FIRST TECHNICAL PROGRESS REPORT

DEMONSTRATION OF NON-POINT POLLUTION MANAGEMENT ON CASTRO VALLEY CREEK

FOR

U.S. ENVIRONMENTAL PROTECTION AGENCY

WATER PLANNING DIVISION

WASHINGTON DC 20460

MAY 1979

BY

ALAMEDA COUNTY FLOOD CONTROL AND

WATER CONSERVATION DISTRICT

HAYWARD, CALIFORNIA

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ABSTRACT

This report comprises the first technical progress report for the EPA sponsored project titled "Demonstration of Non-Point Pollution Management on Castro Valley Creek." This project is part of the San Francisco Bay Area's 208 Continuing Planning Process and is the first prototype project in EPA's Region IX to be part of the Nationwide Urban Runoff Program. This report describes each of the project's work tasks and what portions of each task have been accomplished. Preliminary information based on field measurements and literature reviews is also included.

As of March 8, 1979 about $32,000, which is 30% of the first year's project costs ($108,000), has been incurred. As of that date the first year's work on the project is about 42% (20 weeks) complete. More than 1,300 person-hours have been spent on the project. The major project activities - receiving water monitoring, street surface monitoring, and street cleaning are each about one-quarter complete and data analysis has been initiated. Field measurements of stormwater quality, pollutant accumulation rates, and street cleaner performance are presented in this report, but the data is not fully analyzed.

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SECTION I

INTRODUCTION

This report comprises the first technical progress report for this project titled "Demonstration of Non-Point Pollution Management On Castro Valley Creek." The primary objective of the project is to demonstrate the potential role of street cleaning in the management of water quality in order to help meet the 1972 Clean Water Act's goal of Clean Water.

The project is being conducted by the Alameda County Flood Control and Water Conservation District (District) with 75% funding by the U.S. Environmental Protection Agency (EPA). The District's purpose is to determine if the street cleaning control measure considered in the local 208 program is cost-effective in improving water quality. This project is one of about 30 projects in EPA's Nationwide Urban Runoff Program. EPA's purpose in conducting this and the other prototype projects is to provide a means for obtaining information essential to developing a nationwide perspective for control of urban runoff problems.

Progress on each of this project's tasks are discussed in a later section. As each task progresses, data is obtained that can be used to compare the monitored mass pollutant flows of the sampled storms with the total pollutant removal of the various street cleaning programs. This comparison will be made using a basic level of analysis. A valid data set for this analysis consists of a data point for a monitored runoff event that occurs between adjacent street surface monitoring data points. By the end of March, 1979, at least seven valid data sets have been collected.

DESCRIPTION OF STUDY AREA

The Castro Valley Watershed is about 5.6 sq. miles in area and is located within the San Francisco Bay Area (Figure 1). An aerial view of the watershed is presented on Figure 2. The study area is the Castro Valley Creek branch (2.4 sq. mi.) of the Castro Valley Watershed. The study area is predominantly residential. The majority of the residential land use consists of single family housing with lot sizes varying from 5,000 to 10,000 sq. ft. The estimated residential population density is approximately 20 people per acre. Residential land use predominates at 2464 acres (70 percent), commercial land use occupies about 246 acres (7 percent), and the remaining land use is open space (809 acres or 23 percent). Development along the stream banks within Castro Valley is intense and houses are often constructed directly over the existing streambed. Some light commercial areas, more than a dozen schools, and a short portion of Interstate Highway 580 are also contained within the area. Examples of typical Castro Valley land uses are shown on Figure 3.

Topography within the drainage basin is highly variable, with land slopes ranging from 10 percent to 70 percent in the upper end of the basin and slopes as low as 1 percent in the valley portion near San Lorenzo Creek. The streambed in the lower portions of the drainage basin ranges from 20 to 50 feet in width and 8 to 10 feet in depth. The streambed is often strewn with litter and debris.

The study area was divided into four sub-areas (Figure 4). These horizontal divisions across the watershed, based on topography and street patterns, increase the amount of useful data obtained from the monitoring activities.

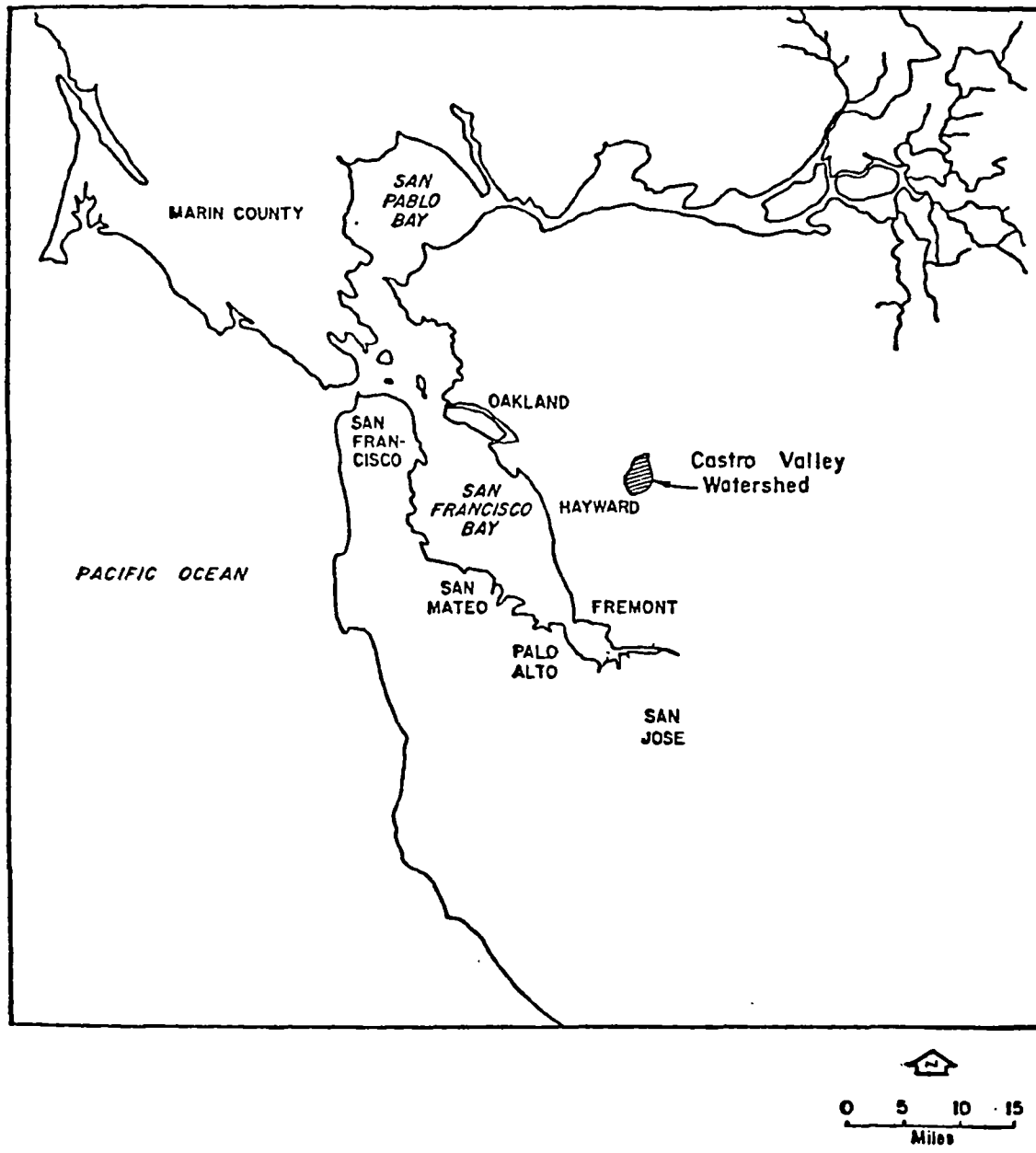


FIGURE 1. SAN FRANCISCO BAY AREA SHOWING THE GENERAL LOCATION OF THE CASTRO VALLEY WATERSHED

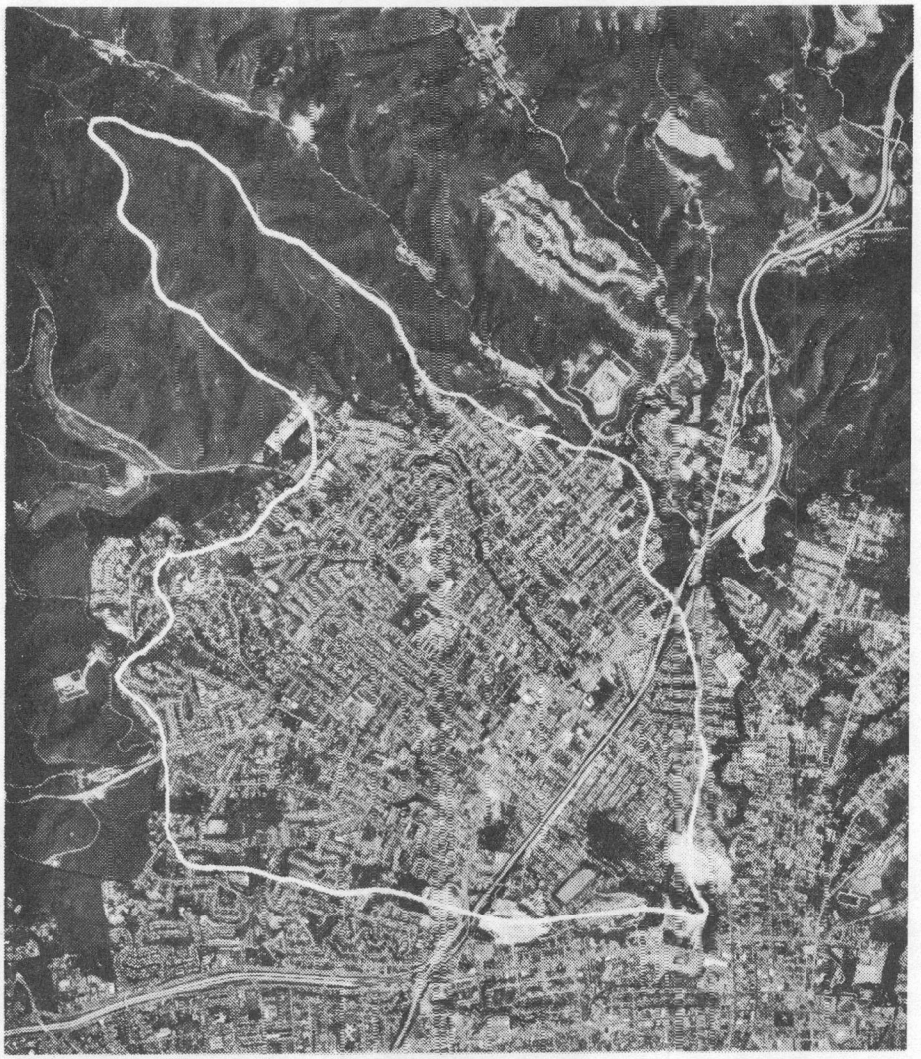


Figure 2
Aerial View of Castro Valley

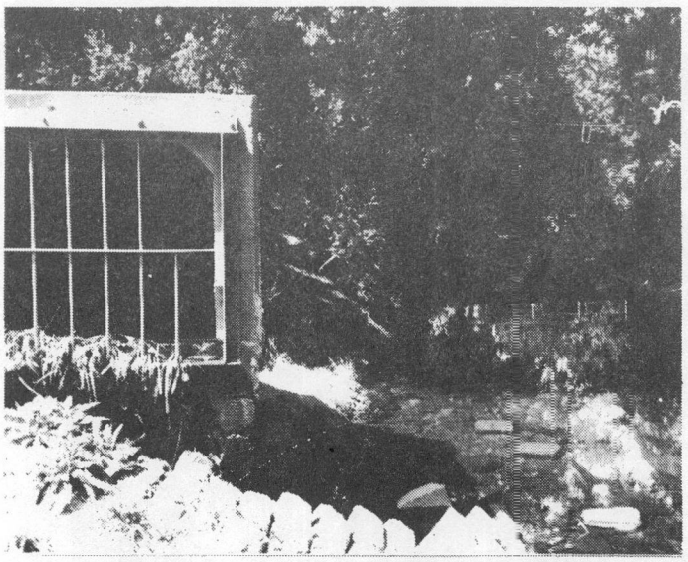
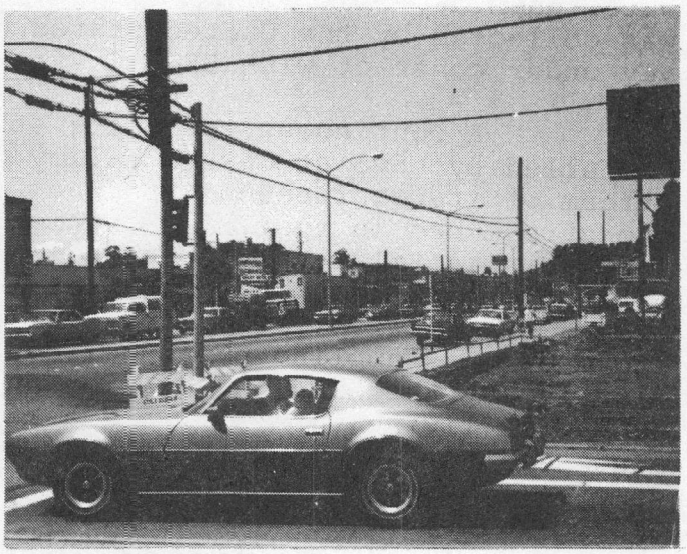
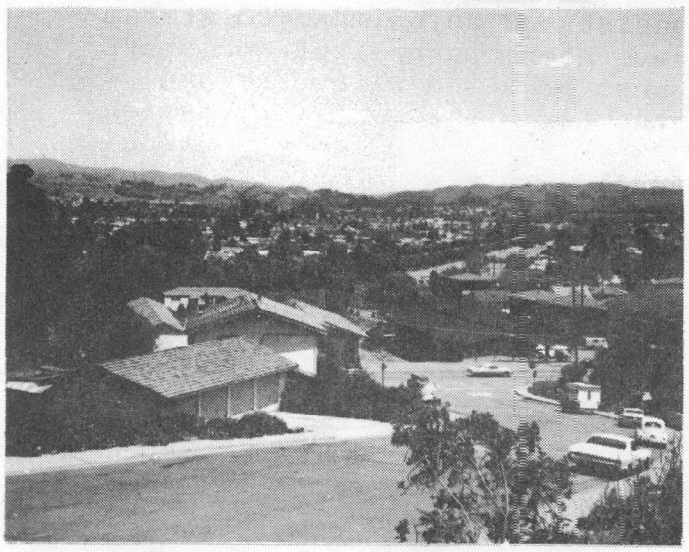


FIGURE 3
a. Castro Valley Creek
and Storm Sewer Outfall.

b. Commercial Land Use
Castro Valley, Cal.





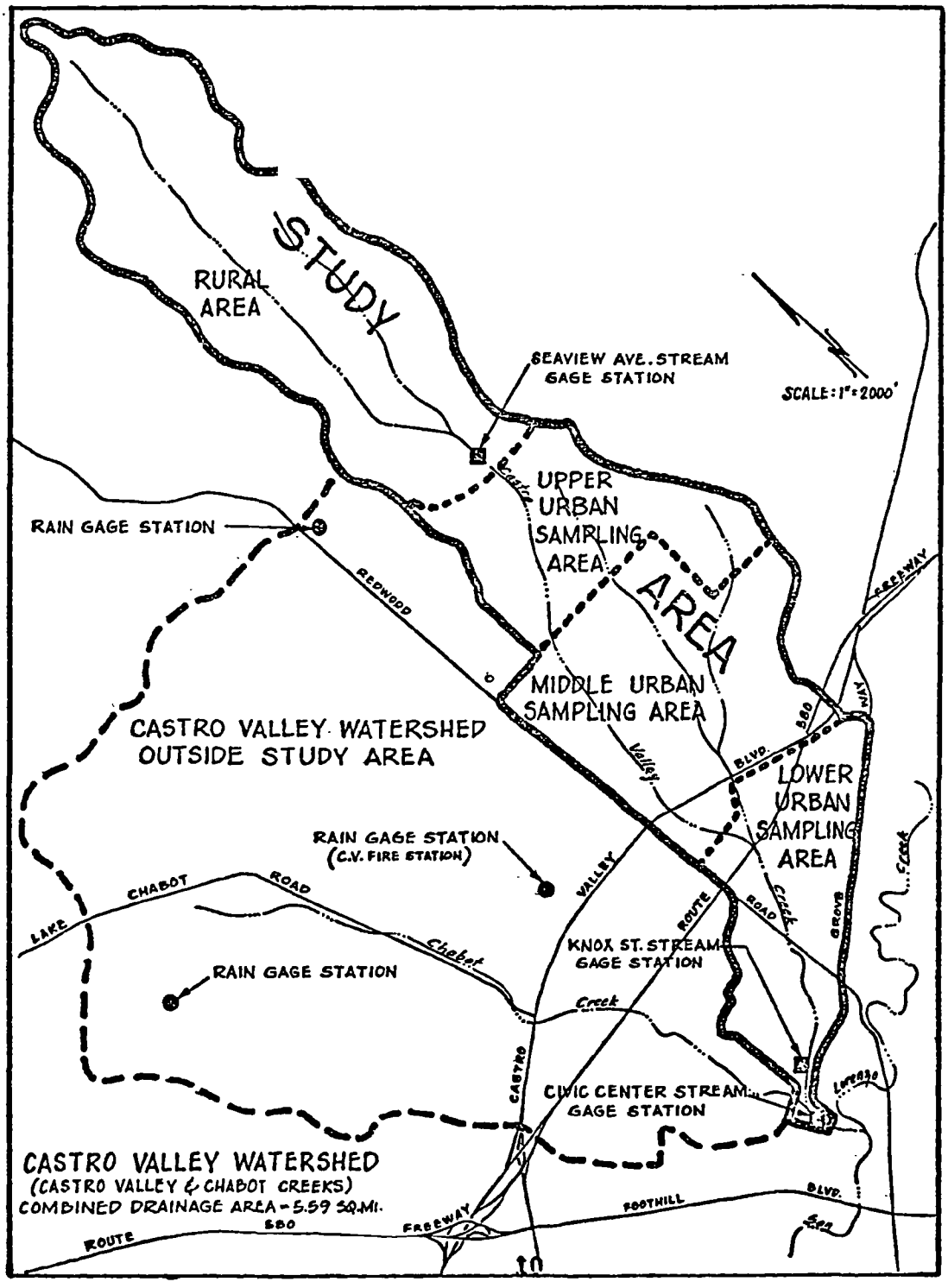
c. Residential Land Use
and Topography
Castro Valley, Cal.

There are many similarities in the three lower urban sub-areas. The three most important are the types of gutters, the shapes of the curbs and the condition of the street surfaces. Seventy-five percent of the gutters are concrete and 25 percent are asphalt. The shapes of the curbs (straight or rolled) may influence how much of the street surface contaminants are kept within the gutter and thus are available to the street cleaners, and how much is transported to the shoulder of the road and not available for pickup by normal street cleaner operation. The condition of the street surface contaminants and the performance of street cleaning equipment: 91 percent of the street surfaces in the lower three urban test areas are in fair condition, with little variability in condition or width (95 percent of the streets in these sub-areas are 20 feet to 40 feet wide).

A variable that may significantly influence the quantity of nutrients that may be removed by street cleaning operations is the amount of leaf material on the streets. The largest accumulation of leaves on the streets is in the middle urban sub-area, but this difference does not appear to be significant. Two important variables that influence the effectiveness of the rain-flushing of particulates from the street surface are speed of the traffic and density of the traffic. These two variables are also very similar for the three urban sub-areas.

The Castro Valley Creek branch of the Castro Valley Watershed was selected as the study area in order to reduce the study area to a more manageable size (from 5.6 sq. mi. to 2.4 sq. mi.).

FIGURE 4. STUDY AREA DIVISIONS (CASTRO VALLEY CREEK-DRAINAGE AREA = 2.41 SQ. MI.)



San Lorenzo Creek, downstream of the confluence of Castro Valley and Chabot Creeks, is a large watercourse with contiguous urban development. This creek carries the flow to its discharge point into San Francisco Bay. The Castro Valley watershed is considered representative of much of the residential development in the San Francisco Bay Region.

SECTION II

TASK PROGRESS

TASK 1 WORK PLAN DEVELOPMENT

The objective of this task was to prepare a suitable work plan describing necessary components of the project to obtain the stated objectives.

This first task has been completed and it involved the preparation of the Work Plan which was submitted in January, 1979. It was based upon the original and revised submitted narrative statements. (The work plan was approved shortly after its submittal.) Limited amounts of the material submitted in the work plan are included in this progress report. The following discussions describe the scope of each task, the progress towards completion (as of April 2, 1979) and preliminary results.

TASK 2 EXPERIMENTAL DESIGN

The objective of this task was to determine an appropriate balance between sampling effort and expected resultant precisions based on the available project funds.

This task was completed during the development of the work plan. It involved determining the optimal sampling and testing procedures to be used in the evaluation tests.

This discussion describes the procedures used to calculate the necessary number of street surface subsamples and the number of storms needed. The number of storms monitored is most important. Final data analysis is dependent on monitoring representative storms having large variabilities in rainfall characteristics. An estimated twenty monitored storms are necessary to obtain an 80% confidence level that monitored storm yields would be different for a monthly versus a daily street cleaning program.

The analytical procedure used to determine the number of street subsamples needed involved weighing individual subsamples in the study area to calculate the standard deviations (σ) and the means ($\bar{x}$) of the street surface loading values. From these two values, the number of subsamples necessary (N), depending on the allowable error (L), was determined. An allowable error value of about 25 percent, or less, was used. The formula used (after Cochran 1963) is:

$$N = 4\sigma^2/L^2.$$

- With a 95 percent confidence limit, it determines the number of samples necessary to determine the true value for the loading with a range of $\pm L$.

Individual samples were taken at 100 locations in the three study areas to determine the loading variability. The loadings were found to vary within the study area but the median values in the three test areas, were fairly close. The overall minimum loading measured was about 50 lb/curb-mile, the overall maximum value was about 3000 lb/curb-mile, and the overall median value was about 400 lb/curb-mile. The median values in the three areas were about 320, 540 and 470 lb/curb-mile.

The following table summarizes the number of sub-samples necessary for the three test areas and for several allowable error values:

NUMBER OF SAMPLES REQUIRED IF THE ALLOWABLE ERROR IS:					
Study Area	5%	10%	25%	50%	100%
Lower-urban	400+	100	20	5	3
Middle-urban	400+	250	36	8	4
Upper-urban	400+	200	25	6	3
Total urban area	1200+	550	81	19	10

The most rigorous sampling program that could be conducted using a single sampling team was therefore chosen based on an allowable error of 25 percent. This allowable error prercentage was chosen to keep the precision and the sampling effort at reasonable levels. The three test areas can be sampled in less than 5 hours. The data were also examined to determine if the study areas should be divided into meaningful test groups. As described in the study

area description section of this work plan, the only major differences between the test areas was topography. The test areas were therefore generally divided on the basis of topography.

The total amount of street surface particulates removed during each test is insignificant when compared to the total street surface loadings in the whole test area. (Generally, the sample would be 0.1 percent of the total street surface loadings for the area.)

TASK 3 RECEIVING WATER MONITORING

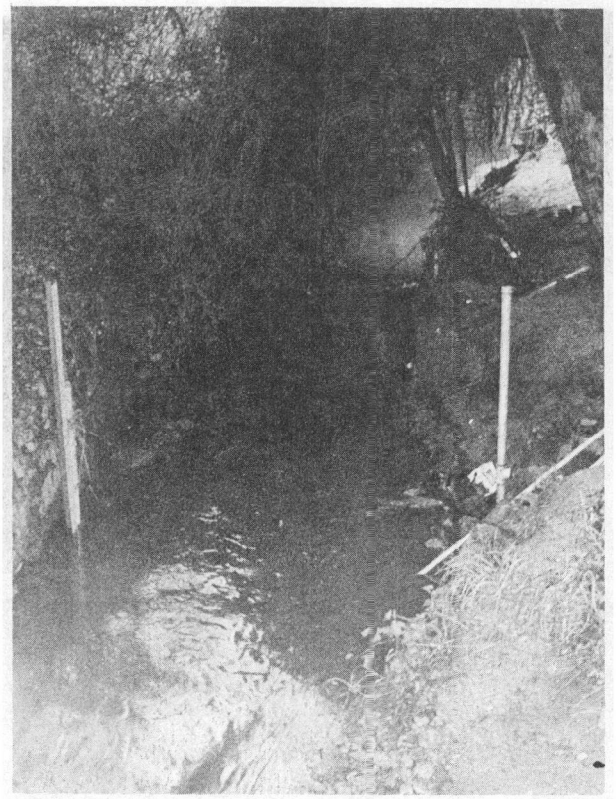
The objective of this task is to monitor washoff quantities in Castro Valley Creek during a variety of rainstorms during the project period.

Runoff event monitoring commenced on December 5, 1978, with the completion of installation by USGS of two receiving water monitoring stations located at Seaview Avenue (USGS #11181004) and Knox Street (USGS #11181096). Figure 5 shows some of the monitored flows at these two locations. To meet USGS fiscal year budgeting requirements, the District will be contracting with USGS in May for the following year's laboratory services.

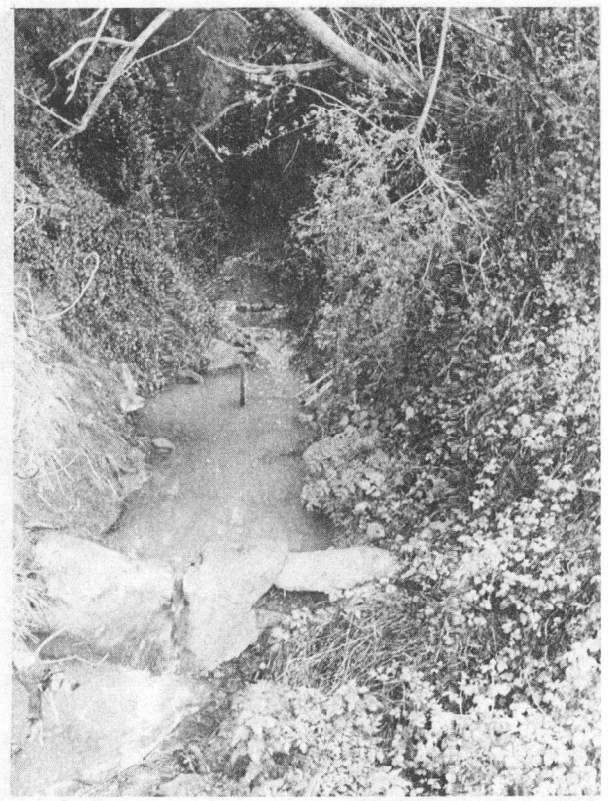
To date, 15 individual storms have been monitored. However, for the majority of the data analysis purposes, a monitored storm cannot be used unless a street surface sample is collected from the entire study area before and after that specific storm. If an unmonitored storm occurs in a series of monitored events between adjacent street surface tasks, the complete runoff yield for that storm series cannot be calculated to be compared to the differences in street loading and the initial street loading before the runoff event. So far, seven valid data sets have been obtained for use in the basic level of analysis this first project year.

Since the onset of the 1978/79 wet season measurable rain has occurred on 39 days (with 4 days of rain prior to initiation of field activities). These events are summarized on Table 1. The total amount of rain from September, 1978 to April 17, 1979, has

FIGURE 5 RUNOFF FLOWS AT MONITORING STATION SITES



A. Discharge at Knox Street Station



B. Discharge at Seaview Avenue Station

C. Discharge and Staff Gage
at Seaview Avenue Station

TABLE 1

RAIN EVENTS DURING FIELD ACTIVITIES[1/]

Date	Total (inches)	Duration (hours)	Average Intensity (inches/hour)	Peak Intensity (inches/hour)
Dec. 17, 1978 *	.39	12.5	.03	.14
Dec. 18	.05	15.75	.003	.03
Dec. 19	.01	0.25	.01	.01
Jan. 3, 1979	.10	3.25	.03	.03
Jan. 4	.03	9.25	.003	.02
Jan. 5	.01	0.25	.01	.01
Jan. 7 *	.34	14.75	.02	.05
Jan. 8 *	1.24	6.0	.21	.40
Jan. 9	.18	8.25	.02	.04
Jan. 10 *	.78	4.25	.18	.39
Jan. 11	1.80	20.75	.09	.27
Jan. 14 *	1.43	20.75	.07	.33
Jan. 15	.28	12.75	.02	.09
Jan. 17	.24	5.75	.04	.11
Jan. 30	.01	.25	.01	.01
Feb. 3	.01	.25	.01	.01
Feb. 13 *	1.11	13.25	.08	.25
Feb. 14	.09	9.25	.01	.01
Feb. 15	.01	.25	.01	.01
Feb. 16 *	.49	11.75	.04	.21
Feb. 17	.01	.25	.01	.01
Feb. 18	.45	8.75	.05	.20
Feb. 19 *	.06	1.25	.05	.05
Feb. 20 *	.74	17.75	.04	.25
Feb. 21 *	.41	11.0	.04	.17
Feb. 22 *	.64	13.25	.05	.30
Feb. 23	.18	23.25	.01	.07
Feb. 25	.07	2.75	.03	.04
Feb. 26	.09	9.50	.01	.06
Feb. 28 *	.58	6.25	.09	.17

1/ Proctor School Rain Gage, USGS # 71-1810.08

* Monitored Events

been 19.4 inches, as compared with an annual average of 21.7 inches. These individual rains have lasted from 15 minutes to 23 hours. Yet, for analytical purposes, the storm periods have ranged to a maximum of 7 days. The storms of most concern (relating street cleaning activity to stormwater quality) are expected to be within the range of 0.1 to 0.5 of an inch. Storms larger than this may have large erosion yields.

The following is a discussion of the rain characteristics of the storm periods which constitute the first five valid data sets. Within these valid data sets the minimum amount of rain has been 0.39 of an inch and the maximum has been 2.8 inches. Peak intensities within these individual storm periods range from a low of 0.14 in./hr. to a high of 0.4 in./hr. Average intensities have ranged from 0.04 to 0.23 in./hr. Data analysis may be more difficult with some of the storm data due to masking effects of erosion (erosion may deposit soil onto the streets and hinder the comparison of runoff yield with before and after street loadings).

Figure 6 is a USGS computer plot of average daily water discharge as a function of time measured at the Knox Street station. The ordinate is a logarithmic discharge scale and the abscissa is time. The maximum daily averaged flow shown is 37 cfs. Figures 7 and 8 are USGS plots of precipitation and instantaneous discharge at Knox and Seaview stations respectively of February 16-22.

FIGURE 6

DAILY AVERAGE DISCHARGE AS A FUNCTION OF TIME

CASTRO VALLEY CREEK AT KNOX STREET

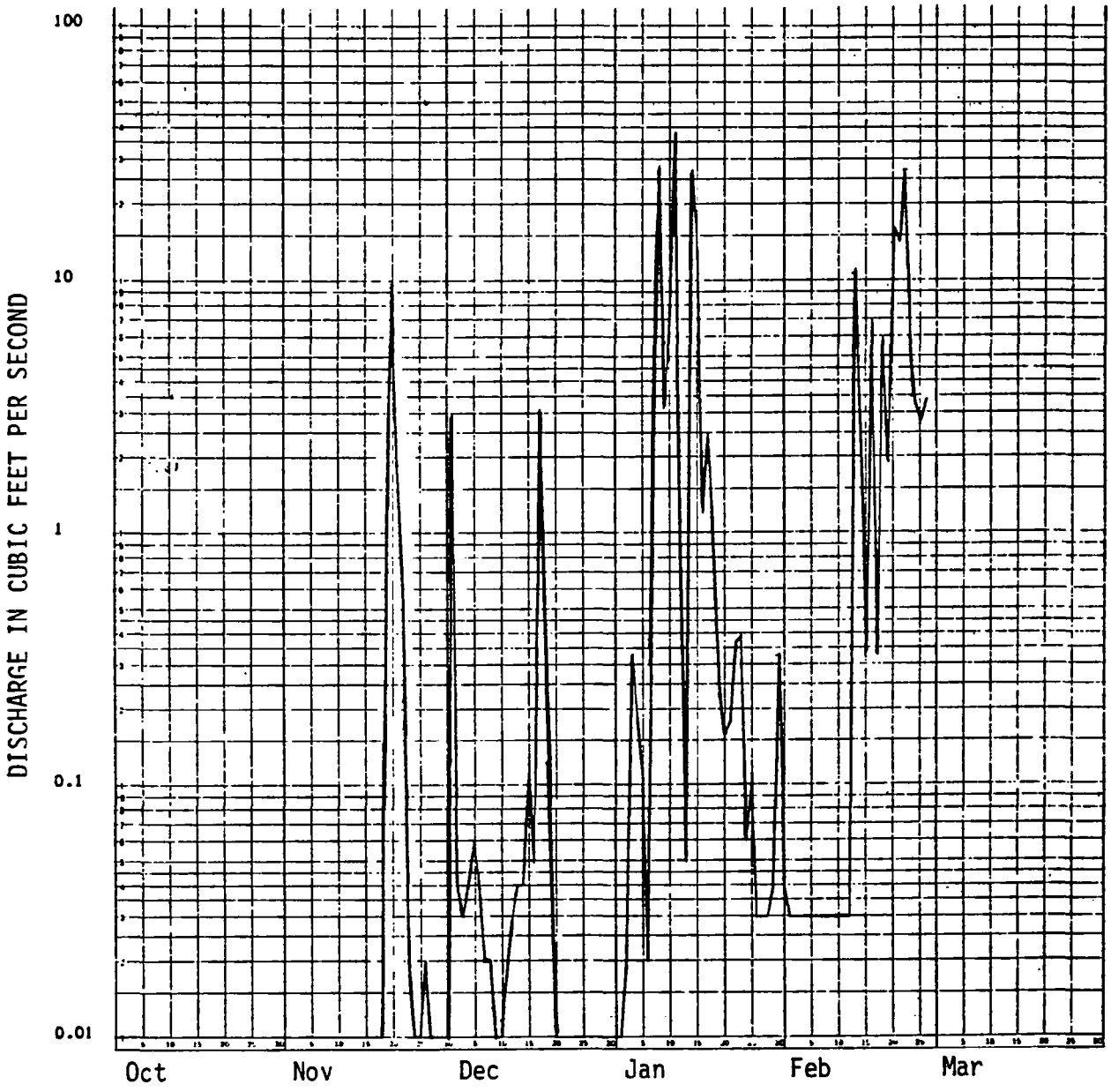
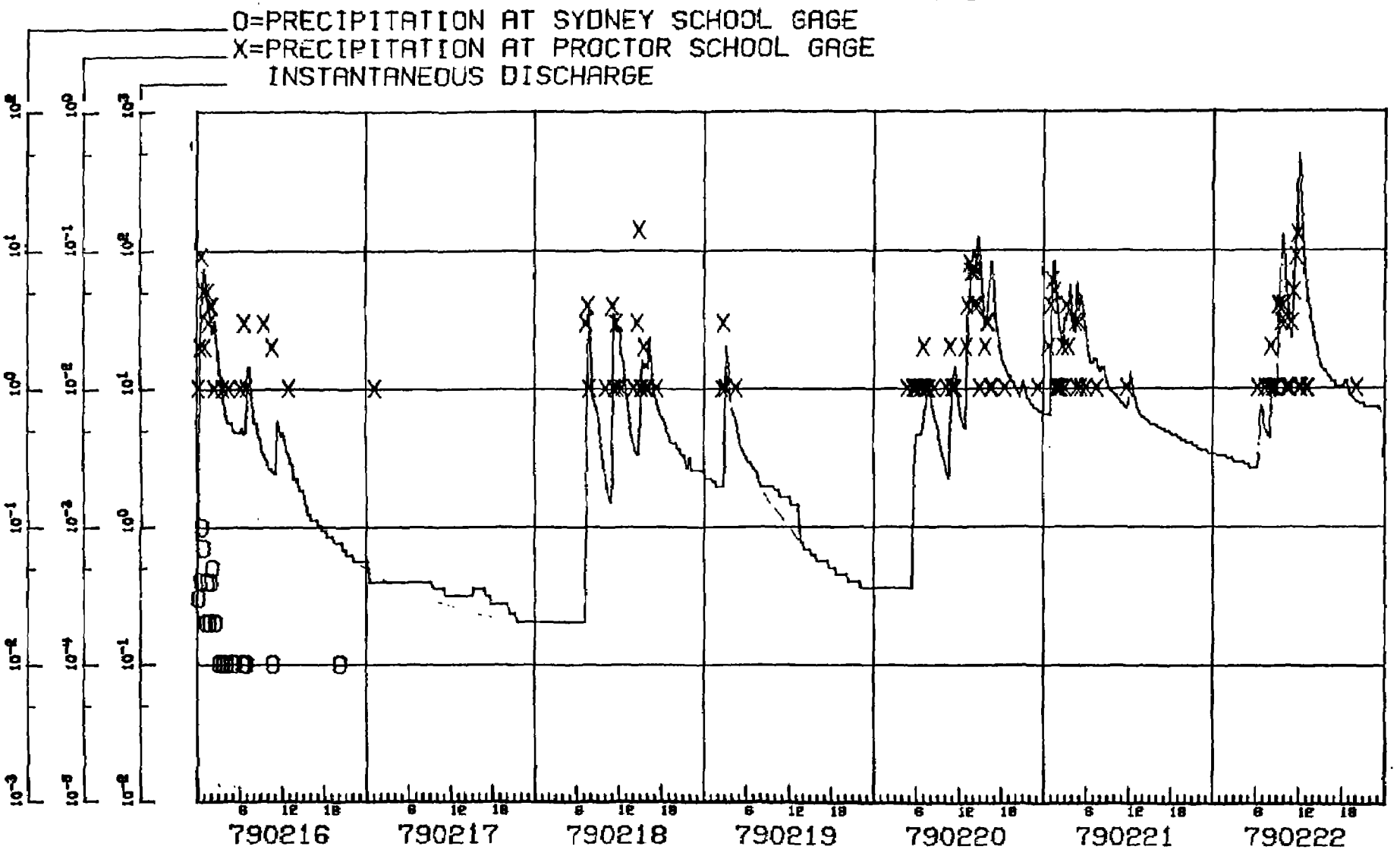
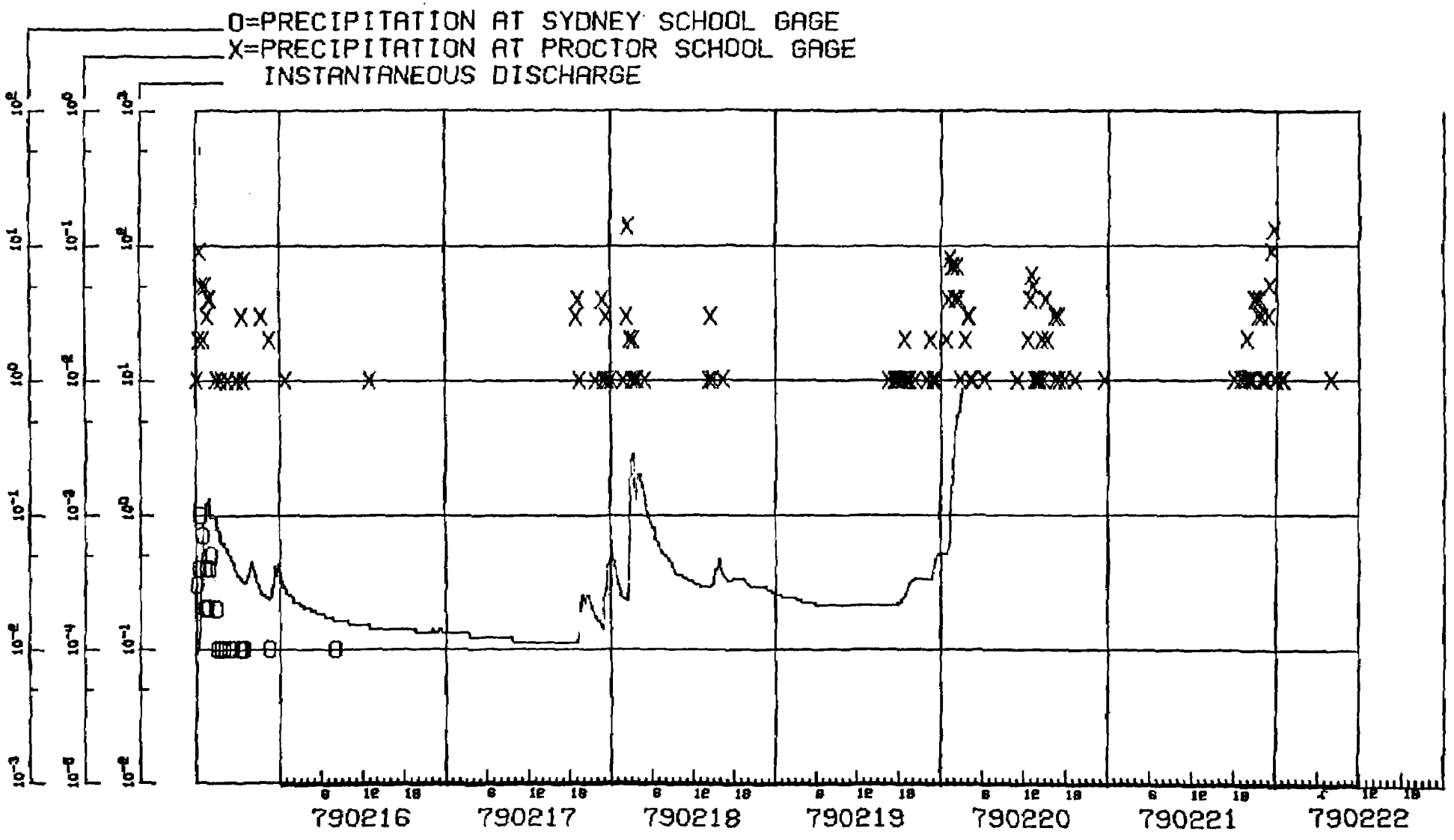


FIGURE 7 PRECIPITATION & INSTANTANEOUS DISCHARGE AT KNOX STREET



11181006 CASTRO VALLEY C AT KNOX ST

FIGURE 8 PRECIPITATION & INSTANTANEOUS DISCHARGE AT SEAVIEW STREET



11181004 CASTRO VALLEY C AT SEAVIEW AVE

Water Quality Data

Table 2 presents the water quality values measued from initiation of project field activities through January 14, 1979, (last date of sample analysis received from the laboratory). The values shown are for hourly composite samples. The values not yet received from the lab will be for total storm composites. The reason for taking composite instead of discrete samples is to save considerable laboratory and labor costs while still determining mass emissions per monitored event. The samples at both the Seaview Avenue station (rural) and the Knox Street station (urban) were taken by ISCO automatic samplers (Model #1680) and are controlled by ISCO bubble-type flow meters. The samplers are set to take samples at predetermined flow increments. USGS personnel checked the results from the laboratory as part of the quality control process of the cooperative agreement between the District and the USGS. Values for lead are not reported here but will be made available at a later date. The USGS central laboratory in Denver had a problem with contamination of their acid preservatives and it was decided to verify the accuracy of the data before it was released.

Probably the most important progress of the project has been the education and experience acquired by the District's personnel in performing water resource investigations. For example, the District personnel have never worked with the ISCO automatic sampling equipment before and now after one season of monitoring, they are experienced at correcting mechanical problems which occur

TABLE 2
SUMMARY OF RECEIVING WATER QUALITY VALUES MONITORED: November 1978 - January 14, 1979
Knox and Seaview Stations on Castro Valley Creek

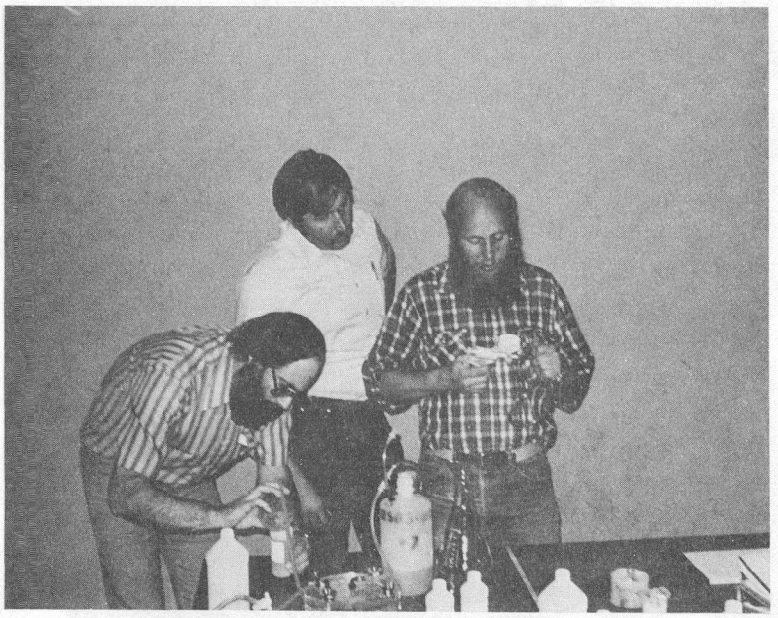
MONITORING STATION AND DATE	Temp °C	Sp. Cond.	pH	Total Solids (mg/l)	Pb (ug/l)	Zn (ug/l)	As (ug/l)	SO_4 (mg/l)	COD (mg/l)	TKN (mg/l)	NH_4 (mg/l)	TP (mg/l)	Total Solids Non Filter (mg/l)	SO_4 Dis. Cations (MEQ/l)	SO_4 Dis. Anions (MEQ/l)	Turbidity (NTU)
Knox																
12-17-78																
0645	10.5	111	7.2	395		250	1	52	200	3.5	.03	.74	130	0	1.083	31
0745		125	6.8													
0845	10.5	320	7.0	143		90	2	21	83	1.2	.01	.38	34	0	.437	20
0945	10.5	459	7.4	273		100	2	49	83	1.1	.02	.46	18	0	1.020	14
1045	11.0	233	7.4	321		100	2	62								
1145	11.0	233	7.2	261		140	2	37	110	1.4	.02	.46	69	0	.770	26
1245	11.0	96	7.1	288		220	3	27	130	1.8	.02	.48	134	0	.562	37
1345	11.0	151	7.5	240		170	3	13	110	1.4	0.05	0.40	150	0	.271	25
1445	11.0	158	7.2	222		100	4	21	59	1.5	0.02	0.41	113	0	.437	26
1545	11.0	110	7.0	200		130	3	15	93	1.5	0.03	0.41	121	0	.312	32
Knox																
1-7-79																
1800	11.0	133	7.7	125		70			54	.97	.03	.22	42			29
1900	11.0	127	7.7	126		80			48	.99	.04	.25	31			30
2000	11.0	108	7.6	111		110			44	.73	.05	.21	33			33
2100	11.0	136	7.5	116		30			32	.67	.03	.23	35			16
2200	11.0	178	7.5	138		100			39	.66	.01	.21	11			10
2300	11.0	202	7.6	131		100			43	.81	.03	.23	30			13
Knox																
1-8-79																
1030	11.0	96	7.2	361		430			140	3.2	.07	.58	246			84
1130	10.0	70	7.5	412		340			110	2.1	.07	.66	312			108
1230	11.0	53	7.4	856		520			140	3.3	.09	.92	552			156
1330	11.0	108	7.2	710		300			120	3.4	.11	.88	572			140
1430	10.0	169	7.5	342		180			26	1.9	.12	.61	190			68
Seaview																
1-8-79																
1230	10.0	153	7.6	1990		580			220	7.6	.39	2.1	1420			400
1330	10.0	273	7.4	766		200			100	3.4	.22	1.0	524			320
1430	11.0	342	7.3	497		170			74	2.4	.13	.88	298			136
Seaview																
1-10/1-11-79																
2200	11.0	156	7.6	1340		250										608
2300	11.0	148	7.6	4300		90										624
2400	11.0	210	7.6	292		70										432
0100	11.0	233	7.6	1640		60										352
0200	11.0	168	7.5	684		130										312
0300	11.0	343	7.5	632		110										280
0400	11.0	571	7.5	584		100										264
0500	11.0	479	7.7	500		90										200
0600	12.0	323	7.7	934		180										264
0700	12.0	418	7.7	954		160										192
Knox																
1-10/1-11-79																
2110	12	84	8.0	380		180										40
2210	10.5	114	7.6	327		220										64
2310	12	126	7.5	311		120										64
0010	12	172	7.6	296		120										39
0110	11	82	7.7	200		110										36
0210	12	146	7.7	278		110										52
0310	11	220	7.7	256		110										54
0410	11	271	7.6	274		110										58
0510	12	226	7.5	262		110										40
0610	12	223	7.5	336		120										74
0710	13	326	7.9	343		110										68
Seaview																
1-14-79																
0500	9.0	263	7.3	364		50										72
0600	9.0	316	7.2	369		60										116
0700	9.0	287	7.2	381		70										120
0800	9.0	1073	7.2	518		120										272
0900	9.0	439	7.3	643		140										240
Knox																
1-14-79																
0400	10.0	313	7.3	201		150										48
0500	9.0	91	7.0	175		110										33
0600	9.0	442	7.2	152		100										36
0700	9.0	145	7.2	169		90										44
0800	9.0	553	7.2	175		80										42
0900	9.5	247	7.2	178		100										32
1000	9.5	346	7.4	182		80										37

Lead Values to be reported at a later date.

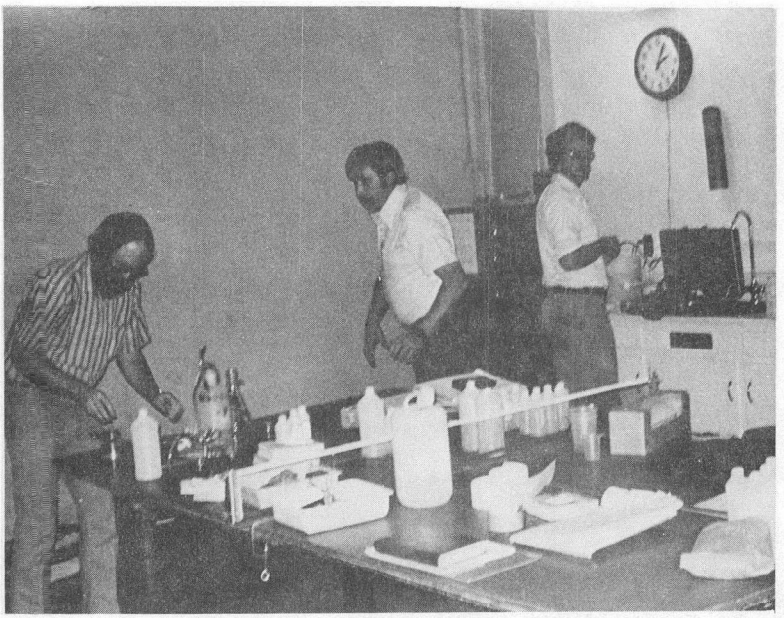
in the equipment. An example of the level of skill acquired by District personnel is that USGS has recently asked the District to provide training in the operation of the ISCO automatic equipment to an adjoining county. This acquisition of water resource investigation skills will benefit this project during the second year in terms of improved efficiency.

The use of these newly acquired skills is illustrated by figures on the following pages. These figures, photographed at the District's basement laboratory, show preparation of water samples for shipment to the USGS laboratory for chemical analysis and the maintenance of the water sampling equipment.

FIGURE 9 FILTRATION AT DISTRICT LABORATORY

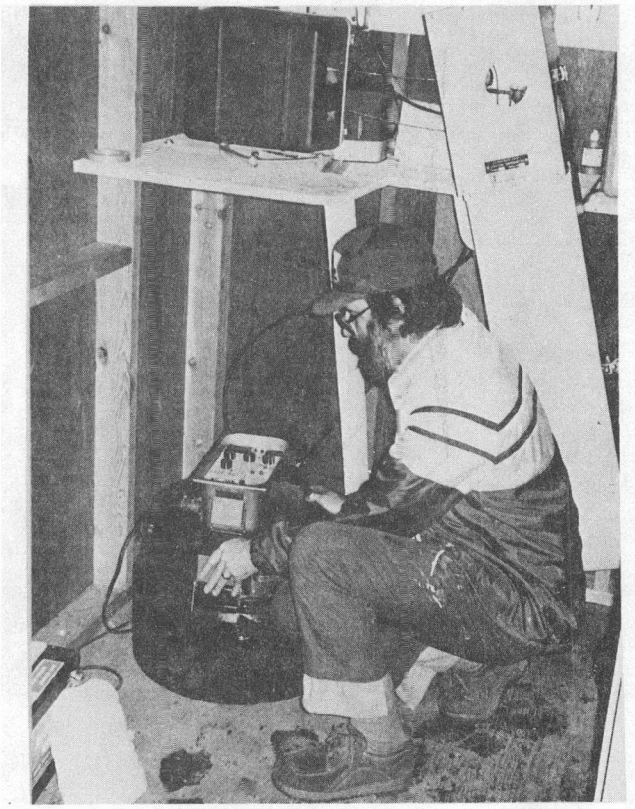


Principle Investigator and Flood Control District Personnel Filtering Runoff Samples for Analysis



Engineer/Scientists Prepare Water Samples for Shipment to USGS Lab in Denver

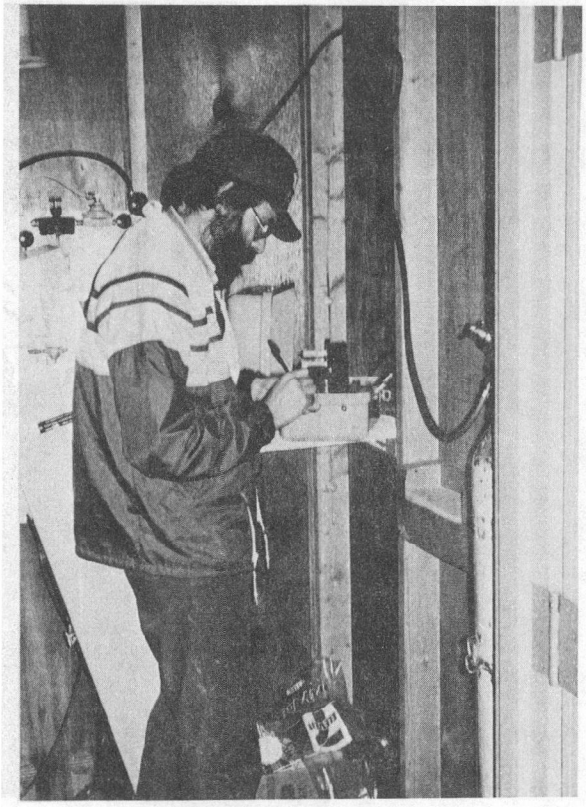
FIGURE 10 MAINTENANCE OF WATER SAMPLING EQUIPMENT



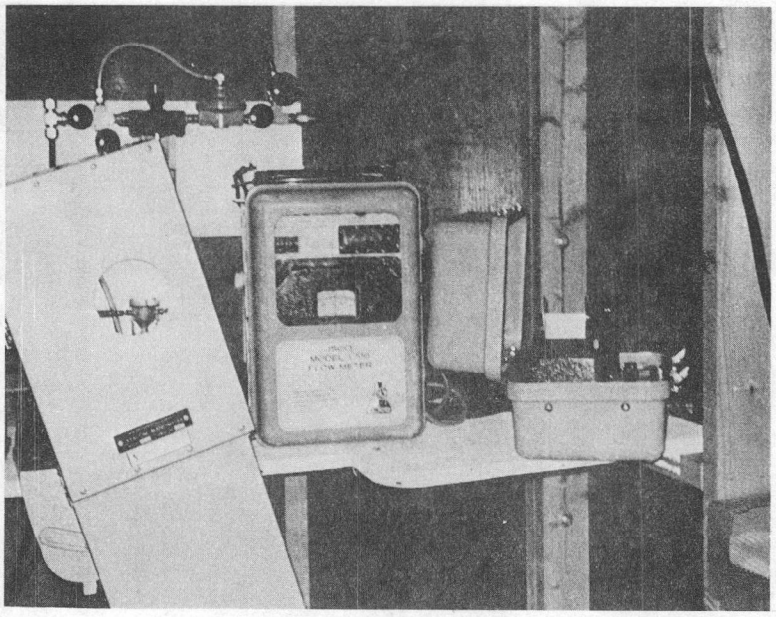
Removing Top of Automatic Sampler
at Knox Street Station

Capping Water Sample Bottles in
Preparation for Transporting to Lab

FIGURE 11 FLOW MONITORING OPERATION



Checking Flow Recorder for
Time of Sample Collection



Flow Monitoring Equipment, left to right,
Manometer, Flow Meter, and Flow Recorder

TASK 4 STREET SURFACE MONITORING

The objectives of this task are to monitor street surface particulate loadings to supply information for comparison with the runoff yields and to monitor the effectiveness of the street cleaning programs.

Table 3 summarizes the number of street surface samples collected between December 4, 1978 and March 7, 1979. All of these samples have been analyzed by particle size for chemical constituants.

Table 4 lists the loading values of the street surface contaminant samples.

TABLE 3 SAMPLE COLLECTION SUMMARY

Type of Sample	Number of Samples Collected
Leaf Removal	12
Street Cleaning	16
Accumulation	34
TOTAL	62

Loading of Contaminants

The preferred approach to determining loading values of street surface contaminants for a given area is by direct sampling because this method considers the site-specific conditions of a given area. Previous research studies (URS, 1974) have found that geographical location (climate category), land use, street surface condition and type of adjacent landscaping are the most significant

TABLE 4 LOADING VALUES FOR STREET SURFACE SAMPLES

Sample Date	*Sample ID#	Lbs/Curb Mile	Date	ID#	Lbs/Curb Mile
12/ 4/78	L- 1L	936	1/25	S- 3M (before)	703
12/ 4	L-2M	524	1/25	S- 4M (after)	473
12/ 4	L- 3U	526	1/25	A-16L	927
12/ 5	L- 4L	437	1/25	A-17U	466
12/ 5	L- 5M	586	2/ 1	A-19L	465
12/ 5	L- 6U	524	2/ 1	A-21U	425
12/ 6	L- 7L	527	2/ 1	S-20M (before)	462
12/ 6	L- 8M	878	2/ 1	S- 6M (after)	455
12/ 6	L- 9U	475	2/ 7	S-23M (before)	673
12/ 7	L-10L	789	2/ 7	S- 8M (after)	429
12/ 7	L-11M	724	2/ 7	A-22L	703
12/ 7	L-12U	541	2/ 8	A-24U	577
			2/15	A-25L	444
			2/15	A-26M	360
			2/15	A/27U	703
			2/23	A-28L	637
12/15	A- 1L	769	2/23	A-29M	335
12/15	A- 2M	1108	2/23	A-30U	258
12/15	A- 3U	750	2/27	A-32M	567
12/20	A- 4L	700	2/27	S-33U (before)	488
12/20	A- 5M	843	2/27	S-12U (after)	198
12/20	A- 6U	546	2/28	A-31L	903
12/28	A- 7L	978	2/28	S-10U (before)	332
12/28	A- 8M	1069	2/28	S-11U (after)	202
12/28	A- 9U	841	3/ 2	A-34L	1646
1/10/79	A-10L	420	3/ 2	S-35M	636
1/10	A-11M	335	3/ 2	S-36U (before)	236
1/10	A-12U	485	3/ 2	S-14U (after)	249
1/16	A-13L	470	3/ 5	S-15U (before)	298
1/16	A-14M	494	3/ 5	S-16U (after)	193
1/16	A-15U	427	3/ 7	A-37L	896
1/19	S- 1M (before)	454	3/ 7	A-38M	657
1/19	S- 2M (after)	381	3/ 7	A-39U	271

L = leaf removal test samples
A = accumulation test samples
S = street cleaning test samples

*Location
U = upper area
M = middle area
L = lower area

factors making up loading values. The data concerning traffic effects were not clear; some studies, notably Shaheen (1975) found a correlation between pollutant loadings and automobile traffic for individual cities.

Loadings Over Time

Figure 12 shows the street surface loading values as a function of time. In general, the pattern of data illustrates the sawtooth pattern associated with the deposition and removal of particulates. The highest loading measured was 1646 lbs/curb mile in the lower subarea and the lowest loading was 193 lbs/curb mile in the upper area. This minimum value represents the cleanest that any of the subareas have been after being cleaned either by rain or by street cleaning. It is interesting to note that this loading was a result of street cleaning and was cleaner than the rains had gotten the area. For the most part, the upper subarea was the cleaner of the three subareas. The maximum loading values were measured in the lower subarea. This probably results from the fact that as of March 7, no street cleaning had been conducted in the lower subarea.

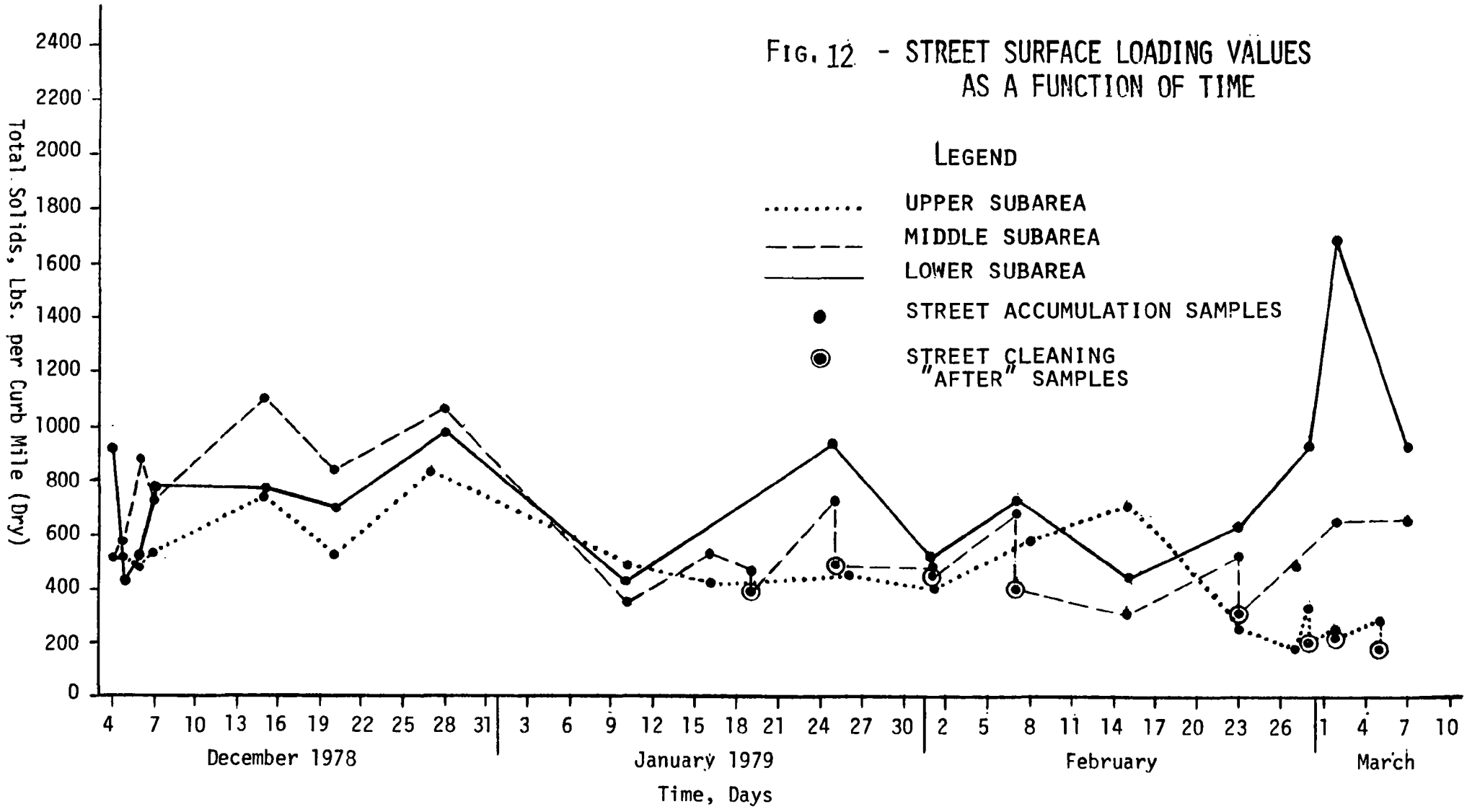


FIG. 12 - STREET SURFACE LOADING VALUES AS A FUNCTION OF TIME

Figure 13 shows the equipment used to monitor the street surface contaminants. This equipment consists of two 2.5 HP vacuums with accessories, one 5000 watt generator and an equipment trailer. Figure 14 is one example of local media coverage of the project. Publicity such as this has been found to be a good way to communicate project activities to study area residents. Other progress in the publicity area has included a newspaper article and a television interview. Figure 15 shows the compositing of all the street surface samples in preparation for shipment to the lab for chemical analysis.

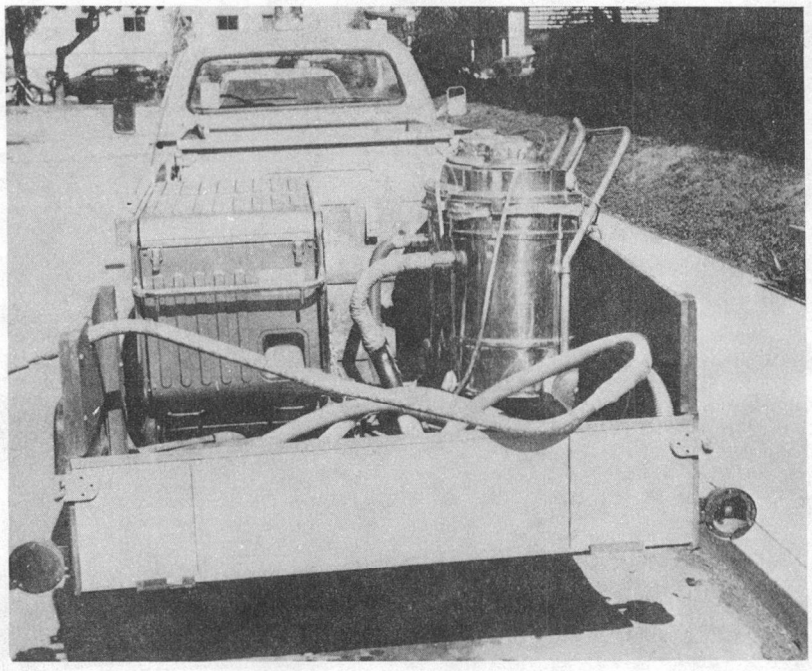


FIGURE 13 EQUIPMENT AND TRAILER FOR STREET SURFACE MONITORING

The Daily Review
SECOND SECTION
WT Hay. Friday, February 9, 1979 13

Tidying up the town

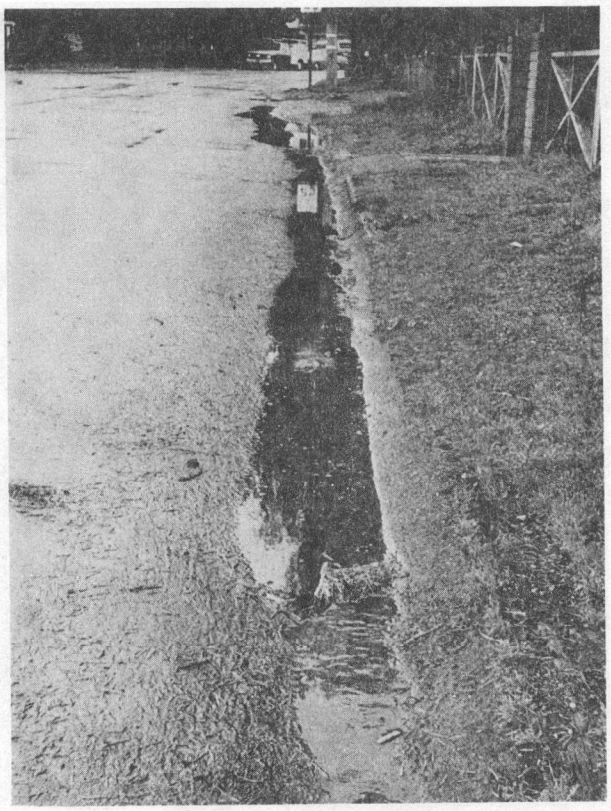
The process looks like a "Keep America Beautiful" commercial gone berserk — crews of men driving big street sweepers down Castro Valley streets, and then carefully vacuuming up the bits of dirt they missed. But it's really a project for cleaning up the bay. Alameda County Flood Control officials are trying to find out if sweeping the streets will keep oil, dirt and other gunk from washing into local streams, and eventually into the bay, during rainstorms. Fred Wolin, an engineer-scientist with the department, vacuumed a section of Knox Street during this week's evaluation of the program by federal Environmental Protection Agency officials.

FIGURE 14
Newspaper Coverage of Collection Procedure for Street Surface Samples

FIGURE 15 COMPOSITING STREET SURFACE SAMPLES

Consultants Compositing Street Surface Samples for Shipment to Laboratory

FIGURE 16 WET GUTTER AND STREET



Runoff Ponding in Rolled Gutter
Near Seaview Avenue Station

The above figure illustrates a street surface sample problem. Extensive gutter flow and ponding on the street can occur for long periods of time after rain has ended. For analytical purposes, street surface samples should be obtained at the earliest possible time after a storm has been monitored. A stormwater sample cannot be used in the complete data analysis unless a street surface sample is obtained from the whole study area before and after that specific rain. Street sampling locations need to be periodically moved to avoid these conditions. If the sampling station cannot be conveniently moved, then the sample strip must be shortened before the gutter is reached. Very little particulate pollutants would be in the curb if the curb was covered with flowing water for long periods of time.

TASK 5 STREET CLEANING AND LEAF REMOVAL TESTS

The objective of this task is to measure the effectiveness of various standard street cleaning programs and leaf removal practices.

As of March 2, 1979, eight street sweeping tests and twelve leaf removal tests have been conducted. The results of these street cleaning tests are shown on Table 5. Of the two removal measures shown, the preferred one is the pounds per curb mile removed measure (unit removal rate) rather than the percent of the before loading removed. The pounds per curb mile removal value is necessary in designing a program to meet a goal of removing a certain number of pounds of pollutant in a given area. A pounds per curb mile removal value is necessary for this study in order to perform mass balance calculations and to compare pollutant removals from the study area by street cleaning and storm events.

The preliminary results so far indicate relatively good pollutant removals. The three lowest removal values shown on Table 5 (73 lbs., 7 lbs. and negative 14 lbs. per curb mile) were probably

TABLE 5
PRELIMINARY RESULTS OF STREET CLEANING PERFORMANCE VALUES

Location	Date of Test	Amounts Removed (lbs/curb mile)	Percentage of Before Loading Removed (%)
Middle Subarea	1/19/79	73	16
Middle Subarea	1/25	231	33
Middle Subarea	2/ 1	7	1
Middle Subarea	2/ 7	245	36
Upper Subarea	2/27	290	59
Upper Subarea	2/28	131	39
Upper Subarea	3/ 2	-14	-6
Upper Subarea	3/ 5	105	35

caused by the street cleaning equipment not being maintained at optimum condition. On the January 19 test, the left gutter broom required maintenance and similarly on February 1, the main pickup broom was worn to the maximum extent. On the next test, 6 days later, an improvement to over 200 lbs/curb mile pickup occurred because of replacement of this broom. The lowest removal value occurred on the March 2 test, when the operator noted 75% wear on the main pickup broom and when the street surface loadings before the test were very low.

Table 6 compares street cleaning performance data for total solids loading from this demonstration project with previous values obtained from the development of the County's 208 Plan and from the completed San Jose street cleaning demonstration project. As can be seen, this year the amounts removed from Castro Valley were higher than the previous Castro Valley and Oakland data. The removal value obtained in the Oakland industrial area was higher, but the initial loading was much higher. The removal values for San Jose's good asphalt areas were lower. The poor condition asphalt streets and oil and screened surface streets in San Jose had greater removal values (due to greater initial street loading values).

TABLE 6

COMPARISON OF STREET CLEANING

PERFORMANCE VALUES

	Date	Amount Removed (lbs/curb mile)	% of Before Loading Removed
Castro Valley-M[1/] average	1979	140	22
Castro Valley-U-average	1979	130	32
Castro Valley-R[2/] average	1977	23	3
Oakland-R[3/] average	1977	50	5
Oakland-I[4/] one test only	4/5/77	380	14
San Jose-[5/] asphalt streets-average	1976-1977	104	37
San Jose-poor asphalt streets-average	1976-1977	540	40
San Jose-oil and screened surfaces streets-average	1976-1977	170	9

1/ Middle Study Area; upper study area

2/ Residential Area, Source: Alameda County 208 Plan

3/ Industrial Area, Source: Alameda County 208 Plan

4/ Industrial Area, Source: Alameda County 208 Plan

5/ San Jose Demonstration Project, Source: Pitt

Street Cleaning Test Schedule

Table 7 shows a revision of the preliminary street cleaning schedule. This schedule was revised due to the cancellation of the regenerative air type of street cleaning equipment (Tymco) tests. The Tymco equipment was cancelled due to financial considerations. Essentially the revision moved up the second and third phases of Mobil cleaning so as to obtain a complete set of data for the Mobil street cleaner operating in all three study areas.

TABLE 7 REVISED STREET CLEANING SCHEDULE(1)

5-DAY Work-Weeks		Upper Urban Area	Middle Urban Area	Lower Urban Area
11/20	11/24/78	1(2)	1(2)	1(2)
11/27	12/1	4L(3)	4L(3)	4L(3)
12/4	12/8	0	0	0
12/11	12/15	0	0	0
12/18	12/22	0	0	0
12/25	12/29	0	0	0
1/1	1/5/79	0	0	0
1/8	1/12	0	0	0
1/15	1/19	0	1	0
1/22	1/26	0	1	0
1/29	2/2	0	1	0
2/5	2/9	0	1	0
2/12	2/16	0	0	0
2/19	2/23	0	0	0
2/26	3/2	3	0	0
3/5	3/9	0	0	0
3/12	3/16	0	5	0
3/19	3/23	0	0	1
3/26	3/30	0	0	1
4/2	4/6	0	0	1
4/9	4/13	0	0	1
4/16	4/20	0	0	1
4/23	4/27	0	0	5
4/30	5/4	1	0	0
5/7	5/11	1	0	0
5/14	5/18	1	0	0
5/21	5/25	1	0	0
5/28	6/1	1	0	0

(1) All performed w/Mobil - number of street cleaning tests per week are shown.

(2) Not monitored; a starting date

(3) Leaf removal tests

TASK 6 PROJECT REVIEW MEETINGS

The objective of this task is to communicate preliminary findings and to obtain guidance from various interested parties.

The first meeting with the EPA project officer was held in January 1979 in San Francisco to discuss the work plan. The next meeting is scheduled in May to review this technical progress report.

A meeting, late in February, was held with the project Technical Advisory Committee members. These members represent the Regional Water Quality Control Board, the Corps of Engineers, the U.S. Geological Survey, ABAG, and the District. An EPA representative was also present. The purpose of the meeting was to review the project work plan. The discussion centered on the street cleaning regime and the consequent division of the study area into three subareas. The major reason for this division was that the study area, even at two square miles, was too big to sample and clean in one day. Without the division there would not have been sufficient time for sampling the streets on the day of street cleaning, and would have exceeded available project resources. Another reason is that the division will allow us to study the effects of the different topography and different land uses of the subareas. The result of the meeting was the decision that during the second project year a more direct scheme of cleaning the entire study area at one time would be used. The Technical Advisory Committee will probably next meet in July (after preliminary data analysis is underway) to review this progress report and resultant data available at that time.

TASK 7 DATA ANALYSIS AND REPORT PREPARATION

The objective of this task is to analyze the data in accordance with the objectives of the study and to present the results in a concise and readable manner.

The data analysis has just started and some preliminary data and is shown in tables and figures of this report. The runoff and street surface data collection effort will continue during the dry season; however, this dry season data will not be reflected in the data analysis of the Annual Report.

The first formal report (i.e., the Work Plan) was completed in January 1979. This report is the first technical progress report and discusses the project progress to April 1979. The next report will be the Annual Report available for review in September of this year. This Annual Report will cover the task progress and detailed data analysis from the initiation of the project in November 1979 through data collected to June 1979. This Annual Report will also constitute the Work Plan for second year activities. The Annual Report is expected to be published by EPA. The next progress report will be submitted in January, 1980 and the final report draft will be submitted, in September, 1980.

SECTION III

SCHEDULE

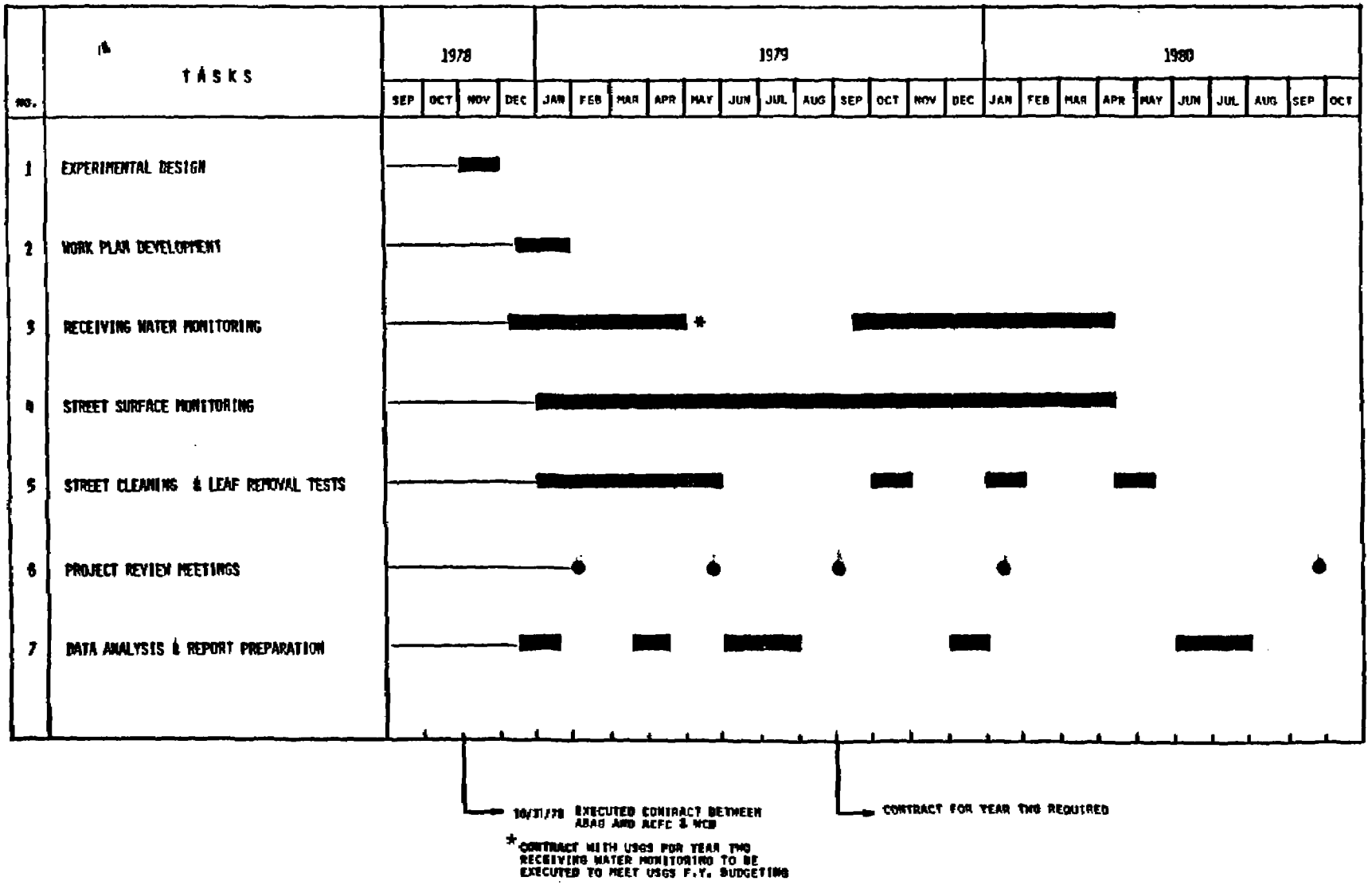
The proposed schedule for conducting the tasks of the demonstration project is shown on Figure 16.

The Work Plan was approved in early February, 1979, and the experimental design (Task 2) was completed as part of the work plan development. The two receiving water monitoring stations (of Task 3) became operational in December, 1978. This runoff monitoring will be kept operational throughout the dry season until October to allow for monitoring of possible summer storms. Base flow monitoring will be performed in May to compare base flow quality with stormwater quality.

Task 4, street surface monitoring will also continue until October for the first year of the project. Between June and September, samples will be taken every other week. In September, weekly samples will be taken.

Task 5, street cleaning and leaf removal tests began in early December with twelve leaf removal tests conducted. Full-scale street cleaning tests began on January 19, 1979. These full-scale tests will continue until June using the street cleaning schedule presented in this report. The use of a regenerative air street cleaner was cancelled in March due to budget constraints.

FIGURE 17. SCHEDULE FOR CASTRO VALLEY DEMONSTRATION PROJECT



The first EPA project review meeting in February consisted of work plan review and approval. The second formal meeting is scheduled for mid-May to discuss this progress report and the possibility of additional project funding. The third review meeting is scheduled for the first of September to discuss the Annual Report and continuation of second year efforts. Tentatively, the second year's first progress report would be submitted in January 1980 and the final report would be available in September, 1980.

It is imperative to have signed contract agreements with ABAG/EPA no later than September 1 to keep work on schedule without any lapse of time between first and second year activities.

SECTION IV

PROJECT COSTS

The first year's project costs were estimated to be $108,000; $75,000 was to be funded by EPA and $33,000 matched by the Alameda County Flood Control and Water Conservation District. As of March 8, 1979, (20 weeks and 42% of the way through the project), the total estimated project expenditures were about $32,145 (30% of the estimate). EPA costs have totaled $20,202 (27% of $75,000). The Flood Control District's match totaled $11,942 (36% of $33,000). ABAG, the project sponsor, has been credited its $5,000 share of the first year's project cost with services yet to be rendered.

More than 1,300 person-hours have been spent by District personnel and consultants on the project as of March 8, 1979. The following list summarizes actual expenditures and budget estimates to March 1, 1979, by task:

	Task Title	Actual/Budget	%
1	Work Plan Development	$2,825/ 3,500 =	81%
2	Experimental Design	$2,848/ 1,500 =	190%
3	Receiving Water Monitoring	$8,914/38,000 =	23%
4	Street Surface Monitoring	$7,480/26,060 =	29%
5	Street Cleaning and Leaf Removal Tests	$2,229/12,000 =	19%
6	Project Review Meetings	$1,234/ 1,900 =	65%
7	Data Analysis and Report Preparation	$1,200/20,000 =	6%

SECTION V

APPENDIX

The raw data is not included here. It is too lengthy to reproduce in this interim report. It is available for viewing at the District offices in Hayward. The raw data will be included in the September Annual Report.