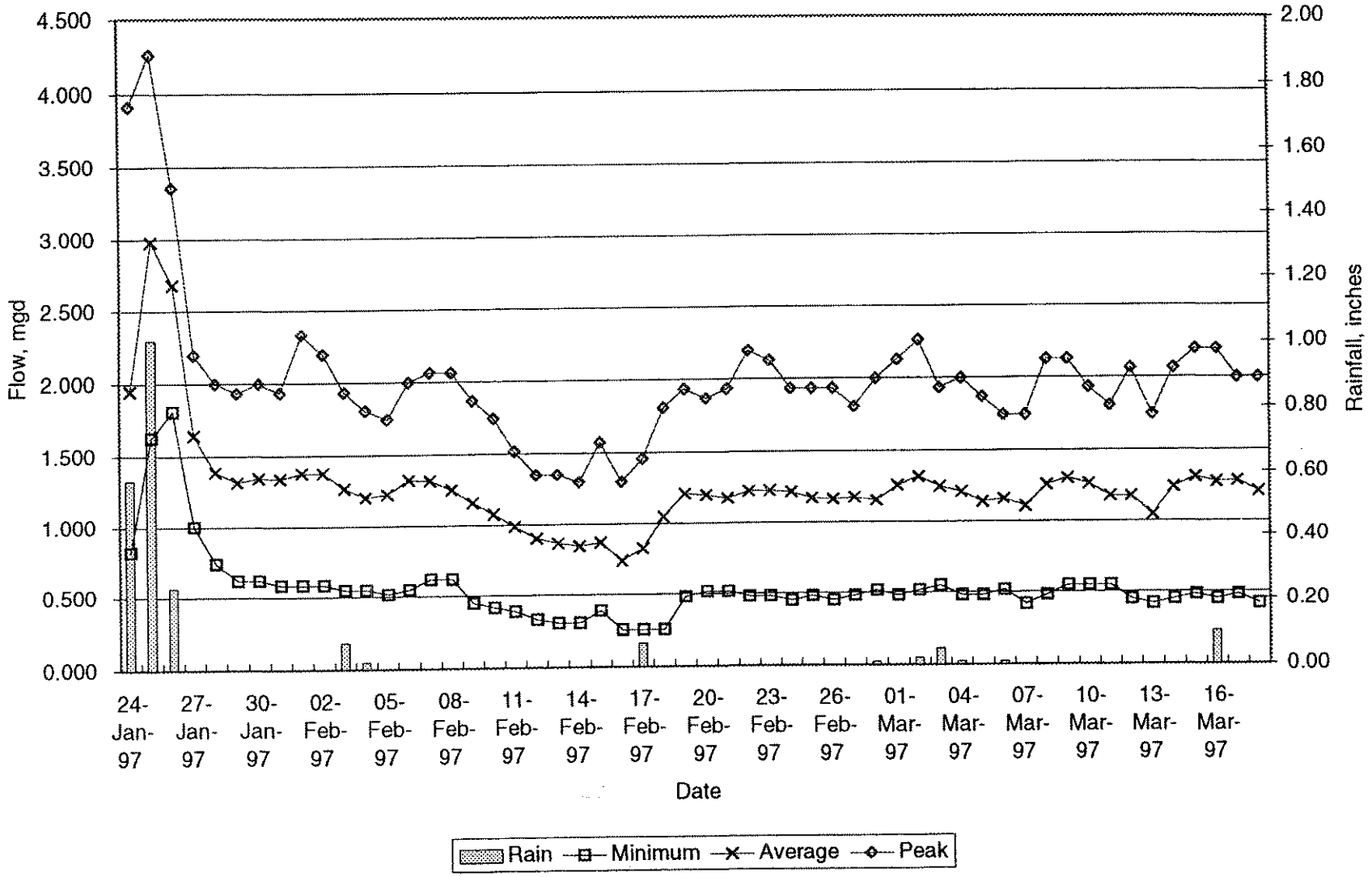
County of San Mateo
Daily Flow Rates -- Site 53 -- 559 Oakside
21" Diameter



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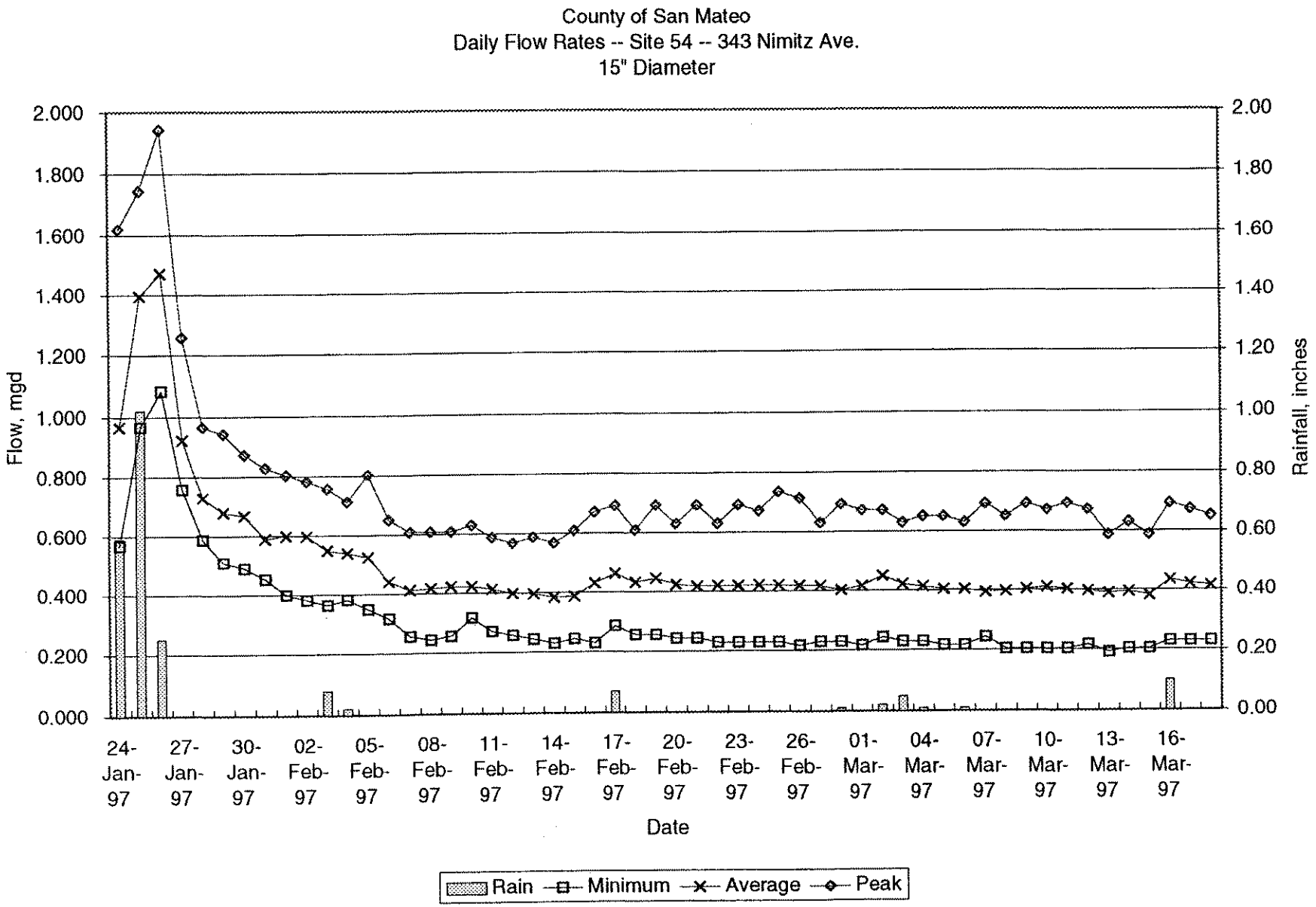
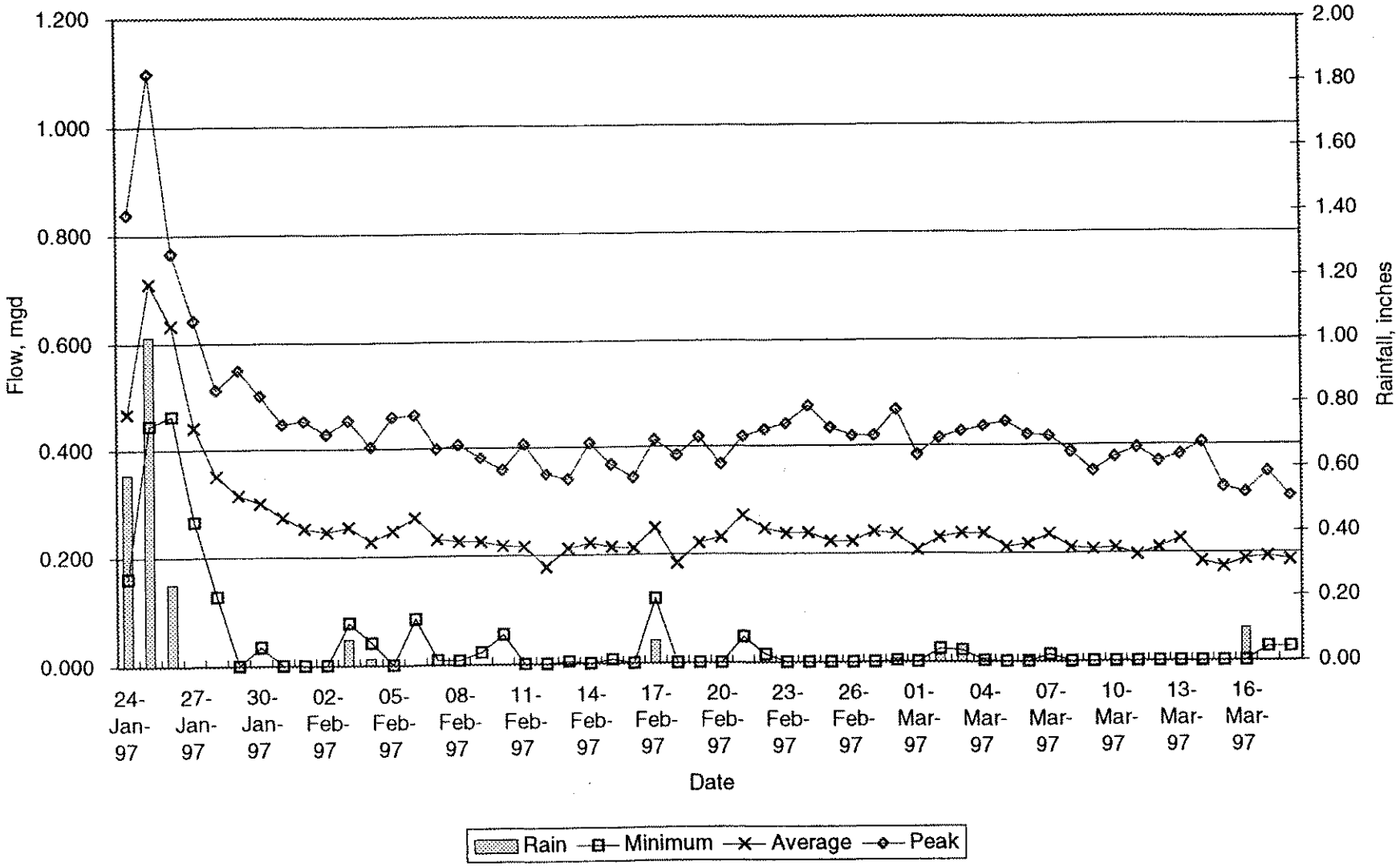

County of San Mateo
Daily Flow Rates -- Site 54 -- 343 Nimitz Ave.
15" Diameter
Flow, mgd
Rainfall, inches
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
24-Jan-97
27-Jan-97
30-Jan-97
02-Feb-97
05-Feb-97
08-Feb-97
11-Feb-97
14-Feb-97
17-Feb-97
20-Feb-97
23-Feb-97
26-Feb-97
01-Mar-97
04-Mar-97
07-Mar-97
10-Mar-97
13-Mar-97
16-Mar-97
Date
Rain
Minimum
Average
Peak

County of San Mateo
Daily Flow Rates -- Site 55 -- Woodside Rd. near Churchhill
10" Diameter



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APPENDIX C

SMOKE TESTING TECHNICAL MEMORANDUM AND RESULTS

MEMORANDUM 14692-003

October 13, 1998

TO: MARK WELSH
COUNTY OF SAN MATEO, DPW

FROM: BRIAN HAMMER
BROWN AND CALDWELL

SUBJECT: WASTEWATER MASTER PLAN
SMOKE TESTING FIELD INSPECTION

This technical memorandum presents the results of the smoke testing program performed during the summer of 1998 as part of the Wastewater Master Plan. Smoke testing was performed in sections of the Burlingame Hills, Crystal Springs, Devonshire, Emerald Lake, and Fair Oaks Sewer Districts.

Smoke Testing

Smoke testing is a quick and effective method for identifying many types of wastewater collection system deficiencies. Typical defects encountered during a smoke testing program include the following:

1. Broken or deteriorated building laterals.
2. Improperly capped cleanouts.
3. Broken or deteriorated sewer mains.
4. Unsealed or damaged manholes.
5. Sags and/or obstructions in the mains.
6. Direct and indirect connections between storm and sanitary sewer systems.
7. Untrapped or improper building plumbing.
8. Illegal sewer connections.

Although smoke testing is an efficient method of identifying collection system inadequacies, certain conditions affect the interpretation and effectiveness of the test. One factor that affects smoke testing results is the extent and porosity of the cover over the sewer main or service lateral. For instance, pilot studies have indicated that only one-third or less of defective laterals are detected by smoke testing.

Another limitation is that smoke cannot emerge through highly impervious surfaces such as concrete or asphalt, unless they are cracked. Additionally, smoke will not travel through saturated soil. Therefore, this fieldwork is most effectively conducted only during dry weather, when the soil is at its driest condition.

Smoke Testing Field Procedures

The smoke testing program consisted of public notification and actual smoke testing. Public notification was accomplished by means of two separate public notices prior to smoke testing: one distributed approximately 1 week followed by another 24-48 hours in advance of testing, to individual residences and businesses. These notices, shown in Figure 1, explained the reason smoke testing was being performed and gave a brief description of the procedures to be used by the smoke testing crew. The notices also advised persons with respiratory ailments or similar problems to contact the County Department of Public Works office so field crews could provide these people with special attention during the smoke testing operation.

The smoke testing field program consisted of circulating a nontoxic and nonstaining "smoke" through the sewer system. A specialized blower was used to circulate smoke through the sewer system at a rate of approximately 1,500 cubic feet per minute. Smoke traveled through the connecting mainlines and service laterals until it came out of defects or roof vents. Each defect found was photographed using digital cameras to document the defect. The crew maintained field logs in which they recorded the address, relative location, and type of defect found. Information from the field logs was input to a specialized ACCESS database for documentation and analysis. Inspection forms were then printed directly from the program along with the digital image of the defect.

Smoke Testing Results

Smoke testing was performed during the dry months of August and September 1998 to prevent smoke from being trapped in high groundwater and saturated soils. Smoke testing was performed in all subbasins in the Districts of Burlingame Hills and Devonshire, with the exception of those areas where the crew did not have access, and in selected subbasins of the Crystal Springs, Emerald Lakes, and Fair Oaks Districts. Those selected subbasins were 21line1, 21line2, 22line2, and SP in the Crystal Springs District, 45 in the Emerald Lake District, and 54 in the Fair Oaks Sewer Maintenance District. These subbasins are shown in Figure 2. Some sewer lines in these areas could not be accessed. Approximately 140,000 lineal feet of sewer line was tested during the 3-week inspection period.

A total of 201 defects was located and documented by field crews during the smoke testing period. Table 1 provides a summary of the defects for each of the Districts. The most prevalent defect noted was faulty cleanouts. Cross-connections between the sanitary sewer and the storm drain system were not noted during the testing period. Summary tables of the smoke testing results are provided in Attachments A1 and A2. Smoke testing forms and photographs of the defects are provided in Attachment B.

Potential health concern defects exist where direct physical contact with sewage or sewer gas is possible through open pipes, uncapped cleanouts, or poor plumbing connections. Whenever a resident reported smoke inside a building, a crew member inspected the location of the smoke to determine the source of the smoke. The smoke sources commonly found inside a home or commercial building were dried out or defective sink/bathtub traps, faulty plumbing, untrapped connections to the sewer, and area or floor drains. Area and floor drains were documented where applicable. Residents were provided with practical information regarding what could be done about the other problems to protect against the possibility of sewer gas or sewage entering the residence or business.

Uncapped cleanouts at ground or below ground level are both a public health concern and potential inflow source. The majority of defects noted were uncapped cleanouts where either the cap was loose, broken or deteriorated, or missing from the cleanout. We recommend the county consider having these cleanouts capped tightly to prevent sewage form spilling out into public areas and to eliminate cleanouts as a source of inflow.

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APPENDIX D

TELEVISION INSPECTION RESULTS

County of San Mateo - Wastewater Master Plan
Mainline Sewer Internal Inspection
District: Fair Oaks

RUN No.	STREET OR PARCEL No.	UPSTREAM MANHOLE No.	DOWNSTREAM MANHOLE No.	DEPTH	LENGTH BETWEEN MANHOLES, ft	COMPLETE FOOTAGE TAPED, ft	PIPE SIZE, in	PIPE JOINT LENGTH, ft	PIPE MATERIAL TYPE	DATE OF INSPECTION	VIDEO TAPE No.	MAINLINE SEWER DEFECTS																						T	EST. I/I FLOW RATE, gpm	TOTAL No. of DEFECTS TO REHABILITATE	Total Score	COMMENTS
												CRACK		JTS		LATERALS			ROOTS		I/I						ALIGN		STRUC.			M.S.		S.C.						
												CP1	CP2	OJ1	OJ2	PT1	PT2	PT3	RJ	RT	I1	I2	I3	I4	I5	I6	A1	A2	S1	S2	S3	M1	M2	C1	C2					
51,52	155 Elanor Dr.	2064	2041			12	6		VCP	1/20/99	10-1, 2	2							3										1							6	492	
71	39 Melanie Ln.	2011	2010			178	6		VCP	2/1/99	11-9	12		1					7										5							25	166	
50	139 Elanor Dr.	2065	2064			154	6		VCP	1/20/99	9-15	9							10	1								1	3							24	138	
56	238 Elanor Dr.	2063	2062			67	6		VCP	1/20/99	10-6	8							2										1							11	113	Poor grade of line. Unable to get by.
45	2100 Stockbridge Ave.	1813	1812			285	6		VCP	1/19/99	9-10	20																3	2					4		25	84	Needs to be replaced very soon
48, 49	139 Elanor Dr.	2066	2065			127	6		VCP	1/20/99	9-13,1 4	7							11	3									1					3		22	69	Shattered pipe.
54	167 Elanor Dr.	2042	2041			37	6		VCP	1/20/99	10-4	6							5																	11	62	Reverse set up.
65, 67	439 Stockbridge Ave.	2009	2007			49	6		VCP	1/21/99	11-3, 5	1							2									1								4	61	Hole in pipe shifted pipe unable to TV. Will revers set up.
57	234 Elanor Dr.	2063	2062			39	6		VCP	1/20/99	10-7	7																						1		7	56	Poor grade of line.
82	3383 Middlefield Rd.	1448	1447	3		369	6		VCP	4/8/99	22-1	2						7										7						7		16	51	
58	234 Elanor Dr.	2062	2061			113	6		VCP	1/20/99	10-8	16							7	1														1		24	50	Poor grade of line.
81	3260 Middlefield Rd.	1447	1446	3		366	6		VCP	4/7/99	21-6	3						6											3					8		12	46	
26	234 Polhemus Ave.	1747	1746			312	6		VCP	1/12/99	8-3	18						1	1									3						5		23	43	
30	222 Polhemus Ave.	1743	1742			313	6		VCP	1/13/99	8-7	19							1									1	1					1		22	43	
59	214 Elanor Dr.	2061	2051			214	6		VCP	1/20/99	10-9, 10	10							10										1							21	42	Shattered pipe.
46	2120 Stockbridge Ave.	1815	1813			246	6		VCP	1/19/99	9-11								1											1				1		2	41	
25	234 Polhemus Ave.	1748	1747			103	6		VCP	1/12/99	8-2	14																								14	41	Line needs replaced almost every joint cracked or shattered
2	Page & 15-th Ave.	88	89	4		10	6		VCP	11/23/98	1-2			2																					2	40	Unable to get camera by due to offset in line.
53	161 Elenor Dr.	2041	2042			118	6		VCP	1/20/99	10-3	9							14	1																24	36	Poor grade of line. Unable to get by.
7	3257 6-th	1319	1317			211	8		VCP	1/5/99	6-12	6															1		1					6		8	36	
76	2951 Milddlfield Rd.	1442	1442-A	4		263	6		VCP	4/7/99	21-1	1						6										1	1					10		9	33	1442-A is an extra MH.
61	200 Elanor Dr.	2051	2050			144	6		VCP	1/20/99	10-11	10							14	2														2		26	33	
62	475 Elanor Dr.	2003	2004			318	6		VCP	1/20/99	10-12	14							1									2						1		17	30	Pipe needs to be replaced. Poor grade of line.
27	230 Polhemus Ave.	1746	1743			313	6		VCP	1/13/99	8-4	20							5									1						1		26	29	
55	167 Elanor Dr.	2042	2049			202	6		VCP	1/20/99	10-5	12						1	16	1														4		30	28	Poor grade of line.
31	214 Polhemus Ave.	1742	1741			313	6		VCP	1/13/99	8-8	19							2									1						4		22	28	
47	139 Elanor Dr.	2067	2066			67	6		VCP	1/20/99	9-12	4							4																	8	24	
23	241 Polhemus Ave.	1749	1748			210	6		VCP	1/12/99	7-14	15							1															3		16	23	
39	2023 Stockbridge Ave.	1811	1810			119	6		VCP	1/19/99	9-4																	1						2		1	23	
32	211 Polhemus Ave.	1741	1739			317	6		VCP	1/13/99	8-9	12		1					5	1								1						2		20	22	
41	1950 Stockbridge Ave.	1809	1808			125	6		VCP	1/19/99	9-6																	1								1	20	
36, 38	1926 Stockbridge Ave.	1808	1807			150	6		VCP	1/18/99	9-3								1									1						3		2	19	
80	3162 Middlefield Rd.	1455	1454	4		306	6		VCP	4/7/99	21-5	1						2											1					5		4	19	Pulled out a lot of grease.
17	598 5-th Ave.	1360	1323			409	6		VCP	1/11/99	7-8	4						2	4										1					8		11	18	
44	2054 Stockbridge Ave.	1812	1811			230	6		VCP	1/19/99	9-9	4																1						3		5	17	
24	236 Polhemus Ave.	1771	1748			326	6		VCP	1/12/99	8-1	2							12	5							2	1						5		22	17	
70	401 Stockbride Ave.	2009	2008			102	6		VCP	2/1/99	11-8	7																	1	2				1		10	17	Broken pipe hole in pipe. Needs replaced.

RUN No.	STREET OR PARCEL No.	UPSTREAM MANHOLE No.	DOWNSTREAM MANHOLE No.	DEPTH	LENGTH BETWEEN MANHOLES, ft	COMPLETE FOOTAGE TAPED, ft	PIPE SIZE, in	PIPE JOINT LENGTH, ft	PIPE MATERIAL TYPE	DATE OF INSPECTION	VIDEO TAPE No.	MAINLINE SEWER DEFECTS																				T	EST. I/I FLOW RATE, gpm	TOTAL No. of DEFECTS TO REHABILITATE	Total Score	COMMENTS
												CRACK		JTS		LATERALS			ROOTS		I/I						ALIGN		STRUC.			M.S.		S.C.						
												CP1	CP2	OJ1	OJ2	PT1	PT2	PT3	RJ	RT	I1	I2	I3	I4	I5	I6	A1	A2	S1	S2	S3	M1	M2	C1	C2					
3	Page & 15-th Ave.	87	88	4.8		18	6		VCP	11/23/98	1-3	1																								1	17	
77	2929 Middlefield Rd.	1442-A	1441			244	6		VCP	4/7/99	21-2	2						4									1		1						7		8	16	
21	1776 Stockbridge Ave.	1794	1793			40	6		VCP	1/12/99	7-12	1							2																		3	13	
1	3523 Page	95	98	2.7		52	6		VCP	11/23/98	1-1	1															2								1		3	12	
74	3620 Douglas Ave.	2483	2482	7		258	6		VCP	4/6/99	20-9							1											1						3		2	11	Tape and log says MH 2501 to 2482 should have been 2483 to 2482.
6	Page & 17-th Ave.	65	72 (Burried)	3.7		147	6		VCP	11/24/98	1-6	1		4													1								3		6	10	Unable to get camera by due to offset in line.
69	36 Melanie Ln.	2010	2009			20	6		VCP	2/1/99	11-7	1																		1							2	10	Line needs to be replaced. Unable to TV line Entire line bottom of pipe is gone at MH 2009.
18	4298 Stockbridge Ave	1790	1789			10	6		VCP	1/11/99	7-9								1																		1	10	
73	2500 Bay Rd.	2551	2550	5		375	6		VCP	4/6/99	20-8	1						1	1									1							7		4	10	
4, 5	Page & 17-th Ave.	73	65	3.7		298	6		VCP	11/24/98	1-4, 5	5		4																						5		9	9	Unable to get camera by due to offset in line.
34	1890 Stockbridge Ave.	1806-A	1805			78	6		VCP	1/18/99	8-11	2																									2	8	
8	3257 Fair Oaks	1317	1316			315	8		VCP	1/5/99	6-13	1	1					3																		14	5	8	
20	1806 Stockbridge Ave.	1799	1794			184	6		VCP	1/11/99	7-11	3															3								2		6	8	
63	481 Elanor Dr.	2005	2004			206	6		VCP	1/21/99	11-1	4																								1		4	6	
11	676 6-th Ave.	1320	1319			126	8		VCP	1/6/99	7-2	2															1										3	6	At 43' VCP to Iron Pipe. Removed 10 gal rock sand and grease.
68	76 Melanie Ln.	2013	2012			209	6		VCP	1/21/99	11-6	2							11																1		13	5	
19	1770 Stockbridge Ave.	1793	1790			443	6		VCP	1/11/99	7-10	2						2	7																9		11	5	
66	481 Stockbridge Ave.	2007	2005			171	6		VCP	1/21/99	11-4	2							1																		3	4	
33	1890 Stockbridge Ave.	1806	1806-A			25	6		VCP	1/18/99	8-10																								1			4	
14	590 6-th Ave.	1355	1323			212	6		VCP	1/11/99	7-5							2	1																6		3	3	
22	1846 Stockbridge Ave.	1800	1799			267	6		VCP	1/12/99	7-13	1																								5		1	3	
42	2054 Stockbridge Ave.	1818	1817			167	6		VCP	1/19/99	9-7																3								2		3	3	
28	8 Betty Lane	1773	1772			323	6		VCP	1/13/99	8-5	1							3								3										7	3	
75	2696 Bay Rd.	2484	2483	5		257	6		VCP	4/6/99	20-10	1						1																	4		2	3	
84	834 Douglas Ave.	2501	2482	7		277	8		VCP	4/8/99	22-3																2								5		2	3	Unable to get by due to heavy sag.
83	2600 Douglas Ave.	2503	2501	8		367	8		VCP	4/8/99	22-2																2								7		2	2	
72	2384 Bay Rd	2550	2549	7		374	6		VCP	4/6/99	20-7							2							1		1								7		4	2	
16	3300 Edison Way	1324	1323			343	6		VCP	1/11/99	7-7							2																	8		2	2	
43	2022 Stockbridge Ave.	1817	1811			75	6		VCP	1/19/99	9-8																1										1	1	
79	3096 Middlefield Rd.	1454	1453	4		318	6		VCP	4/7/99	21-4																								4			1	
29	222 Polhemus Ave.	1772	1743			91	6		VCP	1/13/99	8-6								1																		1	1	
35	1860 Stockbridge Ave.	1805	1800			185	6		VCP	1/18/99	8-12							1									1								1		2	1	
12	3355 Edison Way	1321	1320			104	10		VCP	1/6/99	7-3																1										1	1	
78	3060 Middlefield Rd.	1453	1452	4		273	6		VCP	4/7/99	21-3																								2			1	
37	1926 Stockbridge Ave.	1807	1806			142	6		VCP	1/18/99	9-2							1																	1		1	1	
9	727 6-th Ave	1316	1312			315	8		VCP	1/5/99	6-14	2						2											1						20		5	1	
64	481 Stockbridge Ave.	2006 c/o	2005			4	6		VCP	1/21/99	11-2																		1						4		1		Unable to shattered pipe.
60	200 Elanor Dr.	2051	2061			54	6		VCP	1/20/99	10-10																		1								1		Shattered pipe. Unable to get by.
40	1990 Stockbridge Ave.	1810	1809			149	6		VCP	1/19/99	9-5																												
15	3355 Edison Way	1323	1322			50	8		VCP	1/11/99	7-6																												

RUN No.	STREET OR PARCEL No.	UPSTREAM MANHOLE No.	DOWNSTREAM MANHOLE No.	DEPTH	LENGTH BETWEEN MANHOLES, ft	COMPLETE FOOTAGE TAPED, ft	PIPE SIZE, in	PIPE JOINT LENGTH, ft	PIPE MATERIAL TYPE	DATE OF INSPECTION	VIDEO TAPE No.	MAINLINE SEWER DEFECTS																						T	EST. I/I FLOW RATE, gpm	TOTAL No. of DEFECTS TO REHABILITATE	Total Score	COMMENTS
												CRACK		JTS		LATERALS			ROOTS		I/I						ALIGN		STRUC.			M.S.		S.C.					
												CP1	CP2	OJ1	OJ2	PT1	PT2	PT3	RJ	RT	I1	I2	I3	I4	I5	I6	A1	A2	S1	S2	S3	M1	M2	C1	C2				
13	3355 Edison Way	1322	1321			52	10		VCP	1/11/99	7-4																											Spend two days cleaning pipe. Could not completely clean the pipe. Pipe looks like 8" Iron Pipe.
10	787 6-th Ave.	1312	1300			170	8		VCP	1/5/99	7-1																											Heavy flow in line even slightly plugged off.
TOTAL						15025						330	1	12				47	167	15				1			25		31	28	1					221		658		

Insert “E” Tab Here

APPENDIX E

HYDRAULIC MODEL TECHNICAL MEMORANDUM

MEMORANDUM 14692-006

December 22, 1998

TO: MARK WELSH
COUNTY OF SAN MATEO, DPW

FROM: CHARLIE JOYCE
BROWN AND CALDWELL

SUBJECT: WASTEWATER MASTER PLAN
FLOW PROJECTIONS AND HYDRAULIC MODELING

This technical memorandum presents the results of the hydraulic modeling performed to determine the amount of available capacity in the County of San Mateo (County) trunk sewers. Modeling was performed on the major trunk sewers in Burlingame Hills (BH), Crystal Springs (CS), Devonshire (DS), Emerald Lake (EL), and Fair Oaks (FO), Oak Knoll (OK) and Scenic Heights (SH) sewer districts.

Design Flow Projections

Wastewater flows were divided into base sanitary flow (BSF) and wet weather infiltration/inflow (I/I) components for this study. Base sanitary flow factors are based on dry weather flow monitoring performed during the winter of 1997. Due to limited rainfall during the winter of 1997, additional wet weather flow monitoring was performed during the following season. El Nino effects resulted in extensive rainfall during the January and February of 1998. Wet weather flow projections are based on flow monitoring results from second flow monitoring program.

BSF. BSF is wastewater contributed by residential, commercial, industrial, and public users. Base flow is directly related to land use and varies throughout the day and between weekdays and weekends. BSF from residential areas has a typical diurnal pattern with peak flows occurring in the morning after 7:00 a.m. and a second smaller peak occurring in the evening.

BSF flow contributions to the hydraulic model are based on the flow monitoring data collected during dry weather periods. Actual dry weather hydrographs were extracted from the flow monitoring data and used in the model. Dry weather periods were used to minimize the amount of groundwater infiltration included in the calculation. Groundwater infiltration occurs when groundwater levels are above the sewer pipes and the pipes have defects that allow infiltration. Some groundwater infiltration is undoubtedly included in the BSF rates, however, extensive review of accurate water use date in each District would be needed to determine the amount of groundwater infiltration in each area.

Dry weather flow projections were prepared for current land use conditions only. Land use planners for the County and affected City agencies indicated that growth or significant in-filling was not expected in the future.

Flow monitoring was not performed in the OK and SH Districts. BSF calculations for these Districts are based on the number of parcels in the District and a per parcel water use rate of 220 gallons per day. A conservative sanitary peaking factor of 3.5 was used to determine the peak dry weather flow.

Wet Weather I/I Flow

I/I consists of direct inflow of storm water runoff and rainfall-induced infiltration of storm water percolating into the collection system. Inflow occurs when storm water enters the collection system through illegally connected catch basins, area drains, or home roof gutter downspouts, or through manhole covers of cleanout lids. Inflow can become severe if surface flooding occurs and manholes and cleanouts are submerged or used to drain low-lying areas.

I/I accounts for the large increase in peak flows that occur during rainfall events. In areas with older sewers, I/I is typically the largest component of the total wastewater flow. I/I was evaluated by calculating the "R" factor for each of the monitored basins for each storm. An "R" factor is the percentage of rainfall that enters the collection system as I/I. The composite minimum and maximum "R" factor for each District is listed in Table 1.

Table 1, R Factors

District	Minimum R factor	Maximum R factor
Burlingame Hills	0.026	0.113
Crystal Springs	0.027	0.102
Devonshire	0.018	0.040
Emerald Lake	0.024	0.105
Fair Oaks	0.012	0.111

To determine the effects of I/I on the capacity of the wastewater conveyance system a wet weather design storm was developed. The January 18, 1998 rainfall event was very similar to a 5-year design storm in terms of intensity, duration, and volume. Therefore, this storm was selected as the design event. Minor adjustments were made to the rainfall hydrograph to account for differences in the volume between the actual storm and the 5-year design rainfall.

To develop wet weather hydrographs for use in the model, unit hydrographs were developed for each basin. Unit hydrographs are based on the "R" factor and the individual runoff characteristics for each basin. Synthetic hydrographs were added to the base flow hydrographs and the total hydrograph was input to the model.

Due to the lack of flow monitoring data for the OK and SH areas, a conservative I/I rate of 2,400 gallons per acre per day was used. This rate is used by the Central Contra Costa Sanitary District and is the most conservative rate in use in the Bay Area.

Capacity Analysis

Major trunk sewers in each of the sewer Districts were modeled to determine if any capacity deficiencies exist. The HYDRA model developed by PIZER, Inc. was used to simulate wastewater flows in the each of the Districts collection systems. HYDRA routes flow hydrographs through the collection system and accounts for the time delays of peak flow from various tributary areas as the flows move downstream. A standard Manning's friction coeffcient of 0.0135 was used for the analysis.

Modeled flow is compared to the theoretical capacity of each pipe segment. The capacity of each pipeline is a function of the pipeline slope and diameter. Surveying was required in various areas to verify the pipeline slope. If capacity deficiencies were detected, the program was used to size the appropriate relief and/or replacement sewer size.

Hydraulic models of the Harbor Industrial and Kensington Square districts were not prepared due to their small size. Both districts are much less than 50 acres in size. An 8-inch diameter sewer with a slope of 0.1 percent has enough capacity to serve a tributary area greater than 50 acres in size using conservative flow factors for BSF and I/I. Therefore, it was assumed that trunk sewers in the Harbor Industrial and Kensington Square districts have adequate capacity.

Hydrographs produced by the model were compared to the actual wet weather hydrographs from the flow monitoring to verify model calibration. An example of a model calibration hydrograph for the Burlingame Hills District is shown in Figure 1.

The modeled sewers for each District and the results of the modeling are shown on Figure 2 through Figure 8. Relief sewer sizes for each District are summarized in Tables 2 through Table 5. Hydraulic capacity deficiencies were not found in the DS, OK or SH Districts. Complete model results are given in Attachment A.

Table 2, Hydraulic Modeling Results, Burlingame Hills

Upstream Manhole	Downstream Manhole	Existing Diameter, inches	Length, ft	Recommended Relief Sewer Sizes, inches
B004603	B000204	6-8	2,610	8
B000204	B000104	8	216	12
Total			2,826	

Table 3, Hydraulic Modeling Results, Crystal Springs

Upstream Manhole	Downstream Manhole	Existing Diameter, inches	Length, ft	Recommended Relief Sewer Sizes, inches
C019105	C014405	10	1,714	8
C014405	C000301	10	3,280	12
Total			4,994	

Table 4, Hydraulic Modeling Results, Emerald Lake

Upstream Manhole	Downstream Manhole	Existing Diameter, inches	Length, ft	Recommended Relief Sewer Sizes, inches
E115601	E115201	6	455	8
E102322	E101634	8	1,163	8
E101634	E101134	8	342	12
Total			1,960	

Table 5, Hydraulic Modeling Results, Fair Oaks

Upstream Manhole	Downstream Manhole	Existing Diameter, inches	Length, ft	Recommended Relief Sewer Sizes, inches
F198636	F198227	10	1,170	8
F197727	F193228	10	1,327	10
F193228	F191828	8-10	1,743	15
F190528	F183828	15	1,253	15
F183828	F170419	18	2,911	30
F170419	F169919	15-18	870	27
F169919	F168014	15	1,642	15
F157414	F156914	10	1,049	10
F156914	F156714	10	176	15
F120311	F117211	8-10	921	18
F117211	F116211	10-12	1,883	12
F116211	F115610	12-18	1,489	24
F156614	F145009	15-21	2,979	24
F143709	F115510	10-21	3,251	15
F115510	F114904	30	2,857	45
TOTAL			25,521	

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535 Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
1	149	0.0117	142.04	0.2	0.9	1.01	1.33	154.74	152.94	***/***
		10	140.29	0.0	0.0	2.87	76.05	230.12	229.17	
F214535						0.67		-75.38	-76.23	
2	251	0.0117	140.29	0.2	0.9	1.01	1.33	152.94	150.50	***/***
		10	137.35	0.0	0.0	2.87	76.15	229.17	227.83	
F214435						0.67		-76.23	-77.33	
3	133	0.0108	137.35	0.2	0.9	1.01	1.28	150.50	149.31	***/***
		10	135.91	0.0	0.0	2.87	79.21	227.83	227.09	
F214335						0.69		-77.33	-77.78	
4	144	0.0055	135.91	0.2	0.9	1.01	0.91	149.31	145.67	***/***
		10	135.12	0.0	0.0	2.87	111.28	227.09	226.29	6
F214235						0.88	0.10	-77.78	-80.62	12
5	80	0.0071	135.12	0.2	0.9	1.01	1.04	145.67	147.55	***/***
		10	134.55	0.0	0.0	2.87	97.64	226.29	225.82	
F214135						0.79		-80.62	-78.27	
6	256	0.0061	134.55	0.2	0.9	1.01	0.96	147.55	150.45	***/***
		10	133.00	0.0	0.0	2.87	105.92	225.82	224.45	4
F214035						0.84	0.06	-78.27	-74.00	12
7	69	0.0086	133.00	0.2	0.9	1.01	1.14	150.45	143.66	***/***
		10	132.41	0.0	0.0	2.87	89.13	224.45	224.03	
F213935						0.74		-74.00	-80.37	
8	224	0.0046	132.41	0.2	0.9	1.01	0.84	143.66	140.52	***/***
		10	131.37	0.0	0.0	2.87	120.96	224.03	222.83	6
F2138A35						1.00	0.18	-80.37	-82.31	12
9	181	0.0062	131.37	0.2	0.9	1.01	0.97	140.52	138.30	***/***
		10	130.25	0.0	0.0	2.87	104.78	222.83	221.84	4
F213835						0.83	0.05	-82.31	-83.54	12
10	133	0.0114	130.25	0.2	0.9	1.01	1.31	138.30	136.54	***/***
		10	128.74	0.0	0.0	2.87	77.35	221.84	221.10	
F213735						0.68		-83.54	-84.56	
11	139	0.0088	128.74	0.2	0.9	1.01	1.16	136.54	134.26	***/***
		10	127.51	0.0	0.0	2.87	87.62	221.10	220.33	
F2136A35						0.73		-84.56	-86.07	
12	224	0.0104	127.51	0.2	0.9	1.01	1.25	134.26	130.13	***/***
		10	125.18	0.0	0.0	2.87	80.81	220.33	219.13	
F213635						0.70		-86.07	-89.00	

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
13	245	0.0111	125.18	0.2	0.9	1.01	1.29	130.13	130.26	***/***
		10	122.46	0.0	0.0	2.87	78.22	219.13	217.81	
F213535						0.68		-89.00	-87.55	
14	133	0.0100	122.46	0.2	0.9	1.01	1.23	130.26	129.43	***/***
		10	121.13	0.0	0.0	2.87	82.42	217.81	217.07	
F213436						0.71		-87.55	-87.64	
15	384	0.0104	121.13	0.2	0.9	1.01	1.25	129.43	125.99	***/***
		10	117.14	0.0	0.0	2.87	80.86	217.07	215.05	
F213336						0.70		-87.64	-89.06	
16	208	0.0079	117.14	0.2	0.9	1.01	1.09	125.99	123.57	***/***
		10	115.50	0.0	0.0	2.87	92.82	215.05	213.93	
F213236						0.76		-89.06	-90.36	
17	296	0.0084	115.50	0.3	1.4	1.56	1.12	123.57	122.70	***/***
		10	113.02	0.0	0.0	4.42	138.53	213.93	210.03	8
F198636						1.00	0.43	-90.36	-87.33	12
18	267	0.0070	113.02	0.3	1.4	1.56	1.03	122.27	120.00	***/***
		10	111.15	0.0	0.0	4.42	151.52	210.03	206.66	8
F198536						1.00	0.53	-87.76	-86.66	12
19	282	0.0076	111.15	0.3	1.4	1.56	1.07	120.00	118.00	***/***
		10	109.00	0.0	0.0	4.42	145.22	206.66	203.11	8
F198436						1.00	0.49	-86.66	-85.11	12
20	325	0.0090	109.00	0.3	1.4	1.56	1.17	118.00	116.00	***/***
		10	106.07	0.0	0.0	4.42	133.55	203.11	199.04	8
F198336						1.00	0.39	-85.11	-83.04	12
21	160	0.0136	106.07	0.3	1.4	1.56	1.43	116.00	114.00	***/***
		10	103.89	0.0	0.0	4.42	108.63	199.04	196.96	4
F198227						0.86	0.12	-83.04	-82.96	12
22	224	0.0133	103.89	0.3	1.4	1.56	1.42	114.00	110.00	***/***
		10	100.92	0.0	0.0	4.42	110.12	196.96	194.11	6
F198127						0.87	0.14	-82.96	-84.11	12
23	229	0.0147	100.92	0.3	1.4	1.56	1.49	110.00	104.86	***/***
		10	97.56	0.0	0.0	4.42	104.68	194.11	191.20	4
F198027						0.83	0.07	-84.11	-86.34	12
24	251	0.0220	97.56	0.3	1.4	1.60	1.82	104.86	96.60	***/***
		10	92.05	0.0	0.0	4.53	87.73	191.20	187.85	
F197827						0.73		-86.34	-91.25	

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535 Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
25	293	0.0081	92.05	0.3	1.4	1.60	1.11	96.60	95.00	***/***
		10	89.68	0.0	0.0	4.53	144.52	187.85	183.98	8
F197727						1.00	0.49	-91.25	-88.98	12
26	261	0.0498	89.68	0.3	1.4	1.60	2.74	95.00	86.89	***/***
		10	76.69	0.0	0.0	4.53	58.26	183.98	180.51	
F197427						0.57		-88.98	-93.62	
27	240	0.0144	76.69	0.3	1.4	1.60	1.47	86.89	77.49	***/***
		10	73.24	0.0	0.0	4.53	108.41	180.51	177.31	4
F197327						0.85	0.12	-93.62	-99.82	12
28	240	0.0140	73.24	0.3	1.4	1.60	1.45	77.49	78.00	***/***
		10	69.88	0.0	0.0	4.53	109.85	177.31	174.11	6
F197227						0.86	0.14	-99.82	-96.11	12
29	293	0.0068	69.88	0.3	1.4	1.60	1.01	78.00	79.50	***/***
		10	67.89	0.0	0.0	4.53	157.72	174.11	170.24	10
F197127						1.00	0.58	-96.11	-90.74	12
30	314	0.0102	67.89	0.5	1.6	2.01	0.69	79.50	71.60	***/***
		8	64.68	0.0	0.0	8.90	292.94	170.24	148.07	12
F193228						1.00	1.32	-90.74	-76.47	12
31	304	0.0098	64.68	0.5	1.6	2.01	0.67	71.60	68.00	***/***
		8	61.69	0.0	0.0	8.90	298.60	148.07	127.47	12
F193128						1.00	1.33	-76.47	-59.47	15
32	394	0.0083	61.69	0.5	1.6	2.01	1.12	68.00	67.50	***/***
		10	58.42	0.0	0.0	5.69	179.27	127.47	120.07	10
F193028						1.00	0.89	-59.47	-52.57	15
33	267	0.0031	58.42	0.5	1.6	2.01	0.69	67.50	66.20	***/***
		10	57.59	0.0	0.0	5.69	292.92	120.07	114.48	15
F192528						1.00	1.32	-52.57	-48.28	15
34	48	0.0027	57.59	0.5	1.6	2.01	0.64	66.20	66.20	***/***
		10	57.46	0.0	0.0	5.69	313.82	114.48	113.27	15
F192428						1.00	1.37	-48.28	-47.07	18
35	139	0.0031	57.46	0.5	1.6	2.01	0.68	66.20	65.60	***/***
		10	57.03	0.0	0.0	5.69	293.63	113.27	110.24	15
F192228						1.00	1.32	-47.07	-44.64	15
36	277	0.0034	57.03	0.5	1.6	2.01	0.71	65.60	64.80	***/***
		10	56.10	0.0	0.0	5.69	281.86	110.24	104.45	15
F192028						1.00	1.30	-44.64	-39.65	15

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535

Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
37	309	0.0052	56.10	0.5	1.6	2.01	2.61	64.80	64.01	***/***
		15	54.50	0.0	0.0	2.53	76.97	104.45	104.09	
F191828						0.67		-39.65	-40.08	
38	245	0.0102	54.50	0.5	1.6	2.01	3.65	64.01	61.91	***/***
		15	52.01	0.0	0.0	2.53	54.94	104.09	103.48	
F191728						0.55		-40.08	-41.57	
39	251	0.0080	52.01	0.5	1.6	2.01	3.24	61.91	57.92	***/***
		15	50.00	0.0	0.0	2.53	61.89	103.48	102.85	
F191428						0.59		-41.57	-44.93	
40	261	0.0075	50.00	0.5	1.6	2.01	3.14	57.92	54.23	***/***
		15	48.04	0.0	0.0	2.53	63.91	102.85	102.20	
F191128						0.60		-44.93	-47.97	
41	288	0.0081	48.04	0.5	1.6	2.01	3.25	54.23	52.75	***/***
		15	45.72	0.0	0.0	2.53	61.71	102.20	101.49	
F190828						0.59		-47.97	-48.74	
42	293	0.0024	45.72	0.9	2.1	2.83	1.76	52.75	51.30	***/***
		15	45.03	0.0	0.0	3.56	160.76	101.49	99.95	15
F190528						1.00	1.07	-48.74	-48.65	18
43	256	0.0027	45.03	0.9	2.1	2.83	1.87	51.30	49.68	***/***
		15	44.35	0.0	0.0	3.56	151.36	99.95	98.68	12
F190218						1.00	0.96	-48.65	-49.00	18
44	304	0.0027	44.35	0.9	2.1	2.83	1.87	49.68	49.00	***/***
		15	43.54	0.0	0.0	3.56	151.13	98.68	97.20	12
F190118						1.00	0.96	-49.00	-48.20	18
45	400	0.0018	43.54	0.9	2.1	2.83	1.56	49.00	52.11	***/***
		15	42.80	0.0	0.0	3.56	181.37	97.20	95.27	15
F190018						1.00	1.27	-48.20	-43.16	21
46	171	0.0006	42.80	1.4	3.3	4.20	1.43	52.11	52.55	***/***
		18	42.70	0.0	0.0	3.68	294.89	95.27	94.50	24
F183828						1.00	2.78	-43.16	-41.95	30
47	224	0.0003	42.70	1.4	3.3	4.20	0.96	52.55	52.64	***/***
		18	42.64	0.0	0.0	3.68	435.75	94.50	93.54	30
F172719						1.00	3.24	-41.95	-40.90	33
48	192	0.0018	42.64	1.4	3.3	4.20	2.48	52.64	52.32	***/***
		18	42.30	0.0	0.0	3.68	169.47	93.54	92.71	18
F172619						1.00	1.72	-40.90	-40.39	24

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
49	373	0.0002	42.30	1.4	3.3	4.20	0.75	52.32	51.99	***/***
		18	42.24	0.0	0.0	3.68	562.29	92.71	91.18	33
F172519						1.00	3.46	-40.39	-39.19	36
50	21	0.0257	42.24	1.4	3.3	4.20	9.45	51.99	51.98	***/***
		18	41.70	0.0	0.0	3.68	44.47	91.18	90.99	
F172419						0.49		-39.19	-39.01	
51	298	0.0004	41.70	1.4	3.3	4.20	1.18	51.98	53.58	***/***
		18	41.58	0.0	0.0	3.68	355.39	90.99	89.75	27
F172319						1.00	3.02	-39.01	-36.17	30
52	107	0.0017	41.58	1.4	3.3	4.20	2.42	53.58	53.25	***/***
		18	41.40	0.0	0.0	3.68	173.88	89.75	89.24	18
F171819						1.00	1.79	-36.17	-35.99	24
53	187	0.0005	41.40	1.4	3.3	4.20	1.36	53.25	53.55	***/***
		18	41.30	0.0	0.0	3.68	308.39	89.24	88.42	24
F1717A19						1.00	2.84	-35.99	-34.87	30
54	208	0.0005	41.30	1.4	3.3	4.24	1.29	53.55	54.96	***/***
		18	41.20	0.0	0.0	3.71	328.12	88.42	87.50	27
F171719						1.00	2.95	-34.87	-32.54	30
55	37	0.0051	41.20	1.4	3.3	4.24	4.22	54.96	54.66	***/***
		18	41.01	0.0	0.0	3.71	100.40	87.50	87.25	4
F171619						0.80	0.02	-32.54	-32.59	21
56	394	0.0000	41.01	1.4	3.3	4.24	0.30	54.66	53.90	***/***
		18	41.00	0.0	0.0	3.711	428.06	87.25	85.61	48
F171519						1.00	3.94	-32.59	-31.71	54
57	320	0.0003	41.00	1.4	3.3	4.24	1.04	53.90	51.35	***/***
		18	40.90	0.0	0.0	3.71	406.98	85.61	84.26	30
F171419						1.00	3.20	-31.71	-32.91	33
58	59	0.0093	40.90	1.4	3.3	4.24	5.69	51.35	50.65	***/***
		18	40.35	0.0	0.0	3.71	74.51	84.26	83.93	
F171319						0.66		-32.91	-33.28	
59	53	0.0019	40.35	1.4	3.3	4.24	2.56	50.65	51.10	***/***
		18	40.25	0.0	0.0	3.71	165.63	83.93	83.62	18
F171219						1.00	1.68	-33.28	-32.52	24
60	267	0.0005	40.25	1.4	3.3	4.24	1.30	51.10	47.62	***/***
		18	40.12	0.0	0.0	3.71	326.05	83.62	82.47	27
F170519						1.00	2.94	-32.52	-34.85	30

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AP214535 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
61	75	0.0016	40.12	1.4	3.3	4.24	2.36	47.62	46.76	***/***
		18	40.00	0.0	0.0	3.71	179.86	82.47	82.07	18
F170419						1.00	1.88	-34.85	-35.31	24
62	251	0.0013	40.00	1.4	3.3	4.24	2.10	46.76	45.18	***/***
		18	39.68	0.0	0.0	3.71	201.49	82.07	80.99	21
F170319						1.00	2.14	-35.31	-35.81	24
63	107	0.0004	39.68	1.4	3.3	4.24	1.14	45.18	45.00	***/***
		18	39.64	0.0	0.0	3.71	372.10	80.99	80.47	27
F170219						1.00	3.10	-35.81	-35.47	30
64	298	0.0005	39.64	1.4	3.3	4.24	1.28	45.00	43.91	***/***
		18	39.50	0.0	0.0	3.71	331.93	80.47	79.21	27
F170119						1.00	2.96	-35.47	-35.30	30
65	139	0.0010	39.50	1.4	3.3	4.20	1.15	43.91	43.71	***/***
		15	39.36	0.0	0.0	5.30	365.43	79.21	77.36	24
F170019						1.00	3.05	-35.30	-33.65	27
66	59	0.0134	39.36	1.4	3.3	4.20	4.19	43.71	43.57	***/***
		15	38.57	0.0	0.0	5.30	100.22	77.36	76.55	4
F169919						0.80	0.01	-33.65	-32.98	18
67	245	0.0056	38.57	1.4	3.3	4.20	2.72	43.57	40.64	***/***
		15	37.19	0.0	0.0	5.30	154.53	76.55	73.86	12
F169719						1.00	1.48	-32.98	-33.22	18
68	245	0.0039	37.19	1.4	3.3	4.20	2.26	40.64	40.00	***/***
		15	36.24	0.0	0.0	5.30	186.24	73.86	71.17	15
F169613						1.00	1.95	-33.22	-31.17	21
69	107	0.0049	36.24	1.4	3.3	4.20	2.53	40.00	39.97	***/***
		15	35.72	0.0	0.0	5.30	166.36	71.17	69.87	15
F169514						1.00	1.68	-31.17	-29.90	21
70	96	0.0101	35.72	1.4	3.3	4.20	3.64	39.97	39.00	***/***
		15	34.75	0.0	0.0	5.30	115.37	69.87	68.69	8
F168714						0.91	0.56	-29.90	-29.69	18
71	448	0.0059	34.75	1.4	3.3	4.20	2.79	39.00	36.39	***/***
		15	32.09	0.0	0.0	5.30	150.51	68.69	63.95	12
F168614						1.00	1.41	-29.69	-27.56	18
72	245	0.0057	32.09	1.4	3.3	4.20	2.73	36.39	35.10	***/***
		15	30.70	0.0	0.0	5.30	153.97	63.95	61.26	12
F168514						1.00	1.47	-27.56	-26.16	18

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** AF214535 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
73	165	0.0048	30.70	1.4	3.3	4.20	2.51	35.10	34.55	***/***
		15	29.91	0.0	0.0	5.30	167.61	61.26	59.38	15
F168114						1.00	1.70	-26.16	-24.83	21
74	32	0.0022	29.91	1.4	3.3	4.24	1.69	34.55	40.88	***/***
		15	29.84	0.0	0.0	5.35	250.15	59.38	58.82	18
F168014						1.00	2.54	-24.83	-17.94	24

Lateral length= 16087 Upstream length= 16087

*** BF157414 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
75	298	0.0036	34.88	0.3	0.9	1.12	0.74	40.88	38.00	***/***
		10	33.80	0.0	0.0	3.17	150.89	67.09	65.01	8
F157414						1.00	0.38	-26.21	-27.01	12
76	304	0.0063	33.80	0.3	0.9	1.12	0.97	38.00	37.31	***/***
		10	31.90	0.0	0.0	3.16	114.81	65.01	63.06	6
F157314						0.90	0.14	-27.01	-25.75	12
77	149	0.0061	31.91	0.3	0.9	1.12	0.96	37.31	36.00	***/***
		10	31.00	0.0	0.0	3.16	116.14	63.06	62.06	6
F157214						1.00	0.16	-25.75	-26.06	12
78	149	0.0033	31.00	0.3	0.9	1.12	0.70	36.00	35.68	***/***
		10	30.51	0.0	0.0	3.16	158.28	62.06	61.06	10
F157114						1.00	0.41	-26.06	-25.38	12
79	149	0.0032	30.48	0.3	0.9	1.12	0.70	35.68	35.00	***/***
		10	30.00	0.0	0.0	3.16	159.92	61.06	60.06	10
F157014						1.00	0.42	-25.38	-25.06	12
80	139	0.0009	30.00	0.3	0.9	1.12	0.36	35.00	34.38	***/***
		10	29.88	0.0	0.0	3.16	308.91	60.06	59.13	15
F156914						1.00	0.75	-25.06	-24.75	18
81	37	0.0011	29.88	0.3	0.9	1.12	0.40	34.38	34.34	***/***
		10	29.84	0.0	0.0	3.16	276.05	59.13	58.82	15
F156814						1.00	0.71	-24.75	-24.48	15

Lateral length= 1225 Upstream length= 1225

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** DF141610 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
82	309	0.0029	11.51	0.1	0.0	0.08	3.18	20.32	18.40	***/***
		18	10.61	0.0	0.0	0.07	2.49	23.46	23.46	
F141610						0.12		-3.14	-5.06	
83	298	0.0035	10.61	0.1	0.0	0.08	3.46	18.40	16.70	***/***
		18	9.58	0.0	0.0	0.07	2.29	23.46	23.46	
F141510						0.12		-5.06	-6.76	
84	304	0.0030	9.58	0.1	0.0	0.08	3.22	16.70	14.30	***/***
		18	8.67	0.0	0.0	0.07	2.46	23.46	23.46	
F141410						0.12		-6.76	-9.16	
85	293	0.0031	8.67	0.1	0.0	0.08	3.28	14.30	14.99	***/***
		18	7.76	0.0	0.0	0.07	2.41	23.46	23.46	
F140810						0.12		-9.16	-8.47	
86	37	0.0008	7.76	0.1	0.0	0.08	1.68	14.99	15.03	***/***
		18	7.73	0.0	0.0	0.07	4.72	23.46	23.46	
F140710						0.17		-8.47	-8.43	
87	32	0.0078	7.73	0.1	0.0	0.08	5.21	15.03	15.00	***/***
		18	7.48	0.0	0.0	0.07	1.52	23.46	23.46	
F140610						0.10		-8.43	-8.46	

Lateral length= 1273 Upstream length= 1273

*** CF260308 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
88	171	0.0042	9.25	0.3	0.1	0.40	0.80	17.48	16.00	
		10	8.53	0.0	0.0	2.13	49.70	9.68	8.96	
F260308						0.52		7.80	7.04	
89	187	0.0039	8.53	0.3	0.1	0.40	0.76	16.00	14.70	
		10	7.81	0.0	0.0	2.07	51.97	8.97	8.25	
F2602A08						0.53		7.03	6.45	
90	405	0.0036	7.81	0.3	0.1	0.40	0.74	14.70	13.10	
		10	6.35	0.0	0.0	2.02	53.71	8.26	6.80	
F260208						0.54		6.44	6.30	

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** CF260308 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
91	298	0.0035	6.35	0.3	0.1	0.40	0.72	13.10	12.90	
		10	5.32	0.0	0.0	1.99	54.85	6.81	5.78	
F260108						0.55		6.29	7.12	
92	96	0.0026	5.32	0.3	0.1	0.40	0.63	12.90	13.00	
		10	5.07	0.0	0.0	1.81	63.20	5.82	5.57	
F260008						0.60		7.08	7.43	
93	330	0.0029	5.07	0.3	0.1	0.40	0.67	13.00	11.60	
		10	4.10	0.0	0.0	1.88	59.48	5.55	4.58	
F259308						0.57		7.45	7.02	
94	288	0.0029	4.10	0.3	0.1	0.40	0.66	11.60	10.70	
		10	3.26	0.0	0.0	1.88	59.71	4.58	3.74	
F259208						0.58		7.02	6.96	
95	277	0.0031	3.26	0.3	0.1	0.40	0.68	10.70	9.70	
		10	2.41	0.0	0.0	1.91	58.22	3.73	2.88	
F259108						0.57		6.97	6.82	
96	358	0.0024	2.41	0.3	0.1	0.40	0.61	9.70	8.80	
		10	1.54	0.0	0.0	1.77	65.42	2.92	2.05	
F259008						0.61		6.78	6.75	
97	346	0.0025	1.54	0.3	0.1	0.40	0.62	8.80	7.98	
		10	0.66	0.0	0.0	1.80	63.95	2.04	1.16	
F258908						0.60		6.76	6.82	
98	346	0.0032	0.66	0.3	0.1	0.40	0.69	7.98	7.04	
		10	-0.43	0.0	0.0	1.93	57.46	1.13	0.04	
F258304						0.56		6.85	7.00	
99	330	0.0037	-0.43	0.3	0.1	0.40	0.75	7.04	6.65	
		10	-1.65	0.0	0.0	2.04	53.04	0.02	-1.20	
F258204						0.54		7.02	7.85	
100	11	0.1409	-1.65	0.3	0.1	0.40	4.61	6.65	6.98	***
		10	-3.20	0.0	0.0	1.12	8.59	-0.87	-0.91	
F254904						0.22		7.52	7.89	

Lateral length= 3443 Upstream length= 3443

*** EF120311 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace

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101	394	0.0044	11.08	0.3	1.1	1.35	0.81	16.36	16.14	***/***
		10	9.36	0.0	0.0	3.82	165.68	34.17	30.29	10
F120311						1.00	0.53	-17.81	-14.15	15
102	85	0.0007	9.36	0.3	1.1	1.35	0.33	16.14	16.80	***/***
		10	9.30	0.0	0.0	3.82	412.02	30.29	29.42	18
F120211						1.00	1.02	-14.15	-12.62	18
103	85	0.0007	9.30	0.3	1.1	1.35	0.33	16.80	17.34	***/***
		10	9.24	0.0	0.0	3.82	412.02	29.42	28.54	18
F118711						1.00	1.02	-12.62	-11.20	18
104	48	0.0092	9.24	0.3	1.1	1.35	1.18	17.34	14.93	***/***
		10	8.80	0.0	0.0	3.82	114.34	28.54	27.99	6
F118611						0.90	0.17	-11.20	-13.06	12
105	224	0.0044	8.80	0.3	1.1	1.35	0.45	14.93	13.37	***/***
		8	7.81	0.0	0.0	5.96	298.58	27.99	20.78	12
F117411						1.00	0.89	-13.06	-7.41	15
106	85	0.0058	7.81	0.3	1.1	1.35	0.51	13.37	13.37	***/***
		8	7.32	0.0	0.0	5.96	261.43	20.78	17.99	10
F117311						1.00	0.83	-7.41	-4.62	12
107	43	0.0116	7.32	0.3	1.1	1.35	1.33	13.37	12.70	***/***
		10	6.82	0.0	0.0	3.82	101.52	17.99	17.82	4
F117211						0.81	0.02	-4.62	-5.12	12
108	43	0.0002	6.82	0.3	1.1	1.35	0.19	12.70	12.60	***/***
		10	6.81	0.0	0.0	3.82	717.83	17.82	17.32	21
F117111						1.00	1.16	-5.12	-4.72	21
109	224	0.0052	6.81	0.3	1.1	1.35	0.88	12.60	12.50	***/***
		10	5.65	0.0	0.0	3.82	152.12	17.32	15.19	8
F117011						1.00	0.46	-4.72	-2.69	12
110	272	0.0040	5.65	0.3	1.1	1.35	0.77	12.50	12.00	***/***
		10	4.57	0.0	0.0	3.82	173.72	15.19	12.64	10
F116911						1.00	0.57	-2.69	-0.64	15
111	267	0.0016	4.57	0.3	1.1	1.35	0.80	12.00	11.50	***/***
		12	4.14	0.0	0.0	2.65	167.74	12.64	11.79	12
F116811						1.00	0.54	-0.64	-0.29	15
112	224	0.0020	4.14	0.3	1.1	1.35	0.89	11.50	11.25	***/***
		12	3.70	0.0	0.0	2.65	151.88	11.79	10.98	10
F116711						1.00	0.46	-0.29	0.27	15
113	261	0.0016	3.70	0.3	1.1	1.35	0.81	11.25	11.00	***
		12	3.27	0.0	0.0	2.65	165.84	10.98	10.03	12
F116611						1.00	0.53	0.27	0.97	15

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** EF120311 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
114	277	0.0016	3.27	0.3	1.1	1.35	0.80	11.00	10.75	***
		12	2.83	0.0	0.0	2.65	168.90	10.03	9.04	12
F116511						1.00	0.55	0.97	1.71	15
115	272	0.0016	2.83	0.3	1.1	1.35	0.80	10.75	10.50	***
		12	2.39	0.0	0.0	2.65	167.37	9.04	8.06	12
F116411						1.00	0.54	1.71	2.44	15
116	298	0.0001	2.39	0.3	1.1	1.35	0.23	10.50	9.85	***
		12	2.35	0.0	0.0	2.65	581.02	8.06	6.99	24
F116211						1.00	1.11	2.44	2.86	24
117	288	0.0030	2.35	0.3	1.1	1.35	1.09	9.85	9.00	***
		12	1.50	0.0	0.0	2.65	123.91	6.99	5.96	8
F116110						1.00	0.26	2.86	3.04	15
118	330	0.0010	1.50	0.6	2.3	2.69	1.89	9.00	8.50	***
		18	1.16	0.0	0.0	2.36	142.24	5.96	5.42	15
F116010						1.00	0.80	3.04	3.08	21
119	320	0.0010	1.16	0.6	2.3	2.69	1.89	8.50	8.00	***
		18	0.83	0.0	0.0	2.36	142.18	5.42	4.88	15
F115910						1.00	0.80	3.08	3.12	21
120	309	0.0006	0.83	0.6	2.3	2.69	1.50	8.00	7.73	***
		18	0.63	0.0	0.0	2.36	179.46	4.88	4.35	18
F115810						1.00	1.19	3.12	3.38	24
121	213	0.0011	0.63	0.6	2.3	2.69	1.94	7.70	7.25	***
		18	0.40	0.0	0.0	2.36	138.94	4.35	3.98	15
F115710						1.00	0.75	3.35	3.27	21
122	565	0.0031	0.40	0.6	2.3	2.69	3.26	7.25	6.37	***
		18	-1.33	0.0	0.0	2.36	82.51	3.98	3.05	
F115610						0.71		3.27	3.32	

Lateral length= 5127 Upstream length= 5127

*** FF012611 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
123	373	0.0018	5.70	0.1	0.2	0.22	0.52	13.67	13.06	
		10	5.03	0.0	0.0	1.33	42.88	6.10	5.43	
F012611						0.48		7.57	7.63	

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** FF012611 Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
124	21	0.0005	5.03	0.1	0.2	0.22	0.27	13.06	13.93	
		10	5.02	0.0	0.0	0.84	83.20	5.62	5.61	
F011511						0.71		7.44	8.32	
125	293	0.0034	5.02	0.1	0.2	0.22	0.72	13.93	12.24	
		10	4.02	0.0	0.0	1.68	31.08	5.36	4.36	
F011411						0.40		8.57	7.88	
126	384	0.0003	4.02	0.1	0.2	0.22	0.22	12.24	11.12	
		10	3.90	0.0	0.0	0.63	102.70	4.70	4.58	4
F011311						0.82	0.01	7.54	6.54	12
127	96	0.0042	3.90	0.1	0.2	0.22	0.79	11.12	11.16	
		10	3.50	0.0	0.0	1.79	28.13	4.22	3.82	
F011211						0.38		6.90	7.34	
128	155	0.0032	3.50	0.1	0.2	0.22	0.70	11.16	10.50	
		10	3.00	0.0	0.0	1.64	31.96	3.84	3.34	
F011111						0.41		7.32	7.16	
129	32	0.0188	3.00	0.1	0.2	0.22	1.68	10.50	10.10	
		10	2.40	0.0	0.0	3.09	13.26	3.22	2.62	
F011011						0.27		7.28	7.48	
130	107	0.0052	2.40	0.1	0.2	0.22	0.89	10.10	9.25	
		10	1.84	0.0	0.0	1.93	25.10	2.70	2.14	
F010911						0.36		7.40	7.11	
131	171	0.0030	1.84	0.1	0.2	0.22	0.68	9.25	8.52	
		10	1.32	0.0	0.0	1.61	32.92	2.19	1.67	
F010811						0.41		7.06	6.85	
132	314	0.0030	1.32	0.1	0.2	0.22	0.67	8.52	7.10	
		10	0.38	0.0	0.0	1.60	33.18	1.67	0.73	
F010711						0.42		6.85	6.37	
133	336	0.0035	0.38	0.1	0.2	0.22	0.73	7.10	5.65	***
		10	-0.80	0.0	0.0	0.63	30.64	0.74	0.45	
F010611						0.40		6.36	5.20	
134	139	0.0024	-0.80	0.1	0.2	0.22	0.97	5.65	4.80	***
		12	-1.13	0.0	0.0	0.44	22.91	0.45	0.43	
F010506						0.34		5.20	4.37	
135	187	0.0020	-1.13	0.1	0.2	0.22	0.89	4.80	4.80	***
		12	-1.50	0.0	0.0	0.44	25.10	0.43	0.42	
F010406						0.36		4.37	4.38	

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** FF012611 Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
136	384	0.0011	-1.50	0.5	1.0	1.23	0.66	4.80	3.31	***
		12	-1.92	0.0	0.0	2.42	185.82	0.42	-0.80	12
F005006						1.00	0.57	4.38	4.11	18

Lateral length= 2992 Upstream length= 2992

*** SOUTH TRUNK Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
137	53	0.0191	29.84	1.6	4.2	5.33	5.00	34.34	36.00	***/***
		15	28.83	0.0	0.0	6.73	106.63	58.82	57.03	6
F156714						0.84	0.33	-24.48	-21.03	18
138	421	0.0032	28.83	1.6	4.2	5.34	2.04	36.00	32.61	***/***
		15	27.50	0.0	0.0	6.74	262.37	57.03	49.81	18
F156614						1.00	3.31	-21.03	-17.20	24
139	53	0.0185	27.50	1.6	4.2	5.34	4.93	32.61	32.61	***/***
		15	26.52	0.0	0.0	6.74	108.45	49.81	48.59	6
F156514						0.85	0.42	-17.20	-15.98	18
140	11	0.1382	26.52	1.6	4.2	5.34	21.91	32.92	31.20	***/***
		18	25.00	0.0	0.0	4.68	24.39	48.59	48.59	
F156314						0.35		-15.67	-17.39	
141	293	0.0028	25.00	1.6	4.2	5.34	3.14	31.20	31.20	***/***
		18	24.17	0.0	0.0	4.68	170.38	48.59	46.61	18
F156214						1.00	2.21	-17.39	-15.41	24
142	330	0.0048	24.17	1.6	4.2	5.34	4.10	31.20	29.98	***/***
		18	22.57	0.0	0.0	4.68	130.23	46.61	44.41	12
F156114						1.00	1.24	-15.41	-14.43	21
143	320	0.0038	22.57	1.6	4.2	5.34	3.65	29.98	29.87	***/***
		18	21.34	0.0	0.0	4.68	146.27	44.41	42.27	15
F156014						1.00	1.69	-14.43	-12.40	21
144	139	0.0006	21.34	1.7	4.6	5.90	2.26	29.87	28.25	***/***
		21	21.25	0.0	0.0	3.80	260.92	42.27	41.81	27
F149414						1.00	3.64	-12.40	-13.56	33

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** SOUTH TRUNK Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
145	107	0.0015	21.25	1.7	4.6	5.91	3.44	28.25	27.90	***/***
		21	21.09	0.0	0.0	3.80	171.82	41.81	41.34	21
F149314						1.00	2.47	-13.56	-13.44	27
146	314	0.0012	21.09	1.7	4.6	5.91	2.08	27.90	26.41	***/***
		18	20.70	0.0	0.0	5.17	284.39	41.34	38.58	24
F149214						1.00	3.83	-13.44	-12.17	27
147	298	0.0037	20.70	1.7	4.6	5.91	3.58	26.41	25.15	***/***
		18	19.60	0.0	0.0	5.17	164.97	38.58	36.12	18
F149114						1.00	2.33	-12.17	-10.97	24
148	309	0.0021	19.60	1.7	4.6	5.91	2.70	25.15	24.00	***/***
		18	18.95	0.0	0.0	5.17	218.53	36.12	33.59	21
F149014						1.00	3.20	-10.97	-9.59	27
149	384	0.0053	18.95	1.7	4.8	6.09	6.50	24.00	22.80	***/***
		21	16.90	0.0	0.0	3.92	93.79	33.59	32.29	
F145009						0.77		-9.59	-9.49	
150	43	0.0044	16.90	1.7	4.8	6.09	5.91	22.80	22.88	***/***
		21	16.71	0.0	0.0	3.92	103.09	32.29	32.02	6
F144909						0.82	0.18	-9.49	-9.14	24
151	240	0.0041	16.71	1.7	4.8	6.09	5.68	22.88	22.35	***/***
		21	15.73	0.0	0.0	3.92	107.24	32.02	31.06	8
F144109						0.85	0.41	-9.14	-8.71	24
152	245	0.0040	15.73	1.7	4.8	6.09	5.62	22.35	20.91	***/***
		21	14.75	0.0	0.0	3.92	108.35	31.06	30.08	10
F143909						0.85	0.47	-8.71	-9.17	24
153	64	0.0034	14.75	1.7	4.8	6.09	5.21	20.91	20.91	***/***
		21	14.53	0.0	0.0	3.92	116.88	30.08	29.73	12
F143709						1.00	0.88	-9.17	-8.82	24
154	160	0.0151	14.53	1.7	4.8	6.09	10.93	20.91	21.00	***/***
		21	12.11	0.0	0.0	3.92	55.72	29.73	29.05	
F143609						0.55		-8.82	-8.05	
155	288	0.0036	12.11	1.7	4.8	6.09	5.34	21.00	20.70	***/***
		21	11.07	0.0	0.0	3.92	114.04	29.05	27.91	12
F143509						0.90	0.75	-8.05	-7.21	24
156	256	0.0032	11.07	1.7	4.8	6.09	5.03	20.70	19.50	***/***
		21	10.25	0.0	0.0	3.92	121.08	27.91	26.89	12
F143409						1.00	1.06	-7.21	-7.39	24

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** SOUTH TRUNK

Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
157	298	0.0030	10.25	1.7	4.8	6.09	4.89	19.50	18.50	***/***
		21	9.35	0.0	0.0	3.92	124.69	26.89	25.72	15
F143309						1.00	1.21	-7.39	-7.22	24
158	288	0.0031	9.35	1.7	4.8	6.09	4.97	18.50	17.00	***/***
		21	8.45	0.0	0.0	3.92	122.58	25.72	24.59	15
F143209						1.00	1.12	-7.22	-7.59	24
159	288	0.0034	8.45	1.7	4.8	6.09	5.16	17.00	15.00	***/***
		21	7.48	0.0	0.0	3.92	118.08	24.59	23.46	12
F143110						1.00	0.93	-7.59	-8.46	24
160	240	0.0029	7.48	1.8	4.8	6.15	4.80	15.00	15.92	***/***
		21	6.78	0.0	0.0	3.95	128.00	23.46	22.23	15
F140510						1.00	1.34	-8.46	-6.31	24
161	330	0.0027	6.78	1.8	4.8	6.14	4.59	15.92	12.68	***/***
		21	5.90	0.0	0.0	3.95	133.81	22.23	20.93	15
F140410						1.00	1.55	-6.31	-8.25	24
162	346	0.0025	5.90	1.8	4.8	6.14	4.46	12.68	10.38	***/***
		21	5.03	0.0	0.0	3.95	137.80	20.93	19.57	15
F140310						1.00	1.69	-8.25	-9.19	24
163	341	0.0076	5.03	1.8	4.8	6.14	7.75	10.38	6.91	***/***
		21	2.44	0.0	0.0	3.95	79.29	19.57	18.23	
F139710						0.69		-9.19	-11.32	
164	341	0.0074	2.44	1.8	4.8	6.14	7.63	6.91	7.50	***/***
		21	-0.07	0.0	0.0	3.95	80.54	18.23	16.88	
F139610						0.69		-11.32	-9.38	
165	11	0.1145	-0.07	1.8	4.8	6.14	4.16	7.50	6.37	***/***
		10	-1.33	0.0	0.0	17.43	147.69	16.88	3.05	8
F139110						1.00	1.98	-9.38	3.32	12
166	565	0.0001	-1.33	2.3	7.0	8.74	2.56	6.37	7.91	***
		30	-1.40	0.0	0.0	2.76	341.33	3.05	2.32	42
F115510						1.00	6.18	3.32	5.59	48
167	554	0.0001	-1.40	2.3	7.0	8.75	2.40	7.91	7.24	***
		30	-1.46	0.0	0.0	2.76	365.12	2.32	1.66	45
F115404						1.00	6.35	5.59	5.58	54
168	533	0.0013	-1.46	2.3	7.0	8.75	8.16	7.24	8.37	***
		30	-2.13	0.0	0.0	2.76	107.17	1.66	1.03	12
F115304						0.85	0.59	5.58	7.34	33

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** SOUTH TRUNK

Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
169	480	0.0008	-2.13	2.5	7.1	9.05	6.39	8.37	6.98	***
		30	-2.50	0.0	0.0	2.85	141.70	1.03	0.40	24
F115204						1.00	2.66	7.34	6.58	36
170	373	0.0010	-2.50	2.5	7.1	9.06	7.35	6.98	6.98	***
		30	-2.88	0.0	0.0	2.86	123.38	0.40	-0.10	18
F115104						1.00	1.72	6.58	7.08	33
171	352	0.0009	-2.88	2.5	7.1	9.06	6.94	6.98	6.28	***
		30	-3.20	0.0	0.0	2.86	130.61	-0.10	-0.70	21
F115004						1.00	2.12	7.08	6.98	36
172	298	0.0035	-3.20	3.0	7.3	9.74	13.53	6.28	5.60	***
		30	-4.23	0.0	0.0	3.07	72.02	-0.91	-1.53	
F114904						0.65		7.19	7.13	
173	197	0.0033	-4.23	3.0	7.3	9.76	13.22	5.60	7.90	***
		30	-4.88	0.0	0.0	3.08	73.81	-1.53	-2.02	
F114804						0.66		7.13	9.92	
174	85	0.0019	-4.88	3.0	7.3	9.76	9.99	7.90	5.50	***
		30	-5.04	0.0	0.0	3.08	97.72	-2.02	-2.35	
F114703						0.79		9.92	7.85	
175	320	0.0028	-5.04	3.0	7.3	9.76	12.27	5.50	4.00	***
		30	-5.95	0.0	0.0	3.08	79.50	-2.35	-3.01	
F114603						0.69		7.85	7.01	
176	320	0.0021	-5.95	3.0	7.3	9.76	10.53	4.00	3.00	***
		30	-6.62	0.0	0.0	3.08	92.66	-3.01	-3.66	
F114503						0.76		7.01	6.66	
177	165	0.0019	-6.62	3.0	7.3	9.82	9.98	3.00	2.20	***
		30	-6.93	0.0	0.0	3.09	98.39	-3.66	-4.11	
F114403						0.79		6.66	6.31	
178	176	0.0029	-6.93	3.0	7.3	9.82	12.39	2.20	7.16	***
		30	-7.44	0.0	0.0	3.09	79.22	-4.11	-4.57	
F114303						0.69		6.31	11.73	
179	160	0.0004	-7.44	3.0	7.3	9.82	4.81	7.16	4.79	***
		30	-7.51	0.0	0.0	3.09	203.89	-4.57	-5.01	33
F114203						1.00	5.00	11.73	9.80	42
180	357	0.0049	-7.51	3.0	7.3	9.82	16.11	4.79	1.83	
		30	-9.26	0.0	0.0	5.10	60.91	-6.05	-7.80	
F114103						0.58		10.84	9.63	

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FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

Lateral length= 11746 Upstream length= 38901
*** NORTH TRUNK Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
181	309	0.0017	-1.92	0.5	1.0	1.23	1.50	3.31	3.13	***
		15	-2.45	0.0	0.0	1.55	81.76	-0.80	-1.13	
F003606						0.70		4.11	4.26	
182	320	0.0022	-2.45	0.5	1.0	1.23	1.68	3.13	2.52	***
		15	-3.14	0.0	0.0	1.55	72.92	-1.13	-1.46	
F003506						0.65		4.26	3.98	
183	320	0.0004	-3.14	0.5	1.0	1.23	0.76	2.52	4.02	***
		15	-3.28	0.0	0.0	1.55	161.89	-1.46	-1.79	15
F003406						1.00	0.47	3.98	5.81	18
184	362	0.0010	-3.28	0.5	1.0	1.23	1.13	4.02	4.32	***
		15	-3.63	0.0	0.0	1.55	108.90	-1.79	-2.16	8
F003306						0.86	0.10	5.81	6.48	18
185	43	0.0063	-3.63	0.5	1.0	1.23	2.87	4.32	4.50	***
		15	-3.90	0.0	0.0	1.55	42.73	-2.16	-2.25	
F003206						0.48		6.48	6.75	
186	267	0.0010	-3.90	0.5	1.0	1.23	1.13	4.50	4.38	***
		15	-4.16	0.0	0.0	1.55	108.52	-2.25	-2.53	6
F0031A06						0.85	0.10	6.75	6.91	18
187	293	0.0009	-4.16	0.5	1.0	1.23	1.08	4.38	3.68	***
		15	-4.42	0.0	0.0	1.55	113.68	-2.53	-2.84	8
F003106						0.89	0.15	6.91	6.52	18
188	384	0.0010	-4.42	0.8	1.5	1.90	1.88	3.68	4.02	***
		18	-4.81	0.0	0.0	1.66	101.02	-2.84	-3.20	4
F003006						0.81	0.02	6.52	7.22	21
189	373	0.0009	-4.81	0.8	1.5	1.90	1.81	4.02	4.14	***
		18	-5.16	0.0	0.0	1.66	105.06	-3.20	-3.56	6
F002906						0.83	0.09	7.22	7.70	21
190	245	0.0024	-5.16	1.0	1.7	2.23	2.92	4.14	4.02	***
		18	-5.76	0.0	0.0	1.95	76.52	-3.56	-3.91	
F002805						0.67		7.70	7.93	
191	400	0.0004	-5.76	1.0	1.7	2.23	1.21	4.02	2.88	***
		18	-5.93	0.0	0.0	1.95	183.74	-3.91	-4.43	18
F002705						1.00	1.02	7.93	7.31	24

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MGD

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** NORTH TRUNK Analysis of Existing Pipes

Link	Long	Slope / Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes / Vel / d/D	Qmax / %Cap / QRem	GrUp / HGLUp / DiffUp	GrDn / HGLDn / DiffDn	SrCh/Dlt / Parallel / Replace
192	357	0.0015	-5.93	1.0	1.7	2.23	2.27	2.88	2.99	
		18	-6.46	0.0	0.0	2.30	98.31	-4.74	-5.27	
F002605						0.79		7.62	8.26	
193	405	0.0018	-6.46	1.1	2.0	2.57	9.64	2.99	3.23	
		30	-7.17	0.0	0.0	2.37	26.67	-5.54	-6.25	
F002505						0.37		8.53	9.48	
194	346	0.0001	-7.17	1.1	2.0	2.58	2.77	3.23	3.13	
		30	-7.22	0.0	0.0	0.99	93.09	-5.26	-5.31	
F002405						0.76		8.49	8.44	
195	346	0.0004	-7.22	1.1	2.0	2.58	4.63	3.13	3.16	
		30	-7.36	0.0	0.0	1.42	55.63	-5.84	-5.98	
F002305						0.55		8.97	9.14	
196	346	0.0005	-7.36	1.1	2.0	2.56	5.25	3.16	3.20	
		30	-7.54	0.0	0.0	1.55	48.72	-6.07	-6.25	
F002205						0.51		9.23	9.45	
197	288	0.0004	-7.54	1.1	2.0	2.58	4.50	3.20	3.00	***
		30	-7.65	0.0	0.0	0.81	57.26	-5.08	-5.12	
F002105						0.56		8.28	8.12	
198	352	0.0002	-7.65	1.3	2.3	3.03	3.47	3.00	3.20	***
		30	-7.73	0.0	0.0	0.95	87.22	-5.12	-5.19	
F002004						0.73		8.12	8.39	
199	346	0.0004	-7.73	1.3	2.3	3.03	4.46	3.20	3.44	***
		30	-7.86	0.0	0.0	0.95	67.87	-5.19	-5.25	
F001904						0.62		8.39	8.69	
200	400	0.0004	-7.86	1.3	2.3	3.03	4.74	3.44	3.57	***
		30	-8.03	0.0	0.0	0.95	63.81	-5.25	-5.33	
F001804						0.60		8.69	8.90	
201	171	0.0004	-8.03	1.3	2.3	2.98	4.66	3.57	3.74	***
		30	-8.10	0.0	0.0	0.94	63.96	-5.33	-5.37	
F001704						0.60		8.90	9.11	
202	267	0.0004	-8.10	1.5	2.6	3.34	5.74	3.74	4.18	***
		33	-8.20	0.0	0.0	0.87	58.19	-5.37	-5.41	
F001604						0.57		9.11	9.59	
203	426	0.0000	-8.20	1.5	2.6	3.34	2.03	4.18	1.54	***
		33	-8.22	0.0	0.0	0.87	164.43	-5.41	-5.47	30
F001304						1.00	1.31	9.59	7.01	42

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MGD

FAIR OAKS SEWER DISTRICT 5-year 6-hour Storm

*** NORTH TRUNK Analysis of Existing Pipes

Link	Long	Slope Diam	Invert Up/Dn	San Inf	Sto Mis	Qdes Vel d/D	Qmax %Cap QRem	GrUp HGLUp DiffUp	GrDn HGLDn DiffDn	SrCh/Dlt Parallel Replace
204	320	0.0002	-8.22	1.5	2.6	3.30	4.69	1.54	1.54	
		33	-8.30	0.0	0.0	1.28	70.22	-6.47	-6.55	
F001204						0.64		8.01	8.09	
205	240	0.0002	-8.30	1.5	2.6	3.34	4.28	1.54	3.95	
		33	-8.35	0.0	0.0	1.21	78.06	-6.43	-6.48	
F001104						0.68		7.97	10.43	
206	330	0.0005	-8.35	1.5	2.6	3.34	6.33	3.95	3.44	
		33	-8.50	0.0	0.0	1.58	52.85	-6.87	-7.02	
F000303						0.54		10.82	10.46	
207	53	0.0089	-8.50	1.5	2.6	3.34	27.95	3.44	4.43	
		33	-8.97	0.0	0.0	4.61	11.96	-7.79	-8.26	
F0002A03						0.26		11.23	12.69	
208	21	0.0138	-8.97	1.5	2.6	3.34	34.87	4.43	1.83	
		33	-9.26	0.0	0.0	5.44	9.59	-8.33	-8.62	
F000203						0.23		12.76	10.45	
209	100	0.0074	-9.26	4.3	7.8	11.38	25.53	1.83	3.00	
		33	-10.00	0.0	0.0	6.07	44.59	-7.91	-8.65	
F000103						0.49		9.74	11.65	

Lateral length= 8430 Upstream length= 50323

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APPENDIX F

CAPITAL IMPROVEMENT PROJECTS

District: Fair Oaks Priority: 1

Project: Berkshire Avenue

Project Purpose: Hydraulics and Operations & Maintenace

Project Location: Berkshire Avenue from El Camino Real to Huntington Avenue
MH 1566-1490

Existing Conditions:

Pipeline: 256 feet of 12-inch diameter
500 feet of 15-inch diameter
1633 feet of 18-inch diameter

Television Inspection: Not Inspected

Operation & Maintenance 3 callouts/year: [Y] / N

Manhole Inspection: Roots / Pipe / Grease

Hydraulics: Yes, needs 33-inch diameter replacement sewer

Alternative 1: Replace with 33-inch diameter sewer

Alternative 1 Cost: $609,200

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Selby Lane #2

Project Purpose: Hydraulics

Project Location: Selby Lane Logan Lane to Austin Avenue
MH 1704-1699

Existing Conditions:

Pipeline: 144 feet of 15-inch diameter
767 feet of 18-inch diameter
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 30-inch diameter replacement sewer

Alternative 1: Replace with 30-inch diameter sewer

Alternative 1 Cost: $209,500

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Bay Road #2

Project Purpose: Hydraulics and Operations & Maintenance

Project Location: Bay Road from 7th Avenue to 2nd Avenue
MH 1162-1156

Existing Conditions:

Pipeline: 589 feet of 12-inch diameter
1144 feet of 18-inch diameter
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: [Y] / N
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 24-inch diameter replacement sewer

Alternative 1: Replace with 24-inch diameter sewer

Alternative 1 Cost: $337,900

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Selby Lane #1

Project Purpose: Hydraulics

Project Location: Selby Lane from El Camino Real to Logan Lane
MH 1699-1680

Existing Conditions:

Pipeline: 1667 feet of 15-inch diameter
Television Inspection Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: [Roots] / Pipe / Grease
Hydraulics Yes, needs 24-inch diameter replacement sewer

Alternative 1: Replace with 24-inch diameter sewer

Alternative 1 Cost: $325,000

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Nimitz Avenue

Project Purpose: Hydraulics

Project Location: Nimitz Avenue from Selby Lane to Himmel Street
MH 1905-1838

Existing Conditions:

Pipeline: 222 feet of 12-inch diameter
989 feet of 15-inch diameter
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 21-inch diameter replacement sewer

Alternative 1: Replace with 21-inch diameter sewer

Alternative 1 Cost: $218,000

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Bay Road #1

Project Purpose: Hydraulics

Project Location: Bay Road from 12th Avenue to 7th Avenue
MH 1172-1162

Existing Conditions:

Pipeline: 644 feet of 10-inch diameter
1411 feet of 12-inch diameter

Television Inspection: Not Inspected

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: [Roots] / Pipe / [Grease]

Hydraulics: Yes, needs 21-inch diameter replacement sewer

Alternative 1: Replace with 21-inch diameter sewer

Alternative 1 Cost: $369,900

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: 12th Avenue

Project Purpose: Hydraulics

Project Location: 12th Avenue from Spring Street to Fair Oaks Avenue
MH 1203-1172

Existing Conditions:

Pipeline: 956 feet of 10-inch diameter
Television Inspection:
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: [Roots] / Pipe / [Grease]
Hydraulics: Yes, needs 18-inch diameter replacement sewer

Alternative 1: Replace with 18-inch diameter sewer

Alternative 1 Cost: $133,800

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Woodside Road

Project Purpose: Hydraulics

Project Location: Woodside Road from Bonsen Court to Churchill Avenue
MH 1986-1982

Existing Conditions:

Pipeline: 1167 feet of 10-inch pipe
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 12-inch diameter replacement sewer

Alternative 1: Replace with 12-inch diameter sewer

Alternative 1 Cost: $128,400

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Santiago Avenue

Project Purpose: Hydraulics

Project Location: Santiago Avenue from Hull Avenue to Woodside Road
MH 1932-1977

Existing Conditions:

Pipeline: 1367 feet of 10-inch diameter
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 12-inch diameter replacement sewer

Alternative 1: Replace with 12-inch diameter sewer

Alternative 1 Cost: $150,400

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks

Priority: 1

Project: El Camino Real #2

Project Purpose: Hydraulics

Project Location: El Camino Real from Berkshire Avenue to Stockbridge Avenue
MH 1567-1574

Existing Conditions:

Pipeline: 1289 feet of 10-inch diameter
Television Inspection: Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics: Yes, needs 18-inch diameter replacement sewer

Alternative 1: Replace with 18-inch diameter sewer

Alternative 1 Cost: $180,500

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 1

Project: Milton Street/Hull Avenue

Project Purpose: Hydraulics

Project Location: Milton Street and Hull Avenue from Santiago Avenue to Sequoia Avenue
MH 1932-1930, MH 1930-1925, MH 1925-1918

Existing Conditions:

Pipeline: 639 feet of 8-inch diameter
1189 feet of 10-inch diameter

Television Inspection: Not Inspected

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: Roots / Pipe / Grease

Hydraulics: Yes, needs 15-inch diameter replacement sewer

Alternative 1: Replace with 15-inch diameter sewer

Alternative 1 Cost: $219,400

Alternative 2: n/a

Alternative 2 Cost: n/a

Alternative 3: n/a

Alternative 3 Cost: n/a

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Eleanor Drive

Project Purpose: Structural

Project Location: Eleanor Drive
MH 2063-2067

Existing Conditions:

Pipeline: 1756 feet of 6-inch diameter
Television Inspection: 1 piece missing
7 broken
severe roots and cracks
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: [Roots] / [Pipe] / Grease
Hydraulics:

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (136)

Alternative 1 Cost: $240,500

Alternative 2: Pipe Bursting

Alternative 2 Cost: $158,040

Alternative 3: Remove and Replace

Alternative 3 Cost: $149,260

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Melanie Lane

Project Purpose: Structural

Project Location: Melanie Lane from Eleanor Drive to Stockbridge Avenue
MH 2013-2009, MH 2011-2003

Existing Conditions:

Pipeline: 1767 feet of 6-inch diameter
Television Inspection: 1 minor offset joint
4 piece missing
9 broken
severe roots and cracks
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (36)

Alternative 1 Cost: $161,300

Alternative 2: Pipe Bursting

Alternative 2 Cost: $159,030

Alternative 3: Remove and Replace

Alternative 3 Cost: $150,195

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Middlefield Road

Project Purpose: Structural

Project Location: Middle Field Road from 7th Avenue to Dumbarton Avenue
MH 1442-1448

Existing Conditions:

Pipeline: 1279 feet of 6-inch diameter

Television Inspection: 1 minor offset joint
5 broken
9 piece missing
severe cracks
grease

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: Roots / Pipe / Grease

Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (52)

Alternative 1 Cost: $137,500

Alternative 2: Pipe Bursting

Alternative 2 Cost: $115,110

Alternative 3: Remove and Replace

Alternative 3 Cost: $108,715

Project Concerns:

Recommended Alternative:

District: Fair Oaks

Priority: 3

Project: Polhemus Avenue

Project Purpose: Structural

Project Location: Polhemus Avenue from Selby Lane to Polhemus Court
MH 1749-1739, MH 1743-1773, MH 1746-1771

Existing Conditions:

Pipeline: 3456 feet of 6-inch diameter

Television Inspection: 1 protruding lateral
2 broken
5 piece missing
5 sags
severe roots and cracks

Operation & Maintenance 3 callouts/year: Y / N

Manhole Inspection: Roots / Pipe / Grease

Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (135)

Alternative 1 Cost: $367,200

Alternative 2: Pipe Bursting

Alternative 2 Cost: $311,040

Alternative 3: Remove and Replace

Alternative 3 Cost: $293,760

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Page Street

Project Purpose: Structural

Project Location: Page Street from Wayne Court East to Rose Avenue
MH 98-89, MH 73-66

Existing Conditions:

Pipeline: 1211 feet of 6-inch diameter
57 feet of 8-inch diameter

Television Inspection: 3 sags
10 minor offset joints
severe cracks

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: Roots / [Pipe] / Grease

Hydraulics:

Alternative 1: Increase Operations & Maintenace (rc)
Spot Repair

Alternative 1 Cost: $111,900

Alternative 2: Pipe Bursting for 6-inch diameter
Sliplining for 8-inch diameter
Spot Repair (21)

Alternative 2 Cost: $114,120

Alternative 3: Remove and Replace

Alternative 3 Cost: $107,935

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Stockbridge Avenue

Project Purpose: Structural

Project Location: Stockbridge Avenue from Alameda De Las Pulgas to Parker Avenue
MH 1816-1789

Existing Conditions:

Pipeline: 2756 feet of 6-inch diameter

Television Inspection: 1 collapsed
2 broken
8 sags
8 piece missing
severe roots and cracks

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: Roots / [Pipe] / Grease

Hydraulics:

Alternative 1: Increase Operatons & Maintenance (rc)
Spot Repair (43)

Alternative 1 Cost: $241,100

Alternative 2: Pipe Bursting

Alternative 2 Cost: $248,040

Alternative 3: Remove and Replace

Alternative 3 Cost: $234,260

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: 6th Avenue

Project Purpose: Structural

Project Location: 6th Avenue from Spring Street to Edison Way
MH 1355-1300, MH 1324-1360

Existing Conditions:

Pipeline: 1122 feet of 8-inch diameter
511 feet of 10-inch diameter

Television Inspection: 3 broken
3 sags
severe roots and cracks

Operation & Maintenance 3 callouts/year: Y / N

Manhole Inspection: Roots / Pipe / Grease

Hydraulics:

Alternative 1: Increase Operations & Maintenace (rc)
Spot Repair (7)

Alternative 1 Cost: $140,900

Alternative 2: Sliplining
Spot Repair (7)

Alternative 2 Cost: $97,480

Alternative 3: Remove and Replace

Alternative 3 Cost: $146,470

Project Concerns:

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Bay Road #3

Project Purpose: Structural

Project Location: Bay Road and Douglas Avenue
MH 2549-2552, MH 2482-2506, MH 2482-2503

Existing Conditions:

Pipeline: 2478 feet of 6-inch diameter

Television Inspection: 1 I/I at lateral connection
2 piece missing
roots and cracks
5 sags

Operation & Maintenance 3 callouts/year: Y / [N]

Manhole Inspection: [Roots] / [Pipe] / Grease

Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (?)

Alternative 1 Cost: $185,900 *

Alternative 2: Pipe Bursting

Alternative 2 Cost: $223,020

Alternative 3: Remove and Replace

Alternative 3 Cost: $210,630

Project Concerns: No TV.

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: El Camino Real #1

Project Purpose: Structural

Project Location: El Camino Real from Stockbridge Avenue to Tuscaloosa Avenue
MH 1574-1581

Existing Conditions:

Pipeline: 1911 feet of 10-inch diameter
Television Inspection Not Inspected
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: Roots / Pipe / Grease
Hydraulics No

Alternative 1: Increase Operations & Maintenace (rc)
Spot Repair (?)

Alternative 1 Cost: $191,100*

Alternative 2: Sliplining

Alternative 2 Cost: $133,770

Alternative 3: Remove and Replace

Alternative 3 Cost: $191,100

Project Concerns: No TV

Recommended Alternative:

District: Fair Oaks

Priority: 3

Project: Hillside Drive

Project Purpose: Structural

Project Location: Hillside Drive
MH 2254-2272

Existing Conditions:

Pipeline: 1656 feet of 6-inch diameter
Television Inspection Not inspected due to inaccessible manholes
Operation & Maintenance 3 callouts/year: Y / N
Manhole Inspection: Roots / Pipe / Grease
Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (?)

Alternative 1 Cost: $124,200*

Alternative 2: Pipe Bursting

Alternative 2 Cost: $149,040

Alternative 3: Remove and Replace

Alternative 3 Cost: $140,760

Project Concerns: No TV. Roads are too narrow.

Recommended Alternative:

District: Fair Oaks Priority: 3

Project: Glenwood Avenure

Project Purpose: Structural

Project Location: Glenwood Avenue near Ridge Court
MH 2305-2309, MH 2306-2307, MH 2212-2289

Existing Conditions:

Pipeline: 1544 feet of 6-inch diameter
Television Inspection Not inspected due to inaccessible manholes
Operation & Maintenance 3 callouts/year: Y / [N]
Manhole Inspection: [Roots] / [Pipe] / Grease
Hydraulics No

Alternative 1: Increase Operations & Maintenance (rc)
Spot Repair (?)

Alternative 1 Cost: $115,800*

Alternative 2: Pipe Bursting

Alternative 2 Cost: $138,960

Alternative 3: Remove and Replace

Alternative 3 Cost: $131,240

Project Concerns: No TV. Roads are too narrow.

Recommended Alternative:

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APPENDIX G

SANITARY SEWER RATE MODELS

Inflator 3%

Fair Oaks Alternative 1 CIP Summary

Project	Priority	Alternative 1	Alt 1 Description
Bay Rd.#4	1	$1,005,700	Replace with 45-inch sewer
Oakside/Barron Ave	1	$661,800	Replace with 15-inch sewer
Selby Ln #3	1	$864,400	Replace with 30-inch sewer
Berkshire Ave	1	$609,200	Replace with 24-inch sewer
Selby Ln #2	1	$209,500	Replace with 27-inch sewer
Bay Rd.#2	1	$337,900	Replace with 24-inch sewer
Selby Ln #1	1	$325,000	Replace with 15-inch sewer
Nimitz Ave	1	$218,000	Replace with 15-inch sewer
Bay Rd.#1	1	$369,900	Replace with 12-inch sewer
12th Ave	1	$133,800	Replace with 18-inch sewer
Woodside Rd.	1	$128,400	Replace with 18-inch sewer
Santiago Ave	1	$150,400	Replace with 15-inch sewer
El Camino Real#2	1	$180,500	Replace with 15-inch sewer
Milton St/Hull Ave	1	$219,400	Replace with 15-inch sewer
Eleanor Dr	3	$240,500	Increase O&M (rc) Spot Repair (136)
Melanie Ln	3	$161,300	Increase O&M (rc) Spot Repair (36)
Middlefield Rd	3	$137,500	Increase O&M (rc) Spot Repair (52)
Polhemus Ave	3	$367,200	Increase O&M (rc) Spot Repair (135)
Page St	3	$111,900	Increase O&M (rc) Spot Repair (21)
Stochbridge Ave	3	$241,100	Increase O&M (rc) Spot Repair (43)
6th Ave	3	$140,900	Increase O&M (rc) Spot Repair (7)
Bay Rd.#3*	3	$185,900	Increase O&M (rc) Spot Repair
El Camino Real # 1	3	$191,100	Increase O&M (rc) and Spot Repair
Hillside Dr*	3	$124,200	Increase O&M (rc) Spot Repair
Gleanwood Ave*	3	$115,800	Increase O&M (rc) Spot Repair
Total		**$7,431,300**	

Note:

*TV Inspection was not performed.

Fair Oaks Alternative 1 Revenue Requirements

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Expenses										
Admin/Eng	$ 268,794	$ 273,215	$ 223,632	$ 444,404	$ 457,736	$ 471,468	$ 485,612	$ 500,181	$ 515,186	$ 530,642
Capital Projects*	$ -	$ 26,510	$ 240,579	$ 93,698	$ 96,509	$ 1,486,260	$ 1,530,848	$ 1,576,773	$ 1,624,076	$ 1,672,799
Debt Service	$ -	$ -	$ 111	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	$ 553,823	$ 496,190	$ 468,397	$ 354,924	$ 365,572	$ 376,539	$ 387,835	$ 399,470	$ 411,454	$ 423,798
Other	$ 102,466	$ 6,494	$ 141,923	$ 14,786	$ 15,230	$ 15,686	$ 16,157	$ 16,642	$ 17,141	$ 17,655
Sewage Treatment	$ 1,059,631	$ 756,061	$ 1,350,444	$ 1,205,623	$ 1,241,792	$ 1,279,045	$ 1,317,417	$ 1,356,939	$ 1,397,647	$ 1,439,577
Source Control	$ 31,893.00	$ 39,088.00	$ 18,164	$ 28,804	$ 29,668	$ 30,558	$ 31,475	$ 32,419	$ 33,392	$ 34,393
Gross Expenses	**$ 2,016,607**	**$ 1,597,558**	**$ 2,443,250**	**$ 2,142,239**	**$ 2,206,506**	**$ 3,659,557**	**$ 3,769,344**	**$ 3,882,424**	**$ 3,998,897**	**$ 4,118,864**
Offsetting Revenue										
Secure Property Taxes**	$ 114,746	$ 119,740	$ 124,396	$ 131,725	$ 120,000	$ 123,600	$ 127,308	$ 131,127	$ 135,061	$ 139,113
Unsecured Property Taxes	$ 15,677	$ 14,994	$ 14,681	$ 15,138	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Interest Earned***	$ 2,156	$ 3,559	$ 4,911	$ 6,339	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726
HOPTR	$ 2,449	$ 2,395	$ 2,433	$ 2,434	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
Annexation Charges	$ 800	$ 400		$ 1,200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 400
Connection Charges	$ 41,773	$ 33,946	$ 31,341	$ 35,502	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Miscellaneous Revenue	$ 28,986	$ 2,088	$ 65,401	$ 4,487	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Total Offsetting Revenue	**$ 206,587**	**$ 177,122**	**$ 243,163**	**$ 196,825**	**$ 393,526**	**$ 397,126**	**$ 400,834**	**$ 404,653**	**$ 408,587**	**$ 412,639**
Use of Fund Balance	**$ -**	**$ -**	**$ (56,969)**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Net Revenue Requirements	**$ 1,810,020**	**$ 1,420,436**	**$ 2,143,118**	**$ 1,945,414**	**$ 1,812,980**	**$ 3,262,431**	**$ 3,368,510**	**$ 3,477,771**	**$ 3,590,310**	**$ 3,706,225**
Annual Rate Assuming 11,556 Connections****					**157**	**282**	**291**	**301**	**311**	**321**

Note:

*Projected CIP is paid over 5 years.

**Secure Property Tax revenue is assumed to increase at 3% per year

***Interest Earned in projected years is calculated as 5% of Beginning Fund Balance

****Current Rate is $174.

Fair Oaks Alternative 1 Fund Balance

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Beginning Fund Balance	$ 3,636,567	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524
Additions to/(Use of) Balance	$ 184,020	$ 650,906	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ending Fund Balance	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524

Fair Oaks Alternative 2 CIP Summary

Project	Priority	Alternative 2	Alt 2 Description
Bay Rd.#4	1	$963,220	Replace with 45-inch sewer
Oakside/Barron Ave	1	$407,280	Replace with 15-inch sewer
Selby Ln #3	1	$697,590	Replace with 30-inch sewer
Berkshire Ave	1	$465,855	Replace with 24-inch sewer
Selby Ln #2	1	$200,420	Replace with 27-inch sewer
Bay Rd.#2	1	$337,935	Replace with 24-inch sewer
Selby Ln #1	1	$200,040	Replace with 15-inch sewer
Nimitz Ave	1	$145,320	Replace with 15-inch sewer
Bay Rd.#1	1	$226,050	Replace with 12-inch sewer
12th Ave	1	$133,840	Replace with 18-inch sewer
Woodside Rd.	1	$163,380	Replace with 18-inch sewer
Santiago Ave	1	$164,040	Replace with 15-inch sewer
El Camino Real#2	1	$154,680	Replace with 15-inch sewer
Milton St/Hull Ave	1	$219,360	Replace with 15-inch sewer
Eleanor Dr	3	$158,040	Pipe Bursting
Melanie Ln	3	$159,030	Pipe Bursting
Middlefield Rd	3	$115,110	Pipe Bursting
Polhemus Ave	3	$311,040	Pipe Bursting
Page St	3	$114,120	Pipe Bursting
Stochbridge Ave	3	$248,040	Pipe Bursting
6th Ave	3	$97,480	Sliplining and Spot repair
Bay Rd.#3*	3	$223,020	Pipe Bursting
El Camino Real # 1	3	$133,770	Sliplining
Hillside Dr*	3	$149,040	Pipe Bursting
Gleanwood Ave*	3	$138,960	Pipe Bursting
Total		**$6,326,660**	

Note:
*TV Inspection was not performed.

Fair Oaks Alternative 2 Revenue Requirements

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Expenses										
Admin/Eng	$ 268,794	$ 273,215	$ 223,632	$ 444,404	$ 457,736	$ 471,468	$ 485,612	$ 500,181	$ 515,186	$ 530,642
Capital Projects*	$ -	$ 26,510	$ 240,579	$ 93,698	$ 96,509	$ 1,265,332	$ 1,303,292	$ 1,342,391	$ 1,382,662	$ 1,424,142
Debt Service	$ -	$ -	$ 111	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	$ 553,823	$ 496,190	$ 468,397	$ 354,924	$ 365,572	$ 376,539	$ 387,835	$ 399,470	$ 411,454	$ 423,798
Other	$ 102,466	$ 6,494	$ 141,923	$ 14,786	$ 15,230	$ 15,686	$ 16,157	$ 16,642	$ 17,141	$ 17,655
Sewage Treatment	$ 1,059,631	$ 756,061	$ 1,350,444	$ 1,205,623	$ 1,241,792	$ 1,279,045	$ 1,317,417	$ 1,356,939	$ 1,397,647	$ 1,439,577
Source Control	$ 31,893.00	$ 39,088.00	$ 18,164	$ 28,804	$ 29,668	$ 30,558	$ 31,475	$ 32,419	$ 33,392	$ 34,393
Gross Expenses	**$ 2,016,607**	**$ 1,597,558**	**$ 2,443,250**	**$ 2,142,239**	**$ 2,206,506**	**$ 3,438,629**	**$ 3,541,788**	**$ 3,648,042**	**$ 3,757,483**	**$ 3,870,207**
Offsetting Revenue										
Secure Property Taxes**	$ 114,746	$ 119,740	$ 124,396	$ 131,725	$ 120,000	$ 123,600	$ 127,308	$ 131,127	$ 135,061	$ 139,113
Unsecured Property Taxes	$ 15,677	$ 14,994	$ 14,681	$ 15,138	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Interest Earned***	$ 2,156	$ 3,559	$ 4,911	$ 6,339	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726
HOPTR	$ 2,449	$ 2,395	$ 2,433	$ 2,434	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
Annexation Charges	$ 800	$ 400		$ 1,200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 400
Connection Charges	$ 41,773	$ 33,946	$ 31,341	$ 35,502	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Miscellaneous Revenue	$ 28,986	$ 2,088	$ 65,401	$ 4,487	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Total Offsetting Revenue	**$ 206,587**	**$ 177,122**	**$ 243,163**	**$ 196,825**	**$ 393,526**	**$ 397,126**	**$ 400,834**	**$ 404,653**	**$ 408,587**	**$ 412,639**
Use of Fund Balance	$ -	$ -	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Revenue Requirements	**$ 1,810,020**	**$ 1,420,436**	**$ 2,143,118**	**$ 1,945,414**	**$ 1,812,980**	**$ 3,041,503**	**$ 3,140,954**	**$ 3,243,388**	**$ 3,348,896**	**$ 3,457,568**
Annual Rate Assuming 11,556 Connections****					157	263	272	281	290	299

Note:
*Projected CIP is paid over 5 years.
**Secure Property Tax revenue is assumed to increase at 3% per year
***Interest Earned in projected years is calculated as 5% of Beginning Fund Balance
****Current Rate is $174.

Fair Oaks Alternative 2 Fund Balance

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Beginning Fund Balance	$ 3,636,567	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524
Additions to/(Use of) Balance	$ 184,020	$ 650,906	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ending Fund Balance	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524

Fair Oaks Alternative 3 CIP Summary

Project	Priority	Alternative 3	Alt 3 Description
Bay Rd.#4	1	$963,220	Replace with 45-inch sewer
Oakside/Barron Ave	1	$407,280	Replace with 15-inch sewer
Selby Ln #3	1	$697,590	Replace with 30-inch sewer
Berkshire Ave	1	$465,855	Replace with 24-inch sewer
Selby Ln #2	1	$200,420	Replace with 27-inch sewer
Bay Rd.#2	1	$337,935	Replace with 24-inch sewer
Selby Ln #1	1	$200,040	Replace with 15-inch sewer
Nimitz Ave	1	$145,320	Replace with 15-inch sewer
Bay Rd.#1	1	$226,050	Replace with 12-inch sewer
12th Ave	1	$133,840	Replace with 18-inch sewer
Woodside Rd.	1	$163,380	Replace with 18-inch sewer
Santiago Ave	1	$164,040	Replace with 15-inch sewer
El Camino Real#2	1	$154,680	Replace with 15-inch sewer
Milton St/Hull Ave	1	$219,360	Replace with 15-inch sewer
Eleanor Dr	3	$149,260	Remove and Replace
Melanie Ln	3	$150,195	Remove and Replace
Middlefield Rd	3	$108,715	Remove and Replace
Polhemus Ave	3	$293,760	Remove and Replace
Page St	3	$107,935	Remove and Replace
Stochbridge Ave	3	$234,260	Remove and Replace
6th Ave	3	$146,470	Remove and Replace
Bay Rd.#3*	3	$210,630	Remove and Replace
El Camino Real # 1	3	$191,100	Remove and Replace
Hillside Dr*	3	$140,760	Remove and Replace
Gleanwood Ave*	3	$131,240	Remove and Replace
Total		**$6,343,335**	

Note:

*TV Inspection was not performed.

Fair Oaks Alternative 3 Revenue Requirements

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Expenses										
Admin/Eng	$ 268,794	$ 273,215	$ 223,632	$ 444,404	$ 457,736	$ 471,468	$ 485,612	$ 500,181	$ 515,186	$ 530,642
Capital Projects*	$ -	$ 26,510	$ 240,579	$ 93,698	$ 96,509	$ 1,268,667	$ 1,306,727	$ 1,345,929	$ 1,386,307	$ 1,427,896
Debt Service	$ -	$ -	$ 111	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	$ 553,823	$ 496,190	$ 468,397	$ 354,924	$ 365,572	$ 376,539	$ 387,835	$ 399,470	$ 411,454	$ 423,798
Other	$ 102,466	$ 6,494	$ 141,923	$ 14,786	$ 15,230	$ 15,686	$ 16,157	$ 16,642	$ 17,141	$ 17,655
Sewage Treatment	$ 1,059,631	$ 756,061	$ 1,350,444	$ 1,205,623	$ 1,241,792	$ 1,279,045	$ 1,317,417	$ 1,356,939	$ 1,397,647	$ 1,439,577
Source Control	$ 31,893.00	$ 39,088.00	$ 18,164	$ 28,804	$ 29,668	$ 30,558	$ 31,475	$ 32,419	$ 33,392	$ 34,393
Gross Expenses	**$ 2,016,607**	**$ 1,597,558**	**$ 2,443,250**	**$ 2,142,239**	**$ 2,206,506**	**$ 3,441,964**	**$ 3,545,223**	**$ 3,651,580**	**$ 3,761,127**	**$ 3,873,961**
Offsetting Revenue										
Secure Property Taxes**	$ 114,746	$ 119,740	$ 124,396	$ 131,725	$ 120,000	$ 123,600	$ 127,308	$ 131,127	$ 135,061	$ 139,113
Unsecured Property Taxes	$ 15,677	$ 14,994	$ 14,681	$ 15,138	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Interest Earned***	$ 2,156	$ 3,559	$ 4,911	$ 6,339	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726
HOPTR	$ 2,449	$ 2,395	$ 2,433	$ 2,434	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
Annexation Charges	$ 800	$ 400		$ 1,200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 400
Connection Charges	$ 41,773	$ 33,946	$ 31,341	$ 35,502	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Miscellaneous Revenue	$ 28,986	$ 2,088	$ 65,401	$ 4,487	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Total Offsetting Revenue	**$ 206,587**	**$ 177,122**	**$ 243,163**	**$ 196,825**	**$ 393,526**	**$ 397,126**	**$ 400,834**	**$ 404,653**	**$ 408,587**	**$ 412,639**
Use of Fund Balance	**$ -**	**$ -**	**$ (56,969)**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Net Revenue Requirements	**$ 1,810,020**	**$ 1,420,436**	**$ 2,143,118**	**$ 1,945,414**	**$ 1,812,980**	**$ 3,044,838**	**$ 3,144,389**	**$ 3,246,926**	**$ 3,352,540**	**$ 3,461,322**
Annual Rate Assuming 11,556 Connections****					**157**	**263**	**272**	**281**	**290**	**300**

Note:

*Projected CIP is paid over 5 years.

**Secure Property Tax revenue is assumed to increase at 3% per year

***Interest Earned in projected years is calculated as 5% of Beginning Fund Balance

****Current Rate is $174.

Fair Oaks Alternative 3 Fund Balance

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Beginning Fund Balance	$ 3,636,567	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524
Additions to/(Use of) Balance	$ 184,020	$ 650,906	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ending Fund Balance	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524

Fair Oaks Average Alternative CIP Summary

Project	Priority	Minimum Cost	Maximum Cost	Average
Bay Rd.#4	1	$963,220	$1,005,700	$984,460
Oakside/Barron Ave	1	$407,280	$661,800	$534,540
Selby Ln #3	1	$697,590	$864,400	$780,995
Berkshire Ave	1	$465,855	$609,200	$537,528
Selby Ln #2	1	$200,420	$209,500	$204,960
Bay Rd.#2	1	$337,900	$337,935	$337,918
Selby Ln #1	1	$200,040	$325,000	$262,520
Nimitz Ave	1	$145,320	$218,000	$181,660
Bay Rd.#1	1	$226,050	$369,900	$297,975
12th Ave	1	$133,800	$133,840	$133,820
Woodside Rd.	1	$128,400	$163,380	$145,890
Santiago Ave	1	$150,400	$164,040	$157,220
El Camino Real#2	1	$154,680	$180,500	$167,590
Milton St/Hull Ave	1	$219,360	$219,400	$219,380
Eleanor Dr	3	$149,260	$240,500	$194,880
Melanie Ln	3	$150,195	$161,300	$155,748
Middlefield Rd	3	$108,715	$137,500	$123,108
Polhemus Ave	3	$293,760	$367,200	$330,480
Page St	3	$107,935	$114,120	$111,028
Stochbridge Ave	3	$234,260	$248,040	$241,150
6th Ave	3	$97,480	$146,470	$121,975
Bay Rd.#3*	3	$185,900	$223,020	$204,460
El Camino Real # 1	3	$133,770	$191,100	$162,435
Hillside Dr*	3	$124,200	$149,040	$136,620
Gleanwood Ave*	3	$115,800	$138,960	$127,380
Total		**$6,131,590**	**$7,579,845**	**$6,855,718**

Fair Oaks Average Alternative Revenue Requirements

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Expenses										
Admin/Eng	$ 268,794	$ 273,215	$ 223,632	$ 444,404	$ 457,736	$ 471,468	$ 485,612	$ 500,181	$ 515,186	$ 530,642
Capital Projects*	$ -	$ 26,510	$ 240,579	$ 93,698	$ 96,509	$ 1,371,144	$ 1,412,278	$ 1,454,646	$ 1,498,286	$ 1,543,234
Debt Service	$ -	$ -	$ 111	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	$ 553,823	$ 496,190	$ 468,397	$ 354,924	$ 365,572	$ 376,539	$ 387,835	$ 399,470	$ 411,454	$ 423,798
Other	$ 102,466	$ 6,494	$ 141,923	$ 14,786	$ 15,230	$ 15,686	$ 16,157	$ 16,642	$ 17,141	$ 17,655
Sewage Treatment	$ 1,059,631	$ 756,061	$ 1,350,444	$ 1,205,623	$ 1,241,792	$ 1,279,045	$ 1,317,417	$ 1,356,939	$ 1,397,647	$ 1,439,577
Source Control	$ 31,893.00	$ 39,088.00	$ 18,164	$ 28,804	$ 29,668	$ 30,558	$ 31,475	$ 32,419	$ 33,392	$ 34,393
Gross Expenses	**$ 2,016,607**	**$ 1,597,558**	**$ 2,443,250**	**$ 2,142,239**	**$ 2,206,506**	**$ 3,544,441**	**$ 3,650,774**	**$ 3,760,297**	**$ 3,873,106**	**$ 3,989,299**
Offsetting Revenue										
Secure Property Taxes**	$ 114,746	$ 119,740	$ 124,396	$ 131,725	$ 120,000	$ 123,600	$ 127,308	$ 131,127	$ 135,061	$ 139,113
Unsecured Property Taxes	$ 15,677	$ 14,994	$ 14,681	$ 15,138	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Interest Earned***	$ 2,156	$ 3,559	$ 4,911	$ 6,339	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726	$ 220,726
HOPTR	$ 2,449	$ 2,395	$ 2,433	$ 2,434	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
Annexation Charges	$ 800	$ 400		$ 1,200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 400
Connection Charges	$ 41,773	$ 33,946	$ 31,341	$ 35,502	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Miscellaneous Revenue	$ 28,986	$ 2,088	$ 65,401	$ 4,487	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Total Offsetting Revenue	**$ 206,587**	**$ 177,122**	**$ 243,163**	**$ 196,825**	**$ 393,526**	**$ 397,126**	**$ 400,834**	**$ 404,653**	**$ 408,587**	**$ 412,639**
Use of Fund Balance	$ -	$ -	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Revenue Requirements	**$ 1,810,020**	**$ 1,420,436**	**$ 2,143,118**	**$ 1,945,414**	**$ 1,812,980**	**$ 3,147,314**	**$ 3,249,940**	**$ 3,355,644**	**$ 3,464,519**	**$ 3,576,660**
Annual Rate Assuming 11,556 Connections****					**157**	**272**	**281**	**290**	**300**	**310**

Note:

*Projected CIP is paid over 5 years.

**Secure Property Tax revenue is assumed to increase at 3% per year

***Interest Earned in projected years is calculated as 5% of Beginning Fund Balance

****Current Rate is $174.

Fair Oaks Average Alternative Fund Balance

Item	1994/95	1995/96	1996/97	1997/98	Projected 1998/99 Budget	Projected 1999/00	2000/01	2001/02	2002/03	2003/04
Beginning Fund Balance	$ 3,636,567	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524
Additions to/(Use of) Balance	$ 184,020	$ 650,906	$ (56,969)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ending Fund Balance	$ 3,820,587	$ 4,471,493	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524	$ 4,414,524