SAN FRANCISCO BAY AREA
NATIONAL URBAN RUNOFF PROJECT

A Demonstration of Non-Point Source
Pollution Management on
Castro Valley Creek

APPENDIX

By

Robert Pitt and Gary Shawley
Private Consultants

for the

Alameda County Flood Control
and
Water Conservation District
Hayward, CA 94544

with assistance from

Woodward-Clyde Consultants
San Francisco, CA 94111

Prepared for

U. S. Environmental Protection Agency
Water Planning Division
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DISCLAIMER

INTRODUCTION TO APPENDIX

The Appendix is made up of seven appendices, A through G. The Appendix comprises the results of most of the field data and laboratory data reduced by computation to tables and figures. The material contained herein further expands the information and data presented in the report.

APPENDIX A

DESCRIPTION OF STUDY AREA

Castro Valley is an unincorporated community within Alameda County. The project's study area was a 2.4 sq. mi. portion of this unincorporated area. The Castro Valley Creek branch of the Castro Valley Watershed shown in Figure A-1 was selected as the study area because it was a manageable size.

The study area is 1,542 acres and is predominantly residential, with urban, suburban and rural terrain in the flats and hills bordering San Francisco Bay south of Oakland and north of San Jose. The uppermost portion of the study area is rural with about 633 acres of grass and woodlands that is slowly being replaced by suburban development. The Seaview station monitors water quality and quantity from this essentially rural area. Below this station is the urban test area of about 909 acres. Length of the main creek channel between the rural station (Seaview) and the urban station (Knox) is 2.4 miles.

The majority of the residential land use in the urban area consists of single family housing with lot sizes varying from 5,000 square feet to 10,000 square feet. The estimated residential population density is about 20 people per acre. Residential land use of the 909 acre urban study area occupies about 636 acres (70 percent), commercial land use occupies about 64 acres (7 percent), and the remaining land is about 209 acres (23 percent) of open space and institutional land use. Development along the stream banks in Castro Valley is intense and houses are frequently constructed directly over the existing streambed. Some light commercial areas, more than six schools, and a short portion of Interstate Highway 580 are also in the area.

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

Climate of the area is under the marine influence of San Francisco Bay and the Pacific Ocean. The Mediterranean climate is characterized by a dry summer followed by a wet winter with irregularly spaced, frontal rainstorms. Normal annual rainfall is about 21 inches with over 90 percent usually occuring between October and April. Precipitation intensity rarely exceeds 2.6 inches in 24 hours. Snowfall is rarely observed. In a normal rainfall year, there are about 63 days of measurable rainfall. Prevailing winds are from the west to northwest with the strongest winds (to 40 m.p.h.) usually associated with winter storms.

The study area is underlain with alternating sequences of sandstone and

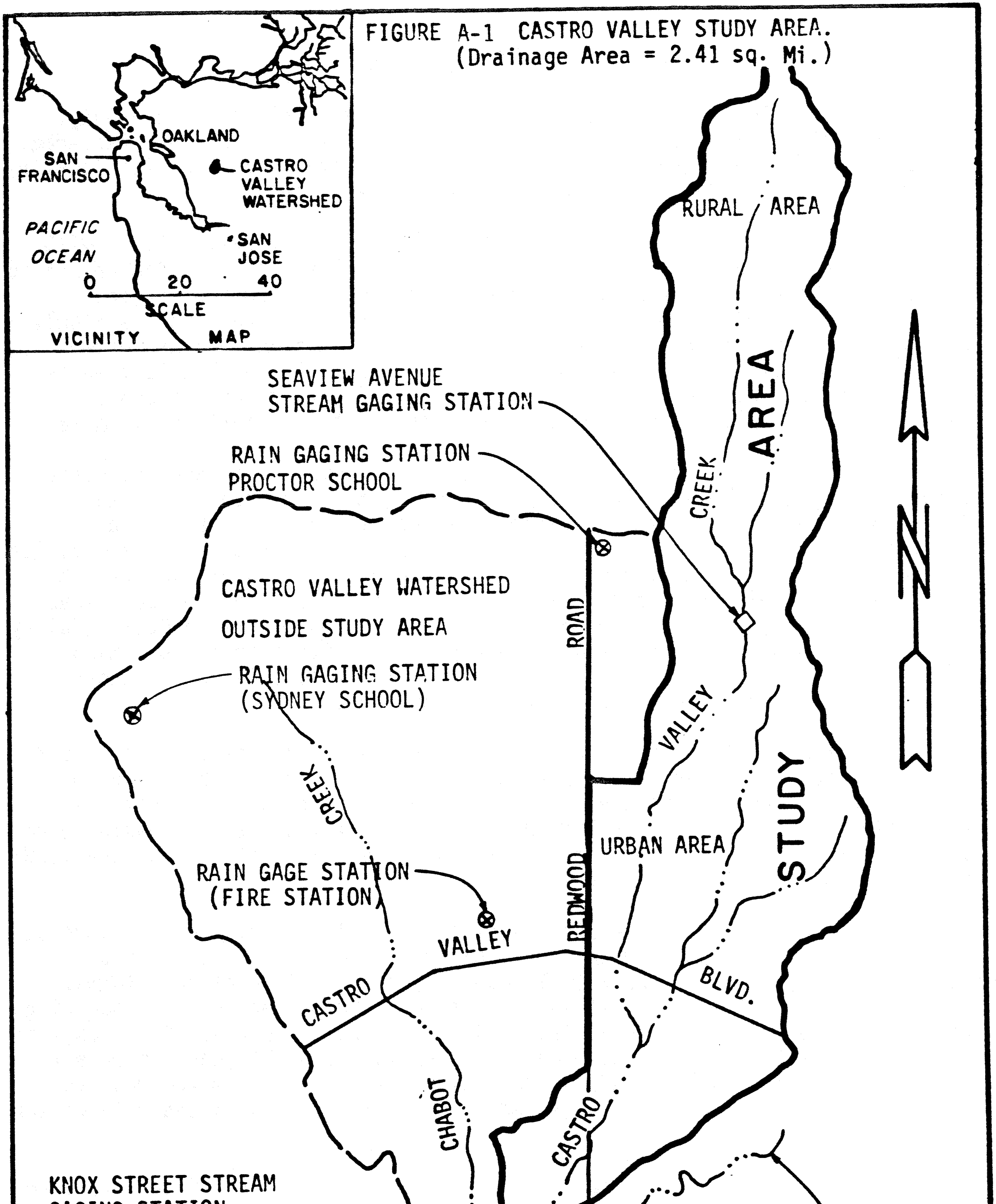


FIGURE A-1 CASTRO VALLEY STUDY AREA.
(Drainage Area = 2.41 sq. Mi.)

Hydrologic Features

Important aspects of the project were dependent on rainfall and resultant runoff. The normal annual rainfall in Castro Valley is about 21 inches. In a normal rain year, there are about 63 days of measurable rainfall (precipitation greater than 0.01 inches). During the project's data collection, October, 1978 to April, 1980, about 20 inches of rain was measured per year with about 60 days per year of rainfall.

Two Stevens continuous recording stream gages were installed and operated by USGS and two automatic ISCO water samplers flow meters and punters were installed and operated by Alameda County Flood Control and Water Conservation District on Castro Valley Creek. The upper gaging station, USGS #11181004, is located at Seaview Street and measured runoff from the relatively undeveloped portions of the study area. The lower gaging station, USGS #11181006, is located at Knox Street and measured the runoff from the urbanized section in addition to the upper undeveloped portion of the study area. Runoff from the urban test area only is determined by subtracting the runoff of the rural station from the urban station. For rainfall measurements, a USGS weighing bucket rain gage (USGS No. 374259122041901) located at Proctor School was used. The Corps of Engineers monitored runoff at another station about 300 feet downstream from the Knox Station at the confluence of Chabot and Castro Valley Creek.

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.

Castro Valley was chosen as the study area for the following reasons:

1. Castro Valley Creek is not affected by either municipal or industrial point sources.

2. Castro Valley Creek is a small stream transversing a well defined suburban area; its upstream waters pass through a relatively undeveloped area.

3. Castro Valley watershed is representative in terms of land use and land surface characteristics of residential watersheds within the San Francisco Bay-Delta region.

4. The existing, usable storm runoff management data base on the entire Castro Valley watershed is extensive (e.g., receiving water quality values for about 30 rain events, plus some dry weather measurements, applications of state-of-the art stormwater models, i.e., applications of the SWMM model for quantity and quality, published estimates of structural management cost and effectiveness values, street surface pollutant accumulation

5. Many western cities discharge into similar small receiving waters and a demonstration of non-point source water pollution abatement through improved management practices may provide the ability to prescribe effective, implementable control plans from cost, technical and political viewpoints for other similar watersheds.

During the first year analysis the study area was divided into four sub-areas (Figure A-2) These horizontal divisions across the watershed were based on topography and street patterns. Land use in the uppermost portion of the watershed (i.e., at the headwaters) is rural, with grass and woodlands slowly being replaced with suburban residential development. This largely open-space portion has the most topographic relief of any of the four sub-areas. The adjacent (upper urbanized) sub-area is primarily suburban residential with one school. There are observable income differences of the households in this upper urban sub-area compared to the two lower urban sub-areas. This higher income sub-area is characterized by slightly larger lot sizes, slightly newer homes, the lowest percentage of low income single family homes, and a larger amount of mixed, deciduous-evergreen landscaping adjacent to the street. The predominant characteristics of this area are the larger portion of higher income single-family homes, a smaller density of on-street parked cars and steep topography. The middle urban sub-area's major difference, when compared to the other urban sub-areas, is a larger percentage of asphalt gutters. There are three schools, some lower income single family homes, and a fair amount of commercial land use in this sub-area. The topography is moderate. The lower urban sub-area is primarily flat with the largest percentage of lower-income single-family homes, two schools and some multiple family housing. The primary difference among the four areas, therefore, is topographic relief.

There are many similarities in the three lower urban sub-areas (Table A-1). The three most obvious 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 configuration of the curb (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 surfaces is a major determinant of the accumulation rate of street surface contaminants and 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 (96 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

FIGURE A-2 CASTRO VALLEY STUDY AREA DIVISIONS.

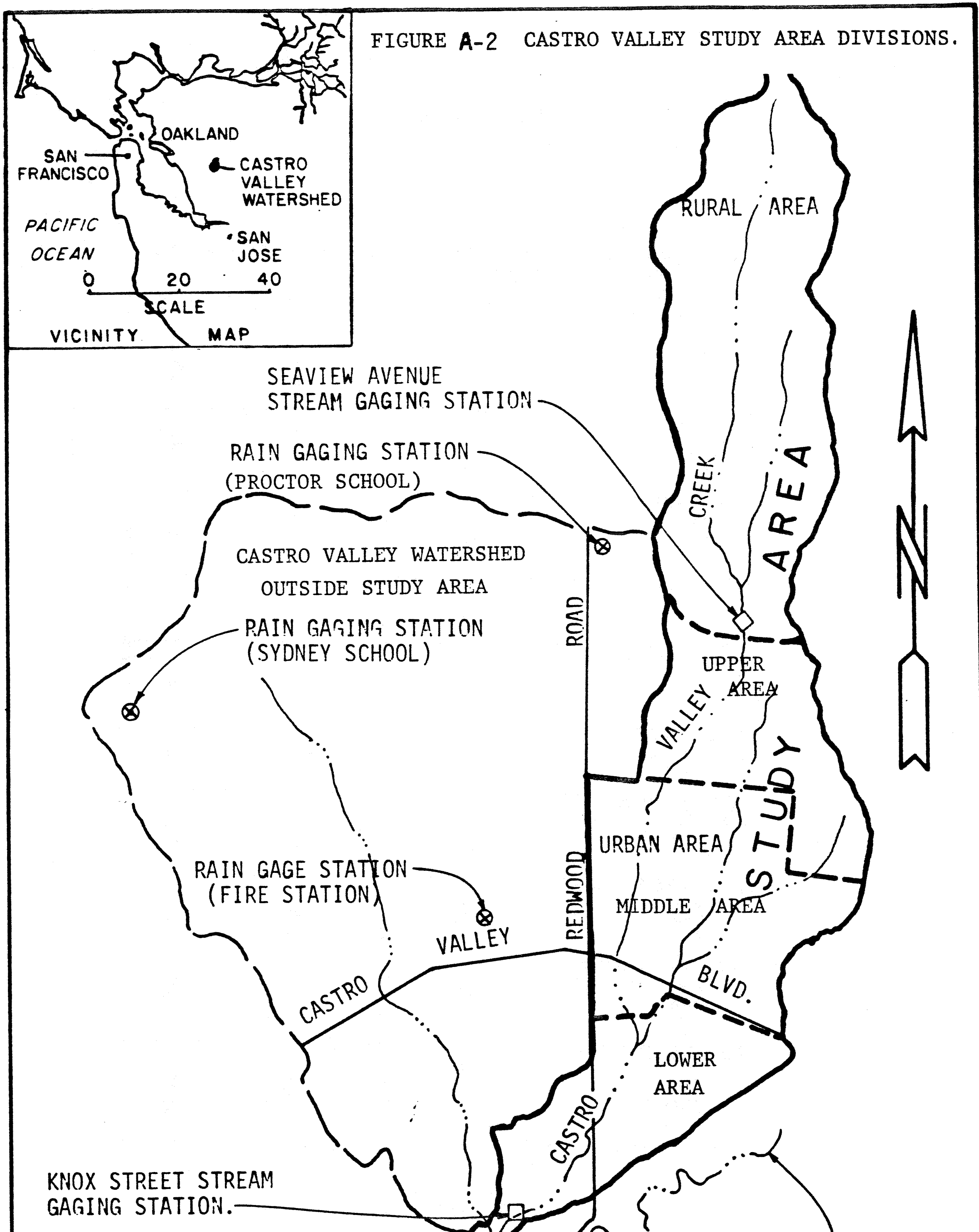


TABLE A-1 URBAN TEST AREA CHARACTERISTICS (PERCENT, UNLESS OTHERWISE NOTED)
DRAINAGE AREA = 909 ACRES

	LOWER	MIDDLE	UPPER	TOTAL
Number of Gutters				
0	0	0	0	2
1	0	0	11	4
2	100	89	89	92
4	9	5	0	2
Gutter Type				
Concrete	93	62	78	76
Asphalt	7	38	17	22
Mixed	0	0	5	2
Gutter Shape				
Straight	0	0	5	2
Rolled	41	52	69	55
Mixed	59	48	26	43
Median Strip				
Yes	0	5	0	2
No	100	95	100	98
Street Condition				
Poor	0	0	3	1
Fair	74	97	97	91
Good	26	3	0	8
Street Width				
20 to 40 feet	93	95	100	96
40 feet	7	5	0	4
Landscaping Type				
Deciduous	78	74	46	65
Evergreen	11	5	0	5
Mixed	11	21	54	30
Landscaping Quantity				
None	11	0	0	3
Some	85	89	91	89
Much	4	11	9	8
Leaves on Street				
Few	81	74	43	65
Some	15	21	45	28
Much	4	5	12	7
Parking Density				
None	4	2	0	2
Light	55	50	89	65
Moderate	37	42	11	30
Heavy	4	6	0	3

TABLE A-I URBAN TEST AREA CHARACTERISTICS (PERCENT, UNLESS OTHERWISE NOTED)
DRAINAGE AREA = 909 ACRES (continued)

	LOWER	MIDDLE	UPPER	TOTAL
Street Density				
Lane miles/acre	-	-	-	.06
Portion of Streets w/curbs & gutters	-	-	-	90
Traffic Density				
Light	79	63	77	72
Moderate	7	26	23	20
Heavy	14	11	0	8
Traffic Speed				
25 MPH	52	39	40	43
25 - 40 MPH	48	58	60	56
40 MPH	0	3	0	1
Topography				
Flat	66	39	3	34
Slight	30	34	3	22
Moderate	4	11	37	18
Moderate/Steep	0	3	11	5
Steep	0	13	46	21
Land Use				
Residential				70
Commercial				7
Other (Schools, Vacant, Open Space)				23
Street Surface Particulate Loadings				
Mean (lbs/curb-mile)	369	675	563	552
Median (lbs/curb-mile)	321	536	467	432
Standard Deviation (lbs/curb-mile)	219	540	363	425
Standard Deviation/Mean (ratio)	0.59	0.80	0.64	0.77
Minimum (lbs/curb-mile)	48	100	82	48
Maximum (lbs/curb-mile)	821	2970	1260	2970
Number of Valid Data Points	27	37	34	98

Average daily traffic (ADT) volumes for the two major arterial streets in the study area are 24,000 for Castro Valley Boulevard which runs north to south and serves as the border between the lower and middle sub-areas; and 19,500 for Redwood Road which is aligned west to east and serves as the northern border of the lower and middle sub-areas ADT volumes for the seven collector streets are about 3,500 for the entire urban test area. ADT volumes for the minor residential streets of the urban study area are 1,000.

Normal street cleaning practice in the study area consists of one pass with a mechanical brush type sweeper at intervals of once about every seven weeks in the residential area (49.2± curb miles) and once per week along Castro Valley Boulevard, the major arterial and commercial strip (2.5 curb miles). There are no special parking restrictions in the study area related to street cleaning activities.

The study area has drop inlets and not catch basin structures. These are cleaned about once per year with a shovel and bucket or a vacuum unit. Leaf disposal is a part of the routine street cleaning effort. Usually twice per year, after major leaf fall, the County Road Department sends in special pieces of equipment to reduce the amount of leaves to be removed by the street cleaners. Residential garbage is collected weekly.by a disposal company.

The Castro Valley Creek branch of the Castro Valley watershed was selected as the study area in order to reduce the study areas to a more manageable size (from 5.6 square miles to 2.4 square miles). The other major reason the Chabot Creek branch of the Castro Valley watershed was not included as part of the study area was that it was advised that it could not be used as a control area because similarities between the two areas had not been proven. Calibration of the areas was not attempted because of insufficient funds in the project budget and expected inaccuracies.

APPENDIX B

EXPERIMENTAL DESIGN, FIELD AND LABORATORY PROCEDURES AND INSTRUMENTATION

The following appendix describes the results of the experimental design and the field sampling procedures used to gather the street surface and receiving water samples. Also described is the quality control in the form of the sampling and calculation sheets and the laboratory procedures and references for the street dirt chemical analysis.

RESULTS OF EXPERIMENTAL DESIGN TESTS

Street surface samples were collected from narrow strips that were the width of the street. The analytical procedure used to determine the number of sub-samples needed involved weighing individual sub-samples in the study area to calculate the standard deviations (o) and the means (x) of street surface loading values.

From these two values, the number of sub-samples necessary (N), depending on the allowable error (L), were determined. An allowable error value of about 25 percent, or less, was used.

The formula used (Cochran 1963) was:

$$N = 4\sigma/L2.$$

With a 95 percent confidence limit, this formula determines the number of samples needed to determine the true value for loading within a range of + L. Initially, individual samples were taken at 100 locations in the three urban study areas to determine the loading variability. Loading varied within the study area but the median values in the three test areas were fairly close. The overall minimum loading was about 50 lbs/curb-mile, the overall maximum value was about 3,000 lbs/curb-mile, and the overall median value was about 400 lbs/curb-mile. The median values in the three areas were about 320, 540, and 470 lbs/curb-mile.

Preliminary statistical analyses (using Student "t" tests) showed little loading variations between candidate sub-division groups. The topographical grouping was made for sampling convenience, as it was difficult to sample the complete study area twice in a single day (as required for the street cleaning tests). The relative variations of particulate loadings within the three test areas did vary. During the second year, the complete study area was tested as a unit to maximize the street particulate loading value range.

The study area configuration for the second year was different than what was flat and had the dirtiest streets and had some commercial land uses. The middle study area was of flat to moderate slope and was mostly residential, while the upper study area was moderate to steep in topography and was also mostly residential. The middle and upper test areas had about the same observed street surface loading conditions. The necessary street cleaning program used during the first year would not allow all three study areas to be sampled and cleaned and sampled again in one day. Therefore, the street cleaning was conducted in each test area on a rotating basis. This resulted in some of the study areas being significantly cleaner than others at any one time. Therefore, the total study area was never at its absolutely cleanest condition, but the total study area did approach the maximum worst case loading conditions. The second year street cleaning program was modified to combine the three test areas. This increased the overall range of street surface loading conditions over what was previously analyzed. This change resulted in the complete study area kept clean for about one month at intermediate valued.

Each of the street surface samples were logged in and physically analyzed using appropriate quality assurance techniques and logging form. Each of the samples were weighed, dried and divided into 8 particle sizes using mechanical sieving techniques to determine the per mile unit weights and percentage distribution of the samples for the various particle sizes. These divided samples were then retained and composited for various chemical analyses. Total solids, lead and zinc were given the highest priority. Approximately 24 composited samples made up of the complete study area for a 3 month period and for each of the particle sizes were analyzed for these parameters. Special asbestos analysis on selected bulk samples were also conducted in conjunction with the special asbestos study task.

Only one level of street cleaning effort was monitored in the second year. This involved cleaning the streets every weekday throughout the study area for a period of about 4 weeks. After the first several days of this cleaning program, the streets were as clean as they were likely to be with street cleaning. Therefore, more than 3 weeks occurred during which monitored rains were affected by the lease quantity of street surface contaminants as possible. This month of extensive street cleaning was followed by 2 months of no street cleaning. Approximately one month without any street cleaning was necessary before the streets were as dirty as they were likely to be. The second month of no street cleaning therefore represented the dirtiest street surface conditions.

Street surface loading values tend to level off with minimal increases in street surface loading conditions because of increased fugitive dust losses from the street surfaces from winds and traffic turbulence. Therefore, even though the water pollution potential of the street surface contaminants will not increase beyond this state, the potential air pollution problems associated with fugitive dust losses from the street surfaces will increase. These air pollutant losses can be estimated by observing the deposition and accumulation

The two months selected for the extensive street cleanings were November of 1979 and February of 1980. Thos of these months have moderate to heavy rains. December of 1979 and January of 1980 were also months of relatively heavy rainfall. March and April of 1980, following the February period of extensive street cleaning also contained some monitored rain events for comparison with intermediate street surface loading conditions.

A special street cleaning performance evaluation was made using a regenerative air street cleaner. This street cleaner had never been sufficiently tested in other street cleaning demonstration projects. These special tests were conducted between December 3 and December 21, 1979. Approximately 6 sites were selected outside, but adjacent to, the study area. Each site was several (3 to 5) blocks long and was selected to represent the range of conditions encountered in the study area. Each site, however, had homogeneous conditions within themselves and both sides of the streets were similar. Approximately 15, one-half street sub-sampling strips were collected at each site site before and after the equipment operation. The tests involved sampling each side of the street independently in each of the small test areas, and operating a regenerative street cleaner on one side of the street and a mechanical street cleaner on the other side of the street simultaneously. It is also important that parked car counts be noted for each side of the street. Each of the 6 sites were sampled 5 times over a period of about two weeks. Therefore, each site was cleaned about every other day. The initial cleanings involved dirty streets while the cleaning periods near the end represented very clean street surface conditions. Approximately 120 samples were collected from these sites and were mechanically separated and weighed. No chemical analysis were conducted on these special samples.

STREET SURFACE PARTICULATE SAMPLING PROCEDURES

The sampling procedures described in this appendix have been used in similiar studies. These procedures are intended to maximize the accuracy and completeness of the information from the sampling program. Past testing has shown that the vacuum units used can effectively remove much (>99 percent of the solids) of the street surface contaminants.

EQUIPMENT DESCRIPTION

A light-duty (half-ton capacity) trailer is used to carry the generator, tools, fire extinguisher, vacuum hose and wand, and two wet-dry vacuum units during sample collection. A truck with a suitable hitch and signal light connections is used to pull the trailer. The truck also has warning lights, including a roof top flasher unit. The truck operates with its headlights and warning lights on during the entire period of sample collection. The sampler and hose tender both wear orange, high-visibility vests. The trailer is equipped with a caution sign on its tailgate.

Both the truck and the street cleaner used to clean the test areas are equipped with radios (CB radios are adequate), so that the sampling team can contact the sweeper operator when necessary. Two-horsepower (hp) industrial vacuum cleaners with one secondary filter and a primary dacron filter bag were selected. The vacuum units are heavy duty and made of stainless steel to prevent contamination of the samples. Two 2-hp vacuums are used together by using a wye connector. This combination extended the useful length of the 1.5 in. vacuum hose to 35 ft. and increased the suction so that it was adequate to remove all particles of interest from the street surface. A wand and a gobbler* attachment are also needed. The generator used to power the vacuum units is of sufficient power to handle the electrical current load drawn by the vacuum units - about 5000 watts for two 2-hp vacuums. Finally a secure, protected garage is used to store the trailer and equipment near the study area when not in use.

SAMPLING PROCEDURE

Two people are required for sampling at all times - one acting as the sampler, the other acting as the vacuum hose tender and traffic controller. Two people lessen individual responsibility, enabling both persons to be

Sample collection does not begin before sunrise, nor continue after sunset unless additional personnel are available for traffic control. The street surfaces are also more likely to be dry during daylight hours, which is necessary for good sample collection.

Equipment is checked before each day of sampling. The generator's oil and gasoline levels must be adequate. Vacuum hose, wand and gobbler must also be in good condition. The vacuum units need to be clean, and their electrical cords have to be securely attached to the generator. The trailer lights and warning lights also need to be fully operable.

The generator requires about 3 to 5 minutes to warm up, after which the vacuum units are turned on one at a time (about 5 to 10 seconds apart to prevent excessive current loading on the generator). The amperage and voltage meters of the generator are also periodically checked.

Each subsample includes all of the street surface material that would be removed during a severe rain (including loose materials and caked-on mud in the gutter and street areas). The location of the subsample strip is carefully selected to ensure that it has no unusual loading conditions. For example, a sub-sample is not collected through the middle of a pile of leaves. It is collected where the leaves are lying on the street in their normal distribution pattern. When possible, wet areas are also avoided. If a sample is wet and the particles caked around the intake nozzle, the caked mud from the gobbler is carefully scraped into the vacuum hose while the vacuum units are running at the end of the sampling period.

Each subsample is collected in a narrow strip about 6 in. wide (the width of the gobbler) from one side of the street to the other (curb to curb). In heavily traveled streets where traffic is a problem, some subsamples consist of two separate one-half street strips (curb to crown). Traffic is stopped for subsample collection; the operator sometimes waits for a suitable traffic break. On busy roadways with no parking and good street surfaces, most particulates are found within a few feet of the curb, and a good subsample is collected by vacuuming two adjacent strips from the curb as far into the traffic lanes as possible. A sufficient break in traffic allows a subsample to be collected halfway across the street.

Subsamples taken in areas of heavy parking are collected between vehicles along the curb, as necessary. The sampling line across the street does not to be a continuous line if a parked car blocks the most obvious and easiest subsample strip. A subsample can be collected in shorter strips provided that the combined length of the strip is equal to the cross-the-street width, and that each strip is representative of a different distance from the curb. Again, in all instances, each subsample is representative of the overall curb-to-curb loading conditions.

When sampling, the leading edge of the gobbler is slightly elevated above the street surface (1/8 in.) to permit pebbles and large particles to enter. The gobbler is lifted to accept larger material as necessary. A large accumulation of leaves in the subsample strip is manually picked up and placed in the sample storage container in order to prevent the hose from clogging. If a noticeable decrease in sampling efficiency is observed, the vacuum hoses are cleaned immediately by disconnecting the hose lengths, cleaning out the connectors (placing the debris into the sample storage container), and reversing the air flows in the hoses (blowing them out by connecting the hose to the vacuum exhaust and directing the dislodged debris into the vacuum inlet). If any mud is caked on the street surface in the subsample strip, the operator loosens it by scraping a foot along the subsample path (being certain that street construction material is not removed from the subsample path unless it is very loose). Scraping caked-on mud is done after an initial vacuum pass. After scraping is completed, the strip is revacuumed. A rough street surface is sampled most easily by pulling the wand and gobbler toward the curb (not by pushing). Smooth and busy streets are usually sampled with a pushing action.

An important aspect of the sample collection is the speed at which the gobbler is moved across the street. A very rapid movement significantly decreases the amount of material collected. Too slow a movement requires more time than is necessary. The correct movement rate depends on the roughness of the street and the amount of material on it. When sampling a street that has a heavy loading of particulates or a rough surface, the wand can travel at a velocity of less than one foot per second. In areas of lower loadings and smoother streets, the wand can travel at a velocity of 2 or 3 feet per second. The best indication of the correct collection speed is made by a visual determination of how well the street is being cleaned in the sampling strip and by listening to the collected samples rattling up the wand and through the vacuum hose. The objective is to remove everything that is lying on the street that could be removed by a significant rainstorm. It is quite common to leave a visually cleaner strip on the street where the subsample is collected, even on streets that appear to be clean.

In all cases of subsample collection, the sampler and hose tender continuously watch for oncoming vehicles. While working near the curb, out of the traffic lane (an area of high loading), the sampler monitors the performance of the gobbler visually. In the street he constantly watches traffic (in both directions), and monitors the collection process by listening to particles moving up the wand. A large break in traffic is required to collect dust and dirt from street cracks in the traffic lane, because the sampler has to watch the gobbler to make sure that all of the loose material in the cracks is removed.

When moving from one subsample location to another, the hose, wand, and gobbler are securely placed in the trailer. The hose is placed so as not to touch the generator's muffler, which can burn a hole in it. The generator and vacuum units are left on and in the trailer during the entire subsample collection period.

The length of time it takes to collect the subsamples varies with the number of subsamples and the test area. For the first phase of this study, the test areas require the number of subsamples and sampling periods shown below:

Test Area	No. of Samples	Sampling Period
Lower urban areas	20	1.5 hr.
Middle urban areas	36	2.0 hr.
Upper urban areas	25	1.5 hr.

Several hundred grams of sample material are needed for the laboratory tests. An after-cleaning subsample is not collected from exactly the same location as the before-cleaning subsample. They are taken from the same general area, but at least a few feet apart.

A field-data record sheet (see quality assurance sub-section 4) is kept for each sample. It contains:

- o Subsample numbers
- o Dates and time of the collection period
- o Any unusual conditions or sampling techniques

Subsample numbers are crossed off as each subsample is collected. After cleaning, subsample numbers are specially marked if the street cleaner operated next to the curb at that location. This differentiation enables the effects of parked cars on street cleaning performance to be analyzed.

SAMPLE TRANSFER

After all subsamples for a test area are collected, the hose and wye connections are cleaned by disconnecting the hose lengths, reversing them, and holding them in front of the vacuum intake. Leaves and rocks that may have become caught are carefully removed and placed in the vacuum can. The generator is then turned off. The vacuums are either emptied at the last station or at a more convenient location.

To empty the vacuums, the top motor units are removed and placed out of the way of traffic. The top of the generator is a good location to store them. The vacuum units are then disconnected from the trailer and lifted out. The secondary, coarse vacuum filters are removed from the vacuum can and, using a small whisk broom, are carefully brushed into a large funnel placed in the

The dust inside the can is allowed to settle for a few minutes, then the primary filter is removed and brushed carefully into the sample can with the whisk broom. Any dirt from the top part of the bag where the bag is bent over the top of the vacuum, is also carefully removed and placed into the sample can.

After the filters are removed and cleaned, one person picks up the vacuum can and pours it into the large funnel on top of the sample can, while the other person carefully brushes the inside of the vacuum can with a soft 3 or 4-in. paint brush to remove the collected sample. In order to prevent excessive dust losses, the emptying and brushing is done in areas protected from the wind. To prevent inhaling the sample dust, both the sampler and the hose tender wear mouth and nose dust filters while removing the samples from the vacuums.

To reassemble the vacuum cans, the primary dacron filter bag is inserted into the top of the vacuum can with the filter's eleastic edge bent over the top of the can. The secondary, coarse filter is placed into the can, then assembled on the trailer. The motor heads are then carefully replaced in the vacuum cans, making sure that the filters are on correctly and the excessive electrical cord is wrapped around the handle of the vacuum unit. The vacuum units are then secured to the trailer with an elastic shock cord. The vacuum hoses and wand are attached so that the unit is ready for the next sample collection.

The storage cans are labeled with the date, the test areas's name, and an indication of whether the sample is taken before or after the sweeping test or is an accumulation (or other type of) sample. Finally the lids of the sample cans are taped shut and transported to the laboratory for analysis or storage.

CASTRO VALLEY CREEK MONITORING PROCEDURES

The goal of the monitoring task was to provide water quality data for the Castro Valley Demonstration Project, and to develop a water quality data base for Castro Valley Creek.

It was important periodically to have personnel at the sampling sites to oversee the operation of the automatic samplers and to perform some in-situ tests. It was necessary to mobilize the monitoring team when rain was expected or was reported in other locations within the Bay Area. Due to the nature of storms within the Bay Area, and past experience, some "false starts" resulted. The automatic samplers with ISCO flow gages greatly reduced sample losses or poor quality data.

An early warning system was formulated to assist the monitoring team leader in his deceision when to mobilize the sampling team or when to place them on standby status. It consisted of:

Early Warning System

1. Forecast Office, National Weather Service, Redwood City (876-9462)
2. Oakland Airport FAA Weather Service (632-8827)
3. Weather Band Radio Broadcast
4. Telephone Weather Service (936-1212)
5. North Bay Contact
6. South Bay Contact

The team leader checked each morning with the weather service and also before leaving work in the afternoon. From these reports the status of the monitoring team was determined.

The monitoring was planned on the basis of obtaining samples from 20 storms each year. he actual number of discrete samples was dependent upon the duration of each storm and rating curve availability.

The normal monitoring time was expected to be between 8 and 10 hours. For the storms still in progress after 10 hourse, sampling will continue after the sample bottles are replaced. During the second year, 55 gallon stainless steel drums were used instead of sample bottles.

The Alameda County Flood Control District entered into an agreement with the United States Geological Survey to establish two water quality monitoring stations on Castro Valley Creek. One was located near the intersection of Madison Avenue and Seaview Avenue, and the other near North Third Street and Knox Avenue in Castro Valley. The USGS wa responsible for gathering flww and stage data and developing a rating curve for these stations. The Alameda County Flood Control istrict was responsible for collection or samples for chemical parameters and measurement of field parameter The samples were sent to the USGS Laboratory in enver, Colorado, for analysis.

The Alameda unty Flood Control and Water Cosnervation District contracted with the USG to perform the laboratory analysis f the receiving water samples. USGS performs a series of quality control checks on analytical results made by USGS Central Labs. The results were also checked by the person responsible for the project for which the data was collected. This person looks for outliers (values outside the previously observed or expected range of values) and asks the Central Lab to rerun results to confirm their accuracy.

USGS publishes a series of method manuals on the collection and analysis of water samples. These are not repeated here because of their ready availability and side acceptance.

GAGING STATION SITE SELECTION

Two continuous recording stream gages and two automatic ISCO water samplers with flow meter control were installed by USGS and ACFCWCD on Castro Valley Creek. The Corps of Engineers monitored another station below the confluence of Chabot Creek and Castro Valley Creek.

The criteria used for selecting the sites of the gaging stations and water quality monitoring stations was as follows:

The watershed had two distinct parts - the urban and non-urban areas. The rural area's contributions of sediments and pollutants were be subtracted from the rest of the watershed to give us an accurate accounting of pollutant and sediment loading in the urban study area. To accomplish this, a gaging and water quality monitoring station was established on Castro Valley Creek near the intersections of Seaview Avenue and Madison Avenue. This is the boundary line between the urban and rural areas of the watershed. Another gaging and monitoring station was established near the intersection of Knox Street and North 4th Street. This station was at the lower end of the watershed and measures the total flow and total pollutant loading of the watershed. With the stations located thus it is possible to separate the contributions of each portion of the watershed. The separation was critical since the study was concerned with the urban area.

PRECIPITATION MONITORING

The objective of the precipitation monitoring task is to provide rainfall data for the project and to develop a precipitation data base which correlates closely with the gaging and water quality monitoring stations.

Storm Definition

Because the stream flow data and water quality data had to be correlated with street surface sampling a "storm" was defined as: a period of time that includes a street surface sample taken no more than seven days before a rain event causing runoff and a street surface sample taken as soon as possible (when streets are dry enough) after the termination of rainfall.

Rain Gage Network

Three rain gages were used to monitor precipitation in the project area (Figure A-1). One was located near the intersection of Redwood Road and Proctor Road at Proctor School. This gage measured the rainfall in the upper watershed. Another was located at the Sydney School outside the study area and was used as a check against the Proctor gage. The third one was located at the Castro Valley Fire Station on San Miguel Avenue in central Castro Valley. From these stations, the rainfall record correlated well with the water quality and street surface data collected during the project.

Maintenance

The Proctor and Sydney rain gages were funded by the Corps of Engineers HEC unit and maintained by the U.S. Geological Survey in Menlo Park, California. The Castro Valley Fire Station gage was funded and maintained by the Alameda County Flood Control and Water Conservation District. The stream gaging stations at Knox Street and Seaview Avenue were maintained by the U.S. Geological Survey. The water quality sampling and equipment was maintained by the ACFCWCD.

Stream Flow Measurments

Stream flow measuring was accomplished with the help of the USGS under a cooperative agreement. The agreement provided for gaging stations and equipment with ACFCWCD. The County will providing the manpower and equipment to take water quality samples. The USGS supplied laboratory analysis of the water samples.

1. The stream level was monitored by a manometer-servo water level sensor and recorded on Stevens digital tape recorder. The water quality samples were taken by a modified ISCO automatic wastewater sampler initiated by a continuous recording modified ISCO Flowmeter with printer. All of the

2. A rating curve was established by the USGS and updated during storm events occurring during the project duration. Both high flows and low flows were rated.

Water Quality Parameters

Water Quality Parameters were selected to reflect those that had been monitored in previous water quality investigations and those suggested by EPA. Other parameters were selected by the Principal Investigator to specifically reflect those pollutants most easily identified on street surfaces in the study area. Collected water samples were sent to the USGS Laboratory in Arvada, Colorado for chemical analysis.

The parameters that were monitored are:

Arsenic	Ammonia Nitrogen
Cadmium	Total Nitrogen
Copper	Nitrogen total as Nitrate
Iron	Organic Nitrogen
Lead	Keljdah Nitrogen
Zinc	Nitrite & Nitrate
Mercury	Phosphorus
Nickel	Ortho Phosphate
Filterable Solids	Cations
Nonfilterable Solids	Anions
Volatile Suspended Solids	Alkalinity
Total Residue	Sulfate
	Hardness

Equipment

An ISCO (Instrumentation Specialties Co.) wastewater sampler connected to an ISCO Flowmeter using a pressure sensitve transducer was used to measure stage and an ISCO Printer was used to record amounts of stormflow and times

The power source for the sampling equipment was a 12V 90 amp hour car battery. Each station had 2 batteries assigned to it. During long storms this allowed one to be recharged while the other was in use. One extra battery was kept as a backup for the others. This worked well as one battery did fail during the project.

Sampling Procedure:

The sampling team leader kept track of the weather reports from the National Weather Service each day and determined whether the sampling equipment should be activated. The equipment was activated by a rise in stage. When the sampling equipment was in readiness it used very little power thus could be left on for long periods of time before storms.

The stainless steel container was chilled by the use of 5 gallon containers filled with ice and placed inside the sample container. This kept the sample chilled during monitoring and reduced biological activity that could alter the nutrient samples. When a storm was over and a street surface sample was taken, the water sample was collected and brought back to the ACFCWCD offices to be broken down, preserved and shipped to the USGS Water Quality Laboratory for analysis. The prepared samples were packed in ice and shipped in an insulated water tight container by Express Mail. Express Mail provided delivery within 24 hours of sample collection.

Quality Control:

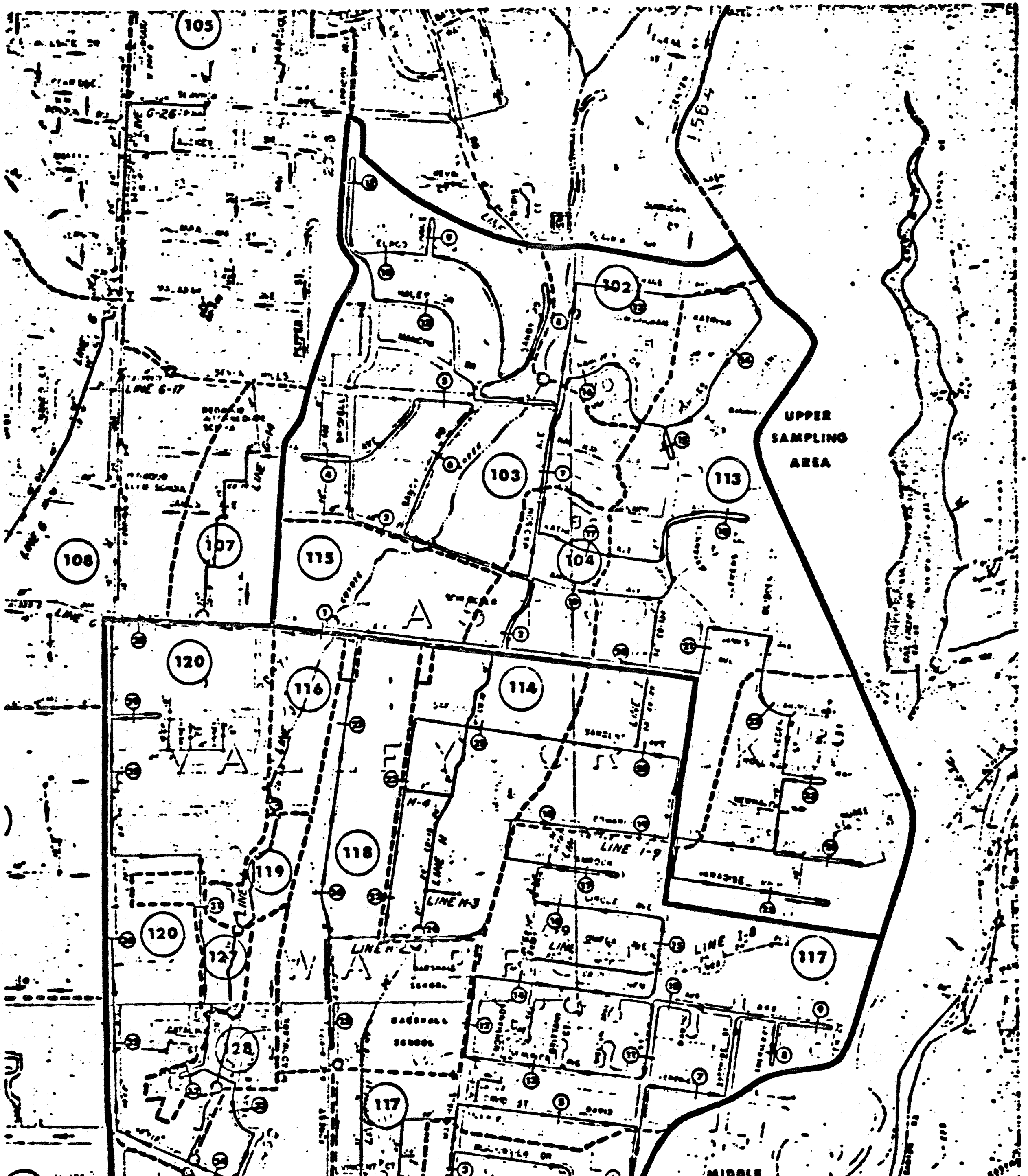
The District used water quality collection and preservation procedures as stated in "Standard Methods for the Examination of Water and Wastewater" Fourteenth Edition, 1975. The laboratory results were checked and monitored by a liaison person at the local USGS Headquarters. Once each year a qualified person from USGS observed the District's personnel sampling procedures and sample breakdown techniques. After observation the USGS representative would discuss problems or lapses in procedure he observed. This kept the District personnel keenly aware of the need for carefulness and the strict adherence to procedure that is necessary for a reliable water quality sampling program.

Training:

The District's personnel received training from the USGS on how to sample streams for water quality. This took the form of 1 day of classroom instruction and 1/2 day out in the field practicing the procedures learned the day before. The USGS was available for consultation on problems that arose during the sampling program.

Sampling and Calculation Sheets

The attached map, check-off lists, log-in and calculation sheets were used by the field and laboratory personnel. The map (Figures C-1 and C-2) show the approximate locations of the sub-sampling strips and the order for their sampling by test area. The sub-sample check-off sheet (Figure C-3) was used by the sampling team to confirm sampling progress, start and end times (to compare with the times of street cleaner operations during tests), to collect parking density information and to note any unusual conditions. The street cleaner operator sheet (Figure C-4) was used to confirm the start and end times of the street cleaning, to verify that the street cleaner was adjusted properly and to note any unusual cleaning conditions. Figure C-5, the log-in sheet, keeps track of the samples and was very important for quality control. Figures C-6 and C-7 helped the lab personnel make the moisture and particle size calculations and also include many cross-checks for quality control. The original wet tare weight of the sample (measured immediately after returning from sample collection and marked on the sampler check-off list) was checked with the wet tare weight before sample drying. The dry tare weight was also checked with the total dry weight after sieve analysis. If any discrepancies exist, the sample identification was confirmed from the log-in and sampler sheets. Many other values on these sheets were useful for quality assurance (such as percent moisture, sample densities particle size distributions and final curb-mile loading values). The project personnel soon learned reasonable ranges for these data and immediately to suspect problems if the data fell out of the reasonable range. The careful logging and tracking procedures (along with marking all samples) enabled problems to be solved with minimal data loss.



105
102
103
113
104
115
107
108
UPPER
SAMPLING
AREA
120
116
114
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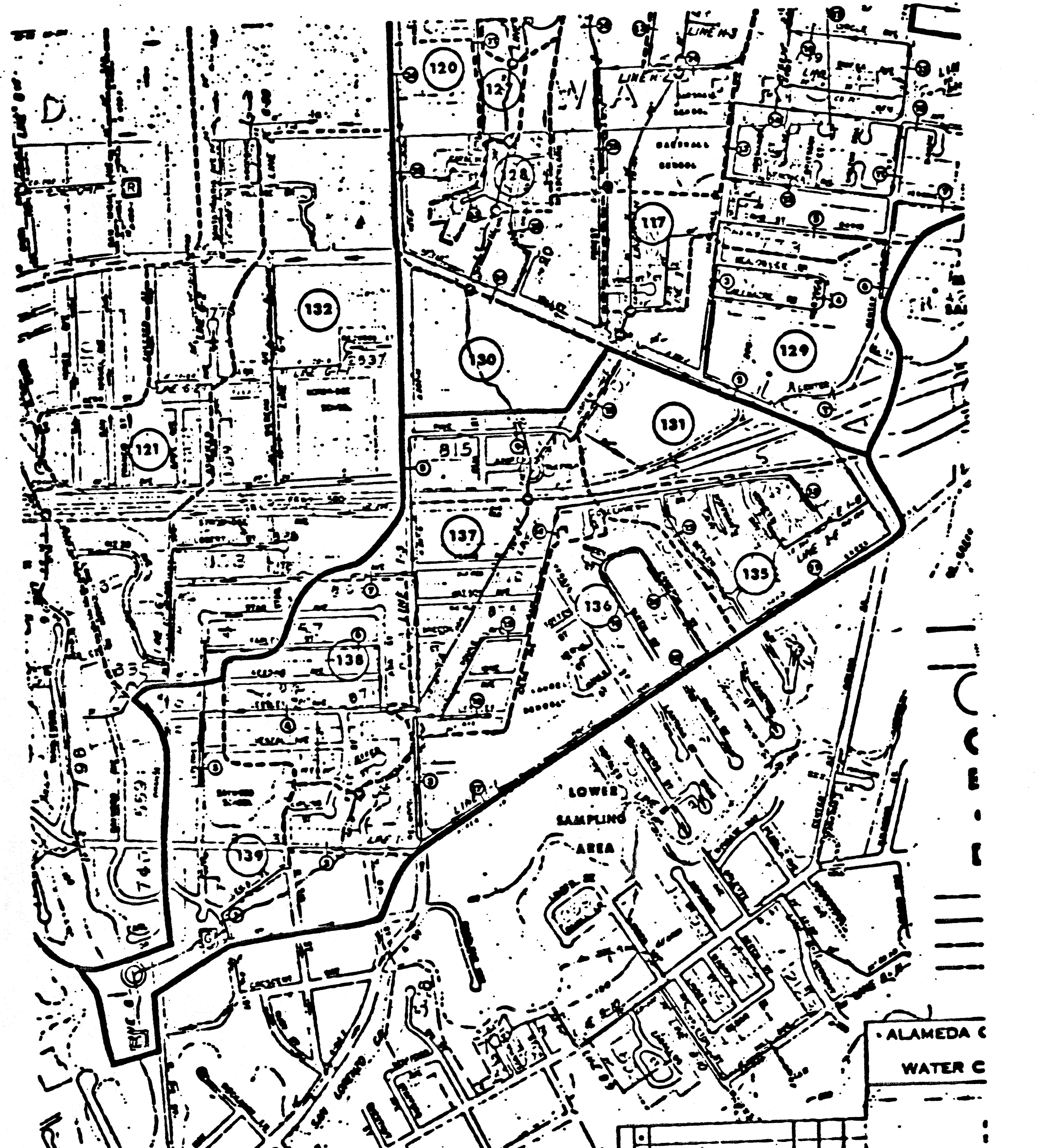
127
117
128
117
LINE G-26
LINE G-17
LINE 1-9
LINE H-3
LINE 1-8
MIDDLE


120
132
130
129
117
131
121
137
135
136
138
139
LOWER
SAMPLING
AREA
ALAMEDA C
WATER C

SAMPLE #	SIEVE SIZE	TARE WT. (GMS)	GROSS WT. (GMS)	NET WT. (GMS)	PERCENT SAMPLE	LBS/CURB MILE	REMARKS
	1/4"						
	#10						
	#20						
	#30						
	#60						
	#140						
	#325						
	Pan						
	1/4"						
	#10						
	#20						
	#30						
	#60						
	#140						
	#325						
	Pan						
	1/4"						
	#10						
	#20						
	#30						
	#60						
	#140						
	#325						
	Pan						
	1/4"						
	#10						
	#20						
	#30						
	#60						
	#140						
	#325						
	Pan						

Test Area Check List

Date

Sample No. ______________
Time of Start ______________

	1	26
	2	27
	3	28
	4	29
	5	30
GWW ______	6	31
	7	32
TARE ______	8	33
	9	34
NWW ______	10	35
	11	36
	12	37
	13	38
	14	39
	15	40
	16	41
	17	42
	18	43
	19	44
	20	45
	21	46
	22	47
	23	48
	24	49
	25	50
		51

Time at End ______

Sample No. ______________
Time of Start ______________

	1	26
	2	27
	3	28
	4	29
	5	30
GWW ______	6	31
	7	32
TARE ______	8	33
	9	34
NWW ______	10	35
	11	36
	12	37
	13	38
	14	39
	15	40
	16	41
	17	42
	18	43
	19	44
	20	45
	21	46
	22	47
	23	48
	24	49
	25	50
		51

Time at End ______

NOTES:

STREET CLEANING TESTS OPERATIONAL INFORMATION

1) Study area: A. Lower Test Area B. Middle Test Area
C. Upper Test Area

2) Date:________________

3) Equipment:____________________

4) Time at start of test:_______________

5) Check list:

a) equipment adjusted to optimum (factory recommended) conditions?

b) hopper empty before test?

6) Estimated volume of hopper contents after test:________________

7) Time at end of test:______________

8) Notes (unusual conditions, rain, etc.):

9) Operator:______________________________

L = Leaf Test
A = Street Accumulation Sample

SAMPLE INVENTORY

Sample ID	Date	Location	Time	Remarks

SAMPLE WEIGHTS

ample ID	Pan #	Tare Wt.	Gross Wt. Wet	Net Wt. Wet	Gross Wt Dry	Net Wt. Dry	% Moisture

Laboratory References for the Chemical Analysis of Street Dirt Samples.

PREPARATION, GRINDING

1975 Annual Book of Standards, preparing Coal Samples for Analysis, (modified procedure), D2013, pg. 271-285.

DIGESTION

1) 1975 Annual Book of ASTM Standards, "Analysis of Coal and Coke Ash," D2795, page 340 (modified procedure).
2) "Interim Methods for Sampling and Analysis of Priority Pollutants in Sediments and Fish Tissue." USEPA

METALS

1) Slavin, Walter, Atomic Absorption Spectroscopy, John Wiley & Sons, New York, NY, 1968, page 66-71.
2) Varian Techtron, Analytical Methods for Flame Spectroscopy, 1972
3) "Methods for Chemical Analysis of Water and Wastes." USEPA, 1974 (EPA-625-16-74-003).
4) "Analytical Methods for Atomic Absorption Spectrophotometry", Perkin-Elmer Corp., 1976.

ORTHO PHOSPHATE & TOTAL PHOSPHATE

1) 1975 Annual Book of ASTM Standards, "Analysis of Coal and Coke Ash", D2795, page 343.
2) "Standard Methods for the Examination of Water and Wastewater", 13th Edition, 1971.
3) "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1975.
4) "Methods for Chemical Analysis of Water and Wastes", USEPA, Washington, D.C., page 249.

KJELDAHL NITROGEN

1) 1975 Annual Book of ASTM Standards, "Nitrogen in the Analysis of Coal and Coke", D3179-73, page 395-398.
2) "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1975, APHA, AWWA, WPCF, page 406-440.

VOLATILE SOLIDS

1) 1975 Annual Book of ASTM Standards, "Volatile Matter in the Analysis Sample of Coal and Coke", D3175-73 (modified procedure), page 375-377.

2) "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1975, APHA, AWWA, WPCF, page 95.

SULFUR

1) "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1975.

2) "Sulfate in Water and Wastewater", Technicon Auto Analyzer II Industrial Method No 118-71W/B, Revised: 1977, Released: 1972, Technicon Industrial Systems.

3) Fisher Model 470 Sulfur Analyzer Instruction Manual, page 34-35.

C.O.D.

1) USDA Handbook #60, page 105.

2) Jackson, M.L. "Soil Chemical Analysis", Prentice Hall, Englewood Cliffs, NJ, 1958.

ARSENIC

1) "Determination of Selenium in Water, Wastewater, Sediments, and Sludge by Flameless Atomic Absorption Spectroscopy", Martin and Kopp, AA Newletter, No. 5, 1975.

2) "Atomic Absorption Analysis with the Graphite Furnace using Matrix Modification", Ediger, AA Newsletter, V. 14 No. 5, 1975.

3) Federal Register, Part II, EPA Water Programs, "Guidelines Establishing Test Procedures for the Analysis of Pollutants", December 1, 1976.

4) "Analytical Methods for Atomic Absorption Spectrophotometry using the HGA Graphite Furnace", Perkin-Elmer, 1973.

5) "Methods for Chemical Analysis of Water and Wastes", USEPA, EPA 600/4-79-020, March, 1979.

APPENDIX C. STREET DIRT DEPOSITION AND ACCUMULATION RATES

TABLE C1 CASTRO VALLEY STREET DIRT MEDIAN PARTICLE SIZE CHANGES FOR VARIOUS ACCUMULATION PERIODS

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Value (1)	First Yr. Lower Area % Change Per Day	First Yr. Middle Area Value (1)	First Yr. Middle Area % Change Per Day	First Yr. Upper Area Value (1)	First Yr. Upper Area % Change Per Day	Second Yr. Complete Area Value (1)	Second Yr. Complete Area % Change Per Day
0	380u	-	560u	-	430u	-	490u	-
1	390	2.6	565	0.9	440	2.3	490	0.3
3	400	2.0	570	0.6	460	2.3	490	0.3
5	420	2.0	575	0.4	490	2.0	495	0.3
7	440	1.5	580	0.4	500	1.5	500	0.3
10	450	1.5	590	0.3	520	1.3	500	0.3
20	510	1.3	610	0.3	570	1.0	510	0.2
30	530	0.4	615	0.1	590	0.4	530	0.2
55	550	0.2	620	0.1	610	0.1	560	0.1
75	-	-	-	-	-	-	590	0.1
110	-	-	-	-	-	-	600	0.1

(1) Values are expressed in microns.

TABLE C-2. CASTRO VALLEY LOADING, DEPOSITION AND ACCUMULATION VALUES

ARSENIC

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	.009	-	.008	-	.004	-	.006	-
1	.010	.0006	.008	.0005	.009	.0004	.007	.0007
3	.011	.0005	.010	.0005	.005	.0004	.008	.0006
5	.012	.0005	.011	.0005	.006	.0004	.010	.0006
7	.013	.0004	.012	.0005	.007	.0003	.010	.0005
10	.014	.0004	.013	.0005	.008	.0003	.013	.0004
20	.017	.0003	.017	.0004	.011	.0003	.017	.0003
30	.020	.0002	.021	.0003	.013	.0002	.020	.0002
55	.022	.0001	.026	.0002	.015	.0001	.025	.0001
75	-	-	-	-	-	-	.026	<.0001
110	-	-	-	-	-	-	.026	<.0001

LEAD

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	0.9	-	1.0	-	0.35	-	0.5	-
1	1.0	0.06	1.1	0.05	0.35	0.025	0.6	0.06
3	1.1	0.05	1.2	0.05	0.40	0.020	0.7	0.05
5	1.2	0.04	1.3	0.05	0.45	0.020	0.8	0.05
7	1.2	0.03	1.4	0.04	0.55	0.020	0.9	0.05
10	1.3	0.03	1.5	0.04	0.60	0.015	1.0	0.04
20	1.4	0.02	1.9	0.03	0.70	0.010	1.3	0.03
30	1.5	0.01	2.2	0.03	0.75	0.010	1.5	0.02
55	1.6	0.005	2.8	0.02	0.90	<0.010	1.8	0.01
75	-	-	-	-	-	-	1.9	0.01
110	-	-	-	-	-	-	2.0	<0.01

(1) Loading (Ldg.) value units are lbs/curb-mile.

TABLE C-3. CASTRO VALLEY LOADING, DEPOSITION AND ACCUMULATION VALUES

VOLITILE SOLIDS

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	40	-	30	-	20	-	20	-
1	40	3	30	4	20	2	23	3
3	50	3	40	4	25	2	28	3
5	55	3	50	4	30	2	34	3
7	60	3	55	3	35	2	39	2
10	65	2	65	3	40	1	48	2
20	80	2	95	3	50	1	60	1
30	90	1	120	2	55	<1	70	1
55	100	<1	150	1	60	<1	88	1
75	-	-	-	-	-	-	100	<1
110	-	-	-	-	-	-	110	<1

C.O.D.

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	50	-	50	-	24	-	25	-
1	50	3	50	3	25	2	30	5
3	60	3	60	3	30	2	40	4
5	65	2	65	3	32	2	50	4
7	65	2	70	2	37	1	60	3
10	75	2	75	2	40	1	70	3
20	90	2	100	2	52	1	85	2
30	110	2	115	2	60	1	100	1
55	120	1	135	1	72	<1	120	1
75	-	-	-	-	-	-	130	1
110	-	-	-	-	-	-	150	1

(1) Loading (Ldg.) value units are lbs/curb-mile.

TABLE C-4. CASTRO VALLEY LOADING, DEPOSITION AND ACCUMULATION VALUES

COPPER

Days After Street Cleaning or Significant Rain	First Yr. Lower Area		First Yr. Middle Area		First Yr. Upper Area		Second Yr. Complete Area	
	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)
0	0.040	-	0.035	-	0.020	-	0.023	-
1	0.045	0.0015	0.035	0.002	0.021	0.001	0.025	0.003
3	0.050	0.0015	0.045	0.002	0.023	0.0008	0.030	0.003
5	0.055	0.001	0.050	0.002	0.024	0.0007	0.036	0.002
7	0.060	0.001	0.055	0.0015	0.026	0.0007	0.040	0.002
10	0.060	0.001	0.060	0.0015	0.029	0.0006	0.050	0.002
20	0.060	0.0005	0.070	0.0015	0.035	0.0006	0.062	0.001
30	0.065	0.0005	0.085	0.001	0.040	0.0004	0.066	0.0004
55	0.065	<0.0005	0.090	<0.001	0.045	0.0002	0.069	<0.0001
75	-	-	-	-	-	-	0.070	<0.0001
110	-	-	-	-	-	-	0.070	<0.0001

CHROMIUM

Days After Street Cleaning or Significant Rain	First Yr. Lower Area		First Yr. Middle Area		First Yr. Upper Area		Second Yr. Complete Area	
	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)
0	0.017	0	0.14	-	0.06	-	0.026	-
1	0.18	0.003	0.15	0.005	0.06	0.003	0.030	0.005
3	0.19	0.003	0.16	0.005	0,07	0.002	0.050	0.005
5	0.19	0.003	0.17	0.004	0.07	0.002	0.055	0.005
7	0.19	0.002	0.18	0.004	0.08	0.002	0.060	0.004
10	0.20	0.002	0.20	0.004	0.08	0.002	0.075	0.003
20	-	-	0.24	0.003	0.10	0.002	0.10	0.002
30	-	-	0.26	0.002	0.11	0.001	0.12	0.002
55	-	-	0.30	0.001	0.12	<0.001	0.13	0.001
75	-	-	-	-	-	-	0.14	0.001
110	-	-	-	-	-	-	0.15	<0.001

(1) Loading (Ldg.) value units are lbs/curb-mile.

TABLE C-5. CASTRO VALLEY LOADING, DEPOSITION AND ACCUMULATION VALUES

SULFUR

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	0.6	-	0.5	-	0.30	-	0.35	-
1	0.7	0.04	0.6	0.03	0.30	0.02	0.40	0.03
3	0.8	0.04	0.7	0.03	0.30	0.02	0.50	0.03
5	0.8	0.03	0.7	0.03	0.40	0.02	0.60	0.03
7	0.8	0.03	0.8	0.03	0.40	0.02	0.65	0.03
10	0.9	0.03	0.8	0.03	0.50	0.02	0.75	0.03
20	1.3	0.02	1.1	0.02	0.60	0.01	0.90	0.02
30	1.4	0.02	1.3	0.02	0.75	0.01	1.10	0.02
55	1.5	0.01	1.6	0.01	0.90	0.01	1.20	0.01
75	-	-	-	-	-	-	1.30	<0.01
110	-	-	-	-	-	-	1.40	<0.01

ZINC

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0	0.19	-	0.14	-	0.06	-	0.08	-
1	0.20	0.006	0.15	0.008	0.07	0.004	0.08	0.007
3	0.21	0.005	0.17	0.007	0.08	0.004	0.09	0.007
5	0.22	0.004	0.18	0.006	0.08	0.004	0.12	0.007
7	0.22	0.004	0.18	0.005	0.09	0.003	0.13	0.006
10	0.23	0.003	0.21	0.005	0.11	0.003	0.15	0.006
20	0.25	0.002	0.27	0.005	0.13	0.003	0.18	0.004
30	0.26	0.001	0.31	0.004	0.14	0.002	0.20	0.003
55	0.26	<0.001	0.37	0.002	0.16	<0.001	0.24	0.002
75	-	-	-	-	-	-	0.27	0.001
110	-	-	-	-	-	-	0.28	<0.001

(1) Loading (Ldg.) value units are lbs/curb-mile.

(2) Accumulation rate units are lbs/curb-mile/day, for the time period from the preceeding time to the time shown. As an example, the value shown for

TABLE C-6. CASTRO VALLEY LOADING, DEPOSITION AND ACCUMULATION VALUES

PHOSPHORUS

Days After Street Cleaning or Significant Rain	First Yr. Lower Area		First Yr. Middle Area		First Yr. Upper Area		Second Yr. Complete Area	
	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)
0	0.27	-	0.26	-	0.15	-	0.15	-
1	0.29	0.017	0.29	0.013	0.15	0.005	0.18	0.013
3	0.32	0.014	0.32	0.012	0.17	0.005	0.21	0.013
5	0.35	0.013	0.35	0.012	0.18	0.005	0.23	0.012
7	0.37	0.010	0.36	0.012	0.19	0.005	0.25	0.010
10	0.40	0.009	0.41	0.012	0.20	0.004	0.29	0.010
20	0.46	0.007	0.50	0.010	0.25	0.003	0.37	0.007
30	0.50	0.005	0.58	0.008	0.28	0.002	0.41	0.004
55	0.54	0.001	0.72	0.003	0.33	0.001	0.49	0.002
75	-	-	-	-	-	-	0.54	0.002
110	-	-	-	-	-	-	0.60	0.001

ORTHO PHOSPHATE

Days After Street Cleaning or Significant Rain	First Yr. Lower Area		First Yr. Middle Area		First Yr. Upper Area		Second Yr. Complete Area	
	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)	Ldg. Value (1)	Accum. Rate (2)
0	0.025	-	0.024	-	0.012	-	0.006	-
1	0.025	0.002	0.025	0.001	0.012	0.0005	0.007	0.0007
3	0.026	-	0.027	0.001	0.013	0.0004	0.008	0.0007
5	0.027	-	0.029	0.001	0.014	0.0004	0.010	0.0006
7	0.028	-	0.030	0.0008	0.015	0.0004	0.011	0.0006
10	0.028	-	0.033	0.0007	0.016	0.0003	0.014	0.0005
20	0.029	-	0.038	0.0006	0.019	0.0002	0.017	0.0004
30	-	-	0.042	0.0004	0.021	0.0001	0.020	0.0002
55	-	-	0.048	0.0002	0.023	<0.0001	0.024	0.0002
75	-	-	-	-	-	-	0.026	0.0001
110	-	-	-	-	-	-	0.028	<0.0001

(1) Loading (Ldg.) value units are lbs/curb-mile.

(2) Accumulation rate units are lbs/curb-mile/day, for the time period from the preceeding time to the time shown. As an example, the value shown for

TABLE C-7 Castro Valley Loading, Deposition and Accumulation Valves for Total Kjeldahl Nitrogen

Days After Street Cleaning or Significant Rain	First Yr. Lower Area Ldg. Value (1)	First Yr. Lower Area Accum. Rate (2)	First Yr. Middle Area Ldg. Value (1)	First Yr. Middle Area Accum. Rate (2)	First Yr. Upper Area Ldg. Value (1)	First Yr. Upper Area Accum. Rate (2)	Second Yr. Complete Area Ldg. Value (1)	Second Yr. Complete Area Accum. Rate (2)
0		-		-		-	0.5	-
1							0.6	0.04
3							0.7	0.04
5							0.8	0.03
7							0.8	0.03
10							0.9	0.03
20							1.2	0.03
30							1.4	0.02
55							1.7	0.01
75	-	-	-	-	-	-	1.8	0.01
110	-	-	-	-	-	-	2.0	<0.01

(1) Loading (Ldg.) value units are lbs/curb-mile.

(2) Accumulation rate units are lbs/curb-mile/day, for the time period from the preceeding time to the time shown. As an example, the value shown for 20 days is the average accumulation rate for the time period 10 to 20 days after cleaning or significant rain. In addition, the first accumulation rate shown (for the 0 to 1 day period) is estimated to be the deposition rate.

APPENDIX D. POSSIBLE URBAN RUNOFF IMPROVEMENTS RESULTING FROM STREET CLEANING

TABLE D-1. STORM HISTORY AND IT'S EFFECTS ON THE STREET CLEANING PROGRAM - YEAR ONE

Monitored Storm Code	Storm Period Date	Storm Period Duration (days)	Total Rain (in.)	Urban Runoff (acre-feet)	Preceeding Dry Period for Street Cleaning (days)	Max. Cleaning Effort Possible (Passes Per Preceeding Week
	11/12-13/78	NA	0.27	1.2	Very long	3
	11/19-22	NA	1.96	28.9	6	3
	12/1	NA	0.36	5.3	9	3
A	12/17-18*	12.5	0.44	5.1	16	3
	1/3-5/79	1.3	0.14	0.9	16	3
B, C & D	1/7-11*	3.5	4.34	151.6	3	2
E	1/14-15*	1.5	1.71	66.6	3	2
	1/17	0.2	0.24	5.9	2	1
	1/30	0.01	0.01	0	13	3
	2/3	0.01	0.01	0	17	3
F,G,H,I, J & K	2/13-3/1*	15	4.94	157.9	27	3
	3/3	4.5	0.03	0	3	2
L	3/15-17*	2.1	0.75	9.5	15	3
M	3/26-28*	2.3	1.98	35.0	9	3
	4/6	0.01	0.02	0	9	3
	4/9	0.01	0.01	0	12	3
	4/16-17	0.6	0.09	1.0	19	3
	4/22-23	0.9	0.15	0.7	5	3
N	4/25-26*	0.5	0.38	6.8	2	1
	5/5-8	2.3	0.14	1.9	9	3
	5/15	0.01	0.01	0	16	3
TOTAL YEAR 1		47.3+ days	17.98	478		56

TABLE D-2. STORM HISTORY AND ITS EFFECTS ON THE STREET CLEANING PROGRAM - YEAR TWO

Monitored Storm Code	Storm Period Date	Storm Period Duration (days)	Total Rain (in.)	Urban Runoff (acre-feet)	Preceeding Dry Period for Street Cleaning (days)	Max. Cleaning Effort Possible (Passes Per Preceeding Week)
	10/15/79	0.01	0.01	0	169	3
1	10/18-20*	1.1	1.01	19.8	172	3
	10/25-26	1.2	1.69	52.3	5	3
	10/30-31	0.1	0.04	0	4	2
3	11/2-5*	0.6	0.60	33.0	9	3
	11/7-8	0.6	0.05	0	2	1
4	11/16-17*	0.5	0.83	17.1	10	3
5	11/22-25*	3.4	0.73	23.7	5	3
6	12/19-20*	1.4	0.57	7.4	24	3
7	12/23-25*	2.7	3.52	140.4	3	2
8	12/30-31*	1.5	0.62	23.6	5	3
	1/1/80	0.01	0.01	0	1	1
	1/2	0.01	0.01	0	2	1
	1/4	0.01	0.01	0	4	2
9	1/8-17*	8.7	4.12	110.5	7	3
10	2/14-21*	10.8	5.93	343.1	28	3
	2/24	0.01	0.01	0	3	2
11	2/27*	0.4	0.73	22.5	6	3
	2/28	0.01	0.01	0	1	1
	2/29	0.01	0.01	0	2	1
12 & 13	3/2-6*	3.2	1.27	42.5	3	2
	3/11	0.01	0.01	0	5	3
	3/14	0.1	0.03	0	8	3
	3/15	0.01	0.01	0	9	3
	3/21	0.01	0.01	0	15	3
14	3/25*	0.2	0.19	2.0	19	3
	3/27	0.01	0.01	0	2	1
15	4/4-5*	NA	1.06	28.9	10	3
16 & 17	4/20-22*	NA	0.39	10.4	15	3
TOTAL YEAR 2		36.6+ Days	23.49	877		70

D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS

STORM CODE:	C	D & E	F	G & H & I & J	K	L	M	N	1	3
SOLIDS:										
e storm street (lbs)	66,300	15,400	37,200	27,100	29,200	43,800	45,000	33,500	32,500	27,900
storm street (lbs)	16,400	18,800	23,000	18,500	37,600	22,300	23,300	23,900	21,100	8,800
street (lbs)	49,900	-3,400	14,200	8,640	-8,400	21,600	21,700	9,500	11,400	19,100
ff yield (lbs)	112,000	65,600	8,000	119,000	12,300	6,990	26,500	4,970	26,500	51,500
e/after ratio	4.0	0.82	1.6	1.5	0.78	2.0	1.9	1.4	1.5	3.2
e/yield ratio	0.59	0.23	4.7	0.23	2.4	6.3	1.7	6.7	1.2	0.54
street/yield ratio	0.45	-0.05	1.8	0.073	-0.68	3.1	0.82	1.9	0.43	0.37
re storm street (lbs)	245	33	63	39	50	69	65	47	73	57
storm street (lbs)	24	27	32	28	64	27	34	33	44	5.2
street (lbs)	221	7	30	11	-14	42	31	14	29	52
off yield (lbs)	-	-	19	80	9.6	6.7	21	8.2	179	104
re/after ratio	10	1.2	2.0	1.4	0.78	2.6	1.9	1.4	1.7	11
re/yield ratio	-	-	3.3	0.49	5.2	10	3.1	5.7	0.41	0.55
street/yield ratio	-	-	1.6	0.14	-1.5	6.2	1.5	1.7	0.16	0.50
:										
re storm street (lbs)	33	4.9	9.8	7.0	8.1	12	12	8.5	9.6	7.7
r storm street (lbs)	3.6	5.1	5.7	4.7	12	4.9	5.9	6.0	6.0	0.62
street (lbs)	30	-0.2	4.1	2.3	-3.5	6.9	5.7	2.5	3.6	7.1
off yield (lbs)	70	41	9.6	54	9.9	4.5	14	4.1	119	77
re/after ratio	9.2	0.96	1.7	1.5	0.68	2.4	2.0	1.4	1.6	12
re/yield ratio	0.47	0.12	1.0	0.13	0.82	2.7	0.86	2.1	0.08	0.1
street/yield ratio	0.42	-0.005	0.43	0.043	-0.4	1.5	0.41	0.61	0.03	0.09
re storm street (lbs)	10,600	1,750	3,070	2,160	2,370	3,740	3,930	2,850	4,880	4,080
r storm street (lbs)	1,310	1,500	1,830	1,440	2,980	1,790	1,860	1,880	3,280	490
street (lbs)	9,330	257	1,240	720	-600	1,950	2,070	970	1,660	3,590
off yield (lbs)	20,000	-	7,200	22,600	3,710	2,490	7,400	2,020	12,400	16,700
re/after ratio	8.1	1.2	1.7	1.5	0.80	2.1	2.1	1.5	1.5	8.6
re/yield ratio	1.1	-	0.43	0.10	0.63	1.5	0.53	1.4	0.39	0.24
street/yield ratio	0.47	-	0.17	0.032	-0.2	0.78	0.28	0.48	0.13	0.21

TABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS

	4	5	6	7	8	9	10	11	12 & 13
TOTAL SOLIDS:									
Before storm street (lbs)	13,200	15,000	32,900	21,400	21,400	30,700	16,300	17,700	13,500
After storm street (lbs)	10,800	7,000	16,700	14,600	20,500	17,400	11,600	6,620	15,300
street (lbs)	2,400	8,000	16,200	6,800	900	13,300	4,700	11,100	-1,800
Run-off yield (lbs)	6,890	9,090	4,710	48,100	14,400	128,000	217,000	33,700	44,500
Before/after ratio	1.2	2.1	2.0	1.5	1.0	1.8	1.4	2.7	0.88
Befpre/yield ratio	1.9	1.7	7.0	0.44	1.5	0.23	0.08	0.52	0.30
street/yield ratio	0.35	0.88	3.4	0.14	0.06	0.12	0.02	0.32	-0.04
LEAD:									
Before storm street (lbs)	23	25	47	26	29	42	25	26	21
After storm street (lbs)	17	11	19	18	21	19	14	8	22
street (lbs)	6	14	28	9	8	23	11	18	-1
Run-off yield (lbs)	29	29	22	38	32	36	286	18	28
Before/after ratio	1.3	2.3	2.5	1.5	1.4	2.2	1.8	3.2	1
Before/yield ratio	0.78	0.86	2.1	0.69	0.9	1.2	0.09	1.4	0.74
street/yield ratio	0.19	0.49	1.3	0.23	0.24	0.65	0.04	1.0	-0.04
ZINC:									
Before storm street (lbs)	3.3	3.4	7.0	3.7	4.1	5.8	3.6	3.7	2.9
After storm street (lbs)	2.6	1.5	2.7	2.6	3.3	2.8	2.1	1.2	3.1
street (lbs)	0.7	1.9	4.3	1.1	0.8	3.0	1.5	2.5	-0.2
Run-off yield (lbs)	12	16	13	51	20	31	163	16	21
Before/after ratio	1.3	2.3	2.6	1.4	1.2	2.1	1.7	3.1	0.9
Before/yield ratio	0.27	0.21	0.55	0.07	0.21	0.19	0.02	0.23	0.14
street/yield ratio	0.06	0.12	0.34	0.02	0.04	0.10	0.01	0.15	-0.01
COD:									
Before storm street (lbs)	1,190	1,450	3,130	2,060	2,170	2,900	1,240	1,400	1,120
After storm street (lbs)	950	670	1,450	1,270	1,400	1,600	980	440	1,140
street (lbs)	240	780	1,680	790	770	1,300	260	960	-20
Run-off yield (lbs)	5,020	4,220	-	15,700	4,090	19,300	50,400	7,300	10,950
Before/after ratio	1.3	2.1	2.1	1.6	1.6	1.8	1.3	32	0.98
Before/yield ratio	0.24	0.34	-	0.13	0.53	0.15	0.02	0.19	0.10
street/yield ratio	0.05	0.18	-	0.05	0.19	0.07	0.01	0.13	-0.002

3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Concluded)

STORM CODE:	C	D & E	F	G & H & I & J	K	L	M	N	1	3
:										
torm street (lbs)	30	4.9	8.7	6.2	6.9	12	13	9.5	4.9	4.2
orm street (lbs)	4	4.2	5.3	4.1	8.7	5.7	7	6.8	3.3	0.5
reet (lbs)	26	0.7	3.4	2.1	-1.8	6.6	6	2.7	1.6	3.7
yield (lbs)	-	-	0.55	5.7	0.86	0.63	1.9	0.25	3.3	0.1
fter ratio	8.1	1.2	1.6	1.5	0.8	2.1	2.0	1.4	1.5	8.1
ield ratio	-	-	16	1.1	8.0	19	6.8	38	1.5	42
reet/yield ratio	-	-	6.2	0.37	-2.1	11	3.3	11	0.5	37
torm street (lbs)	140	22	43	29	33	35	36	27	45	38
orm street (lbs)	16	20	25	19	42	16	18	19	30	6.2
reet (lbs)	120	2	18	10	-8	19	18	8	15	32
yield (lbs)	-	-	-	-	-	-	-	-	-	-
fter ratio	8.8	1.1	1.7	1.5	0.8	2.2	2.0	1.4	1.5	6.1
ield ratio	-	-	-	-	-	-	-	-	-	-
reet/yield ratio	-	-	-	-	-	-	-	-	-	-
SOLIDS:										
storm street (lbs)	1,200	2,100	1,900	1,300	1,500	3,100	3,200	2,800	3,410	2,940
torm street (lbs)	1,600	900	1,100	880	1,800	1,500	1,400	1,700	2,510	360
treet (lbs)	400	1,200	800	460	-300	1,600	1,800	1,100	900	2,580
yield (lbs)	-	-	-	-	-	-	-	-	-	-
after ratio	7.5	2.3	1.7	1.5	0.8	2.1	2.3	1.6	1.4	8.1
yield ratio	-	-	-	-	-	-	-	-	-	-
treet/yield ratio	-	-	-	-	-	-	-	-	-	-
JELDAHL N:										
storm street (lbs)	77	12	23	16	18	17	18	13	63	51
torm street (lbs)	9	11	13	10	22	8	8	9	45	11
treet (lbs)	68	1	10	6	-4	9	10	4	18	40
yield (lbs)	470	-	83	470	97	18	135	41	406	293
after ratio	8.6	1.1	1.8	1.6	0.8	2.1	2.2	1.5	1.4	4.6
yield ratio	0.16	-	0.23	0.03	0.19	0.94	0.13	0.30	0.15	0.17
treet/yield ratio	0.15	-	0.12	0.01	-0.04	0.48	0.07	0.10	0.04	0.14

TABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Concluded)

	14	15	16 & 17	Min.	Max.	Avg.	Avg. lb/curb-Mile
CHROMIUM:							
Before storm street (lbs)	3.3	4.2	5.8	1.3	30	6.3	0.12
After storm street (lbs)	2.3	3.5	3.8	0.5	8.7	3.4	0.066
street (lbs)	1.0	0.7	2.0	-1.8	26	2.9	0.056
Run-off yield (lbs)	-	-	-		5.7	1.3	0.025
Before/after ratio	1.4	1.2	1.5	0.8	8.1	2.1	-
Before/yield ratio	-	-	-	1.1	42	13	-
street/yield ratio	-	-	-	-2.1	37	6.3	-
SULFUR:							
Before storm street (lbs)	52	35	53	16	140	36	0.70
After storm street (lbs)	20	29	28	8	42	19	0.37
street (lbs)	32	6	25	-8	120	17	0.33
Run-off yield (lbs)	-	-	-	-	-	-	-
Before/after ratio	2.6	1.2	1.9	0.8	8.8	2.2	-
Before/yield ratio	-	-	-	-	-	-	-
street/yield ratio	-	-	-	-	-	-	-
VOLATILE SOLIDS:							
Before storm street (lbs)	1,600	2,210	2,790	980	3,410	2,000	39
After storm street (lbs)	1,140	1,540	1,910	360	2,510	1,240	24
street (lbs)	460	670	880	-300	2,580	760	15
Run-off yield (lbs)	-	-	-	-	-	-	-
Before/after ratio	1.4	1.4	1.5	0.8	8.1	2.2	-
Before/yield ratio	-	-	-	-	-	-	-
street/yield ratio	-	-	-	-	-	-	-
TOTAL KJELDAHL N:							
Before storm street (lbs)	36	46	67	12	77	33	0.64
After storm street (lbs)	26	38	40	8	45	20	0.39
street (lbs)	10	8	27	-4	68	13	0.25
Run-off yield (lbs)	-	-	-	18	1,390	290	5.6
Before/after ratio	1.4	1.2	1.7	0.8	8.6	2.0	-
Before/yield ratio	-	-	-	0.02	0.94	0.2	-
street/yield ratio	-	-	-	-0.04	0.48	0.1	-.

ABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Concluded)

	4	5	6	7	8	9	10	11	12 & 13
HROMIUM:									
efore storm street (lbs)	1.3	1.6	4.7	3.2	3.3	4.4	2.2	2.4	1.9
fter storm street (lbs)	1.0	0.7	2.5	2.1	2.9	2.6	1.8	1.0	1.9
street (lbs)	0.3	0.9	2.2	1.1	0.4	1.8	0.4	1.4	0.01
un-off yield (lbs)		0.07	-	2.5	2.7	-	1.2		0.3
efore/after ratio	1.3	2.2	1.9	1.5	1.1	1.7	1.2	2.5	1.0
efore/yield ratio	-	25	-	1.3	1.2	-	1.8	-	6.3
street/yield ratio	-	13	-	0.44	0.15	-	0.37	-	0.04
ULFUR:									
efore storm street (lbs)	18	19	39	22	22	34	19	20	16
fter storm street (lbs)	15	9	18	16	22	17	13	8	18
street (lbs)	3	10	21	6	0.1	16	7	13	-2.3
un-off yield (lbs)	-	-	-	-	-	-	-	-	-
efore/after ratio	1.2	2.1	2.2	1.4	1.0	2.0	1.5	2.7	0.86
efore/yield ratio	-	-	-	-	-	-	-	-	-
street/yield ratio	-	-	-	-	-	-	-	-	-
OLATILE SOLIDS:									
efore storm street (lbs)	980	1,090	2,590	1,760	1,810	2,410	1,100	1,190	990
fter storm street (lbs)	740	520	1,340	1,160	1,460	1,390	840	440	1,000
street (lbs)	240	570	1,250	600	350	1,010	260	750	-10
un-off yield (lbs)	-	-	-	-	-	-	-	-	-
efore/after ratio	1.3	2.1	1.9	1.5	1.2	1.7	1.3	2.7	0.90
efore/yield ratio	-	-	-	-	-	-	-	-	-
street/yield ratio	-	-	-	-	-	-	-	-	-
OTAL KJELDAHL N:									
efore storm street (lbs)	21	21	53	32	30	45	24	25	27
fter storm street (lbs)	18	10	26	23	32	27	18	10	22
street (lbs)	3	11	27	8	-2	18	6	14	5
un-off yield (lbs)	61	78	-	-	120	530	1,390	156	-
efore/after ratio	1.2	2.2	2.0	1.4	0.94	1.7	1.3	2.5	1.2
efore/yield ratio	0.34	0.28	-	-	0.26	0.09	0.02	0.16	-
street/yield ratio	0.06	0.15	-	-	-0.02	0.03	0.004	0.09	-

TABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Contd.)

	14	15	16 & 17	Min.	Max.	Avg.	Avg. lb/curb-Mile
TOTAL P:							
Before storm street (lbs)	11	13	15	4	66	15	0.29
After storm street (lbs)	8	11	11	3	18	8.4	0.16
street (lbs)	3	2	4	-3	58	6.6	0.13
Run-off yield (lbs)	-	-	-	5.8	389	79	1.5
Before/after ratio	1.4	1.2	1.0	0.6	8.3	1.8	-
Before/yield ratio	-	-	-	0.02	2.7	0.7	-
street/yield ratio	-	-	-	-0.23	1.4	0.3	-
O-PO4:							
Before storm street (lbs)	0.5	0.6	0.9	0.3	5.1	1.0	0.019
After storm street (lbs)	0.3	0.5	0.5	0.1	1.4	0.5	0.010
street (lbs)	0.14	0.13	0.37	-0.2	4.5	0.5	0.010
Run-off yield (lbs)	-	-	-	0.9	466	101	1.9
Before/after ratio	1.4	1.3	1.7	0.86	8.5	2.0	-
Before/yield ratio	-	-	-	0.001	1.7	0.19	-
street/yield ratio	-	-	-	-0.004	0.49	0.06	-
ARSENIC:							
Before storm street (lbs)	0.26	0.28	0.46	0.14	2.7	0.5	0.010
After storm street (lbs)	0.13	0.18	0.24	0.04	0.75	0.2	0.004
street (lbs)	0.13	0.10	0.22	-0.14	2.3	0.3	0.006
Run-off yield (lbs)	-	-	-	0.04	3.7	0.7	0.014
Before/after ratio	2.0	1.6	1.9	0.83	16	2.7	-
Before/yield ratio	-	-	-	0.04	8.1	2.4	-
street/yield ratio	-	-	-	-0.52	2.8	0.9	-
COPPER:							
Before storm street (lbs)	2.4	2.9	4.6	1.0	10.6	2.3	0.044
After storm street (lbs)	1.8	2.6	2.7	0.5	3.2	1.5	0.029
street (lbs)	0.6	0.3	1.9	-0.7	9.4	0.8	0.015
Run-off yield (lbs)	-	-	-	0.7	38	9.5	0.18
Before/after ratio	1.3	1.1	1.7	0.78	8.8	2.0	-
Before/yield ratio	-	-	-	0.06	3.0	0.7	-
street/yield ratio	-	-	-	-0.30	1.5	0.3	-

TABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Contd.)

	4	5	6	7	8	9	10	11	12 & 13
TOTAL P:									
Before storm street (lbs)	7	6	14	9	9	13	7	7	4
After storm street (lbs)	6	4	8	6	9	8	5	3	7
street (lbs)	1	2	6	3		6	2	4	-2
Run-off yield (lbs)	11	14	-	164	16	215	389	11	-
Before/after ratio	1.1	1.7	1.8	1.5	1.0	1.7	1.3	2.5	0.6
Before/yield ratio	0.62	0.42	-	0.06	0.55	0.06	0.02	0.71	-
street/yield ratio	0.07	0.17	-	0.02		0.03	0.004	0.42	-
O-PO4:									
Before storm street (lbs)	0.3	0.3	0.7	0.4	0.4	0.6	0.3	0.3	0.3
After storm street (lbs)	0.2	0.1	0.3	0.3	0.4	0.4	0.2	0.1	0.3
street (lbs)	0.04	0.15	0.3	0.08	0.03	0.3	0.07	0.2	-0.04
Run-off yield (lbs)	9	14	-	392	9.7	313	466	39	-
Before/after ratio	1.2	2.1	2.0	1.3	1.1	1.8	1.3	2.5	0.9
Before/yield ratio	0.03	0.02	-	0.001	0.04	0.002	0.001	0.009	-
street/yield ratio	0.004	0.01	-	0.0002	0.003	0.001	0.0002	0.005	-
ARSENIC:									
Before storm street (lbs)	0.17	0.20	0.33	0.22	0.25	0.32	0.15	0.17	0.14
After storm street (lbs)	0.13	0.08	0.13	0.12	0.12	0.16	0.09	0.05	0.13
street (lbs)	0.04	0.12	0.20	0.10	0.13	0.17	0.06	0.12	0.01
Run-off yield (lbs)	0.04	0.07	-	1.8	0.13	1.8	3.7	0.26	-
Before/after ratio	1.3	2.4	2.5	1.8	2.1	2.0	1.6	3.5	1.1
Before/yield ratio	4.7	3.1	-	0.12	1.9	0.18	0.04	0.65	-
street/yield ratio	1.0	1.8	-	0.06	0.97	0.09	0.02	0.47	-
COPPER:									
Before storm street (lbs)	1.0	1.1	3.0	2.1	1.8	2.8	1.6	1.8	1.3
After storm street (lbs)	0.7	0.5	1.7	1.4	1.9	1.6	1.1	0.7	1.5
street (lbs)	0.3	0.6	1.3	0.7	-0.08	1.2	0.5	1.2	-0.2
Run-off yield (lbs)	8	3.9	-	6.3	18	4.6	29	3.1	3.7
Before/after ratio	1.5	2.3	1.8	1.5	0.9	1.8	1.5	2.8	0.9
Before/yield ratio	0.13	0.28	-	0.33	0.10	0.61	0.06	0.58	0.35
street/yield ratio	0.04	0.16	-	0.11	-0.004	0.27	0.02	0.37	-0.06

3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS (Contd.)

STORM CODE:	C	D & E	F	G & H & I & J	K	L	M	N	1	3
:										
storm street (lbs)	66	11	19	13	15	18	18	14	19	16
torm street (lbs)	8	9	11	9	18	8.2	9.1	9.6	13	4.1
treet (lbs)	58	2	8	4	-3	9.3	9.2	4.1	5.4	12
yield (lbs)	130	-	23	130	13	6.7	38	5.8	44	58
after ratio	8.3	1.2	1.7	1.4	0.83	2.2	1.1	1.5	1.4	3.9
yield ratio	0.51	-	0.82	0.10	1.2	2.7	0.47	2.4	0.43	0.27
treet/yield ratio	0.45	-	0.35	0.031	-0.23	1.4	0.24	0.71	0.12	0.21
storm street (lbs)	5.1	0.85	1.4	1.0	1.2	1.9	2.0	1.6	0.9	0.8
torm street (lbs)	0.6	0.71	0.88	0.7	1.4	0.91	1.0	1.1	0.6	0.2
treet (lbs)	4.5	0.14	0.55	0.3	-0.2	0.94	1.0	0.46	0.3	0.6
yield (lbs)	-	-	29	260	8.9	2.9	15	0.9	35	29
after ratio	8.5	1.2	1.6	1.4	0.86	2.1	2.0	1.5	1.5	4.6
yield ratio	-	-	0.05	0.004	0.14	0.66	0.13	1.7	0.03	0.03
treet/yield ratio	-	-	0.02	0.001	-0.004	0.32	0.07	0.49	0.01	0.02
:										
storm street (lbs)	2.7	0.44	0.73	0.54	0.62	0.43	0.45	0.34	0.72	0.62
torm street (lbs)	0.33	0.37	0.45	0.38	0.75	0.20	0.23	0.24	0.51	0.04
treet (lbs)	2.3	0.07	0.28	0.16	-0.14	0.24	0.22	0.11	0.21	0.58
yield (lbs)	-	-	0.30	1.8	0.27	0.10	0.50	0.042	0.22	0.21
after ratio	8.2	1.2	1.6	1.4	0.83	2.2	2.0	1.4	1.4	16
yield ratio	-	-	2.4	0.3	2.3	4.3	0.9	8.1	3.3	3.0
treet/yield ratio	-	-	0.93	0.09	-0.52	2.4	0.44	2.6	0.96	2.8
storm street (lbs)	10.6	1.7	3.3	2.3	2.5	3.1	2.9	2.1	2.2	1.8
torm street (lbs)	1.2	1.5	1.9	1.5	3.2	1.3	1.5	1.5	1.3	0.62
treet (lbs)	9.4	0.2	1.4	0.8	-0.7	1.8	1.4	0.6	0.91	1.2
yield (lbs)	-	-	2.3	13	2.2	1.2	2.9	0.7	38	15
after ratio	8.8	1.1	1.7	1.5	0.78	2.4	1.9	1.4	1.7	2.9
yield ratio	-	-	1.4	0.18	1.1	2.6	1.0	3.0	0.06	0.12
treet/yield ratio	-	-	0.61	0.06	-0.30	1.5	0.48	0.83	0.02	0.08

TABLE D3 STREET SURFACE LOADS, WASH-OFFS AND URBAN RUN-OFF YIELDS FOR MONITORED STORMS

	14	15	16 & 17	Min.	Max	Avg.	Avg. lb/curb-Mile
TOTAL SOLIDS:							
Before storm street (lbs)	24,200	30,300	43,600	13,200	66,300	29,000	560
After storm street (lbs)	16,500	25,300	26,600	6,620	37,600	18,300	350
street (lbs)	7,700	5,000	17,000	-8,400	49,900	10,700	210
Run-off yield (lbs)	688	10,100	11,500	688	217,000	43,700	850
Before/after ratio	1.5	1.2	1.6	0.78	4.0	1.7	-
Before/yield ratio	35	3.0	3.8	0.08	7.0	3.6	-
street/yield ratio	11	0.50	1.5	-0.68	11	1.2	-
LEAD:							
Before storm street (lbs)	40	43	70	21	245	53	1.0
After storm street (lbs)	25	35	34	5.2	64	26	0.50
street (lbs)	15	8	36	-14	221	27	0.52
Run-off yield (lbs)	1.8	14	15	1.8	179	49	0.95
Before/after ratio	1.6	1.2	2.1	0.78	11	2.5	-
Before/yield ratio	2.7	3.2	4.7	0.09	5.7	2.4	-
street/yield ratio	82	0.6	2.4	-1.5	8.2	1.3	-
ZINC:							
Before storm street (lbs)	5.6	6.2	11.1	2.9	33	7.9	0.15
After storm street (lbs)	3.5	5.0	4.8	0.62	12	4.1	0.08
street (lbs)	2.1	12	6.3	-3.5	30	3.8	0.07
Run-off yield (lbs)	1.3	22	9.3	1.3	163	35	0.68
Before/after ratio	1.6	1.2	2.3	0.68	9.2	2.5	-
Before/yield ratio	4.4	0.29	1.2	0.02	4.4	0.7	-
street/yield ratio	1.7	0.06	0.68	-0.4	1.7	0.3	-
COD:							
Before storm street (lbs)	2,070	2,520	3,620	1,120	10,600	2,900	56
After storm street (lbs)	1,200	1,630	2,170	490	3,280	1,470	28
street (lbs)	870	890	1,450	-600	9,330	1,430	28
Run-off yield (lbs)	-	7,590	-	2,020	50,400	12,200	240
Before/after ratio	1.7	1.6	1.7	0.80	8.6	2.3	-
Before/yield ratio	-	0.33	-	0.02	1.5	0.5	-
street/yield ratio	-	0.12	-	-0.2	0.78	0.2	-

ABLE D-4. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR TOTAL SOLIDS

					MONTHLY STREET CLEANING				WEEKLY STREET CLEANING			
torm No.	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Savings (lbs/curb mile) 0.013	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	Savings (lbs/curb mile) 0.0091	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
C	1/8	1	112,000	1,280	330	17,000	94,900	2	630	32,600	79,400	29
& E	1/10-14	1	65,600	298	0	0	65,600	0	0	0	65,600	0
F	2/13-14	27	8,000	720	0	0	8,000	0	70	3,620	4,380	45
,H,I,J	2/15-22	2	119,000	524	0	0	119,000	0	0	0	119,000	0
K	2/28-3/1	5	12,300	565	0	0	12,300	0	0	0	12,300	0
L	3/15-17	15	6,990	847	0	0	6,990	0	197	10,200	- 3,210	100
M	3/26-28	10	26,500	870	0	0	26,500	0	220	11,400	15,100	43
N	4/26	31	4,970	650	0	0	4,970	0	0	0	4,970	0
1	10/18-19	175	26,500	628	0	0	26,500	0	0	0	26,500	0
3	11/3	9	51,500	539	0	0	51,500	0	0	0	51,500	0
4	11/16-17	13	6,890	256	0	0	6,890	0	0	0	6,890	0
5	11/22-25	6	9,090	291	0	0	9,090	0	0	0	9,090	0
6	12/19-20	25	4,710	637	0	0	4,710	0	0	0	4,710	0
7	12/23-25	4	48,100	414	0	0	48,100	0	0	0	48,100	0
8	12/30-31	5	14,400	414	0	0	14,400	0	0	0	14,400	0
1980												
9	1/8-17	8	128,000	594	0	0	128,000	0	0	0	128,000	0
10	2/14-24	30	217,000	316	0	0	217,000	0	0	0	217,000	0
11	2/27-28	6	33,700	342	0	0	33,700	0	0	0	33,700	0
2 & 13	3/2-6	4	44,500	261	0	0	44,500	0	0	0	44,500	0
14	3/25	19	688	468	0	0	688	0	0	0	688	0
15	4/4-5	10	10,100	587	0	0	10,100	0	0	0	10,100	0
6 & 17	4/20-22	15	11,500	843	0	0	11,500	0	193	9,980	1,520	87
vg. or Total			962,000			17,000	945,000	0.2		67,800	894,000	7
inimum												
aximum												

D-4.MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR TOTAL SOLIDS

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.0063	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.0049	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1	112,0001	1.280	830	42,900	69,100	38	930	48,100	63,900	43
	1/10-14	1	65,600	298	0	0	65,600	0	0	0	65,600	0
	2/13-14	27	8,000	720	270	13,900	- 5,960	174	370	19,100	- 11,100	240
,J	2/15-22	2	119,000	524	74	3,830	115,000	3	174	9,000	110,000	8
	2/28-3/1	5	12,300	565	115	5,950	6,350	48	215	11,100	1,180	90
	3/15-17	15	6,990	847	397	20,500	-20,500	290	497	25,700	- 18,700	370
	3/26-28	10	26,500	870	420	21,700	4,790	82	520	26,900	- 380	100
	4/26	31	4,970	650	200	10,300	- 5,370	210	300	15,500	- 10,500	310
	10/18-19	175	26,500	628	178	9,200	17,300	35	278	14,400	12,100	54
	11/3	9	51,500	539	89	4,600	46,900	9	189	9,780	41,700	19
	11/16-17	13	6,890	256	0	0	6,890	0	0	0	6,890	0
	11/22-25	6	9,090	291	0	0	9,090	0	0	0	9,090	0
	12/19-20	25	4,710	637	187	9,670	- 4,960	210	287	14,800	- 10,100	310
	12/23-25	4	48,100	414	0	0	48,100	0	64	3,300	44,800	7
	12/30-31	5	14,400	414	0	0	14,400	0	64	3,300	11,100	23
1980												
	1/8-17	8	128,000	594	144	7,440	121,000	6	244	12,600	115,000	10
	2/14-24	30	217,000	316	0	0	217,000	0	0	0	217,000	0
	2/27-28	6	33,000	342	0	0	33,700	0	0	0	33,700	0
13	3/2-6	4	44,500	261	0	0	44,500	0	0	0	44,500	0
	3/25	19	688	468	18	930	- 240	135	118	6,100	- 5,400	890
	4/4-5	10	10,100	587	137	7,080	3,020	70	237	12,300	- 2,150	120
17	4/10-22	15	11,500	843	393	20,300	- 8,820	180	493	25,500	- 14,000	220
r Total			962,0900			178,000	784,000	19		257,480	704,000	27
um												
um												

-5.MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR LEAD

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	MONTHLY STREET CLEANING Savings (lbs/curb mile) 1.4	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.98	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
79												
	1/8	1										
	1/10-14	1										
	2/13-14	27	19	1.22	0	0	19	0	0.24	12	7	63
0	2/15-22	2	80	0.75	0	0	80	0	0	0	80	0
	2/28-3/1	5	9.6	0.97	0	0	9.6	0	0	0	10	0
	3/15-17	15	6.7	1.33	0	0	6.7	0	0.35	18	-11	270
	3/26-28	10	21	1.26	0	0	21	0	0.28	14	7	67
	4/26	31	8.2	0.91	0	0	8.2	0	0	0	8	0
	10/18-19	175	179	1.41	0.01	0.5	178	0.3	0.43	22	157	12
	11/3	9	104	1.10	0	0	104	0	0.12	6	98	6
	11/16-17	13	29	0.44	0	0	29	0	0	0	29	0
	11/22-25	6	29	0.48	0	0	29	0	0	0	29	0
	12/19-20	25	22	0.91	0	0	22	0	0	0	22	0
	12/23-25	4	38	0.50	0	0	38	0	0	0	38	0
	12/30-31	5	32	0.56	0	0	32	0	0	0	32	0
980												
	1/8-17	8	36	0.81	0	0	36	0	0	0	36	0
	2/14-24	30	286	0.48	0	0	286	0	0	0	286	0
	2/27-28	6	18	0.50	0	0	18	0	0	0	18	0
3	3/2-6	4	28	0.41	0	0	28	0	0	0	28	0
	3/25	19	1.8	0.77	0	0	1.8	0	0	0	2	0
	4/4-5	10	14	0.83	0	0	14	0	0	0	14	0
7	4/20-22	15	15	1.35	0	0	15	0	0.37	19	- 4	130
Total		19	976	0.85		0.5	976	0.05		91	886	9
m			49									
m												

D-5. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR LEAD (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.0068	TWICE WEEKLY: Max. runoff load savings (lbs.)	TWICE WEEKLY: Min. new Runoff Load (lbs.)	TWICE WEEKLY: Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.53	THREE TIMES WEEKLY: Max. runoff load savings (lbs.)	THREE TIMES WEEKLY: Min. new Runoff Load (lbs.)	THREE TIMES WEEKLY: Max. Runoff Imprvmt. (%)
1979												
	1/8	1										
	1/10-14	1										
	2/13-14	27	19	1.22	0.54	28	- 9	150	0.69	36	- 17	190
,J	2/15-22	2	90	0.75	0.07	4	76	5	0.22	12	69	15
	2/28-3/1	5	9.6	0.97	0.29	15	- 5	150	0.44	23	- 13	240
	3/15-17	15	6.7	1.33	0.65	34	- 27	500	0.80	41	- 35	610
	3/26-28	10	21	1.26	0.58	30	- 9	140	0.73	38	- 17	180
	4/26	31	8.2	0.91	0.23	12	- 4	150	0.38	20	- 11	240
	10/18-19	175	179	1.41	0.73	38	140	21	0.88	46	134	26
	11/3	9	104	1.10	0.42	22	82	21	0.57	29	75	28
	11/16-17	13	29	0.44	0	0	29	0	0	0	29	0
	11/22-25	6	29	0.48	0	0	29	0	0	0	29	0
	12/19-20	25	22	0.91	0.23	12	10	55	0.38	20	2	91
	12/23-25	4	38	0.50	0	0	38	0	0	0	38	0
	12/30-31	5	32	0.56	0	0	32	0	0.03	2	30	6
1980												
	1/8-17	8	36	0.81	0.13	7	29	19	0.28	14	22	39
	2/14-24	30	286	0.48	0	0	286	0	0	0	286	0
	2/27-28	6	18	0.50	0	0	18	0	0	0	18	0
13	3/2-6	4	28	0.41	0	0	28	0	0	0	28	0
	3/25	19	1.8	0.77	0.09	5	- 3	280	0.24	12	- 11	670
	4/4-5	10	14	0.83	0.15	8	6	57	0.30	16	- 2	110
17	4/20-22	15	15	1.35	0.67	35	- 20	230	0.82	42	- 27	280
or Total		19	976	0.85		250	726	26		351	627	36
mum			49									
mum												

D-6. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ARSENIC

					MONTHLY STREET CLEANING				WEEKLY STREET CLEANING			
	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Savings (lbs/curb mile) 0.013	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	Savings (lbs/curb mile) 0.0091	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1										
;	1/10-14	1										
	2/13-14	27	0.30	0.013	0	0		0	0.0039	0.22	0.083	73
,J	2/15-22	2	1.8	0.010	0	0		0	0.0009	0.05	1.7	3
	2/28-3/1	5	0.27	0.011	0	0		0	0.0019	0.11	0.16	41
	3/15-17	15	0.10	0.0077	0	0		0	0	0	0.16	0
	3/26-28	10	0.50	0.0081	0	0		0	0	0	0.16	0
	4/26	31	0.04	0.0061	0	0		0	0	0	0.16	0
	10/18-19	175	0.22	0.013	0	0		0	0.0039	0.22	0	100
	11/3	9	0.21	0.011	0	0		0	0.0019	0.11	0.10	52
	11/16-17	13	0.036	0.0031	0	0		0	0	0	0.10	0
	11/22-25	6	0.065	0.0036	0	0		0	0	0	0.10	0
	12/19-20	25										
	12/23-25	4	1.8	0.0039	0	0		0	0	0	0.10	0
	12/30-31	5	0.13	0.0045	0	0		0	0	0	0.10	0
1980												
	1/8-17	8	1.8	0.0057	0	0		0	0	0	0.10	0
	2/14-24	30	3.7	0.0027	0	0		0	0	0	0.10	0
	2/27-28	6	0.26	0.0031	0	0		0	0	0	0.10	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			11.2			0		0%		0.71	10.5	6%
mum			0.75									
mum			N=15									

)-6. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ARSENIC (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.0063	TWICE WEEKLY STREET CLEANING: Max. runoff load savings (lbs.)	TWICE WEEKLY STREET CLEANING: Min. new Runoff Load (lbs.)	TWICE WEEKLY STREET CLEANING: Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING: Savings (lbs/curb mile) 0.0049	THREE TIMES WEEKLY STREET CLEANING: Max. runoff load savings (lbs.)	THREE TIMES WEEKLY STREET CLEANING: Min. new Runoff Load (lbs.)	THREE TIMES WEEKLY STREET CLEANING: Max. Runoff Imprvmt. (%)
979												
	1/8	1										
	1/10-14	1										
	2/13-14	27	0.030	0.013	0.0067	0.037	-0.07	123	0.0081	0.45	-0.15	150
J	2/15-22	2	1.8	0.010	0.0037	0.21	1.6	12	0.0051	0.28	1.5	16
	2/28-3/1	5	0.27	0.011	0.0047	0.26	0.008	96	0.0061	0.34	-0.07	125
	3/15-17	15	0.10	0.0077	0.0014	0.078	0.022	78	0.0028	0.16	-0.06	160
	3/26-28	10	0.50	0.0081	0.0018	0.10	0.40	20	0.0032	0.18	0.32	36
	4/26	31	0.04	0.0061	0	0	0.40	0	0.0012	0.07	-0.03	175
	10/18-19	175	0.22	0.013	0.0067	0.37	-0.15	170	0.0081	0.45	-0.23	200
	11/3	9	0.21	0.011	0.0047	0.26	-0.052	124	0.0061	0.34	-0.13	160
	11/16-17	13	0.036	0.0031	0	0	-0.052	0	0	0	-0.13	0
	11/22-25	6	0.065	0.0036	0	0	-0.052	0	0	0	-0.13	0
	12/19-20	25										
	12/23-25	4	1.8	0.0039	0	0	-0.052	0	0	0	-0.13	0
	12/30-31	5	0.13	0.0045	0	0	-0.052	0	0	0	-0.13	0
1980												
	1/8-17	8	1.8	0.0057	0	0	-0.052	0	0.0008	0.04	1.8	2
	2/14-24	30	3.7	0.0027	0	0	-0.052	0	0	0	1.8	0
	2/27-28	6	0.26	0.0031	0	0	-0.052	0	0	0	1.8	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
r Total			11.2			1.7	9.6	15%		2.3	8.9	21%
um			0.75									
um			N=15									

-7. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR COPPER

Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	MONTHLY STREET CLEANING Savings (lbs/curb mile) 0.076	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.052	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
79											
1/8	1										
1/10-14	1										
2/13-14	27	2.3	0.059	0	0	2.3	0	0.007	0.39	1.9	17
2/15-22	2	13	0.041	0	0	13	0	0	0	Same	0
2/28-3/1	5	2.2	0.045	0	0	2.2	0	0	0		0
3/15-17	15	1.2	0.056	0	0	1.2	0	0.004	0.22	15	18
3/26-28	10	2.9	0.052	0	0	2.9	0	0	0	Same	0
4/26	31	0.7	0.038	0	0	0.7	0	0	0	Same	0
10/18-19	175	38	0.040	0	0	38	0	0	0	Same	0
11/3	9	15	0.032	0	0	15	0	0	0	Same	0
11/16-17	13	7.9	0.018	0	0	7.9	0	0	0	Same	0
11/22-25	6	3.9	0.020	0	0	3.9	0	0	0	Same	0
12/19-20	25										
12/23-25	4	6.3	0.038	0	0	6.3	0	0	0	Same	0
12/30-31	5	18	0.032	0	0	18	0	0	0	Same	0
80											
1/8-17	8	4.6	0.050	0	0	4.6	0	0	0	Same	0
2/14-24	30	29	0.029	0	0	29	0	0	0	Same	0
2/27-28	6	3.1	0.032	0	0	3.1	0	0	0	Same	0
3/2-6	4	3.7	0.023	0	0	3.7	0	0	0	Same	0
3/25	19										
4/4-5	10										
4/20-22	15										
Total		152			0	152	0		0.61	151	<1%
		N=16									

E D-7. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR COPPER (continued)

					TWICE WEEKLY STREET CLEANING				THREE TIMES WEEKLY STREET CLEANING			
m	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Savings (lbs/curb mile) 0.036	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	Savings (lbs/curb mile) 0.028	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1										
E	1/10-14	1										
	2/13-14	27	2.3	0.059	0.023	1.3	1.0	57	0.031	1.7	0.6	74
I,J	2/15-22	2	13	0.041	0.005	0.28	13	2	0.013	0.7	12	5
	2/28-3/1	5	2.2	0.045	0.009	0.50	1.7	23	0.017	0.95	1.3	43
	3/15-17	15	1.2	0.056	0.020	1.1	0.09	92	0.028	1.6	-0.36	130
	3/26-28	10	2.9	0.052	0.016	0.89	2.0	31	0.024	1.3	1.6	45
	4/26	31	0.7	0.038	0.002	0.11	-0.8	16	0.010	0.56	0.14	80
	10/18-19	175	38	0.040	0.004	0.22	38	6	0.012	0.67	37	2
	11/3	9	15	0.032	0	0	Same	0	0.004	0.22	15	1
	11/16-17	13	7.9	0.018	0	0	Same	0	0	0	Same	0
	11/22-25	6	3.9	0.020	0	0	Same	0	0	0	Same	0
	12/19-20	25										
	12/23-25	4	6.3	0.038	0.002	0.11	6.2	2	0.010	0.56	5.7	9
	12/30-31	5	18	0.032	0	0	Same	6	0.004	0.22	18	1
1980												
	1/8-17	8	4.6	0.050	0.014	0.78	3.8	17	0.022	1.2	3.4	26
	2/14-24	30	29	0.029	0	0	Same	0	0.001	0.056	29	<1
	2/27-28	6	3.1	0.032	0	0	Same	0	0.004	0.22	2.9	7
& 13	3/2-6	4	3.7	0.023	0	0	Same	0	0	0	Same	0
	3/25	19										
	4/4-5	10										
& 17	4/20-22	15										
or Total			152			5.3	147	3%		10	142	7%
imum												
imum			N=16									

)-8. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ZINC (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Twice Weekly Street Cleaning: Savings (lbs/curb mile) 0.0063	Twice Weekly: Max. runoff load savings (lbs.)	Twice Weekly: Min. new Runoff Load (lbs.)	Twice Weekly: Max. Runoff Imprvmt. (%)	Three Times Weekly Street Cleaning: Savings (lbs/curb mile) 0.0049	Three Times Weekly: Max. runoff load savings (lbs.)	Three Times Weekly: Min. new Runoff Load (lbs.)	Three Times Weekly: Max. Runoff Imprvmt. (%)
979												
	1/8	1	70	0.58	0.47	26	44	37	0.49	27	43	39
	1/10-14	1	41	0.088	0	0	41	0	0	0	41	0
	2/13-14	27	9.6	0.18	0.07	3.9	5.7	41	0.09	5.1	4.5	53
J	2/15-22	2	54	0.13	0.02	1.1	53	2	0.04	2.3	52	4
	2/28-3/1	5	9.9	0.15	0.04	2.2	7.7	22	0.06	3.5	6.4	35
	3/15-17	15	4.5	0.22	0.11	6.1	-1.6	135	0.13	7.4	-2.9	160
	3/26-28	10	14	0.22	0.11	6.1	7.9	44	0.13	7.4	6.6	53
	4/26	31	4.1	0.15	0.04	2.2	1.9	54	0.06	3.5	0.6	85
	10/18-19	175	119	0.17	0.06	3.3	116	3	0.08	4.6	114	4
	11/3	9	77	0.14	0.03	1.7	75	2	0.05	2.9	74	4
	11/16-17	13	12	0.059	0	0	12	0	0	0	77	0
	11/22-25	6	16	0.061	0	0	16	0	0	0	12	0
	12/19-20	25	13	0.13	0.02	1.1	12	9	0.04	2.3	11	18
	12/23-25	4	51	0.066	0	0	51	0	0	0	51	0
	12/30-31	5	20	0.074	0	0	20	0	0	0	20	0
980												
	1/8-17	8	31	0.10	0	0	31	0	0.01	0.7	30	0
	2/14-24	30	163	0.065	0	0	163	0	0	0	163	0
	2/27-28	6	16	0.066	0	0	16	0	0	0	16	0
3	3/2-6	4	21	0.052	0	0	21	0	0	0	21	0
	3/25	19	1.3	0.10	0	0	1.3	0	0.01	0.7	0.6	54
	4/4-5	10	22	0.11	0	0	22	0	0.02	1.2	21	6
7	4/20-22	15	9.3	0.20	0.09	5.0	4.3	54	0.11	6.2	3.1	67
- Total			779	0.14		59	720	8		75	704	10
m			35	0.051								
m				0.58								

D-8 MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ZINC

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	MONTHLY STREET CLEANING Savings (lbs/curb mile) 0.013	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0091	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1	70	0.58	0.34	19	51	0	0.42	23	47	33
	1/10-14	1	42	0.088	0	0	41	0	0	0	41	0
	2/13-14	27	9.6	0.18	0	0	9.6	0	0.02	1.1	8.4	12
,J	2/15-22	2	54	0.13	0	0	54	0	0	0	54	0
	2/28-3/1	5	9.9	0.15	0	0	9.9	0	0	0	9.9	0
	3/15-17	15	4.5	0.22	0	0	4.5	0	0.06	3.3	1.2	73
	3/26-28	10	14	0.22	0	0	14	0	0.06	3.3	11	24
	4/26	31	4.1	0.15	0	0	4.1	0	0	0	4.1	0
	10/18-19	175	119	0.17	0	0	119	0	0.01	0.6	118	0.5
	11/3	9	77	0.14	0	0	77	0	0	0	77	0
	11/16-17	13	12	0.059	0	0	12	0	0	0	12	0
	11/22-25	6	16	0.061	0	0	16	0	0	0	16	0
	12/19-20	25	13	0.13	0	0	13	0	0	0	13	0
	12/23-25	4	51	0.066	0	0	51	0	0	0	51	0
	12/30-31	5	20	0.074	0	0	20	0	0	0	20	0
1980												
	1/8-17	8	31	0.010	0	0	31	0	0	0	31	0
	2/14-24	30	30	163	0.065	0	163	0	0	0	163	0
	2/27-28	6	6	16	0	0	16	0	0	0	16	0
13	3/2-6	4	21	0.025	0	0	21	0	0	0	21	0
	3/25	19	1.3	0.10	0	0	1.3	0	0	0	1.3	0
	4/4-5	10	22	0.11	0	0	22	0	0	0	22	0
17	4/20-22	15	9.3	0.20	0	0	7.1	0	0.04	2.2	7.1	24
r Total			779	0.14		19	728	2		34	746	4
num			35	0.052								
num				0.58								

-9. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR COD

					Monthly Street Cleaning				Weekly Street Cleaning			
	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Savings (lbs/curb mile) 86	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	Savings (lbs/curb mile) 59	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
979												
	1/8	1	20,000	190	104	5,800	14,200	29	131	7,300	12,700	37
	1/10-14	1										
	2/13-14	27	7,200	55	0	0	Same	0	0	0	7,200	0
	2/15-22	2	22,600	39	0	0	Same	0	0	0	22,600	0
	2/28-3/1	5	3,710	43	0	0	Same	0	0	0	3,710	0
	3/15-17	15	2,490	67	0	0	Same	0	8	450	2,040	18
	3/26-28	10	7,400	71	0	0	Same	0	12	670	6,730	9
	4/26	31	2,020	51	0	0	Same	0	0	0	2,020	0
	10/18-19	175	12,400	88	2	111	12,300	1	29	1,620	10,800	13
	11/3	9	16,700	73	0	0	Same	0	14	780	15,900	5
	11/16-17	13	5,020	21	0	0	Same	0	0	0	5,020	0
	11/22-25	6	4,220	26	0	0	Same	0	0	0	4,220	0
	12/19-20	25										
	12/23-25	4	15,700	37	0	0	Same	0	0	0	15,700	0
	12/30-31	5	4,090	39	0	0	Same	0	0	0	4,090	0
980												
	1/8-17	8	19,300	52	0	0	Same	0	0	0	19,300	0
	2/14-24	30	50,400	22	0	0	Same	0	0	0	50,400	0
	2/27-28	6	7,300	25	0	0	Same	0	0	0	7,300	0
3	3/2-6	4	10,900	20	0	0	Same	0	0	0	10,900	0
	3/25	19										
	4/4-5	10	7,590	45	0	0	Same	0	0	0	7,590	0
7	4/20-22	15										
Total			219,000	54		5,910	213,000	3%		10,800	208,000	5%
m			12,200	20								
m			#:18	190								

-9. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR COD (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING: Savings (lbs/curb mile) 41	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING: Savings (lbs/curb mile) 32	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
979												
	1/8	1	20,000	190	149	8,300	11,700	42	158	8,800	11,200	44
	1/10-14	1										
	2/13-14	27	7,200	55	14	780	6,400	11	23	1,280	5,900	18
J	2/15-22	2	22,600	39	0	0	22,600	0	7	390	22,200	2
	2/28-3/1	5	3,710	43	2	110	3,600	3	11	610	3,100	16
	3/15-17	15	2,490	67	26	1,450	1,040	58	35	1,950	540	78
	3/26-28	10	7,400	71	30	1,670	5,730	23	39	2,170	5,230	29
	4/26	31	2,020	51	10	560	1,460	28	19	1,060	960	53
	10/18-19	175	12,400	88	47	2,620	9,780	21	56	3,120	9,280	25
	11/3	9	16,700	73	32	1,780	14,900	11	41	2,280	14,400	14
	11/16-17	13	5,020	21	0	0	5,020	0	0	0	5,020	0
	11/22-25	6	4,220	26	0	0	4,220	0	0	0	4,220	0
	12/19-20	25										
	12/23-25	4	15,700	37	0	0	15,700	0	5	280	15,400	2
	12/30-31	5	4,090	39	0	0	4,090	0	7	390	3,700	10
980												
	1/8-17	8	19,300	52	11	610	18,700	3	20	1,110	18,200	6
	2/14-24	30	50,400	22	0	0	50,400	0	0	0	50,400	0
	2/27-28	6	7,300	25	0	0	7,300	0	0	0	7,300	0
3	3/2-6	4	10,900	20	0	0	10,900	0	0	0	10,900	0
	3/25	19										
	4/4-5	10	7,590	45	4	220	7,370	3	13	720	6,890	10
7	4/20-22	15										
Total			219,000	54		18,100	200,000	8%		24,200	195,000	11%
um			12,200	20								
um			#:18	190								

E D-10 MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR PHOSPHORUS

					Monthly Street Cleaning				Weekly Street Cleaning			
m	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	Savings (lbs/curb mile) 0.013	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	Savings (lbs/curb mile) 0.0091	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1	130	1.2	0.75	42	88	32	0.89	50	80	38
E	1/10-14	1										
	2/13-14	27	23	0.34	0	0	88	0	0.03	1.7	21	7
I,J	2/15-22	2	130	0.23	0	0	88	0	0	0	21	0
	2/28-3/1	5	13	0.27	0	0	88	0	0	0	21	0
	3/15-17	15	6.7	0.32	0	0	88	0	0.01	0.6	6	9
	3/26-28	10	38	0.32	0	0	88	0	0.01	0.6	37	2
	4/26	31	5.8	0.25	0	0	88	0	0	0	37	0
	10/18-19	175	44	0.34	0	0	88	0	0.03	1.7	42	4
	11/3	9	58	0.29	0	0	88	0	0	0	42	0
	11/16-17	13	11	0.12	0	0	88	0	0	0	42	0
	11/22-25	6	14	0.11	0	0	88	0	0	0	42	0
	12/19-20	25										
	12/23-25	4	164	0.17	0	0	88	0	0	0	42	0
	12/30-31	5	16	0.16	0	0	88	0	0	0	42	0
1980												
	1/8-17	8	215	0.23	0	0	88	0	0	0	42	0
	2/14-24	30	389	0.13	0	0	88	0	0	0	42	0
	2/27-28	6	11	0.13	0	0	88	0	0	0	42	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			1,270			42	1230	3		55	1,220	4
mum			79									
imum			u = 16									

)-10. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR PHOSPHORUS (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0063	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0049	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1	130	1.2	1.0	56	74	43	1.0	58	72	45
	1/10-14	1										
	2/13-14	27	23	0.34	0.13	7.2	16	31	0.18	10	13	43
,J	2/15-22	2	130	0.23	0.02	1.1	129	1	0.07	3.9	126	3
	2/28-3/1	5	13	0.27	0.06	3.3	9.7	25	0.11	6.1	6.9	47
	3/15-17	15	6.7	0.32	0.11	6.1	0.6	91	0.16	8.9	-22	130
	3/26-28	10	38	0.32	0.11	6.1	32	16	0.16	8.9	29	23
	4/26	31	5.8	0.25	0.04	2.2	3.6	38	0.09	5.0	0.8	86
	10/18-19	175	44	0.34	0.13	7.2	37	16	0.18	10	34	23
	11/3	9	58	0.29	0.08	4.5	54	8	0.13	7.2	51	12
	11/16-17	13	11	0.12	0	0	54	0	0	0	51	0
	11/22-25	6	14	0.11	0	0	54	0	0	0	51	0
	12/19-20	25										
	12/23-25	4	164	0.17	0	0	54	0	0.01	0.6	163	0.3
	12/30-31	5	16	0.16	0	0	54	0	0	0	163	0
1980												
	1/8-17	8	215	0.23	0.02	1.1	214	0	0.07	3.9	211	2
	2/14-24	30	389	0.13	0	0	214	0	0	0	211	0
	2/27-28	6	11	0.13	0	0	214	0	0	0	211	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
r Total			1,270			95	1,180	7		124	1,150	10
um			79									
um			u = 16									

D-II. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ORTHO PHOSPHATE

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	MONTHLY STREET CLEANING Savings (lbs/curb mile) 0.029	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.020	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1										
	1/10-14	1										
	2/13-14	27	29	0.025	0	0	Same	0	0.005	0.28	29	1
,J	2/15-22	2	260	0.018	0	0	Same	0	0	0	Same	0
	2/28-3/1	5	8.9	0.022	0	0	Same	0	0.002	0.11	8.8	1
	3/15-17	15	2.9	0.034	0.005	0.28	2.6	10	0.014	0.78	2.1	27
	3/26-28	10	15	0.036	0.007	0.39	15	3	0.016	0.89	14	6
	4/26	31	0.9	0.029	0	0	Same	0	0.009	0.50	0.4	56
	10/18-19	175	35	0.016	0	0	Same	0	0	0	Same	0
	11/3	9	29	0.014	0	0	Same	0	0	0	Same	0
	11/16-17	13	9.0	0.0048	0	0	Same	0	0	0	Same	0
	11/22-25	6	14	0.0052	0	0	Same	0	0	0	Same	0
	12/19-20	25										
	12/23-25	4	390	0.0066	0	0	Same	0	0	0	Same	0
	12/30-31	5	9.7	0.0075	0	0	Same	0	0	0	Same	0
1980												
	1/8-17	8	310	0.011	0	0	Same	0	0	0	Same	0
	2/14-24	30	466	0.0054	0	0	Same	0	0	0	Same	0
	2/27-28	6	39	0.0059	0	0	Same	0	0	0	Same	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			1620			0.67	1620	<<1%		2.6	1620	<1%
mum												
mum												

D-II.MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR ORTHO PHOSPHATE (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.014	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.011	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1										
	1/10-14	1										
	2/13-14	27	29	0.025	0.011	0.61	28	2	0.014	0.78	28	3
,J	2/15-22	2	260	0.018	0.004	0.22	260	<<1	0.007	0.39	260	<1
	2/28-3/1	5	8.9	0.022	0.088	0.45	8.5	5	0.011	0.61	8.3	7
	3/15-17	15	2.9	0.034	0.020	1.1	1.8	38	0.023	1.3	1.6	45
	3/26-28	10	15	0.036	0.022	1.2	14	8	0.025	1.4	14	9
	4/26	31	0.9	0.029	0.015	0.84	0.06	93	0.018	1.0	-0.1	110
	10/18-19	175	35	0.016	0.002	0.11	35	<1	0.005	0.28	35	1
	11/3	9	29	0.014	0	0	Same	0	0.003	0.17	29	1
	11/16-17	13	9.0	0.0048	0	0	Same	0	0	0	Same	0
	11/22-25	6	14	0.0052	0	0	Same	0	0	0	Same	0
	12/19-20	25										
	12/23-25	4	390	0.0066	0	0	Same	0	0	0	Same	0
	12/30-31	5	9.7	0.0075	0	0	Same	0	0	0	Same	0
1980			310	0.011	0	0	Same	0	0	0	Same	0
	1/8-17	8	466	0.0054	0	0	Same	0	0	0	Same	0
	2/14-24	30	39	0.0059	0	0	Same	0	0	0	Same	0
	2/27-28	6										
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			1620			4.5	1620	<1%		5.9	1610	<1%
mum												
mum												

D-12. MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR TKN

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	MONTHLY STREET CLEANING Savings (lbs/curb mile) 0.013	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0091	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
	1979											
	1/8	1	470	1.4	1.4	0	470	0	0.98	23	450	5
	1/10-14	1										
	2/13-14	27	83	0.41	0	0	83	0	0	0	Same	0
,J	2/15-22	2	470	0.29	0	0	470	0	0	0	Same	0
	2/28-3/1	5	97	0.32	0	0	97	0	0	0	Same	0
	3/15-17	15	18	0.31	0	0	18	0	0	0	Same	0
	3/26-28	10	135	0.32	0	0	135	0	0	0	Same	0
	4/26	31	41	0.23	0	0	41	0	0	0	Same	0
	10/18-19	175	406	1.1	0	0	406	0	0.12	6.7	400	2
	11/3	9	293	0.92	0	0	293	0	0	0	Same	0
	11/16-17	13	61	0.38	0	0	61	0	0	0	Same	0
	11/22-25	6	78	0.40	0	0	78	0	0	0	Same	0
	12/19-20	25										
	12/23-25	4										
	12/30-31	5	120	0.54	0	0	120	0	0	0	Same	0
	1980											
	1/8-17	8	530	0.81	0	0	530	0	0	0	Same	0
	2/14-24	30	1390	0.43	0	0	1390	0	0	0	Same	0
	2/27-28	6	156	0.45	0	0	156	0	0	0	Same	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			4350			0	4350	0		30	4320	1%
mum			290									
mum			#:15									

D-12.MAXIMUM RUNOFF YIELD IMPROVEMENTS FOR VARIOUS STREET CLEANING PROGRAMS FOR TKN (continued)

	Storm Date	Preceeding Significant Dry Period (days)	Runoff Yield (lbs.)	Initial Load (lbs/curb mile)	TWICE WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0063	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)	THREE TIMES WEEKLY STREET CLEANING Savings (lbs/curb mile) 0.0049	Max. runoff load savings (lbs.)	Min. new Runoff Load (lbs.)	Max. Runoff Imprvmt. (%)
1979												
	1/8	1	470	1.4	0.68	40	430	9	0.53	48	420	10
	1/10-14	1										
	2/13-14	27	83	0.41	0	0	Same	0	0	0	420	0
,J	2/15-22	2	470	0.29	0	0	Same	0	0	0	Same	0
	2/28-3/1	5	97	0.32	0	0	Same	0	0	0	Same	0
	3/15-17	15	18	0.31	0	0	Same	0	0	0	Same	0
	3/26-28	10	135	0.32	0	0	Same	0	0	0	Same	0
	4/26	31	41	0.23	0	0	Same	0	0	0	Same	0
	10/18-19	175	406	1.1	0.42	23	380	6	0.57	32	370	8
	11/3	9	293	0.92	0.24	13	280	4	0.39	22	271	8
	11/16-17	13	61	0.38	0	0	Same	0	0	0	Same	0
	11/22-25	6	78	0.40	0	0	Same	0	0	0	Same	0
	12/19-20	25										
	12/23-25	4										
	12/30-31	5	120	0.54	0	0	Same	0	0	0	271	0
1980												
	1/8-17	8	530	0.81	0.13	7.2	523	1	0.28	16	Same	3
	2/14-24	30	1390	0.43	0	0	Same	0	0	0	510	0
	2/27-28	6	156	0.45	0	0	Same	0	0	0	Same	0
13	3/2-6	4										
	3/25	19										
	4/4-5	10										
17	4/20-22	15										
or Total			4350			83	4270	2		118	4230	3
mum			290									
mum			#:15									

APPENDIX E. RAIN, RUNOFF AND BASEFLOW CHARACTERISTICS AND URBAN RUNOFF YIELDS

TABLE E-1. CASTRO VALLEY RAIN EVENTS DURING FIELD ACTIVITIES[1] YEAR ONE

Date	Total (inches)	Duration (hours)	Average Intensity (inches/hour)	Peak Intensity (inches/hour)
Dec. 17, 1978*	0.39	12.5	0.03	0.14
Dec. 18	0.05	15.75	0.003	0.03
Dec. 19	0.01	0.25	0.04	0.04
Jan. 3, 1979	0.10	3.25	0.03	0.03
Jan. 4	0.03	9.25	0.003	0.02
Jan. 5	0.01	0.25	0.04	0.04
Jan. 7*	0.34	14.75	0.02	0.05
Jan. 8*	1.24	6.0	0.21	0.40
Jan. 9	0.18	8.25	0.02	0.04
Jan. 10*	0.78	4.25	0.18	0.39
Jan. 11	1.80	20.75	0.09	0.27
Jan. 14*	1.43	20.75	0.07	0.33
Jan. 15	0.28	12.75	0.02	0.09
Jan. 17	0.24	5.75	0.04	0.11
Jan. 30	0.01	0.25	0.04	0.04
Feb. 3	0.01	0.25	0.04	0.04
Feb. 13*	1.11	13.25	0.08	0.25
Feb. 14	0.09	9.25	0.01	0.01
Feb. 15	0.01	0.25	0.01	0.01
Feb. 16*	0.49	11.75	0.04	0.21
Feb. 17	0.01	0.25	0.04	0.04
Feb. 18	0.45	8.75	0.05	0.20
Feb. 19*	0.06	1.25	0.05	0.05
Feb. 20*	0.74	17.75	0.04	0.25
Feb. 21*	0.41	11.0	0.04	0.17
Feb. 22*	0.64	13.25	0.05	0.30
Feb. 23	0.18	23.25	0.01	0.07
Feb. 25	0.07	2.75	0.03	0.04
Feb. 26	0.09	9.50	0.01	0.06
Feb. 28*	0.58	6.25	0.09	0.17
Mar. 1	0.01	0.25	0.04	0.04
Mar. 3	0.03	4.5	0.01	0.01
Mar. 15	0.05	2.7	0.02	0.04
Mar. 16*	0.69	17.3	0.04	0.15
Mar. 17	0.01	0.25	0.04	0.04
Mar. 26	0.40	13.15	0.03	0.13
Mar. 27*	1.45	23.0	0.06	0.38
Mar. 28	0.13	20.85	0.01	0.06
Apr. 6	0.02	0.25	0.08	0.08
Apr. 9	0.01	0.25	0.04	0.04
Apr. 16	0.05	9.15	0.01	0.04
Apr. 17	0.04	6.15	0.01	0.01
Apr. 22	0.04	1.85	0.02	0.03
Apr. 23	0.11	20.0	0.01	0.09
Apr. 25	0.01	0.25	0.04	0.04
Apr. 26*	0.37	12.15	0.03	0.12
May 5	0.02	0.5	0.04	0.02
May 6	0.05	23.5	0.002	0.03
May 7	0.04	12.75	0.003	0.02
May 8	0.03	2.0	0.015	0.02
May 15	0.01	0.25	0.04	0.40

Station discontinued for remainder of water year.
1/ Proctor Schol Rain Gage, USGS No. 374259122041901
1/ Proctor School Rain Gage, USGS #71-1810.08
* Monitored Events

TABLE E-1. CASTRO VALLEY RAIN EVENTS DURING FIELD ACTIVITIES[1]
YEAR TWO

Date	Total (inches)	Duration (hours)	Average Intensity (inches/hour)	Peak 15-Minute Intensity
Oct. 15, 1979	.01	.25	.04	.01
Oct. 18*	.15	2.75	.05	.04
Oct. 19*	.84	22.75	.04	.08
Oct. 20*	.02	.25	.08	.01
Oct. 25*	1.68	7.25	.23	.17
Oct. 26	.01	.25	.04	.01
Oct. 30	.03	2.5	.01	.02
Nov. 2	.01	.25	.04	.01
Nov. 3*	.56	14.75	.04	.16
Nov. 4	.01	--	--	--
Nov. 5	.02	6.25	.003	.01
Nov. 7	.03	1.5	.02	.01
Nov. 8	.02	2	.01	.01
Nov. 16*	.78	7	.11	.10
Nov. 17*	.05	3.75	.01	.01
Nov. 22*	.41	6.25	.07	.06
Nov. 24*	.22	11.25	.02	.02
Nov. 25*	.10	3	.03	.02
Dec. 19*	.44	12.75	.03	.05
Dec. 20*	.13	2.25	.06	.03
Dec. 23*	1.59	16	.10	.10
Dec. 24*	1.46	20.25	.07	.08
Dec. 25*	.47	23.25	.02	.06
Dec. 30*	.25	13.5	.02	.03
Dec. 31	.37	13.75	.03	.03
Jan. 1, 1980	.01	.25	.04	.01
Jan. 2	.01	--	--	--
Jan. 4	.01	--	--	--
Jan. 8*	.05	1.75	.03	.02
Jan. 9*	.38	17.25	.02	.04
Jan. 10*	.42	20.25	.02	.04
Jan. 11*	1.22	23.25	.05	.10
Jan. 12*	.24	20.75	.01	.05
Jan. 13*	1.35	21	.06	.20
Jan. 14*	.01	.25	.04	.01
Jan. 15*	.20	16.25	.01	.02
Jan. 16*	.11	12.5	.01	.02
Jan. 17*	.14	10	.01	.02
Jan. 18*				
Feb. 14*	.66	22.5	.03	.04
Feb. 15*	.64	15	.04	.09
Feb. 16*	1.13	16.75	.07	.15
Feb. 17*	.24	19.75	.01	.02
Feb. 18*	.68	23.15	.03	.10
Feb. 19*	1.31	23.75	.06	.13
Feb. 20*	.89	23.75	.04	.13
Feb. 21*	.38	9.25	.04	.11
Feb. 22*	.08	10.25	.01	.02
Feb. 24*	.01	.25	.04	.01
Feb. 27*	.73	8	.09	.25
Feb. 28*	.01	.25	.04	.01
Feb. 29	.01	.25	.04	.01
Mar. 2*	.33	16	.02	.02
Mar. 3*	.05	10.5	.005	.01
Mar. 4*	.28	1.75	.16	.09
Mar. 5*	.32	22	.01	.07
Mar. 6*	.29	6.15	.05	.13
Mar. 11	.01	.25	.04	.01
Mar. 14	.03	1.25	.02	.01
Mar. 15	.01	.25	.04	.01
Mar. 21	.01	.25	.04	.01
Mar. 25*	.19	3.75	.05	.05
Mar. 27	.01	.25	.04	.01
Apr. 4*	.30	--	--	--
Apr. 5*	.76	--	--	--
Apr. 20				

TABLE E2 SUMMARY OF MONTHLY URBAN RUNOFF AND RAINFALL VOLUMES

	Monthly Runoff Volumes (Acre-Feet)			Ratio of Runoff Volume to Rainfall Volume		
Month	Overall Range (acre-ft per storm)	Average, Only Runoff Causing Events (acre-ft per storm)	Overall Average (acre-ft per storm)	Overall Range	Average, Only Runoff Causing Events	Overall Average
Oct.	0-152	36	18	<0.02-0.41	0.34	0.17
Nov.	0-33	21	18	<0.02-0.73	0.34	0.29
Dec.	5.1-140	36	36	0.17-0.53	0.30	0.30
Jan.	0-152	67	37	<0.02-0.51	0.34	0.19
Feb.	0-343	170	73	<0.02-0.76	0.53	0.22
Mar.	0-43	22	9	<0.02-0.44	0.25	0.10
Apr.	0-29	9.5	7	<0.02-0.36	0.24	0.17
May	0-1.9	1.9	1	<0.02-0.19	0.19	0.10
June	0	0	0	<0.02	<0.02	<0.02
July	0	0	0	<0.02	<0.02	<0.02
Aug.	0	0	0	<0.02	<0.02	<0.02
Sept.	0	0	0	<0.02	<0.02	<0.02

E-4. CASTRO VALLEY CREEK OBSERVED STORM FLOW CONCENTRATIONS
(mg/l, except for arsenic - zinc which are ug/l).

	Seaview Station						Knox Station					
tuent	Min.	Max.	Avg.	Std. Dev.	Std. Dev./ Avg. Ratio	No. of Observ.	Min.	Max	Avg.	Std. Dev.	Std. Dev./ Avg. Ratio	No. of Observ.
alk., as	62	200	117	41	0.4	14	21	91	43	17	0.4	19
rbonate ness, as $CaCO_3$	13	68	43	16	0.4	14	12	44	22	9	0.4	19
hardness, CO_3	94	270	160	54	0.3	14	33	120	66	22	0.3	19
m, diss.	24	66	38	13	0.3	14	9	26	16	5	0.3	19
sium, diss.	8.3	25	16	5	0.3	14	1.3	12	6	3	0.5	19
sium, diss.	1.9	4.4	2.9	0.7	0.2	14	1.1	16	2.6	3.3	1.3	19
n, diss.	13	79	31	16	0.5	14	6.4	24	13	4.3	0.3	19
ide, diss.	15	110	33	23	0.7	15	9	27	17	6	0.3	20
te, diss.	30	100	57	20	0.4	14	13	43	24	8	0.3	20
Solids	402	1,715	910	356	0.4	20	132	730	350	180	0.5	30
rable Solids)	176	495	300	98	0.3	16	73	244	125	43	0.3	21
ilterable ds (SS)	94	1,220	640	375	0.6	16	40	600	250	170	0.7	21
ile, non- erable solids)	26	138	93	38	0.4	14	0	120	51	35	0.7	19
	33	193	110	46	0.4	17	16	230	89	43	0.5	24
Nitrogen	2.0	15	5.3	3.4	0.6	15	1.6	9.2	3.3	1.6	0.5	19
ic Nitrogen	0.8	6.5	3.7	3.3	0.9	15	0.23	24	3.0	4.9	1.6	22
Kjeldahl ogen	0.9	14	4.0	3.2	0.8	16	0.65	7.5	2.1	1.5	0.7	22
ia, as N	0.03	0.35	0.16	0.09	0.6	16	0.02	0.37	0.09	0.08	0.8	22
tes plus ates, as N	0.81	4.9	1.5	1.0	0.7	15	0.67	1.9	1.1	0.39	0.4	19
Phosphorus	0.08	1.9	0.6	0.5	0.9	16	0.15	0.85	0.42	0.19	0.5	21
lved ortho- phates, as PO_4	0.03	0.8	0.4	0.3	0.6	14	0.06	0.95	0.46	0.26	0.6	20
ic	2	9	5	2	0.4	14	1	6	4	2	0.4	20
um	0	23	3	6	2	15	0	12	3	4	1.4	20
ium	0	60	19	18	1.0	15	0	60	13	17	1.3	20
r	30	100	56	18	0.3	15	21	700	100	160	1.6	20
	1,900	50,000	25,000	17,000	0.7	15	5,000	21,000	9,300	4,900	0.5	20
	0	600	113	160	1.4	16	97	3,300	490	610	1.3	25
ry	0	2.6	0.6	0.8	1.5	14	0	2.5	0.4	0.6	1.5	19
l	0	100	69	42	0.6	14	0	100	37	45	1.2	18
	60	496	180	122	0.7	20	93	2,200	310	390	1.3	30

E E-5. CASTRO VALLEY CREEK OBSERVED STORM MASS EMISSIONS
(lbs/storm).

tituent	Seaview Station Min.	Max.	Avg.	No. of Observ.	Knox Station Min.	Max.	Avg.	Std. Dev.	Std. Dev./ Avg. Ratio	No. of Observ.
l alk., as O_3	166	22,000	4,300	14	750	65,000	8,100	15,000	1.9	19
carbonate dness, as $CaCO_3$	63	9,200	1,400	14	310	38,000	4,000	8,400	2.1	19
l hardness, as O_3	82	32,000	5,300	15	1,100	100,000	12,000	23,000	1.9	19
ium, diss.	53	7,200	1,300	14	280	25,000	3,000	5,700	1.9	19
esium, diss.	23	3,200	570	14	97	10,000	1,100	2,300	2.0	19
ssium, diss.	2.0	650	120	14	35	2,000	390	580	1.5	19
um, diss.	38	5,200	970	14	200	20,000	2,600	4,600	1.8	19
ride, diss.	41	4,700	870	15	210	24,000	2,800	5,300	1.9	20
ate, diss.	80	11,000	2,000	14	190	40,000	4,700	8,900	1.9	20
l Solids	600	190,000	22,000	20	1,500	570,000	55,000	110,000	2.1	30
crable Solids S)	380	58,000	9,200	16	1,800	190,000	22,000	40,000	1.8	21
filterable ids (SS)	280	300,000	37,000	16	700	350,000	48,000	85,000	1.8	22
tile Non- terable Solids S)	130	34,000	4,000	14	0	45,000	8,600	13,000	1.5	19
	57	30,000	4,300	17	990	80,000	12,000	17,000	1.4	24
l Nitrogen	2.3	1,300	240	15	14	4,100	520	930	1.8	22
nic Nitrogen	1.5	920	180	15	19	2,200	410	650	1.6	19
l Kjeldahl rogen	1.6	970	170	16	14	2,400	320	550	1.7	22
nia, as N	0.06	40	6.5	16	0.006	150	17	35	2.1	22
ites plus rates, as N	0.37	370	62	15	12	1,800	250	450	1.8	19
l Phosphorus	0.34	140	24	16	4.1	530	78	130	1.7	21
olved Ortho- sphates, as PO_4	0.03	77	12	14	1.2	540	92	150	1.7	20
nic	0.003	2.2	0.31	14	0.03	5.9	0.8	1.4	1.8	20
ium	0	3.6	0.3	15	0	12	1.0	2.8	2.8	20
omium	0	2.1	0.4	15	0	6.3	1.2	1.6	1.4	20
per	0.06	17	2.9	15	1.0	46	9.6	12	1.3	20
	11	12,000	1,800	14	120	150,000	1,800	3,300	1.8	20
	0	32	4.7	16	2.0	310	42	67	1.6	25
cury	0	0.2	0.03	14	0	0.94	0.09	0.22	2.4	19
el	0	25	3.9	14	0	45	4.9	11	2.2	18
	0.1	50	7.0	19	1.5	210	29	44	1.5	30

TABLE E-6. RATIO OF URBAN STORM MASS YIELDS TO NON-URBAN STORM MASS YIELDS

Constituent	Based on lb/acre/year			Standard Deviation	St.Dev./ Average Ratio	Number of Observation
	Minimum	Maximum	Average			
Total alk., as $CaCO_3$	0.1	7.1	1.9	2.0	1.0	14
Non-carbonate hardness, as $CaCO_3$	0.4	11	3.1	3.1	1.0	14
Total hardness as $CaCO_3$	0.1	7.9	2.2	2.2	1.0	14
Calcium, diss.	0.1	8.6	2.4	2.4	1.0	14
Magnesium, diss.	0.1	7.1	1.9	2.1	1.1	14
Potassium, diss.	0.9	17	3.4	4.4	1.3	14
Sodium, diss.	0.3	7.9	2.1	2.0	0.9	14
Chloride, diss.	0.4	8.6	2.8	2.6	0.9	15
Sulfate, diss.	0.1	7.1	2.2	2.1	1.0	14
Total Solids	0.4	18	3.1	4.2	1.4	20
Filterable Solids (TDS)	0.3	21	3.4	5.3	1.5	15
Non-filterable Solids (SS)	0.1	17	3.3	4.9	1.5	15
Volatile, Non-filterable Solids (VSS)	0	1,800	120	470	3.7	14
COD	0.6	31	9.3	11	1.1	17
Total Nitrogen	0.1	19	4.5	6.0	1.3	14
Organic Nitrogen	0	31	7.9	11	1.5	14
Total Kjeldahl Nitrogen	0	23	6.6	9.3	1.4	14
Ammonia, as N	0	11	2.9	3.4	1.2	15
Nitrites plus Nitrates, as N	1.3	51	7.9	13	1.6	14
Total Phosphorus	0.5	19	6.1	6.0	1.0	15
Diss. Ortho-Phosphates, as PO_4	0.2	79	14	20	1.5	14
Arsenic	1.1	26	6.0	6.9	1.1	14
Cadmium	0.4	16	4.4	5.9	1.4	6
Chromium	0	10	3.1	3.3	1.1	11
Copper	0.2	19	4.8	5.6	1.2	15
Iron	0.03	14	3.2	4.3	1.3	14
Lead	0.8	10	4.7	3.1	0.7	9
Mercury	0.3	43	11	14	1.2	12
Nickel	0	21	4.3	6.4	1.5	9
Zinc	0.5	40	12	12	1.0	19

TABLE E-7. GROUPINGS OF CONSTITUENTS BY URBAN TO NON-URBAN MASS YIELD RATIOS (on a lb/acre/year basis)

Range of Average Ratios	Constituents
1.4 - 2.4	Total alkalinity Total hardness Calcium Magnesium Sodium Sulfate
2.5 - 3.5	Non-carbonate hardness Potassium Chloride Total solids Filterable solids Non-filterable solids Ammonia Chromium Iron
3.6 - 5.3	Total nitrogen Cadmium Copper Lead Nickel
5.4 - 7.1	Total Kjeldahl nitrogen Total phosphorus Arsenic
7.2 - 14	COD Organic nitrogen Nitrites plus nitrates Dissolved ortho-phosphates Mercury Zinc
>14	Volatile, non-filterable solids

TABLE E8 RUN-OFF YIELD CALCULATION FOR TOTAL TEST AREA

	Total Solids	Lead	Zinc	Arsenic	Copper	Chromium	COD	Total Phosphorus	Ortho-Phosphate	Total Kjeldahl Nitrogen
nitored	355,400	145	207	3.01	22.3	9.89	65,400	347	317	1,310
rrection	50,700	124	37	4.28	13.8	3.63	33,200	271	1,110	765
r 1 lbs/year	406,000	269	244	7.29	36.1	13.5	99,000	618	1,420	2,080
year s)	450	0.30	0.27	0.0080	0.040	0.015	110	0.70	1.6	2.3
nitored	606,700	832	572	8.22	130	10.2	154,000	922	1,300	3,030
rrection	44,500	28	21	4.04	11	1.9	17,100	362	806	1,230
r 2 lbs/yr.	651,000	860	592	12.3	141	12.1	170,000	1,284	2,110	4,260
/year es)	720	0.95	0.65	0.014	0.16	0.013	190	1.4	2.3	4.7
average d e/year)	600	0.6	0.5	0.01	0.1	0.014	150	1	2	3.5
of total tually d	91%	87%	93%	57%	86%	79%	82%	67%	46%	68%

Table E9 Monthly portion of Annual Baseflow Yield (%)

nth	Flow	Total Solids	COD	TKN	P	OPO_4	As	Cr	Cu	Pb	Zn
tober	2%	2%	3%	2%	<1%	2%	3%	17%	<1%	<1%	2%
vember	2	2	.2	12	6	12	3	<1	<1	<1	3
cember	7	7	6	28	29	30	8	5	<1	1	8
nuary	22	18	17	12	15	12	20	11	31	29	19
bruary	24	22	19	13	17	15	23	13	36	25	21
rch	18	16	16	18	18	16	18	2	23	31	25
ril	6	7	7	4	8	8	10	<1	10	14	12
y	5	6	5	3	6	3	2	<1	<1	<1	<1
ne*	4	4	6	3	<1	0.5	4	13	<1	<1	2
ly *	4	4	6	3	<1	0.5	4	13	<1	<1	2
gust*	4	4	6	3	<1	0.5	4	13	<1	<1	2
ptember*	4	4	6	3	<1	0.5	4	13	<1	<1	2
nnual (lbs)	61 acre-ft	180,000	6000	150	30	120	0.4	0.06	3	6	10
nnual (lbs/acre/yr)	0.8 inches	200	6.5	0.2	0.04	0.13	0.0005	0.00007	0.003	0.0065	0.014

June, July, August and September show average conditions for all four months combined.

TABLE E10 MONTHLY PORTION OF ANNUAL STORM YIELD AND AVERAGE PER STORM PORTION OF ANNUAL YIELD

Total Solids		Lead		Zinc		Arsenic		Copper	
% in month	% per storm	% in month	% per storm	% in month	% per storm	% in month	% per storm	% in month	% per storm
7	4	18	9	18	9	9	5	24	12
10	3	16	5	15	5	4	1	17	6
8	3	10	4	12	5	10	4	16	6
28	6	10	2	15	3	25	6	8	2
37	11	37	11	30	9	30	9	27	8
7	1	5	1	5	1	4	1	4	1
3	<1	4	1	5	1	18	5	4	1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Chromium		COD		Phosphorus		Ortho OPO_4		TKN	
% in month	% per storm	% in month	% per storm	% in month	% per storm	% in month	% per storm	% in month	% per storm
14	7	9	5	12	6	14	7	16	8
8	3	13	4	7	2	2	1	10	5
27	11	11	4	12	5	13	5	5	2
7	2	22	5	31	7	31	7	25	6
30	9	33	9	33	9	26	7	37	11
10	2	7	1	4	1	13	3	4	1
4	1	5	1	1	<1	1	<1	3	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

BLE E-11. URBAN BASE FLOW AND STORM RUNOFF ANNUAL YIELDS COMPARED.

nstituent	Annual Urban Base Flow Total (lbs)	Annual Urban Base Flow Total (lbs/acre/yr)	Percentage of Base-Flow From Urban Area only (%)	Annual Urban Storm Runoff Total (lbs/acre/yr)	Total Urban Runoff and Urban Base Flow (lbs/acre/yr)	Percentage of Total Urban Yield Due to Runoff Only (%)
tal Alk., as $CaCO_3$	40,000	45	51%	70	120	60%
n-carbonate hardness, as $CaCO_3$	46,000	50	75	30	80	40
tal hardness, as $CaCO_3$	86,000	95	61	100	200	50
lcium, diss.	16,000	20	57	30	50	60
gnesium, diss.	11,000	10	65	10	20	50
tassium, diss.	560	0.6	68	3	4	75
dium, diss.	25,000	30	71	20	50	40
loride, diss.	47,000	50	84	25	75	30
lfate, diss.	32,000	35	58	30	70	40
tal Solids	180,000	200	67	600	800	75
lterable Solids (TDS)	170,000	190	66	200	400	50
n-filterable Solids (SS)	1,300	1.4	72	300	300	100
latile Non-filterable olids (VSS)	130	0.14	17	70	70	100
D	6,000	6.5	65	150	160	90
tal Nitrogen	610	0.7	67	5	6	80
ganic Nitrogen	120	0.1	44	5	5	100
tal Kjeldahl Nitrogen	150	0.2	45	3.5	3.7	95
monia, as N	50	0.05	84	0.2	0.3	70
trites plus Nitrates, as N	440	0.5	77	3	3	100
tal Phosphorus	34	0.04	45	1	1	100
ssolved Orth-Phosphates s PO_4	120	0.1	71	2	2	100
senic	0.4	0.0005	84	0.01	0.01	100
dmium	0.07	0.00008	67	0.01	0.01	100
romium	0.06	0.00007	49	0.014	0.014	100
pper	3	0.003	70	0.1	0.1	100
on	54	0.06	21	7	7	100
ad	6	0.0065	45	0.6	0.6	100
rcury	0.2	0.0002	59	0.001	0.001	100
ckel	0	0	-	0.05	0.05	100
nc	10	0.014	65	0.5	0.5	100
ow	61 Acre-ft.	0.8 Inches	53	7.5 Inches	8.3 Inches	90

Table E12 Percent of Observed Baseflow Concentrations that Exceeded Water Quality Criteria > caps.
(Five observations total).*

...tuents:	Irrigation Seaview	Irrigation Knox	Livestock and Wildlife Seaview	Livestock and Wildlife Knox	Industrial Seaview	Industrial Knox	Aquatic Life Seaview	Aquatic Life Knox	Marine Life Seaview	Marine Life Knox	Recreation Uses Seaview	Recreation Uses Knox	Freshwater Public Supplies Seaview	Freshwater Public Supplies Knox
...de	*													
...e														
...able solids (TDS)	0-80%	0-100%			0-100%	0-100%								
...lterable														
...s (SS)							0	0						
...a							0	0						
...es plus Nitrates			0	0										
...phosphates									80%	100%	40%	75%	0	0
...c	0	0											0	0
...n	0	0	0	0			0	0	0	0			0	0
...um	0	0	0	0			0	0	0	0			0	0
	0-20%	0-20%	0	0			0	0	0	0			0	0
							80%	20%					100%	40%
	0	0	20%	0			0	0					20%	20%
...y			20%	20%			100%	80%	100%	80%			0	20%
							0	0	0	0				
			0	0			100%	100%	20%	0			0	0
	0	0	0	0			0	0	0	0	0	0		
...ature							20%	0			0	0		

...s signify that no numeric criteria is available for comparison.

TABLE E-13. PERCENT OF OBSERVED STORM FLOW CONCENTRATIONS THAT EXCEEDED WATER QUALITY CRITERIA (about 35 total observations).

Constituents:	Irrigation Seaview	Irrigation Knox	Livestock & Wildlife Seaview	Livestock & Wildlife Knox	Industrial Seaview	Industrial Knox	Aquatic Life Seaview	Aquatic Life Knox	Marine Life Seaview	Marine Life Knox	Recreation Uses Seaview	Recreation Uses Knox	Freshwater Public Supplies Seaview	Freshwater Public Supplies Knox
Chloride	*												0	0
Sulfate													0	0
Filterable Solids (TDS)	0	0 - 14%			0 - 100%	0 - 29%								
Non-filterable solids (SS)							100%	100%						
Ammonia							0	0						
Nitrites plus Nitrates			0	0									0	0
Ortho-phosphates									100%	100%	64%	65%		
Arsenic	0	0											0	0
Cadmium	0 - 7%	0 - 15%	0	0			7%	15%	13%	25%			7%	15%
Chromium	0	0	0	0			0	0	0	0			7%	5%
Copper	0 - 100%	0 -100%	0	0			7%	20%	67%	45%			0	0
Iron							100%	100%					100%	100%
Lead	0	0	44%	96%			19%	88%					56%	100%
Mercury			14%	11%			85%	95%	85%	84%			14%	5%
Nickel							100%	50%	100%	50%				
Zinc			0	0			100%	100%	80%	97%			0	0
pH	0	0	0	0			3%	2%	3%	2%	0	0	0	0
Temperature							0	0			0	0		

*Blanks signify that no numeric criteria is available for comparison.

TABLE E-14. ALL CASTRO VALLEY CREEK STORM PERIODS (1979 and 1980 WATER YEARS)

Begin (Knox Time) date	Begin (Knox Time) time	End (Knox Time) date	End (Knox Time) time	Monitored Rain Code	Runoff Causing Rain (inches)	Monitored Creek Flows (acre-feet) Urban	Seaview	Knox
11/12/78	0000	11/14/78	0000		0.27	1.2	0	1.2
11/19	0000	11/22	1000		1.92	28.9	0.3	29.2
12/1	0100	12/1	0800		0.36	5.3	0.01	5.3
12/17	0800	12/17	1600	A	0.39	3.7	0.05	3.7
12/18	0300	12/18	1900		0.06	1.4	0	1.4
1/3/79	1800	1/3/79	2200		0.10	0.9	0.04	0.9
1/7	1800	1/8	0000	B	0.34	10.5	0.04	10.5
1/8	1200	1/8	1500	C*	1.24	43.5	0.7	44.2
1/9	0500	1/9	1300		0.18	4.4	0.2	4.6
1/10	2000	1/11	2200	D)	2.58	93.2	1.7	94.9
1/14	0300	1/14	2300	E*)	1.43)	66.6	(6.8	52.8
1/15	0200	1/15	1400		0.28)		(	20.6
1/17	1500	1/17	2200		0.24	5.9	0.2	6.1
2/13	0600	2/14	0900	F*	1.20	28.5	0.9	29.4
2/15	2300	2/16	1400	G*)	0.50	14.6	0.6	15.2
2/18	0600	2/21	1100	H + I)	1.66	55.1	13.1	68.2
2/22	0600	2/22	2000	J)	0.64	45.5	12.7	58.2
2/23	0100	2/24	0000		0.18	4.7	6.1	10.8
2/25	2000	2/26	1000		0.07	2.6	2.6	5.2
2/28	1500	3/1	0000	K*	0.58	6.9	1.8	8.7
3/15	1200	3/17	1500	L*	0.75	9.5	1.5	11.0
3/26	0800	3/28	2300	M*	1.98	35.0	13.6	48.6
4/16	1300	4/16	2300		0.05	1.0	0.3	0.9
4/17	0100	4/17	0600		0.04			0.4
4/23	0400	4/24	0000		0.11	0.7	0.3	1.0
4/26	0500	4/26	2000	N*	0.37	6.8	0.3	7.1
5/6	0000	5/7	1300		0.05	1.9	0.5	2.4
10/18	2100	10/20	0200	1*	0.99	19.8	0.07	19.9
10/25	0300	10/25	1900		1.68	52.3	0.6	52.9
11/3	0800	11/3	2200	3*	0.56	33.0	0.4	33.4
11/16	1600	11/17	0400	4*	0.83	17.1	0.09	17.2
11/22	1400	11/25	2200	5*	0.73	23.7	0.2	23.9
12/19	0600	12/20	1900	6*	0.57	7.4	0.1	7.5
12/23	0800	12/26	1200	7*	3.52	140.4	13.3	153.7
12/30	0100	12/31	2200	8*	0.62	23.6	0.3	23.9
1/8/80	1900	1/18/80	1200	9*	4.12	110.5	56.9	167.4
2/14	0200	2/24	0700	10*	5.94	343.1	91.8	434.9
2/25	1200	2/28	1300	11*	0.74	22.5	7.0	29.5
3/2	0100	3/3	2300	12*)	1.27	13.1	4.1	17.2
3/4	2300	3/7	1100	13)		29.4	9.3	38.7
3/25	0500	3/26	1400	14*)	0.19	2.0	0.8	2.8
4/3	1500	4/6	1500	15*	1.06	28.9	1.9	30.8
4/20	1200	4/21	2000	16*)	0.39	6.9	0	6.9
4/22	1400	4/22	2200	17)		3.5	0	3.5
				TOTALS	40.78	1356.0	251.0	1607.0

* Complete storm data sets

TABLE E.15 URBAN AREA MASS EMISSIONS (lbs/storm)

Storm Date:	Storm Code	Total Alk. as $CaCO_3$	As	Cd	Ca (diss)	Cl (diss)	Cr	COD	Cu	Non-Carbonate Hardness	Total Hardness	Fe	Pb	Mg (diss)	Hg
12/17/78	A		0.03					990							
1/7/79	B							1,160							
1/8/79	C							15,500							
1/10-11	D														
1/14	E														
2/13-14	F	2,400	0.39	0	885	885	0.73	9,220	3.04	1,200	3,580	478	23.9	327	0.03
2/15-16	G	1,220	0.16	0	511	370		1,800	1.59	811	2,038	188	4.12	179	0.0078
2/18-19	H	1,370	0.12	0	535	615	0.27	2,110	1.27	787	2,165	123	7.10	202	0.0067
2/20-21	I	4,027	0.72	0	1,590	1,570	0.43	6,190	4.07	2,410	6,430	291	29.4	601	0.012
2/22	J	2,610	0.71	0	1,230	1,030	4.24	10,000	5.49	1,900	4,500	2,080	47.4	331	0.02
2/28	K	360	0.12	0	134	78	0.37	1,650	0.94	120	485	122	4.72	34.3	0.002
3/15-17	L	903	0.079	0	354	444	0.56	2,170	1.03	1,030	1,863	98	5.95	254	0.0056
3/26-27	M	1,980	0.45	0	699	1,130	1.67	6,140	2.52	840	2,670	399	20.4	255	0
4/26	N	643	0.055	0	313	403	0.35	2,450	0.90	553	1,195	141	9.6	100	0.0113
10/18-19	1	2,760	0.22	0.54	1,240	1,460	3.25	12,500	37.9	2,000	4,760	758	179	395	0.022
11/3	3	1,874	0.208	0.208	1,040	1,250	0.104	16,700	14.6	2,080	3,960	1,150	104	333	0.021
11/16-17	4	753	0.036	0.179	316	316	0	5,020	7.89	431	1,180	205	29.1	96.9	0.007
11/22-25	5	2,730	0.065	0.195	973	1,170	0.065	4,220	3.89	1,300	4,020	325	28.6	389	0.006
12/19-20	6												22.3		
12/23-25	7	7,250	1.77	0.35	4,800	4,740	2.50	15,700	6.26	4,930	12,000	172	37.5	77.0	0.012
12/30-31	8	2,730	0.13	0.195	909	1,230	2.73	4,090	17.5	1,170	3,900	500	31.8	396	0.006
1/8-17/80	9	12,100	1.80	1.90	3,860	4,780		19,300	4.57	3,900	16,500	1,680	35.8	1,580	0.06
2/14-24	10	42,800	3.66	11.3	17,600	18,900	1.18	50,400	28.6	28,600	70,300	530	286	6,800	0.75
2/27-28	11	386	0.26	0.44	184	486	0	7,300	3.05	584	950	783	18.3	127	0.15
3/2-4	12			0.037		424	0.03	2,950	0.90			262	12.2		
3/5-6	13	6,030	0.40	0.11	1,670	2,180	0.27	8,000	2.77	1,650	7,810	949	15.6	861	0.13
3/25	14												1.80		
4/4-5	15							7,590					13.7		
4/20-21	16												11.3		
4/22	17												3.75		

URBAN AREA MASS EMISSIONS (lbs/storm)

Date:	Ni	NH_4 as N	Total N	Total Organic N	TKN	NO_2 + NO_3 as N	Diss.Ortho PO_4 as PO_4	Total P	K (diss)	TDS	Total Solids	Suspended Solids	Volatile Suspended Solids	Na (diss)	SO_4 (diss)	Zn
/78																
9																
9		10.1		360	359			98.4		28,300	84,800	56,400				54.5
11											46,600					22.3
											5,290					3.57
14	0.62	1.05	183	107	107	73.8	37.1	29.8	94.5	7,340	9,150	370		730	1,230	12.4
16	2.39	1.70	153	124	124	31.0	16.6	9.28	38.8	3,220	8,150	3,900	1,200	293	764	4.36
19	0.92	0.98	60	26.3	25.4	35.1	21.0	8.21	31.9	3,997	7,180	2,950	1,080	415	877	4.87
21		5.63	67	0	0	157	110	33.1	152	11,700	18,070	9,250	3,190	1,250	2,330	18.1
	7.66	6.98	435	277	290	145	117	61.8	148	8,960	65,300	38,900	10,500	564	1,500	26.3
	1.88	1.21	39.3	23.9	25.2	13.6	12.5	5.54	20.5	770	4,530	4,320	252	86	143	4.61
17	0	0.22	39.4	14.6	14.8	26.4	7.7	5.77	34.8	2,010	5,840	3,830	110	299	689	3.91
27	0	0	186	97	94	93	6.19	29.7	118	5,160	13,840	18,300	11,170	657	844	12.1
	0	0.90	62	51	50	11.2	1.13	6.59	48	2,130	6,670	3,880	1,360	232	344	4.72
-19	0	20.0	498	384	406	92	34.6	43.8	217	8,931	26,500	19,200	5,300	758	1,730	119
	0	8.33	364	288	293	76	29.2	58.3	1,670	8,230	51,500	41,200	6,870	802	1,670	77.1
-17	0	5.38	104	57.4	61.0	43.1	8.97	10.8	64.6	2,620	6,890	4,740	1,360	237	466	12.2
2-25	0	0.006	123	71.4	77.9	43.5	13.6	14.3	162	7,850	9,090	2,600	2,080	973	1,430	16.2
0-20											4,710					12.8
3-25		44.4	767	0	0	739	392	164	658	31,400	48,100	8,810	2,640	3,250	5,450	51.3
0-31	6.5	2.6	169	117	117	50.7	9.74	16.2	97.4	7,470	14,400	5,390	1,430	909	1,490	19.5
17/80	30.0	34.2	1,100	470	530	570	313	215	596	32,100	128,000	90,800	45,400	3,570	5,480	30.9
-24		113	2,790	1,320	1,390	1,400	466	389	1,360	128,000	217,000	52,900	6,260	14,800	28,700	163
-28	6.09	4.04	211	1,870	156	45.5	38.7	10.5	86	2,790	33,700	34,600	4,870	230	328	16.4
4											10,500					8.91
6	7.98	3.53	190	92	100	91	31.2	31.3	109	14,900	34,000	18,600	3,160	1,760	2,900	11.9
											688					1.26
5											10,100					21.7
-21											9,740					7.35
											1,780					1.97

BLE E16 KNOX STATION WATER QUALITY FOR MONITORED STORMS
(Castro Valley Creek) (mg/l unless otherwise noted).

orm Date:	Total Alk. as $CaCO_3$	As (ug/l)	Cd (ug/l)	Ca (diss)	Cl (diss)	Cr (ug/l)	COD	Cu (g/l)	Non-carbonate Hardness	Total Hardness	Fe (g/l)	Pb (g/l)	Mg (diss)	Hg (g/l)	Ni (g/l)	NH_4 as N
2/17/78		3.0					99									0.04
7/79							41									0.024
/8							132									0.09
/10-11																
/14																
/13-14	33	5	0	12	12	10	120	40	16	49	6,800	300	4.5	0.4	10	0.02
/15-16	34	4	0	14	13	0	46	40	22	56	5,000	100	5.0	0.2	60	0.05
/18-19	48	4	0	18	20	10	69	40	25	73	5,800	200	6.9	0.2	30	0.05
/20-21	39	6	0	15	14	10	72	40	22	61	8,500	200	5.7	0.1	0	0.07
/22	30	6	0	13	9.8	40	96	50	19	49	21,000	300	3.9	0.2	70	0.07
/28	34	6	0	12	9	20	85	50	13	47	8,000	200	4.1	0.1	100	0.09
/15-17	58	3	0	21	21	20	80	40	44	100	4,000	200	12	0.2	0	0.02
/26-27	53	5	0	18	17	20	79	30	21	74	8,500	200	7	0	0	0.03
/26	42	3	0	19	23	20	130	50	32	74	7,900	500	6.4	0.6	0	0.05
0/18-19	51	4	10	23	27	60	230	700	37	88	14,000	3,300	7.3	0.4	0	0.37
1/3	18	2	2	10	12	1	16	140	20	38	11,000	1,000	3.2	0.2	0	0.08
1/16-17	21	1	5	8.8	8.8	0	140	220	12	33	5,700	810	2.7	0.2	0	0.15
1/22-25	42	1	3	15	18	1	65	60	20	62	5,000	440	6.0	0.1	0	0.11
2/19-20											1,100	1,100				
2/23-25	25	5	1	14	13	6	48	21	15	40	4,700	97	1.3	0.1	0	0.12
2/30-31	42	2	3	14	19	42	63	270	18	60	7,700	490	6.1	0.1	100	0.04
/8-17/80	64	6	12	18	18	0	90	44	13	77	20,000	150	7.9	0.2	100	0.16
/14-24	55	5	10	21	20	1	68	39	32	87	11,000	260	8.5	0.8	0	0.13
/27-28	43	4	7	14	13	0	110	50	19	62	16,000	300	6.6	2.5	100	0.06
/2-4			1		18	1	71	30			5,600	300				
/5-6	91	5	2	26	27	5	78	36	27	120	9,500	190	13	1.8	100	0.06
/25												400				
/4-5							100					200				
/20-21												600				
/22/80												400				

TABLE E16 KNOX STATION WATER QUALITY FOR MONITORED STORMS
(Castro Valley Creek) (mg/l unless otherwise noted).

Storm Date	Total N	Total Organic N	TKN	$NO_2 + NO_3$ as N	Diss. Ortho PO_4 as PO_4	Total P	K (diss)	TDS	Total Solids	Suspended Solids	Volatile Suspended Solids	Na (diss)	SO_4 (diss)	Zn (ug/l)
12/17/78		1.4	1.4			0.41			232				19	146
1/7/79		0.75	0.75		0.224			107	132	24.6				93.4
1/8		3.0	3.10			0.85		244	734	490				462
1/10-11									276					124
1/14									173					107.8
2/13-14	2.4	1.4	1.4	0.97	0.49	0.39	1.3	100	140	22	0	10	17	160
2/15-16	4.0	3.1	3.1	0.93	0.43	0.24	1.1	94	223	103	31	10	21	110
2/18-19	2.4	1.3	1.3	1.1	0.64	0.27	1.2	135	279	133	39	16	29	150
2/20-21	3.1	1.7	1.8	1.3	0.86	0.56	1.6	113	329	207	46	12	22	160
2/22	4.1	2.8	2.9	1.2	0.83	0.55	1.5	95	670	466	96	6.4	16	210
2/28	2.4	1.5	1.6	0.77	0.61	0.29	1.5	78	317	260	16	8.3	15	220
3/15-17	1.6	0.63	0.65	0.90	0.31	0.23	1.5	125	269	144	8	16	37	140
3/26-27	2.7	1.6	1.6	1.1	0.21	0.42	1.8	127	350	286	117	14	25	140
4/26	3.3	2.7	2.7	0.62	0.06	0.36	2.6	130	380	216	74	14	22	250
10/18-19	9.2	7.1	7.5	1.7	0.64	0.81	4.0	165	490	354	98	14	32	2,200
11/3	3.5	2.7	2.8	0.73	0.28	0.56	16	79	495	396	66	7.7	16	740
11/16-17	2.9	1.6	1.7	1.2	0.25	0.3	1.8	73	192	132	38	6.6	13	340
11/22-25	1.9	1.1	1.2	0.67	0.21	0.22	2.5	121	140	40	32	15	22	250
12/19-20									232					630
12/23-25	2.3	0.23	0.35	1.9	0.95	0.44	1.8	95	226	112	18	9.6	17	148
12/30-31	2.6	1.8	1.8	0.78	0.15	0.25	1.5	115	221	83	22	14	23	300
1/8-17/80	4.9	2.8	3.0	1.9	0.74	0.71	2.4	148	682	534	100	16	21	170
2/14-24	3.5	1.9	2.0	1.5	0.46	0.45	1.7	157	486	298	34	17	34	180
2/27-28	3.5	24	2.5	0.88	0.52	0.15	1.7	117	671	596	80	11	22	250
3/2-4									342					210
3/5-6	2.6	1.4	1.5	1.1	0.34	0.39	1.5	214	527	306	56	24	43	150
3/25									306					300
4/4-5									180					260
4/20-21									517					390
4/22/80									190					210

TABLE E17 SEAVIEW STATION WATER QUALITY FOR MONITORED STORMS
(Castro Valley Creek) (mg/l unless otherwise noted).

n Date:	Total N	Total Organic N	TKN as N	NO_2 + NO_3 as N	Diss. Ortho PO_4 as PO_4	Total P	K (diss)	TDS	Total Solids	Suspended Solids	Volatile Suspended Solids	Na (diss)	SO_4 (diss)	Zn (ug/l)
79			6.65			1.86		495	1,715	1,220				496
-11									1,087					139
									402					72.4
-14	3.4	1.8	2.0	1.4	0.80	0.53	3.7	253	813	560	86	27	49	150
-16	7.6	2.5	2.7	4.9	0.74	0.41	4.4	433	695	228	52	79	68	90
-19	8.1	6.5	6.8	1.3	0.58	0.45	3.5	261	893	580	100	28	50	150
-21	15	14	14	1.3	0.64	1.9	3.2	190	1,170	818	138	20	35	210
	6.2	4.8	4.9	1.3	0.43	0.73	2.6	176	1,180	1,010	136	13	30	200
	3.6	2.4	2.6	0.95	0.40	0.27	3.1	223	613	378	26	23	44	120
-17	2.0	1.0	1.1	0.90	0.37	0.26	2.4	415	525	110	31	43	100	60
-27	3.8	2.6	2.7	1.1	0.52	0.57	2.7	276	771	440	80	28	59	130
	2.5	1.6	1.7	0.81	0.03	0.37	2.2	409	680	304	74	41	87	110
3-25	5.4	3.9	4.1	1.5	0.10	0.57	2.6	231	1,291	1,060	136	21	46	200
17/ 80	7.3	5.2	5.4	1.9	0.15	0.70	3.2	228	1,212	984	118	24	44	300
-24	5.4	3.7	3.9	1.5	0.31	0.57	2.6	231	1,431	1,200	136	21	46	200
-28	3.6	2.3	2.3	1.3	0.15	0.08	2.6	344	1,028	684	80	34	75	190
4	2.1	0.82	0.85	1.2		0.11		391	485	94				80
6	3.3	2.2	2.3	0.99	0.18	0.38	1.9	300	848	536	108	30	64	150
									405					120
5									982					500

BLE E17 SEAVIEW STATION WATER QUALITY FOR MONITORED STORMS
(Castro Valley Creek) (mg/l unless otherwise noted).

orm Date:	Total Alk. as $CaCO_3$	As, (ug/l)	Cd (ug/l)	Ca (diss)	Cl (diss)	Cr (ug/l)	COD	Cu (ug/l)	Non-carbonate Hardness	Total Hardness	Fe (ug/l)	Pb (ug/l)	Mg (diss)	Hg (ug/l)	Ni (ug/l)	NH_4 as N
8/79							193									0.35
10-11																
14																
13-14	95	6		29	29	30	140	60	31	130	26,000		13	0.2	70	0.22
15-16	120	4		44	110	10	63	40	64	180	12,000		18	0.1	50	0.24
/18-19	110	6		34	31	30	110	50	33	140	27,000		14	0.1	50	0.26
/20-21	66	6		24	19	40	170	70	32	98	37,000		9.2	0.1	100	0.18
/22	62	7		24	15	60	150	70	32	94	36,000		8.3	0.2	100	0.12
/28	92	4		31	28	20	74	50	39	130	14,000		13		100	0.19
/15-17	200	2		66	44	10	50	40	68	270	5,000		25	0.1		0.09
/26-27	120	4		40	25	20	92	30	46	170	17,000	100	16			0.11
/26	180	4		58	44	40	62	60	68	250	12,000		25	0.3		0.07
/23-25	89	9	2	29	19		120	70	37	130	50,000	83	13	0.8	100	0.16
/8-17/ 80	110	6	23	28	22	10	140	100	13	120	48,000	210	13	0.2	100	0.25
/14-24	89	9	2	29	19		120	70	37	130	50,000	83	13	0.8	100	0.16
/27-28	160	3	6	49	29		78	50	49	210	26,000	300	21	2.6	100	0.04
/2-4			1		37	2	33	44			7,300	160				0.03
/5-6	140	5	4	42	26	10	75	40	47	190	1,900	170	20	2.2	100	0.11
/25												100				
/4-5							150					600				

E-18. BASE FLOW CONCENTRATIONS MONITORED

...ituent, ...Unless	Seaview Base Flow Concentrations Oct. (1)	Nov. & Dec. (2)	Jan. & Feb. (3)	Mar. & April (4)	May (5)	June - Sept. (6)	Knox Base Flow Concentrations Oct. (1)	Nov. & Dec. (2)	Jan. & Feb. (3)	Mar. & April (4)	May (5)	June - Sept. (6)
...alk., ...aCO_3	320	360	250	250	320	320	260	300	290	230	210	250
...arbonate ...ness, as ...3	260	340	71	67	140	200	300	300	160	140	340	320
...Hardness ...aCO_3	580	750	320	320	460	520	560	600	450	370	550	550
...um, diss.	130	160	74	74	100	115	110	120	94	74	95	100
...sium, diss.	63	85	33	32	52	58	70	74	52	44	76	73
...sium, diss.	1.1	1.5	2.8	1.1	3.4	2.3	4.5	4.5	2.3	2.0	3.5	4.0
...m, diss.	120	160	57	52	89	105	150	170	100	92	160	160
...ide, diss.	130	170	55	46	95	115	300	290	150	130	300	300
...te, diss.	340	450	120	120	200	270	240	230	160	150	260	250
...Solids	1,110	1,360	537	507	846	980	1,220	1,190	827	689	1,170	1,200
...rable Solids ...)	1,050	1,310	531	493	797	920	1,060	1,130	798	678	1,090	1,080
...ilterable ...ds (SS)	11	42	15	0	0	5	1.0	0	11	5	0	1
...ile Non- ...erable ...ds (VSS)	8	0	14	0	11	10	1.0	0	4	1	5	3
	33	27	34	14	28	30	54	32	30	21	34	44
...Nitrogen	1.8	1.6	1.5	2.6	1.3	1.6	1.7	5.8	3.5	2.6	1.5	1.6
...ic Nitrogen	1.1	0.95	0.64	1.2	0.81	1.0	1.0	0.8	0.6	1.2	0.7	0.8
...Kjeldahl ...rogen	1.6	1.4	0.81	1.4	1.1	1.4	1.1	3.2	0.6	1.2	0.8	1.0
...ia, as N	0.53	0.45	0.17	0.06	0.29	0.41	0.1	2.4	0.02	0	0.05	0.08
...ites plus ...rates, as N	0.18	0.15	0.85	1.2	0.18	0.18	0.6	2.6	2.9	1.4	0.7	0.7
...Phosphorus	2.8	2.4	0.09	0.11	0.03	1.4	0.47	1.2	0.13	-	0.17	0.32
...olved Ortho- ...sphates, as PO_4	2.9	1.9	0.07	0.09	0	1.4	1.1	2.9	0.31	-	0.28	0.7
...nic (ug/l)	2	3	1	0	1	1	3	3	2	1	1	2
...ium (ug/l)	0	0	1	0	0	0	0	0	1	0	0	0
...mium (ug/l)	10	7	0	3	10	10	20	3	1	2	0	10
...er (ug/l)	0	1	17	8	20	10	0	0	23	13	0	0
...(ug/l)	3,400	5,600	3,100	1,100	800	2,100	270	230	1,400	750	170	230
...(ug/l)	0	13	150	29	0	0	0	8	76	41	0	0
...ury (ug/l)	0.2	0.1	0.3	1.7	0.1	0.2	0.6	0.1	0	2.3	0.3	0.5
...el (ug/l)	0	0	0	0	0	0	0	0	0	0	0	0
...(ug/l)	100	70	70	30	50	75	90	80	70	60	30	60

...Based on 10/10-11/79 monitoring
...Based on 11/30-12/1/79 monitoring
...Based on 1/24-25/80 monitoring
(4) Based on 3/28/80 monitoring
(5) Based on 5/25-26/79 monitoring
(6) Based on average of 5/25-26 and 10/10-11 monitoring

CASTRO VALLEY CREEK OBSERVED BASE FLOW RELATIVE
CONCENTRATIONS (mg constituent/kg total solids)

nt	Seaview Station Minimum	Seaview Station Maximum	Seaview Station Average	Seaview Station Number of Observation	Knox Station Minimum	Knox Station Maximum	Knox Station Average	Knox Station Number of Observation
..., as $CaCO_3$	270,000	490,000	380,000	5	180,000	350,000	270,000	5
nate hardness, 3	130,000	290,000	190,000	5	190,000	290,000	240,000	5
rdness, 3	500,000	630,000	570,000	5	460,000	540,000	500,000	5
diss.	120,000	150,000	130,000	5	81,000	110,000	100,000	5
n, diss.	57,000	63,000	61,000	5	57,000	65,000	62,000	5
n, diss.	1,000	5,200	2,700	5	2,800	3,800	3,200	5
diss.	100,000	120,000	110,000	5	120,000	140,000	130,000	5
, diss.	91,000	130,000	110,000	5	180,000	260,000	220,000	5
diss.	220,000	330,000	270,000	5	190,000	220,000	200,000	5
le Solids (TDS)	940,000	990,000	960,000	5	870,000	980,000	940,000	5
erable (SS)	0	31,000	14,000	5	0	13,000	4,300	5
, Non-filterable (VSS)	0	26,000	92,000	5	0	4,800	2,300	5
	20,000	63,000	36,000	5	27,000	44,000	33,000	5
trogen	1,200	5,100	2,400	5	1,300	4,900	3,100	5
Nitrogen	700	2,400	1,200	5	620	1,700	910	5
eldahl Nitrogen	1,000	2,800	1,600	5	660	1,700	1,300	5
as N	120	480	320	5	0	2,000	430	5
plus Nitrates, as N	110	2,400	890	5	490	3,500	1,800	5
osphorus	36	2,500	940	5	150	1,000	420	4
d Ortho-Phosphates,	0	2,600	1,300	3	240	2,400	990	4
	0	2.2	1.4	5	0.9	2.5	2.0	5
	0	1.9	0.4	5	0	1.2	0.2	5
	0	12	6	5	0	16	4.6	5
n	0	24	9	5	0	28	93	5
	950	5,800	3,200	5	150	1,700	670	5
	0	280	70	5	0	92	32	5
	0.07	3.4	0.9	5	0	3.3	0.8	5
	0	0	0	5	0	0	0	5
	52	130	78	5	25	87	68	5

TABLE E20 CASTRO VALLEY CREEK AND URBAN AREA OBSERVED STORM PERIOD RELATIVE CONCENTRATIONS (mg constituent/kg total solids)

	Seaview Station				Knox Station					
Constituent	Min.	Max.	Avg.	No. of Observ.	Min.	Max.	Avg.	Std. Dev.	Std. Dev./ Avg. Ratio	No. of Observ.
Total alk., as $CaCO_3$	53,000	380,000	130,000	14	36,000	300,000	140,000	66,000	0.5	19
Non-carbonate hardness, as $CaCO_3$	11,000	130,000	53,000	14	19,000	160,000	73,000	38,000	0.5	19
Total hardness, as $CaCO_3$	80,000	510,000	200,000	14	73,000	440,000	210,000	100,000	0.5	19
Calcium, diss.	20,000	130,000	47,000	14	19,000	110,000	52,000	23,000	0.4	19
Magnesium, diss.	7,000	48,000	19,000	14	5,800	45,000	20,000	11,000	0.6	19
Potassium, diss.	1,800	6,300	3,400	14	940	32,000	7,100	-	-	19
Sodium, diss.	11,000	110,000	39,000	14	9,600	110,000	42,000	-	-	19
Chloride, diss.	13,000	160,000	44,000	15	15,000	130,000	54,000	27,000	0.5	20
Sulfate, diss.	25,000	190,000	70,000	14	24,000	160,000	76,000	-	-	20
Filterable Solids (TDS)	150,000	810,000	370,000	16	34,000	860,000	390,000	-	-	21
Non-filterable Solids (SS)	190,000	860,000	610,000	16	2,300	880,000	560,000	-	-	22
Volatile Non-filterable Solids (VSS)	42,000	130,000	96,000	14	ø	330,000	134,000	-	-	19
COD	8,800	170,000	100,000	17	22,000	730,000	270,000	160,000	0.6	24
Total Nitrogen	430	13,000	5,500	15	940	19,000	9,600	-	-	19
Organic Nitrogen	1,700	12,000	3,800	15	1,000	36,000	7,500	-	-	22
Total Kjeldahl Nitrogen	1,800	12,000	4,200	16	1,600	15,000	6,200	-	-	22
Ammonia, as N	62	350	170	16	0.7	790	230	-	-	22
Nitrites plus Nitrates, as N	1.6	7,100	1,700	15	1,200	8,400	3,600	-	-	19
Total Phosphorus	76	1,600	590	16	220	2,000	1,200	540	0.4	21
Dissolved Ortho-phosphates, as PO_4	44	1,100	460	14	570	4,200	1,500	-	-	20
Arsenic	2.8	7.4	5.7	14	4.0	36	13	7	0.6	20
Cadmium	ø	19	2.2	15	ø	26	7	9	1.3	20
Chromium	ø	59	22	15	ø	190	40	49	1.2	20
Copper	39	91	64	15	64	1,400	320	420	1.3	20
Iron	2,200	40,000	25,000	15	15,000	260,000	37,000	52,000	1.4	20
Lead	ø	610	120	17	17	6,700	1,500	1,600	1.1	25
Mercury	ø	2.6	0.6	14	ø	3.7	1.1	1.1	1.0	19
Nickel	ø	160	62	16	ø	450	100	-	-	18
Zinc	110	300	180	19	250	4,500	960	-	-	30

TABLE E20 CASTRO VALLEY CREEK AND URBAN AREA OBSERVED STORM PERIOD RELATIVE CONCENTRATIONS (mg constituent/kg total solids)

	Urban Area Only					
Constituent	Min.	Max.	Avg.	Std. Dev.	Std. Dev./Avg. Ratio	of Observ.
Total alk., as $CaCO_3$	12,000	300,000	140,000	76,000	0.5	19
Non-carbonate hardness, as $CaCO_3$	17,000	180,000	83,000	46,000	0.6	19
Total hardness, as $CaCO_3$	28,000	440,000	220,000	110,000	0.5	19
Calcium, diss.	5,500	110,000	57,000	29,000	0.5	19
Magnesium, diss.	69	44,000	20,000	13,000	0.6	19
Potassium, diss.	2,300	32,000	8,500	6,900	0.8	19
Sodium, diss.	6,800	110,000	46,000	26,000	0.6	19
Chloride, diss.	14,000	130,000	62,000	32,000	0.5	20
Sulfate, diss.	9,700	160,000	83,000	44,000	0.5	19
Filterable Solids (TDS)	83,000	860,000	420,000	220,000	0.5	20
Non-filterable Solids (SS)	40,000	1,300,000	590,000	300,000	0.5	20
Volatile Non-filterable Solids (VSS)	19,000	810,000	180,000	180,000	1.0	18
COD	150,000	1,000,000	400,000	210,000	0.5	22
Total Nitrogen	3,700	20,000	11,000	4,900	0.4	19
Organic Nitrogen	∅	56,000	8,300	12,000	1.5	20
Total Kjeldahl Nitrogen	∅	15,000	6,000	4,800	0.8	20
Ammonia, as N	∅	920	260	270	1.0	20
Nitrites plus Nitrates, as N	1,400	15,000	4,900	3,300	0.7	19
Total Phosphorus	920	3,400	1,500	750	0.5	20
Dissolved Ortho-phosphates, as PO_4	170	8,200	2,200	2,000	0.9	19
Arsenic	4.0	40	17	12	0.7	19
Cadmium	∅	52	9	14	1.5	20
Chromium	∅	190	53	54	1.0	18
Copper	36	1,400	340	410	1.2	20
Iron	2,400	52,000	24,000	11,000	0.5	20
Lead	280	6,800	1,900	1,600	0.8	25
Mercury	∅	4.5	1.3	1.4	1.0	19
Nickel	∅	450	130	150	1.2	16
Zinc	240	4,500	1,200	880	0.8	28

LE E-21. NECESSARY CONTROL FOR BASE FLOW CONCENTRATIONS IN CASTRO VALLEY CREEK TO MEET CRITERIA (% removal)

stituents	Level of Observ.*	Value (mg/l) Seaview/ Knox	Irrigation Seaview	Irrigation Knox	Livestock and Wildlife Seaview	Livestock and Wildlife Knox	Industrial Seaview	Industrial Knox	Aquatic Life Seaview	Aquatic Life Knox	Marine Life Seaview	Marine Life Knox	Recreation Uses Seaview	Recreation Uses Knox	Freshwater Supplies Seaview	Freshwater Supplies Knox
erable ids	Max.	1300/1100	62%**	55%**			88%**	86%**								
	Avg.	840/950	40 **	47 **			82 **	84 **								
	Min.	490/680		26 **			69 **	78 **								
o- sphates	Max.	2.9/2.4									100%	100%	90%	88%		
	Avg.	1.6/1.2									100	100	81	75		
	Min.	/0.3										100				
per	Max.	0.02/0.023		13 **												
	Max.	5.6/1.4							82%	29%					95%	79%
	Avg.	2.8/0.56							64						89	46
	Min.	0.8/0.17													63	
	Max.	0.15/0.076			33%										67	34
ury	Max.	0.0017/ 0.0023			41	57%			100	100	94	96				13
	Avg.	0.0005/ 0.0007							90	93	80	86				
	Min.	0.0001/							50							
:	Max.	0.1/0.09							90	89						
	Avg.	0.06/0.07							83	86						
	Min.	0.03/0.03							67	67						

f the maximum concentrations observed meet the criteria, then all observed concentrations will meet the riteria. Similarly, if only the average observed concentrations meet the criteria, then higher concenrations may not meet the criteria. The control necessary for the minimum observed concentrations to eet the criteria is the minimum control that would produce any "results". If no values are shown for verage or minimum concentrations, only the "maximum" values (greater than the average value) require ontrol. If no values, or constituents are shown, then they do not require control, based on the availble numeric criteria. Some narrative criteria may still be exceeded, based on local conditions.

hese removals are necessary to meet the most severe criteria in this class. Many less critical uses in his class may be unaffected by current water quality, or by less demanding controls.

E-22 NECESSARY CONTROL FOR STORM WATER CONCENTRATION IN CASTRO VALLEY CREEK TO MEET CRITERIA (% removal)

...tituents	Level of Observ.*	Value (mg/l) Seaview	Value (mg/l) Knox	Irrigation Seaview	Irrigation Knox	Livestock and Wildlife Seaview	Livestock and Wildlife Knox	Industrial Seaview	Industrial Knox	Aquatic Life Seaview	Aquatic Life Knox	Marine Life Seaview	Marine Life Knox	Recreation Uses Seaview	Recreation Uses Knox	Freshwater Supplies Seaview	Freshwater Supplies Knox
...erable ...ids	Max.	500	244					70%**	39%**								
	Avg.	300	125					50 **									
	Min.	176	73					15 **									
...filter- ...e solids	Max.	1220	600							93%	87%						
	Avg.	640	250							88	68						
	Min.	94	40							15							
...o- ...phates	Max.	0.8	0.95									100%	100%	63%	68%		
	Avg.	0.4	0.46									100	100	23	35		
	Min.	0.03	0.06									99	100				
...ium	Max.	0.023	0.012	57%**	17%**					57	17					57%	17%
...nium	Max.	0.06	0.06													17	17
...er	Max.	0.1	0.7	80 **	97 **		29%				86	50	93				
	Avg.	0.056	0.1	64 **	80 **							11	50				
	Min.	0.030	0.021	33 **	5 **												
	Max.	50	21							98	95					99	99
	Avg.	23	9.3							96	89					99	97
	Min.	1.9	5.0							47	80					84	94
	Max.	0.6	3.3			83%	97			67	94					92	98
	Avg.	0.11	0.49			13	80				59					56	90
	Min.		0.097														50
...ury	Max.	0.0026	0.0025			62	60			98	98	96	96			23	20
	Avg.	0.0006	0.0004							92	88	83	75				
	Min.																
...el	Max.	0.1	0.1							99	99	99	99				
	Avg.	0.069	0.037							86	73	86	73				
...:	Max.	0.50	2.2							98	100	80	95				
	Avg.	0.18	0.31							94	97	44	68				
	Min.	0.06	0.093							83	89						

...e maximum concentrations observed meet the criteria, then all observed concentrations will meet the ...eria. Similarly, if only the average observed concentrations meet the criteria, then higher concen- ...ons may not meet the criteria. The control necessary for the minimum observed concentrations to ... the criteria is the minimum control that would produce any "results". If no values are shown for ...ge or minimum concentrations, only the "maximum" values (greater than the average value) require ...rol. If no values, or constituents are shown, then they do not require control, based on the avail- ... numeric criteria. Some narrative criteria may still be exceeded, based on local conditions.

...e removals are necessary to meet the most severe criteria in this class. Many less critical uses in ... class may be unaffected by current water quality, or by less demanding controls.

TABLE E-23 YEAR ONE FIELD MEASUREMENTS (Contd.)

Storm Data (Contd.)

Date	Time @ Knox	PH		Specific Conductance (umhos/cm)		Temperature (°C)	
		Seaview	Knox	Seaview	Knox	Seaview	Knox
1/10-11/79	2130	7.6	8.0	156	84	11	12
	2230	-	7.6	-	114	-	10.5
	2330	7.6	7.5	148	126	11	12
	0030	7.6	7.6	210	173	11	12
	0130	7.6	7.7	233	82	11	11
	0230	7.5	7.7	169	146	11	12
	0330	7.5	7.7	344	221	11	11
	0430	7.5	7.6	571	271	11	11
	0530	7.7	7.5	480	226	11	12
	0630	7.7	7.5	323	223	12	12
	0730	7.7	7.9	418	326	12	13
1/14/79	0230	7.1	7.5	1,140	1,430	10	10.5
	0300	-	7.3	-	370	-	10
	0400	7.1	7.4	376	313	9.5	10
	0500	7.3	7.0	264	92	9	9.5
	0600	7.2	7.2	316	442	9	9
	0700	7.2	7.2	287	145	9	9
	0800	7.2	7.2	1,073	554	9	9
	0900	7.3	7.2	439	247	9.5	9.5
	1020	-	7.4	-	346	-	9.5
2/13-14/79	Composite	7.1	7.3	368	157	14	5
2/15-16/79	Composite	7.0	7.0	822	156	11	13
2/18-19/79	Composite	7.1	6.7	395	223	8	7
2/20/79	Composite	7.0	7.0	180	110	6	6
2/20-21/79	Composite	-	7.1	-	145	-	6
2/22/79	Composite	6.8	6.9	228	130	8.5	9
2/28-3/1/79	Composite	7.4	7.4	210	75	4	4
3/15-17/79	Composite	7.6	7.6	652	269	5	4
3/26-28/79	Composite	7.1	7.3	420	216	9	7
4/26/79	Composite	7.5	6.9	714	226	16	12
Minimum		6.8	6.8	148	53	4	4
Maximum		7.7	8.0	1,140	1,430	16	13
Mean		7.4	7.4	404	221	10	10
No. of Observations		29	54	29	54	29	54

TABLE E-23. YEAR ONE FIELD MEASUREMENTS

BASE FLOW

Date	Time	PH		Specific Conductance (umhos/cm)		Temperature (°C)	
		Seaview	Knox	Seaview	Knox	Seaview	Knox
1/4/79	0535	-	7.8	-	1044	-	8.5
5/25/79	Composite	7.5	7.7	1153	1193	19	19
Min.		-	7.7	-	1044	-	8.5
Max.		-	7.8	-	1193	-	19
Mean		7.5	7.8	1153	1120	19	14
No. of Observ.		1	2	1	2	1	2

STORM DATA

Date	Time @ Knox	Seaview	Knox	Seaview	Knox	Seaview	Knox
12/17/78	0700	-	7.2	-	111	-	10.5
	0815	-	6.8	-	125	-	10.5
	0910	-	7.0	-	320	-	10.5
	1015	-	7.4	-	459	-	10.5
	1125	-	7.4	-	233	-	11
	1215	-	7.2	-	233	-	11
	1315	-	7.1	-	96	-	11
	1420	-	7.5	-	151	-	11
	1515	-	7.2	-	158	-	11
	1610	-	7.0	-	110	-	11
1/7-8/79	1745	-	7.7	-	133	-	11
	1845	-	7.7	-	127	-	11
	1945	-	7.6	-	108	-	11
	2050	-	7.5	-	136	-	11
	2145	-	7.5	-	178	-	11
	2245	-	7.5	-	203	-	11
	2345	-	7.6	-	178	-	11
1/8/79	0945	-	7.3	-	451	-	10
	1030	-	7.2	-	96	-	11
	1130	-	7.5	-	71	-	10
	1230	-	7.4	-	53	-	11
	1330	7.6	7.2	154	108	10	11
	1430	7.4	7.5	274	169	10	10
	1530	7.3	7.6	343	301	11	11

Table E-24. One Year Storm Turbidity Measurements

Date	Time	Turbidity (NTU) Seaview	Knox
1/7/79	1800	-	29
	1900	-	30
	2000	-	33
	2100	-	16
	2200	-	10
	2300	-	13
1/8/79	1030	-	84
	1130	-	108
	1230	400	156
	1330	320	140
	1430	136	68
1/10/79	2110	-	40
	2210	608	64
	2310	624	64
1/11/79	0010	432	39
	0110	352	36
	0210	312	52
	0310	280	54
	0410	264	58
	0510	200	40
	0610	264	73
	0710	192	68
1/14/79	0400	-	48
	0500	72	38
	0600	116	36
	0700	120	44
	0800	272	42
	0900	240	32
	1000	-	37
2/14/79	0800-0900	432	78
2/16/79	1000	224	46
2/20/79	1900	480	116
2/21/79	1000	-	112
2/22/79	1500	420	204
2/26/79	-	396	68
2/28/79	-	216	112
3/17/79	1400	62	58
3/26/79	1200	228	93
1/18/80	-	160	96
Min.		72	10
Max.		624	204
Mean		290	65
No. of observations		27	39

Table E-25. Year Two Field Measurements

BASE FLOW

DATE	PH Seaview	PH Knox	Specific Conductance (umhos/cm) Seaview	Specific Conductance (umhos/cm) Knox	Temperature (°C) Seaview	Temperature (°C) Knox
10/11/79	6.5	7.2	1100	1180	22	20
11/30/79	7.5	8.0	1870	1810	19	18
1/24/80	7.3	7.8	790	1180	6	4
3/28/80	8.2	-	730	1110	9	6
Min.	6.5	7.2	730	1110	6	4
Max.	8.2	8.0	1870	1810	22	20
Mean	7.4	7.7	1120	1320	14	12
No. of Observ.	4	3	4	4	4	4

STORM DATA

DATE	PH Seaview	PH KNOX	Specific Conductance (umhos/cm) Seaview	Specific Conductance (umhos/cm) Knox	Temperature (°C) Seaview	Temperature (°C) Knox
10/18-22/79	-	6.1	-	230	-	8.5
11/3/79	7.8	7.5	380	120	7	14
11/16-17/79	-	7.7	-	100	-	5
11/22-25/79	-	7.8	-	190	-	19
12/22-26/79	-	7.1	-	150	-	8.5
12/30-31/79	-	8.0	-	170	-	15.5
1/8-18/80	6.0	7.2	340	220	11	11
2/14-24/80	6.5	7.4	330	230	10	10
2/25-28/80	7.4	7.5	540	180	8	8
3/2-3/80	7.6	7.6	650	240	6	5
3/4-7/80	7.1	7.0	460	330	5	5
4/3-6/80	8.1	7.0	560	170	19.5	13
Min.	6.0	6.1	330	100	5	5
Max.	8.1	8.0	650	330	19.5	15.5
Mean	7.2	7.3	470	190	9.5	10.2
No. of Obser.	7	12	7	12	7	12

APPENDIX E.

SAN FRANCISCO BAY AREA

NATIONAL URBAN RUNOFF PROJECT

STORM RUNOFF HYDROGRAPHS

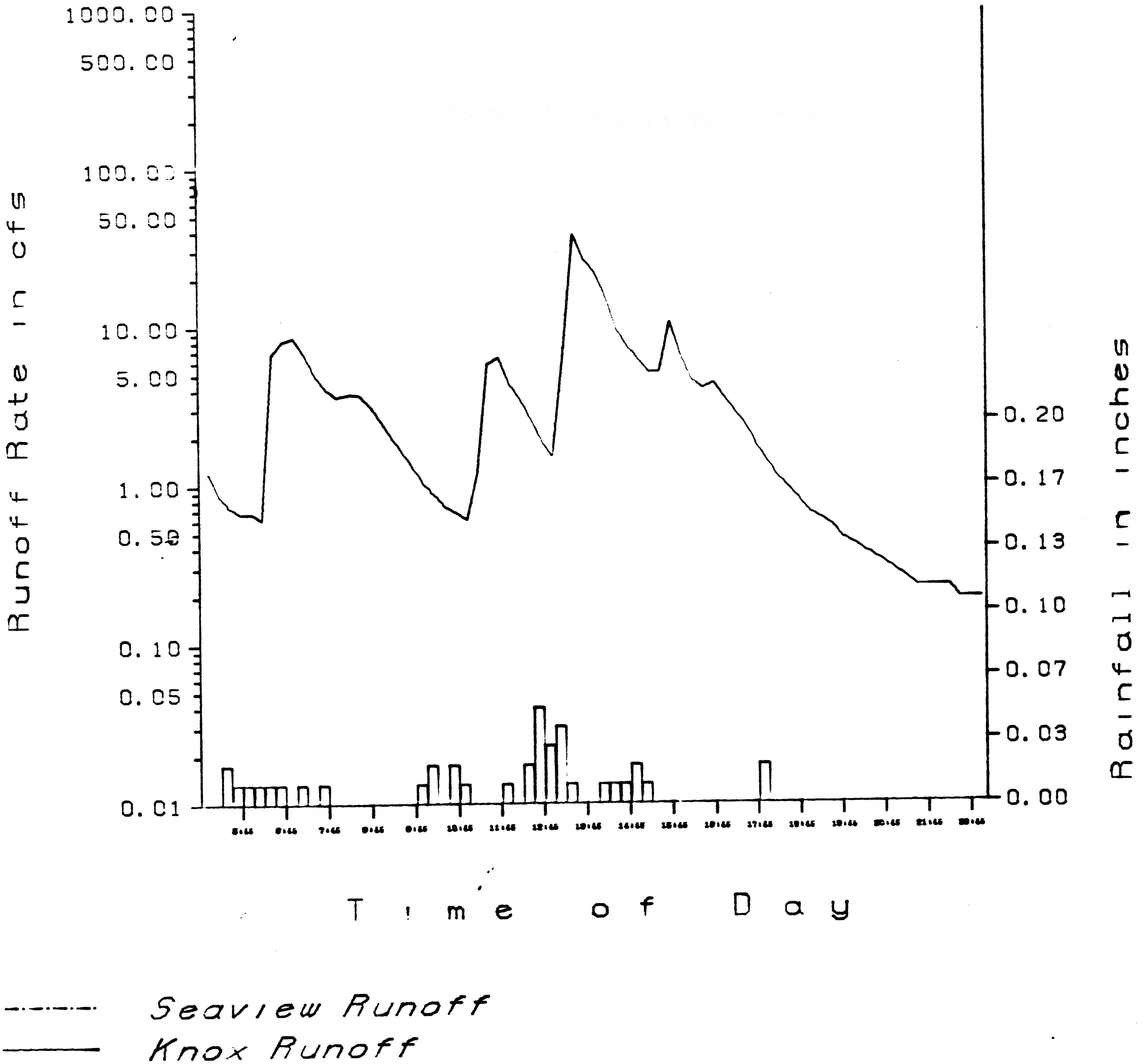
1978- 1980

FIGURE E-1 THROUGH E-30

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

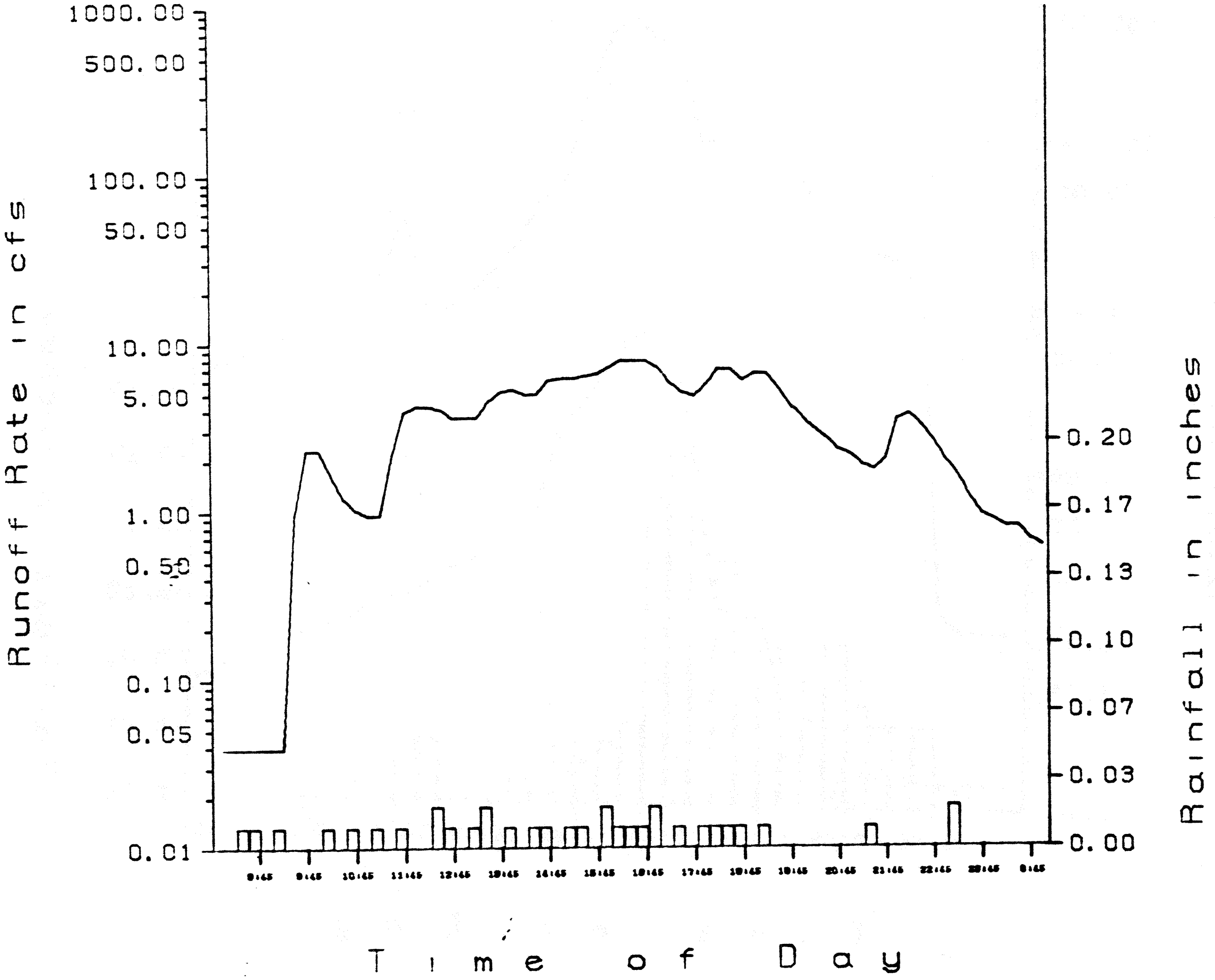
Storm of DECEMBER 17, 1978
STØRM "A"



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of JANUARY 7 & 8, 1979
STØRM "B"



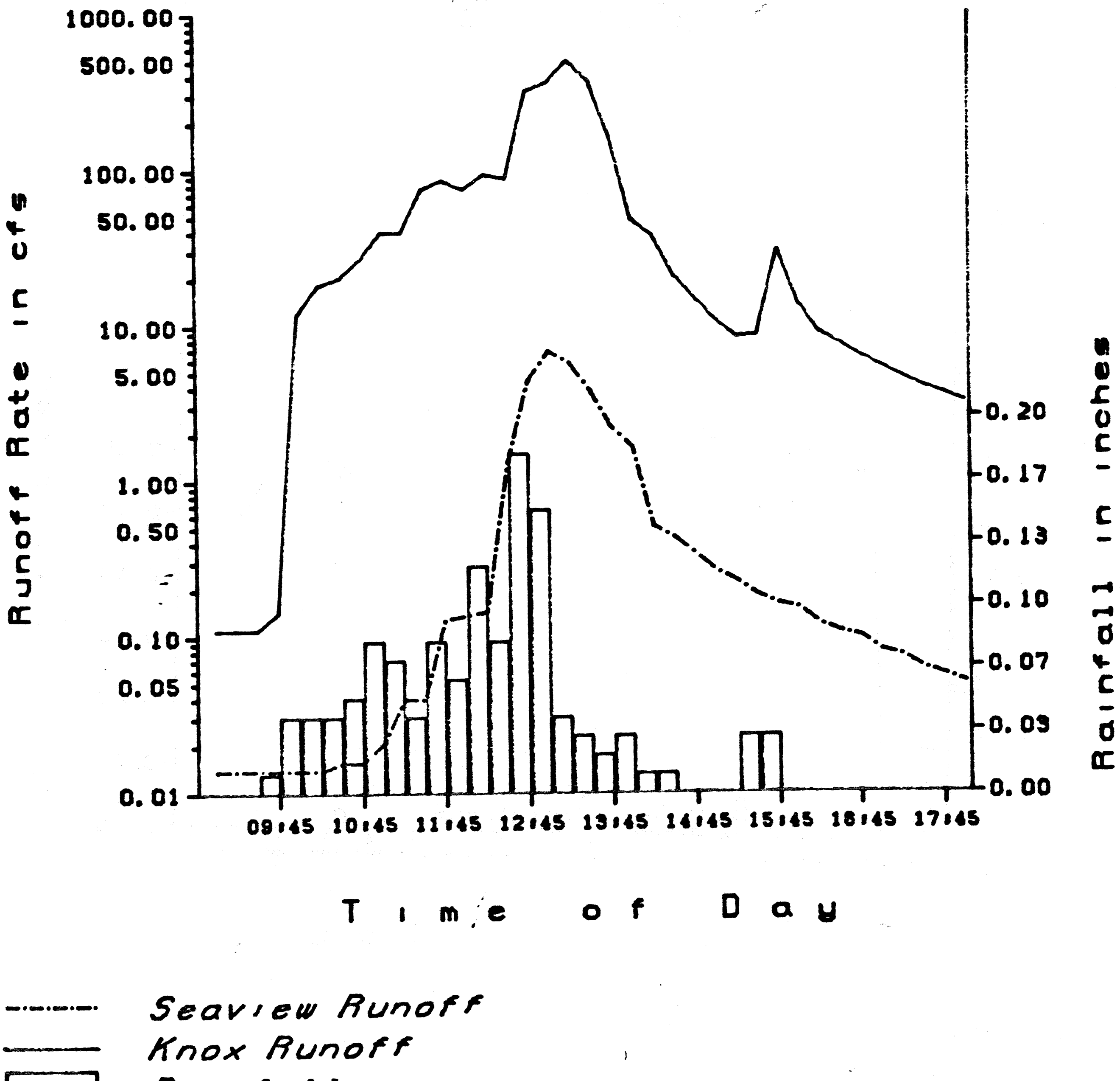
-·-·-·- *Seaview Runoff*

——— *Knox Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

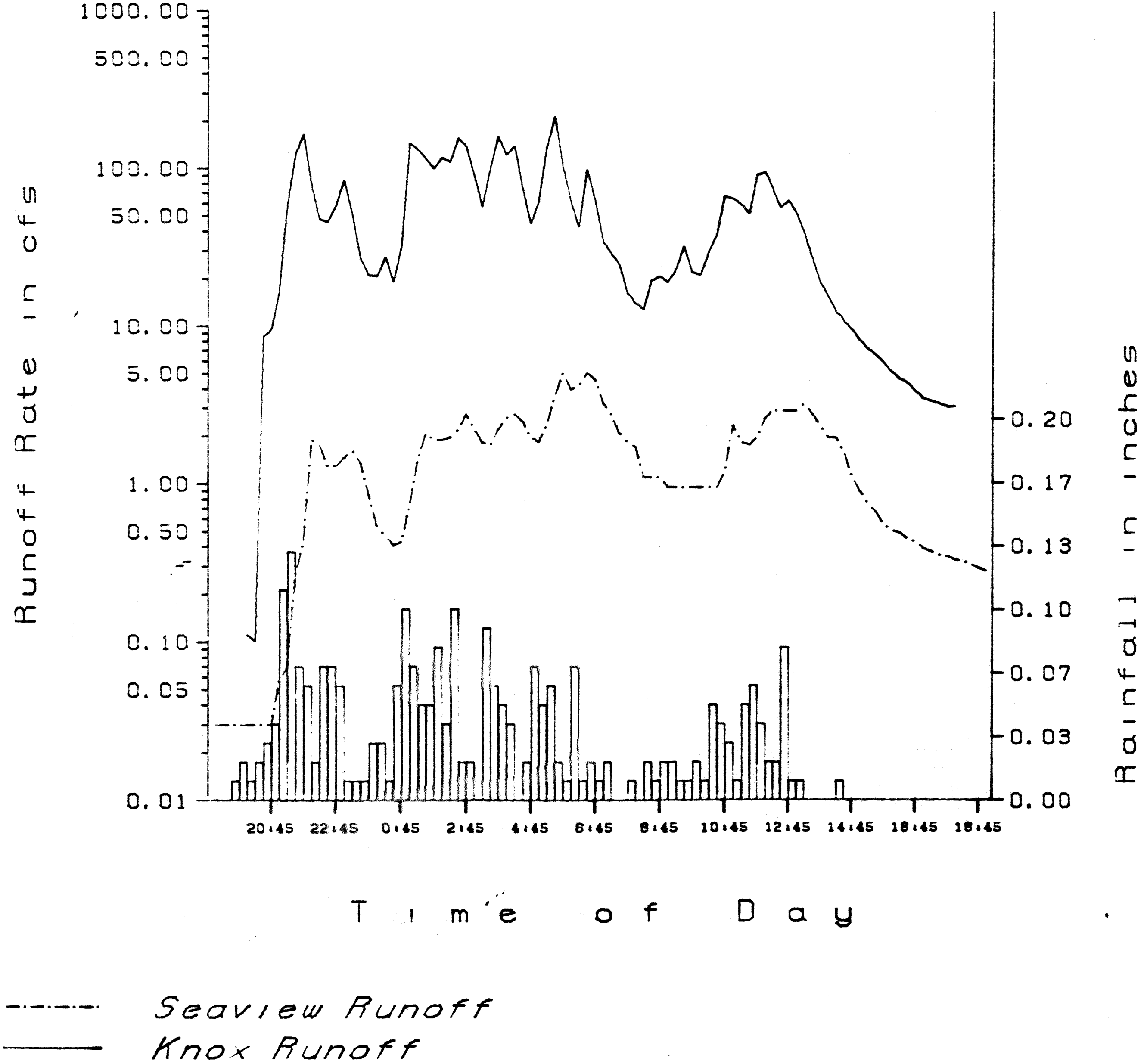
Storm of JANUARY 8, 1979
STØRM "C" - 1979



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

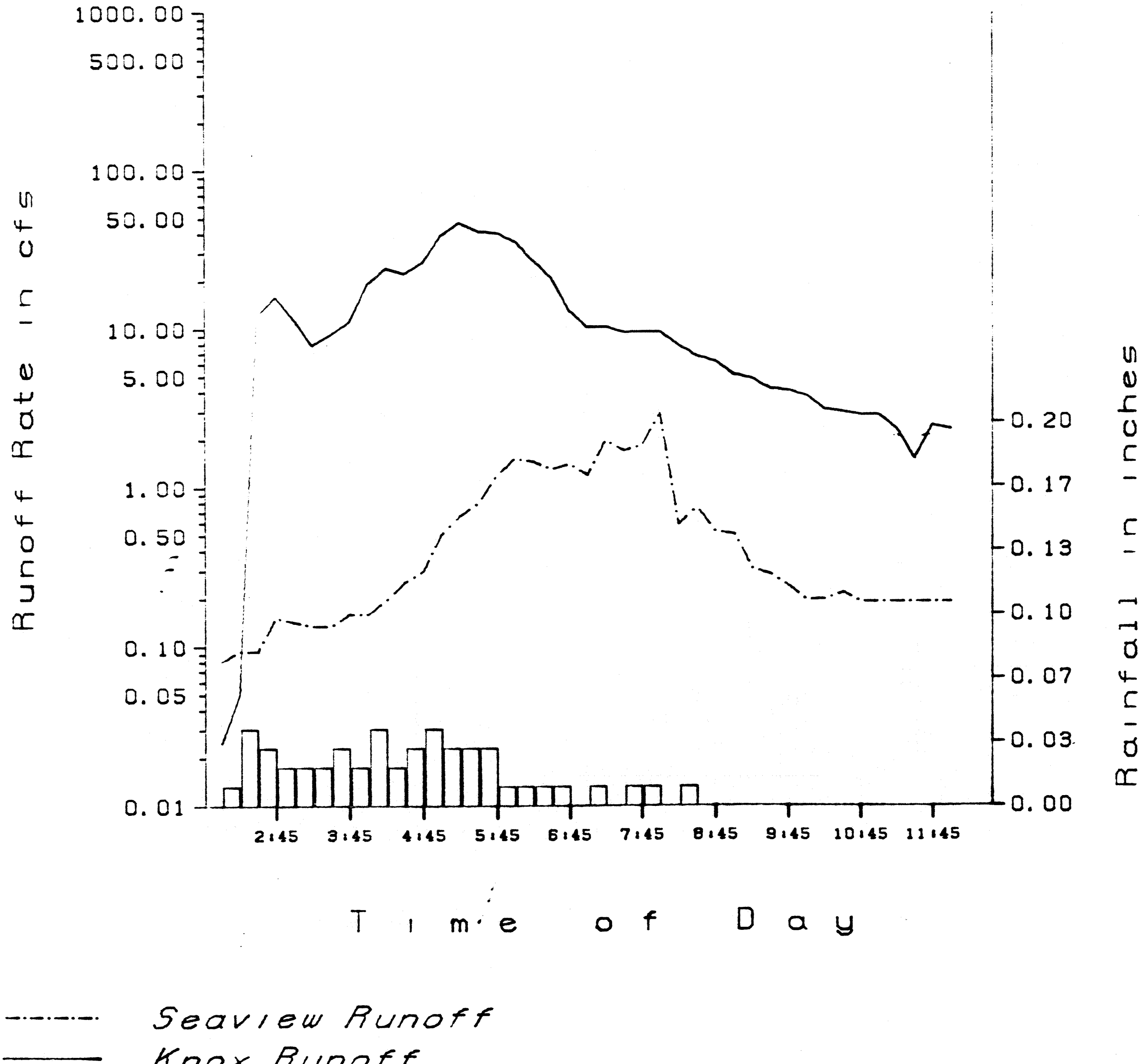
Storm of JANUARY 10 & 11, 1979
STØRM "D"



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

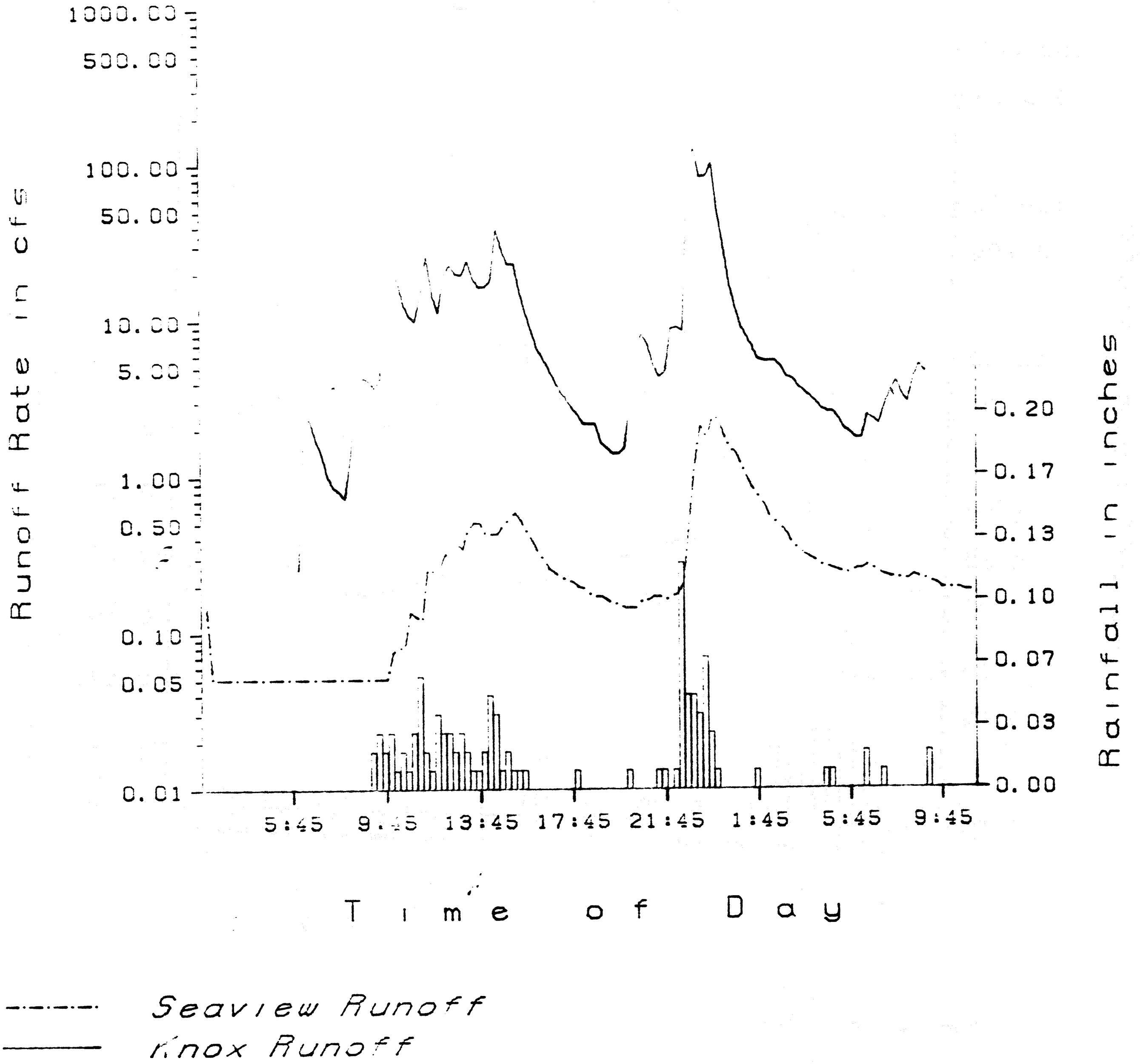
Storm of JANUARY 14, 1979
STØRM "E"



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

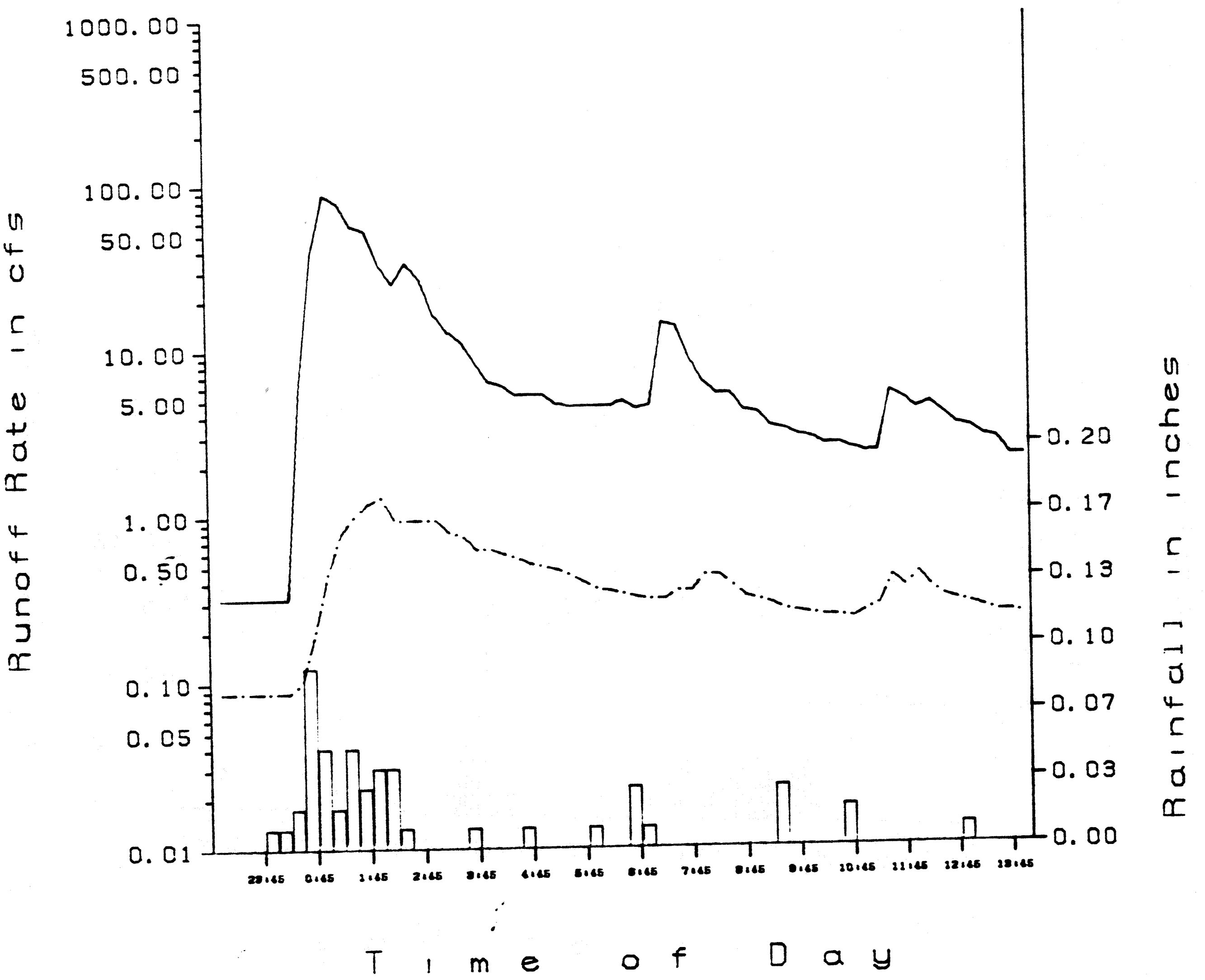
Storm of FEBRUARY 13 & 14, 1979
STORM "F"



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of FEBRUARY 15 & 16, 1979
STØRM "G"

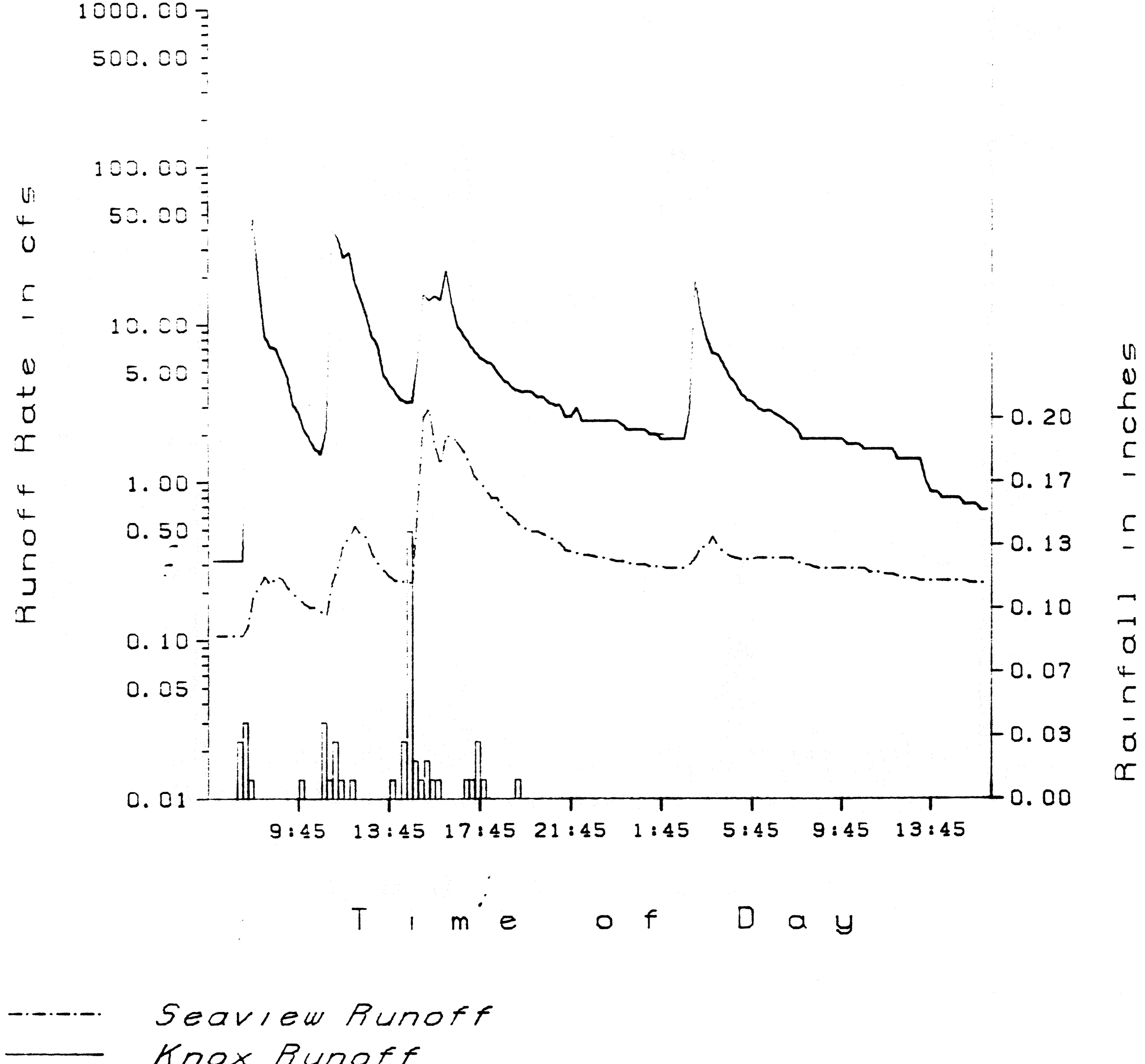


-·-·-·- *Seaview Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

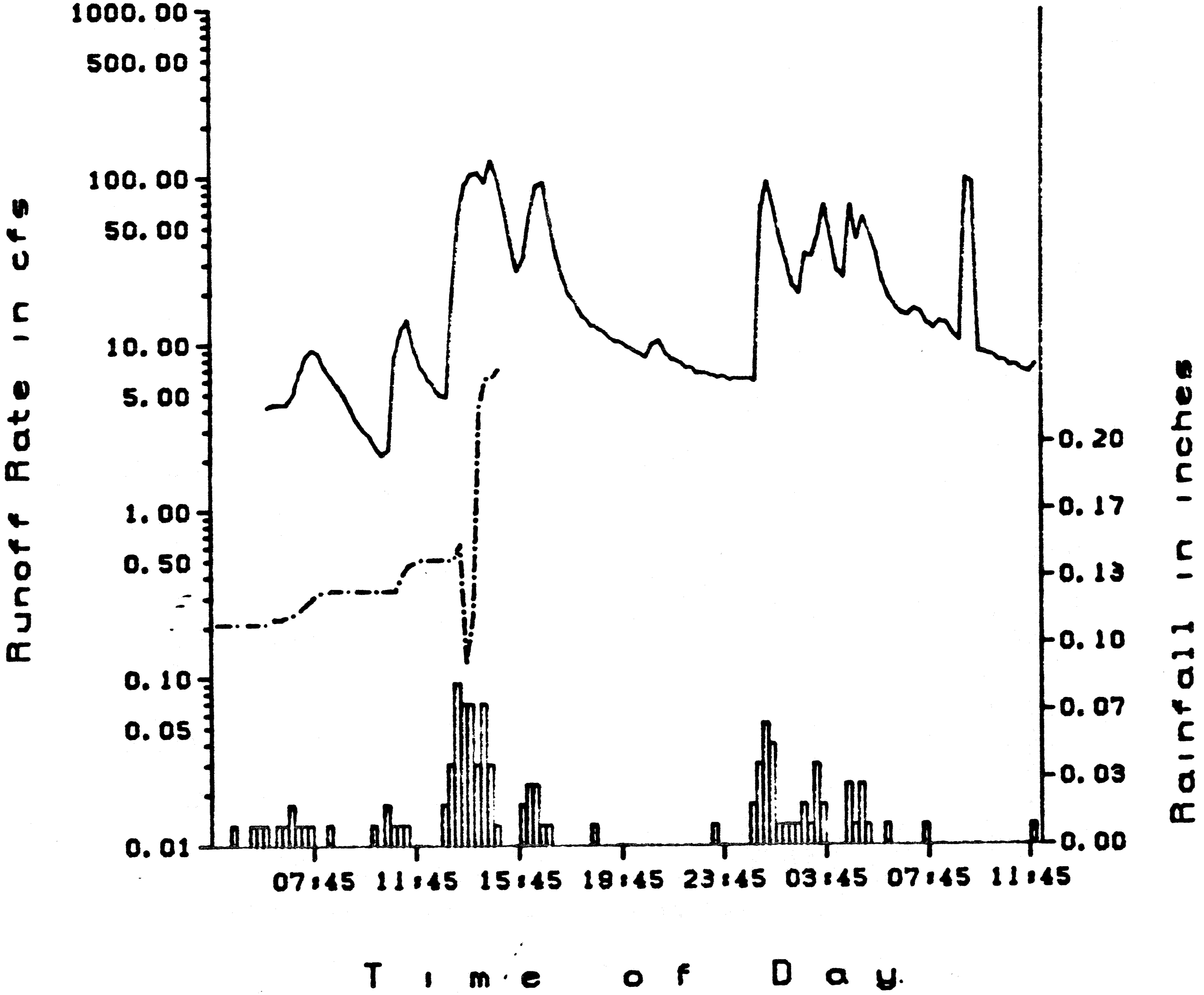
Storm of FEBRUARY 18 & 19 ,1979
STORM "H"



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of FEBRUARY 20 - 21, 1979
STØRM "I" - 1979

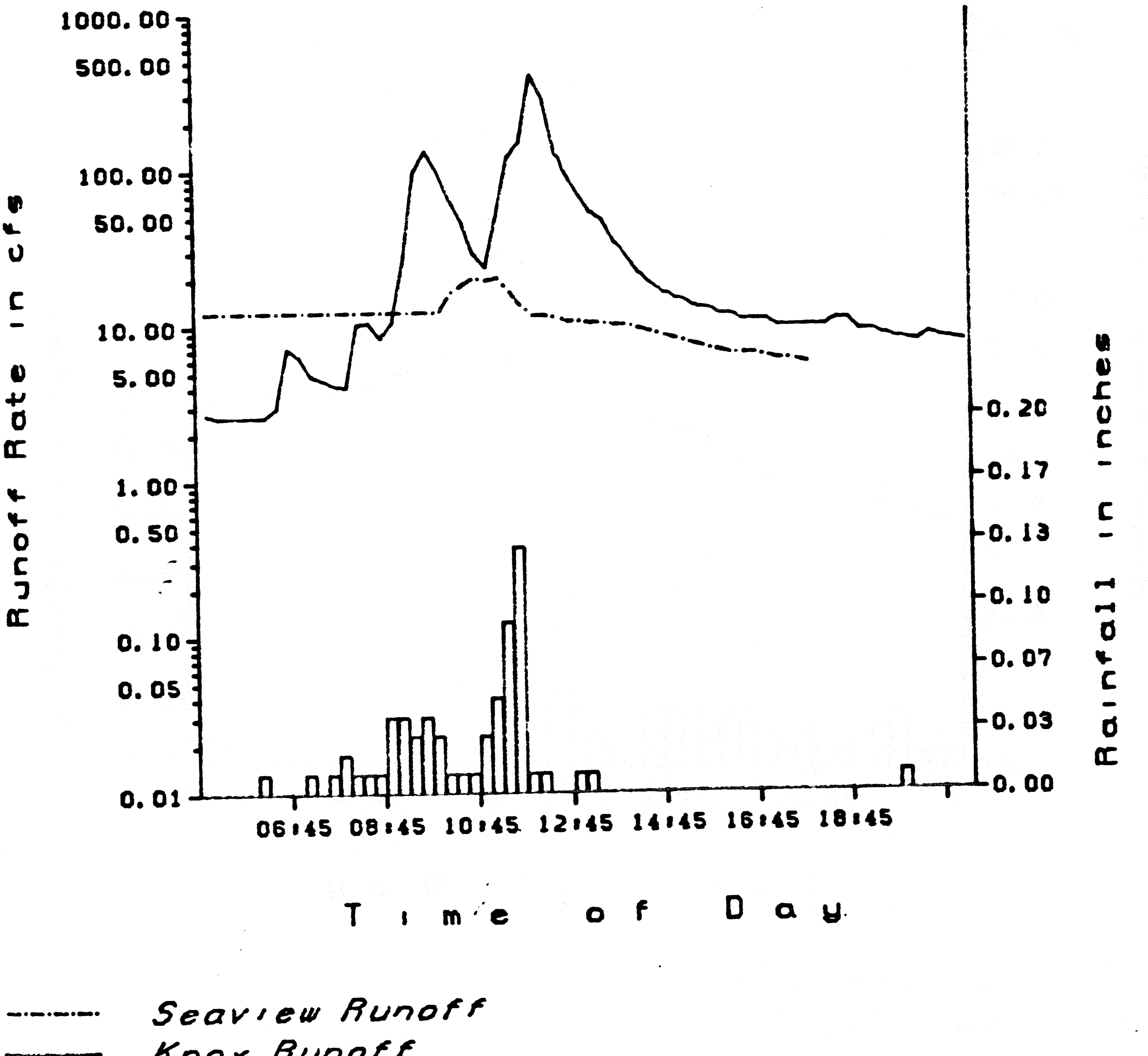


------- Seaview Runoff
——— Knox Runoff

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

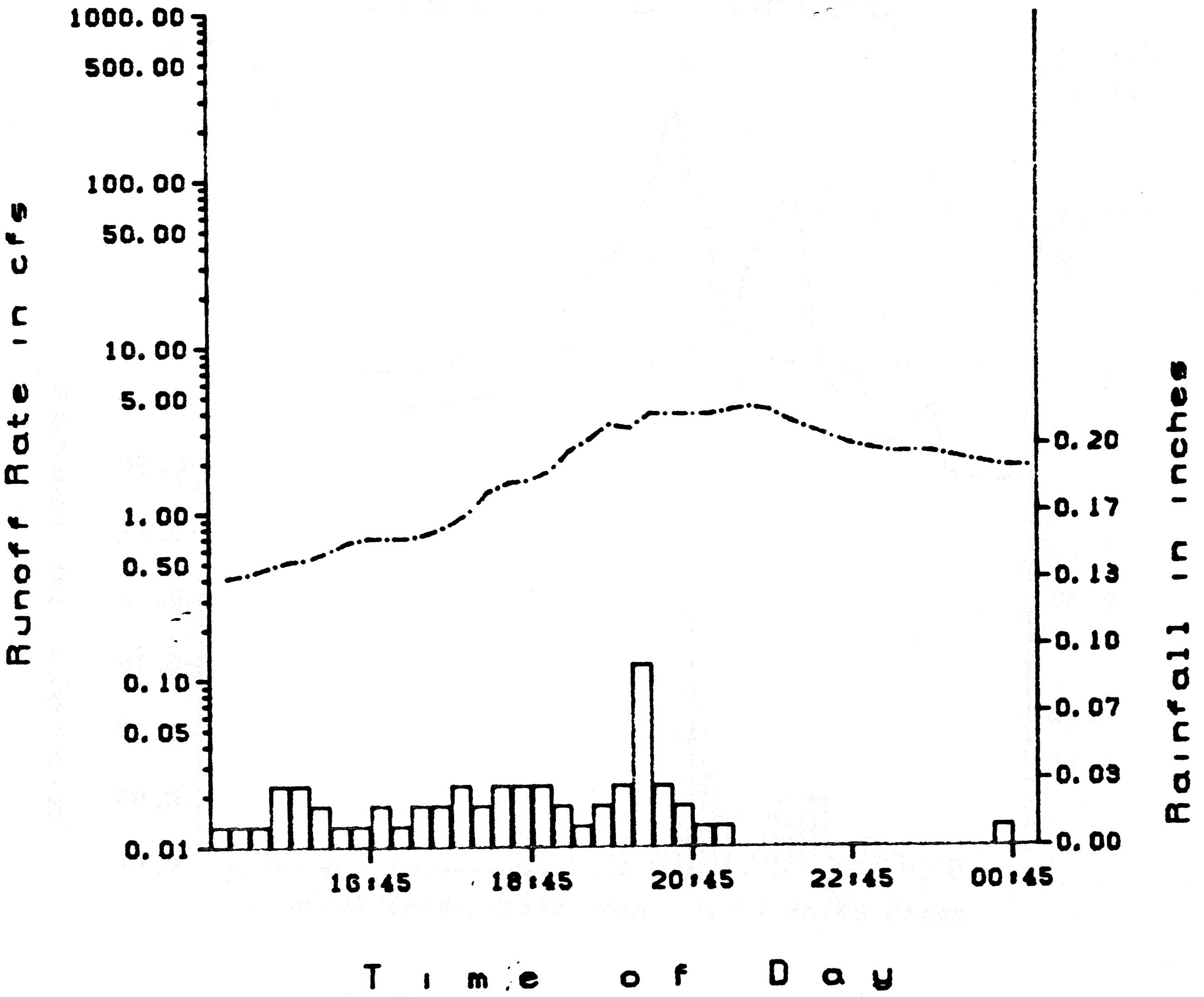
Storm of FEBRUARY 22, 1979
STORM "J" - 1979



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of FEBRUARY 28 - MARCH 1, 1979
STORM "K" - 1979



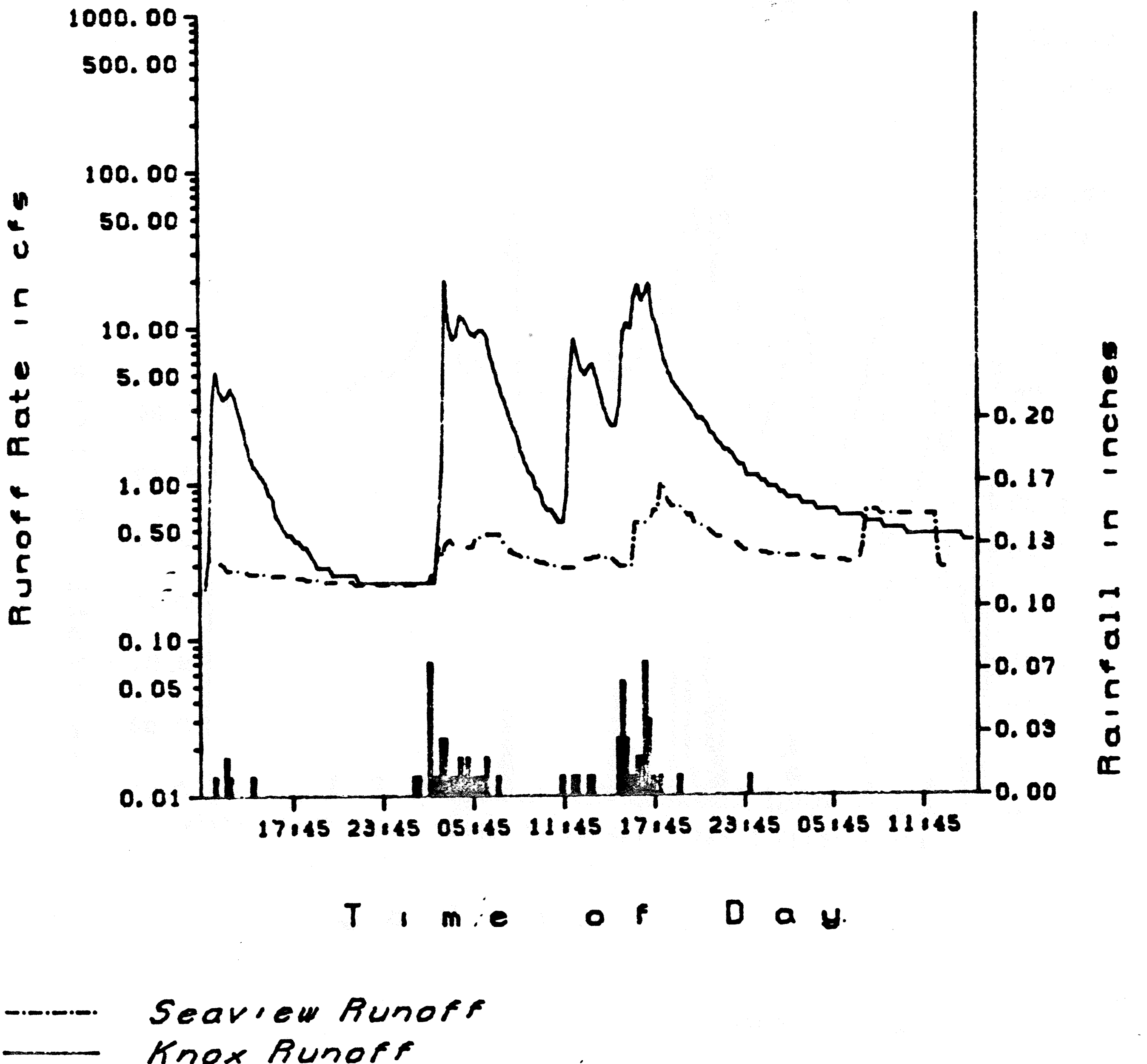
-·-·-·- *Seaview Runoff*

——— *Knox Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

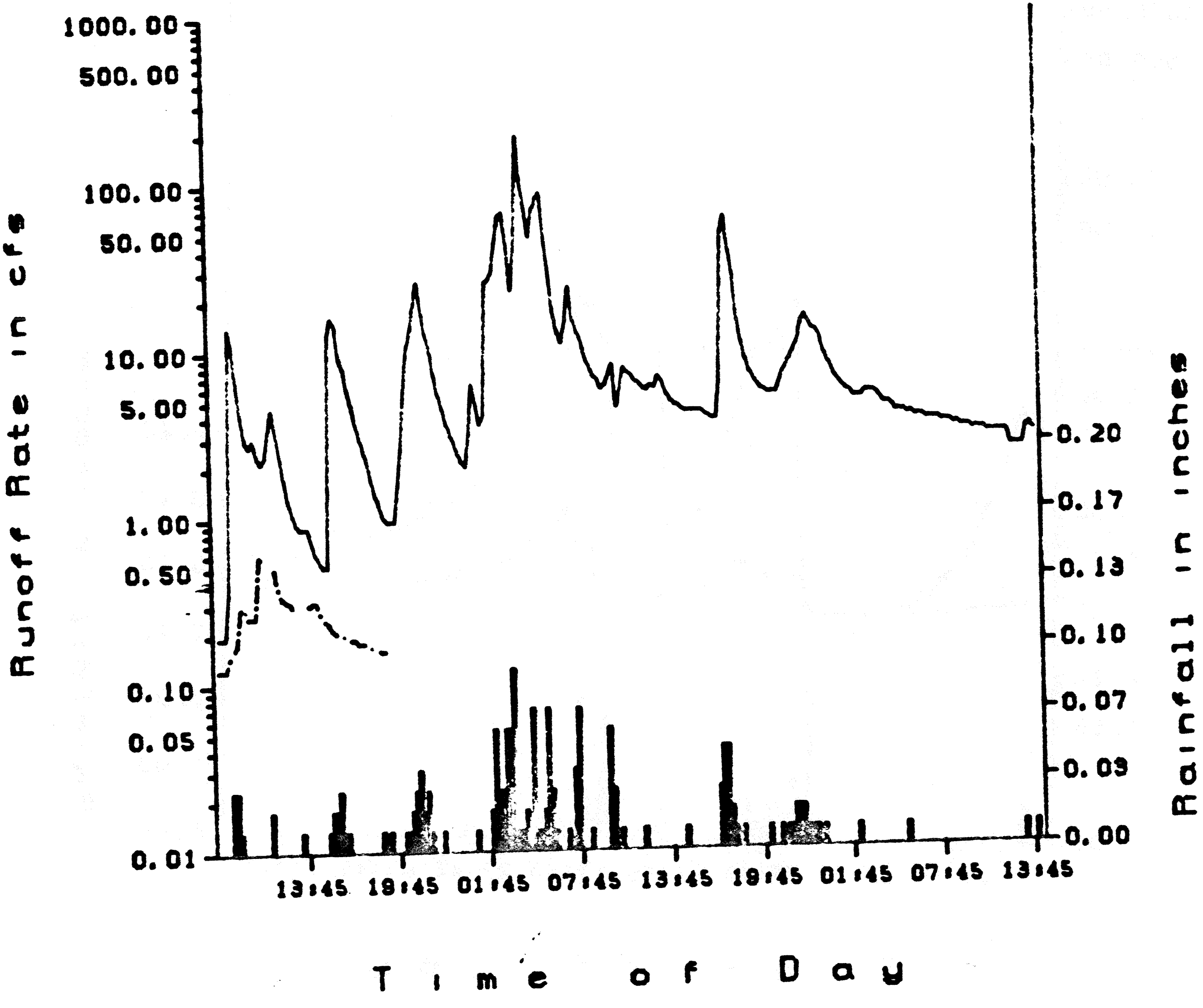
Storm of MARCH 15 - 17, 1979
STORM "L" - 1979



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of MARCH 26 - 28, 1979
STORM "M" - 1979

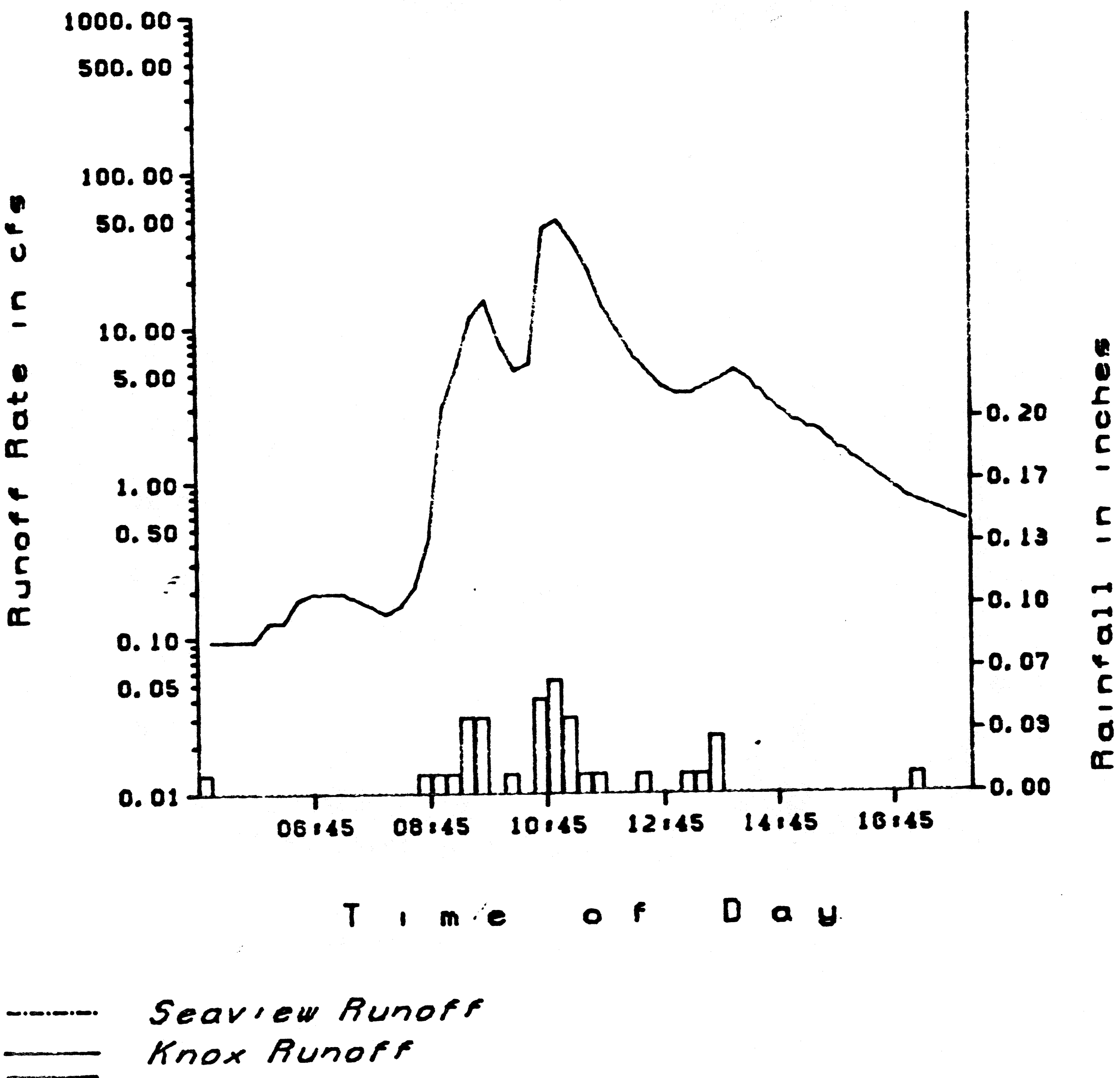


-.-.-.- *Seaview Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

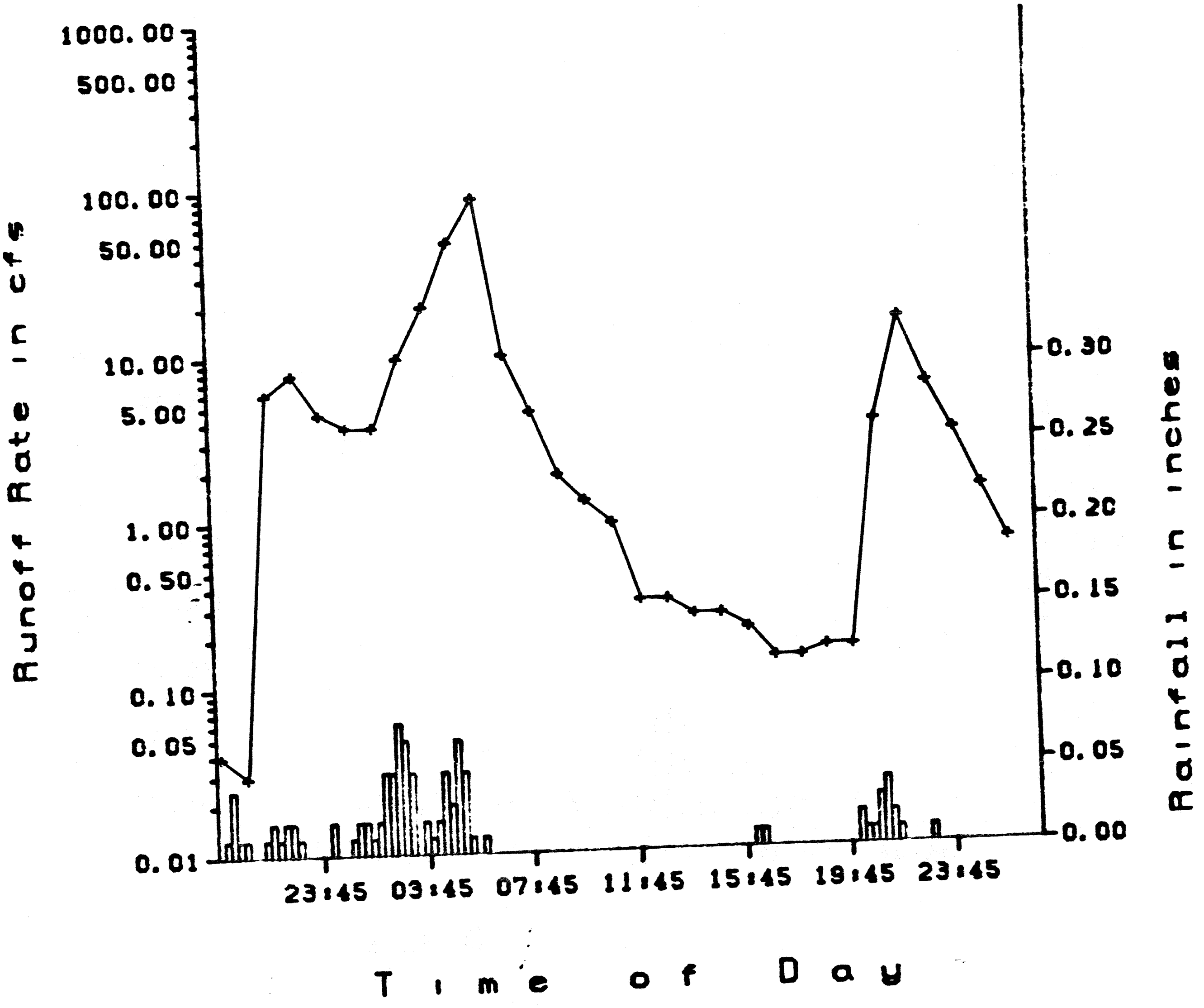
Storm of APRIL 26, 1979
STORM "N" - 1979



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

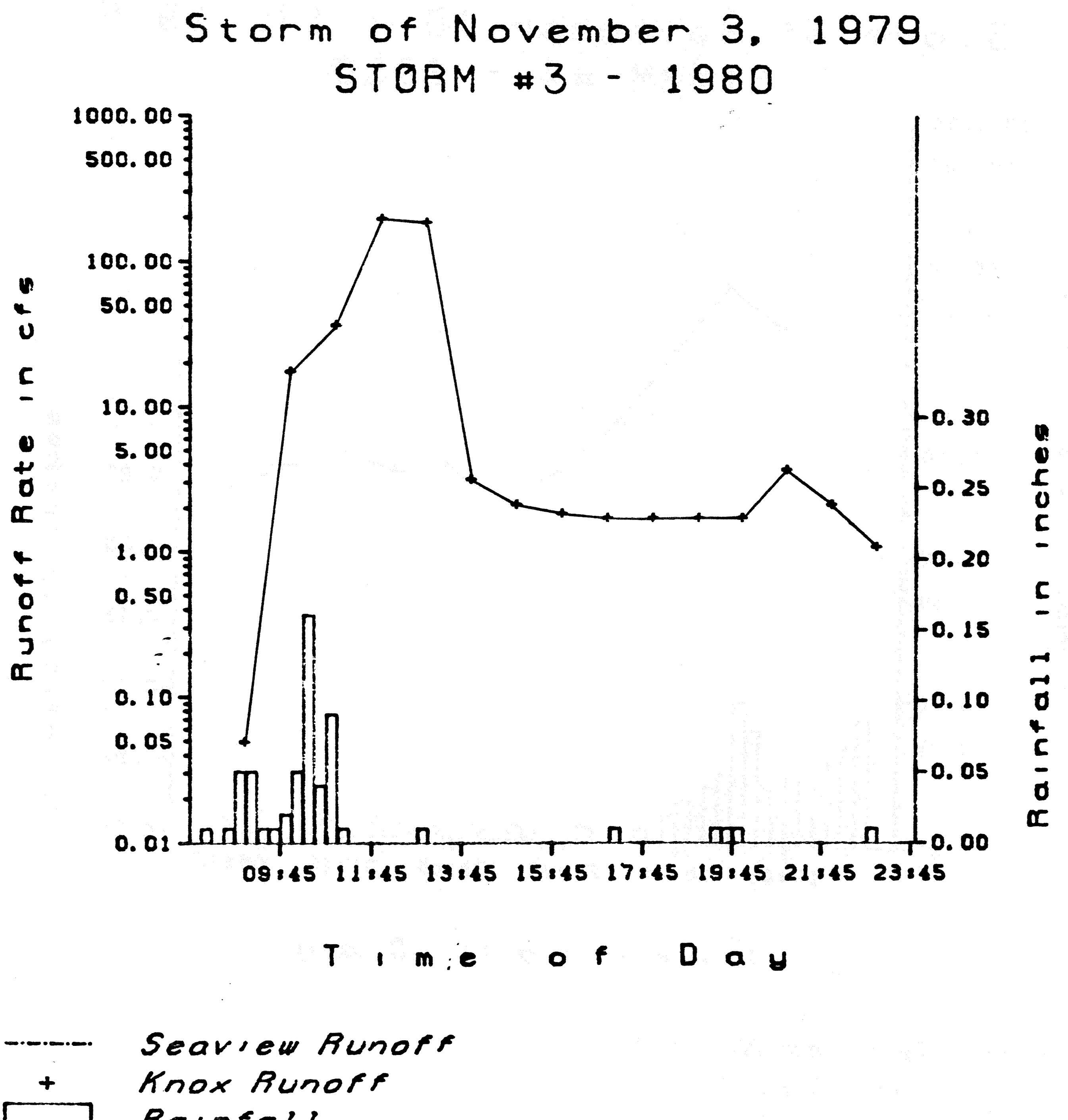
Storm of October 18 - 20, 1979
STORM #1 - 1980



Seaview Runoff

San Francisco Bay Area
National Urban Runoff Project

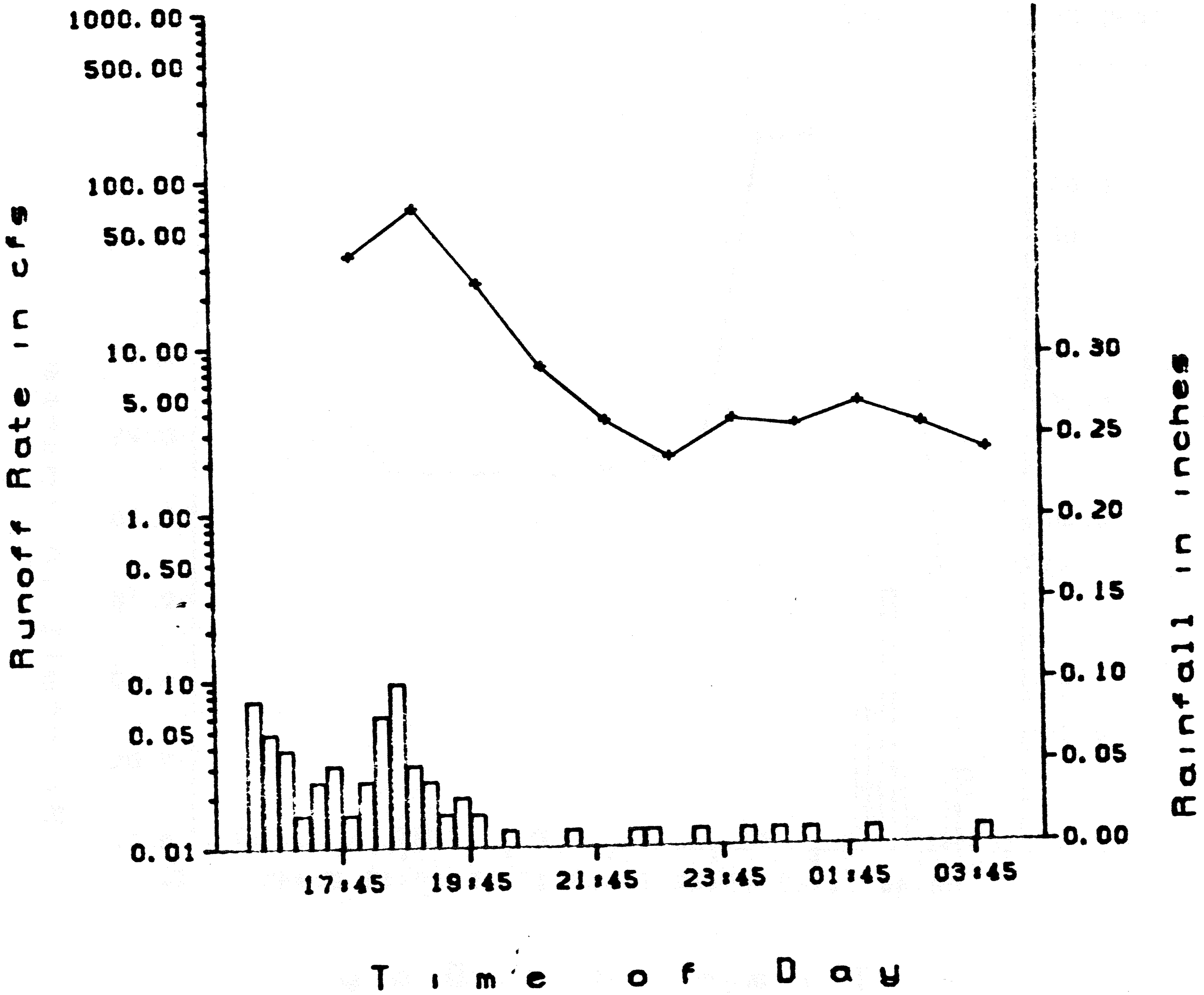
SEAVIEW and KNOX Gaging Stations



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of November 16 - 17, 1979
STORM #4 - 1980

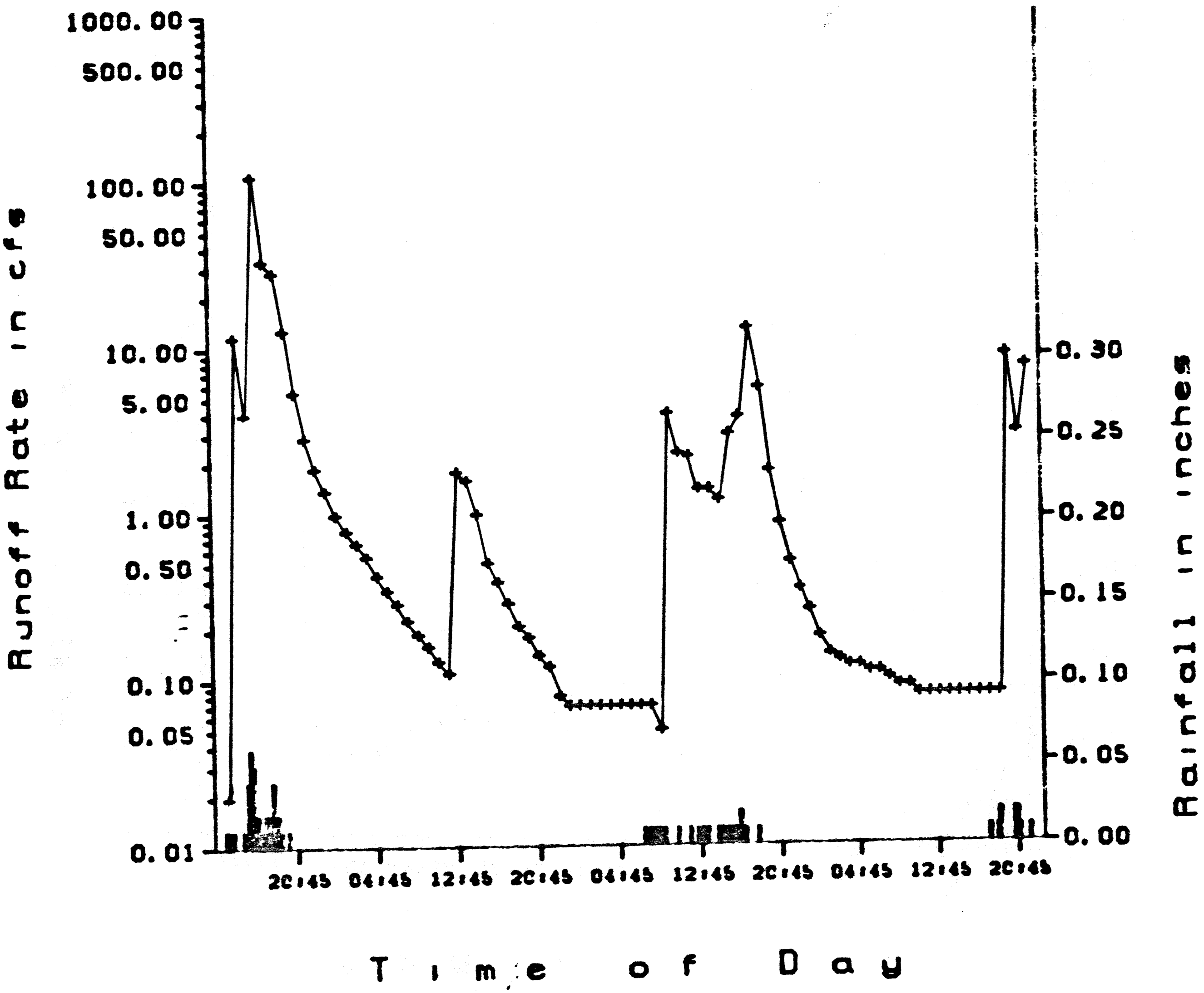


Seaview Runoff
\+ Knox Runoff

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of November 22 - 25, 1979
STORM #5 - 1980

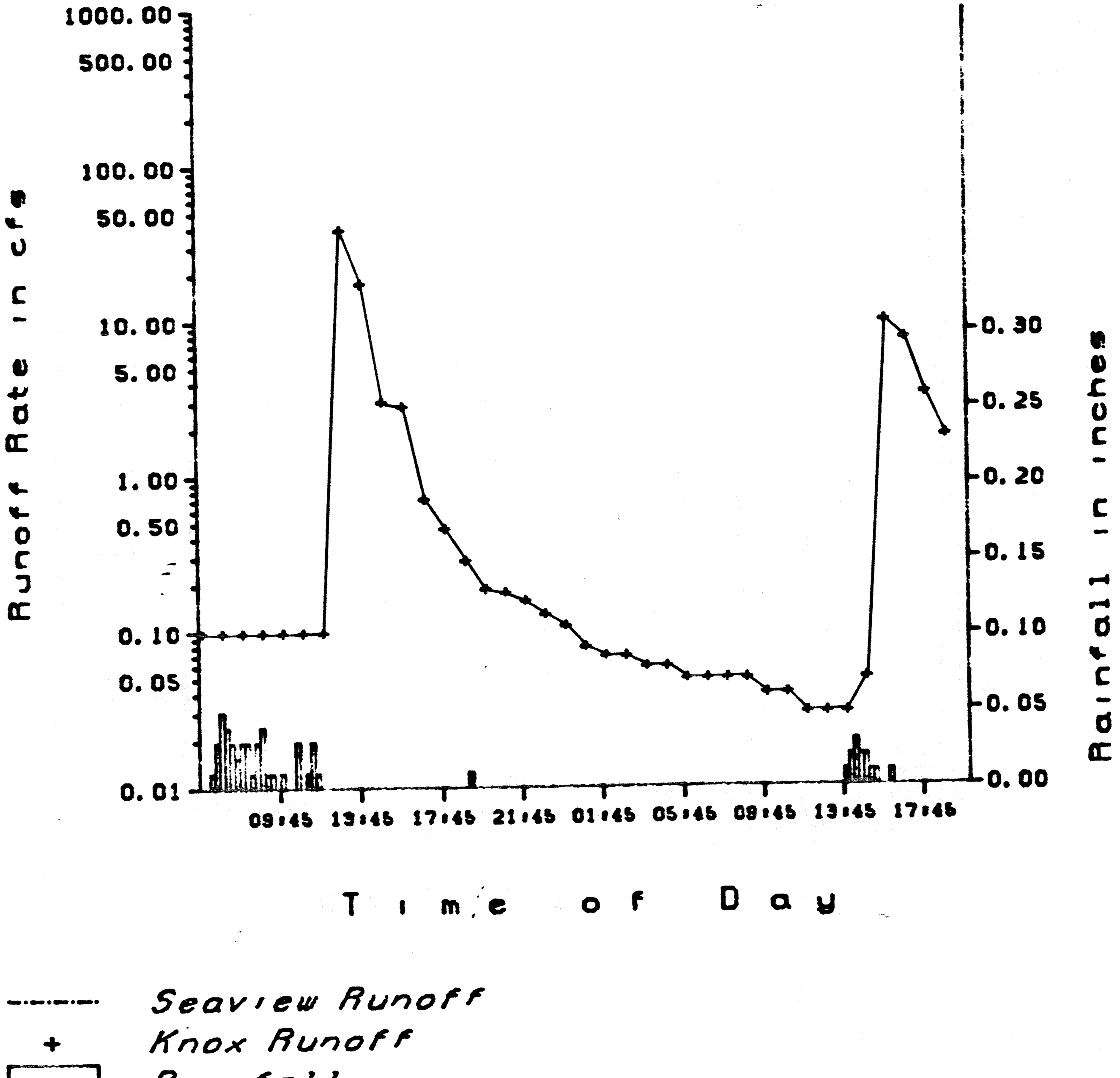


Seaview Runoff
+ *Knox Runoff*
Rainfall

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

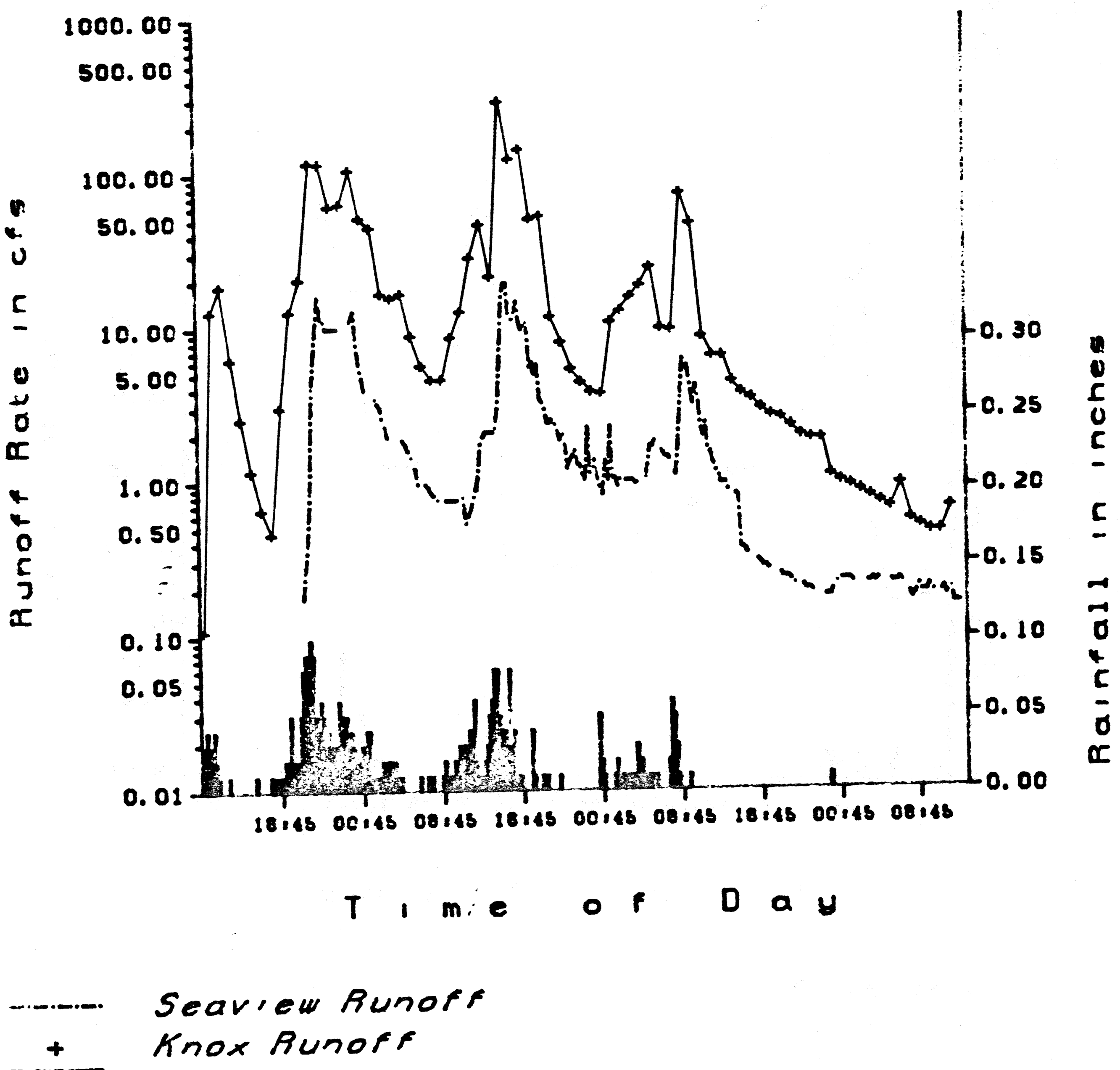
Storm of December 19 - 20, 1979
STORM #6 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

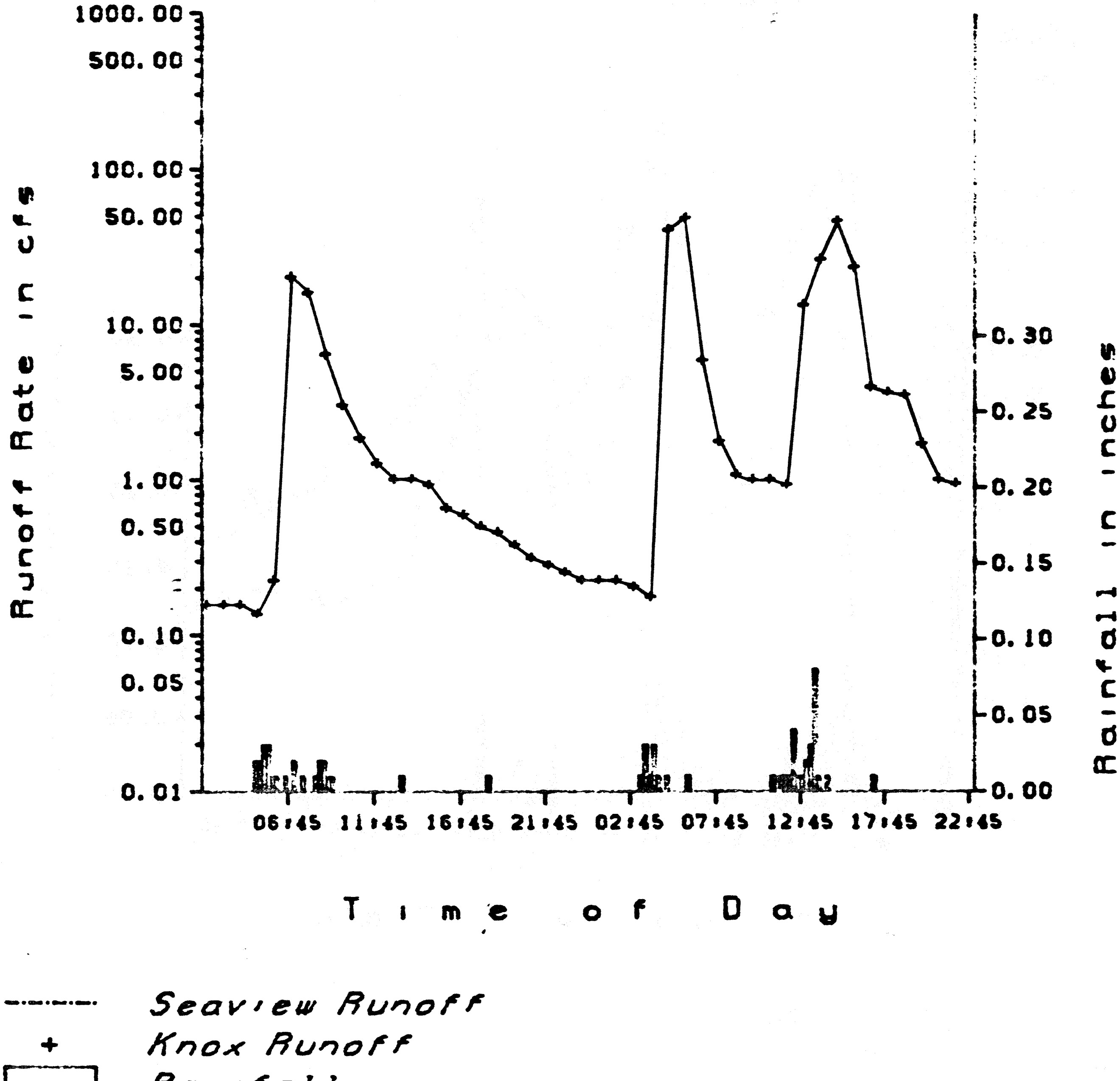
Storm of December 23 - 26, 1979
STORM #7 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

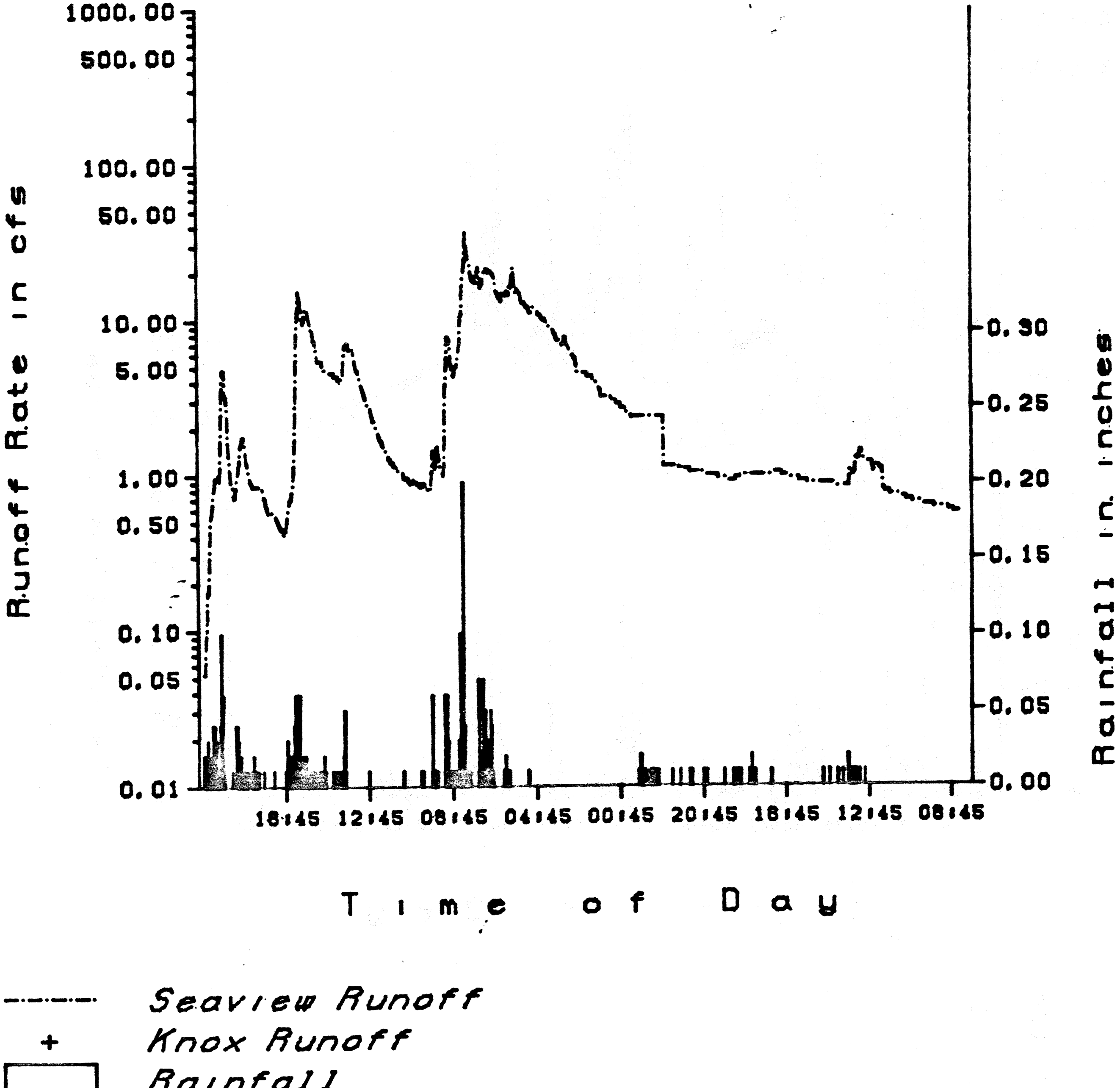
Storm of December 30 - 31, 1979
STORM #8 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

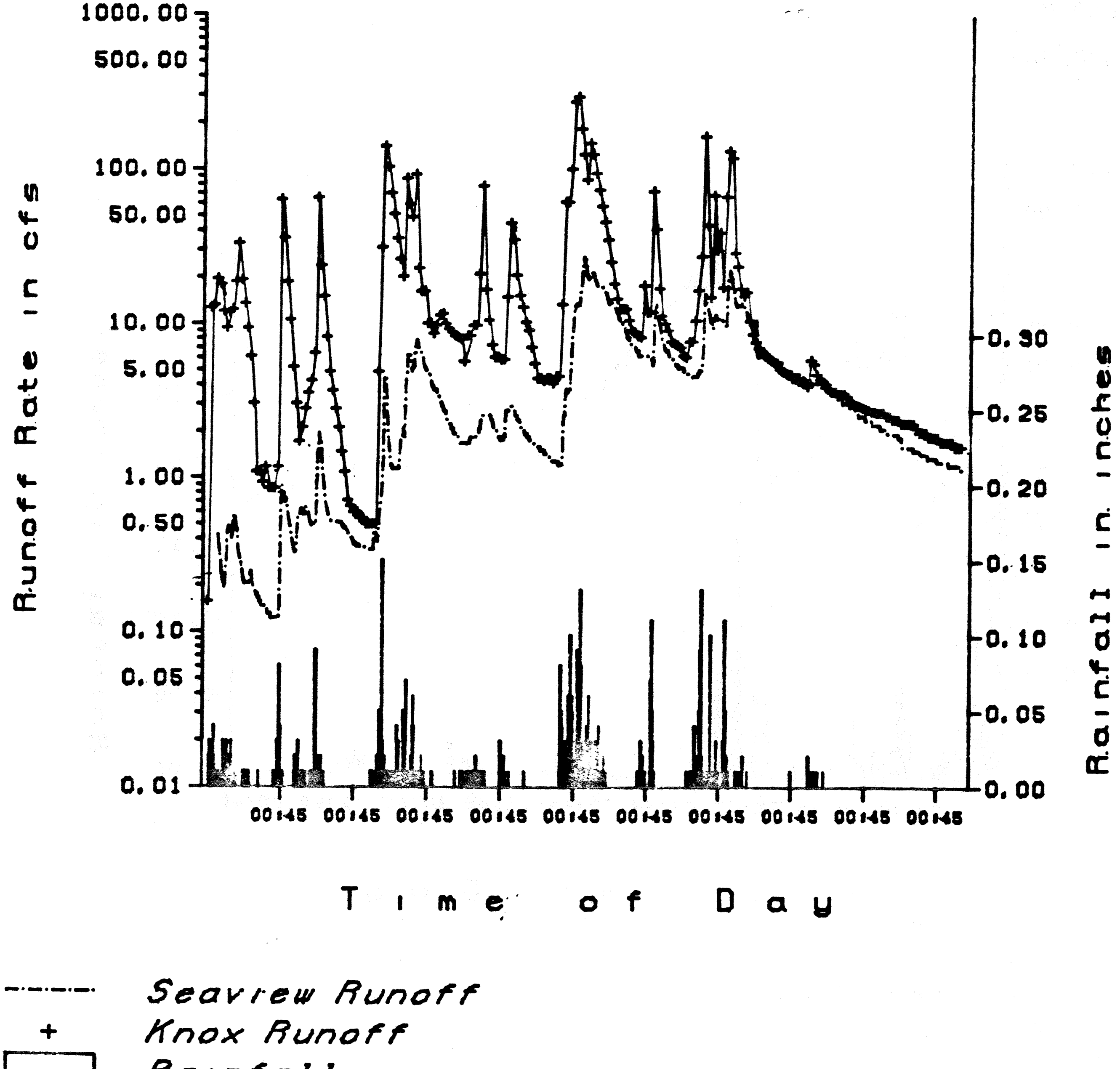
Storm of January 10 - 18, 1980
STØRM #9 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

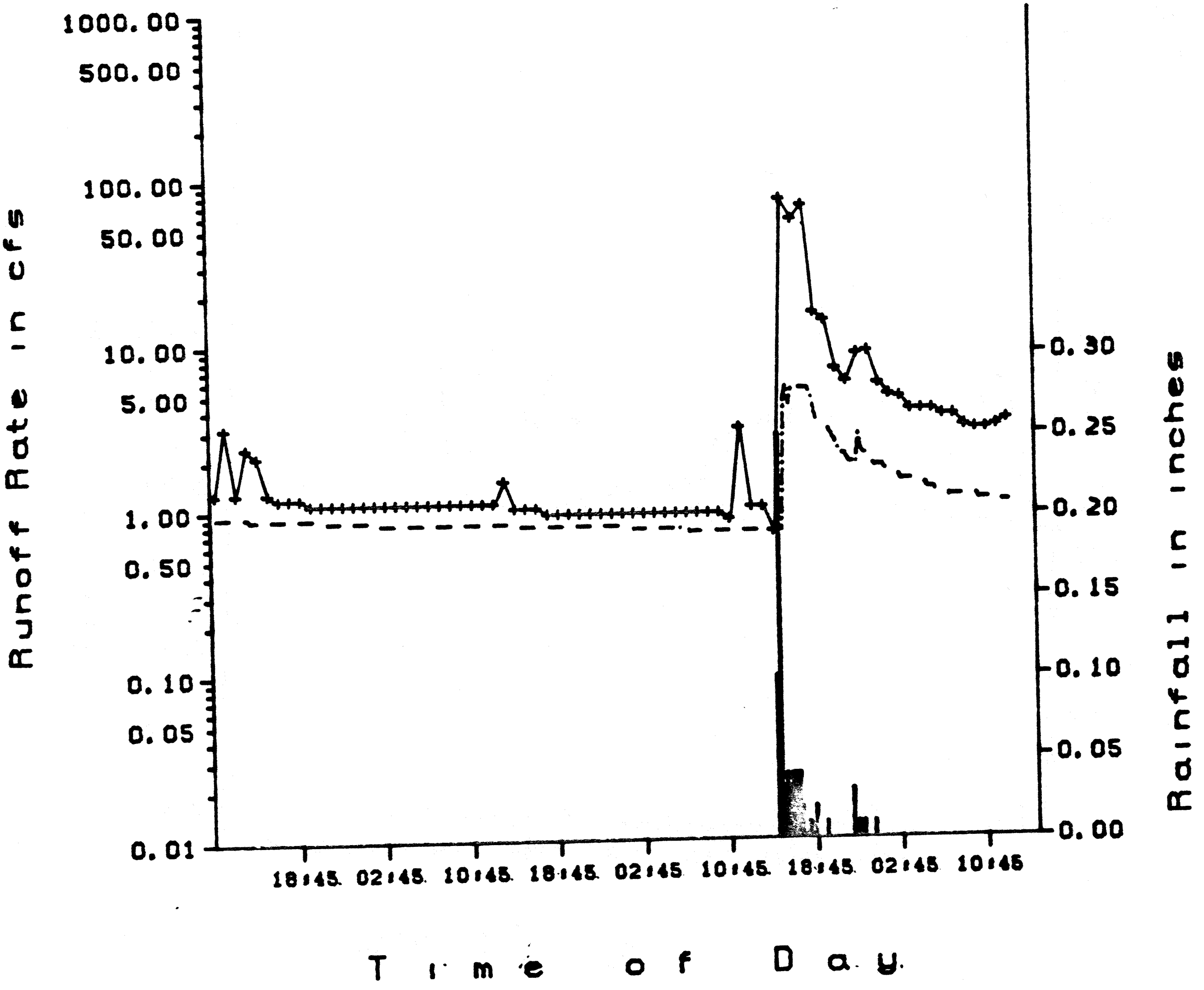
Storm of February 14 - 24, 1980
STØRM #10 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of February 25 - 28, 1980
STØRM #11 - 1980

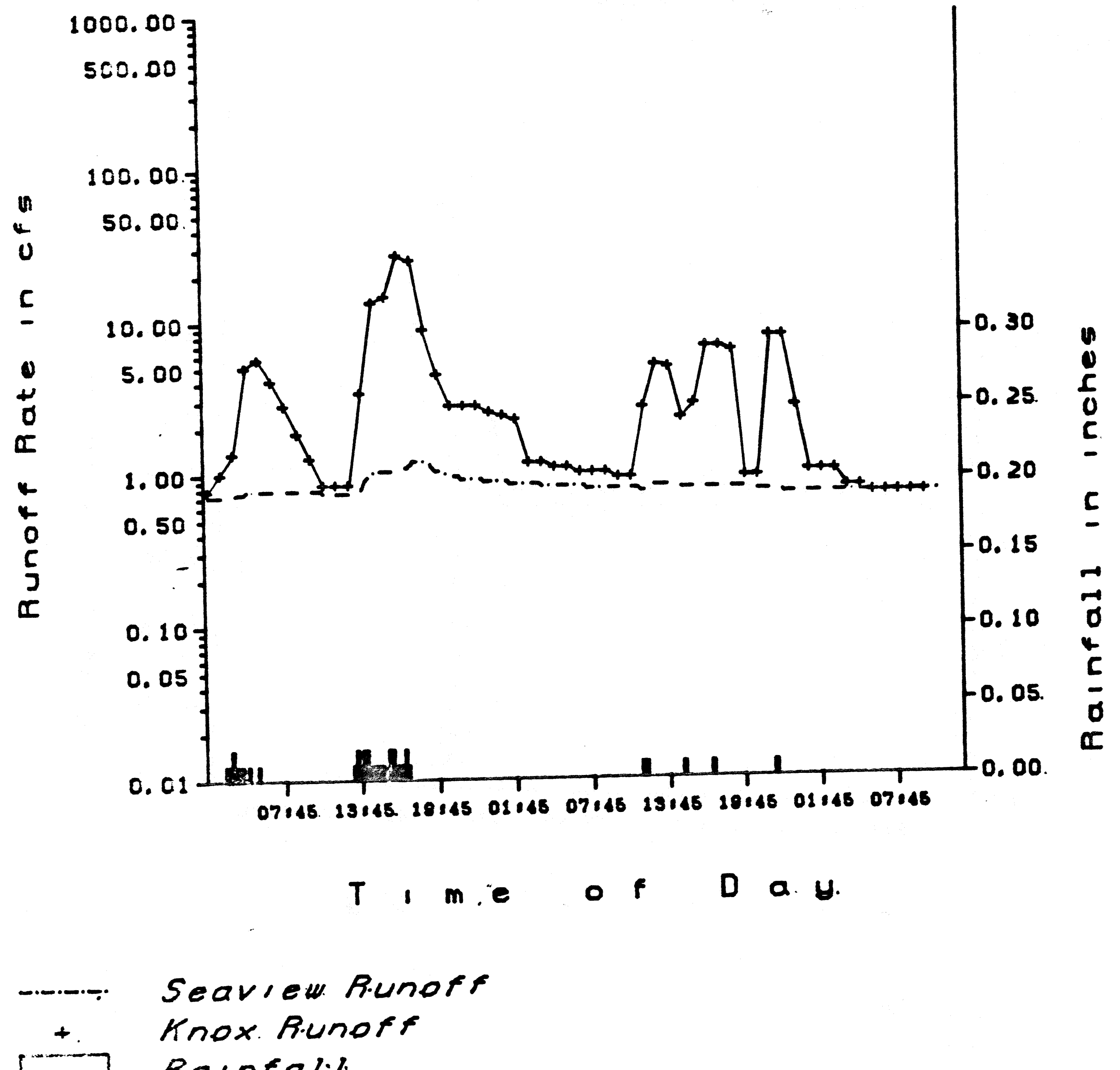


Seaview Runoff
+ Knox Runoff

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

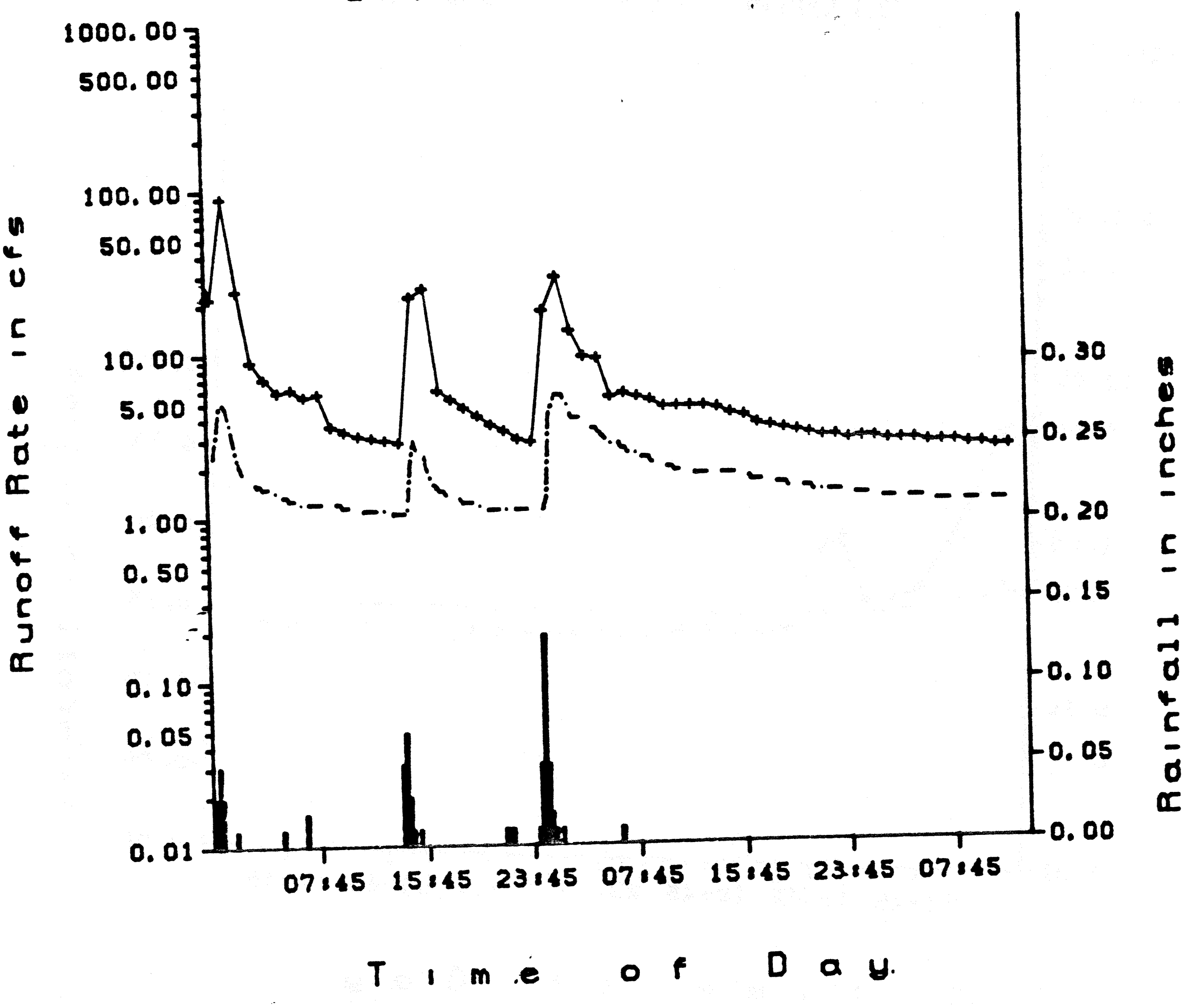
Storm of March 2 - 4, 1980
STØRM #12 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of March 4 - 7, 1980
STØRM #13 - 1980



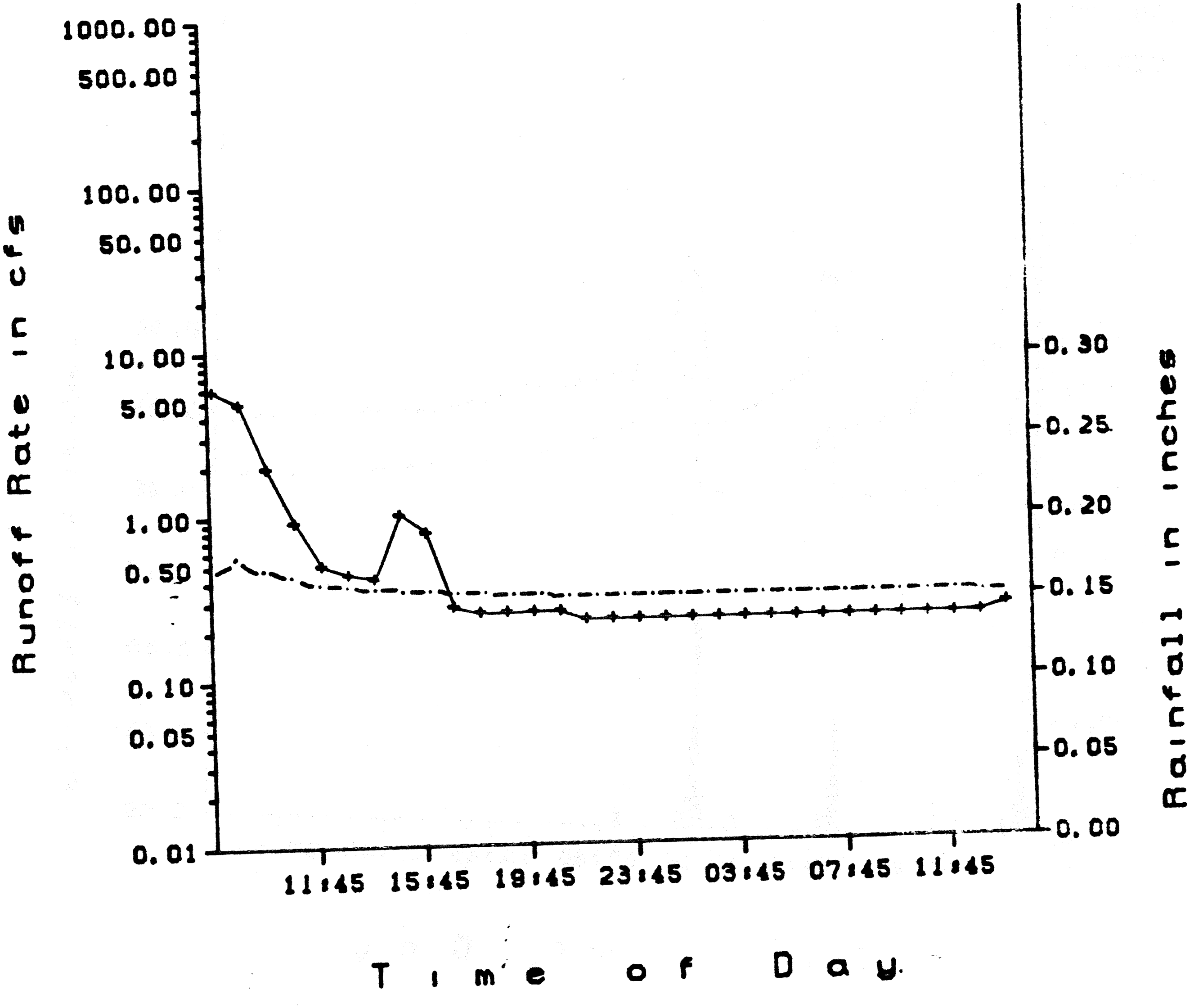
-.-.-.-.- *Seaview Runoff*

\+ *Knox Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of March 25 - 26, 1980
STØRM #14 - 1980

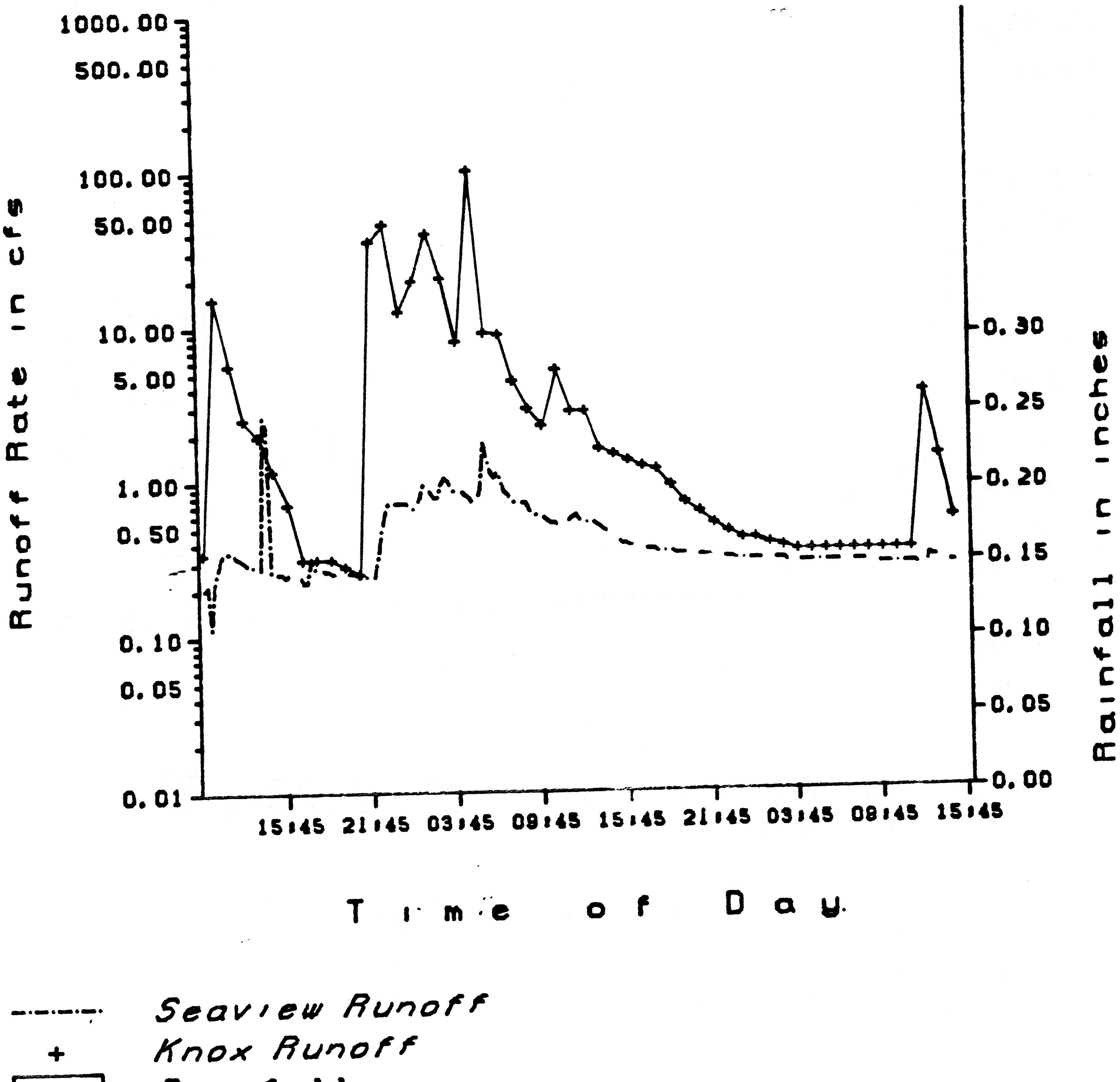


-·-·-·-·- *Seaview Runoff*

San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

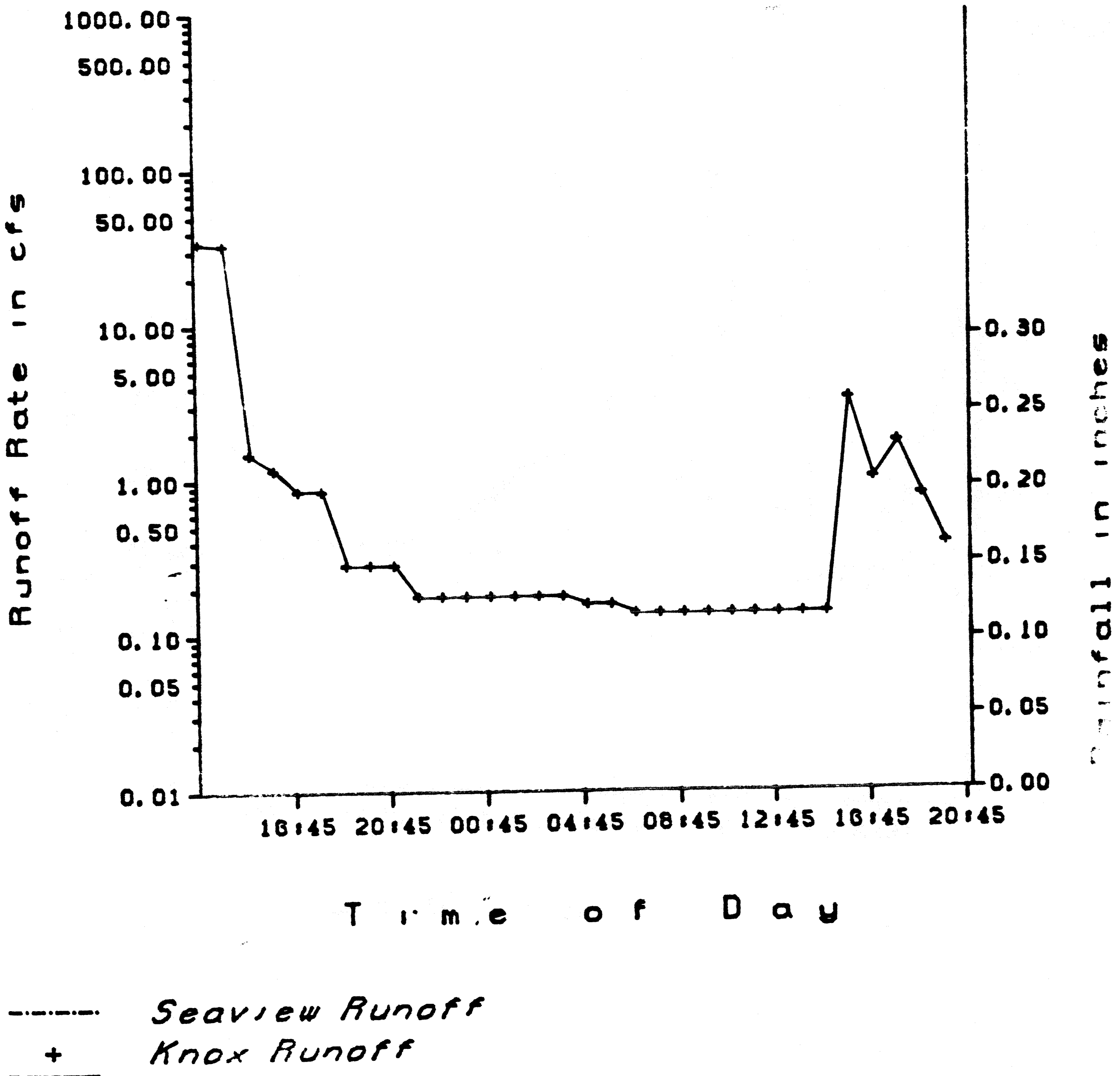
Storm of April 4- 6, 1980
STORM #15 - 1980



San Francisco Bay Area
National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

Storm of April 20 - 21, 1980
STØRM #16 - 1980



National Urban Runoff Project

SEAVIEW and KNOX Gaging Stations

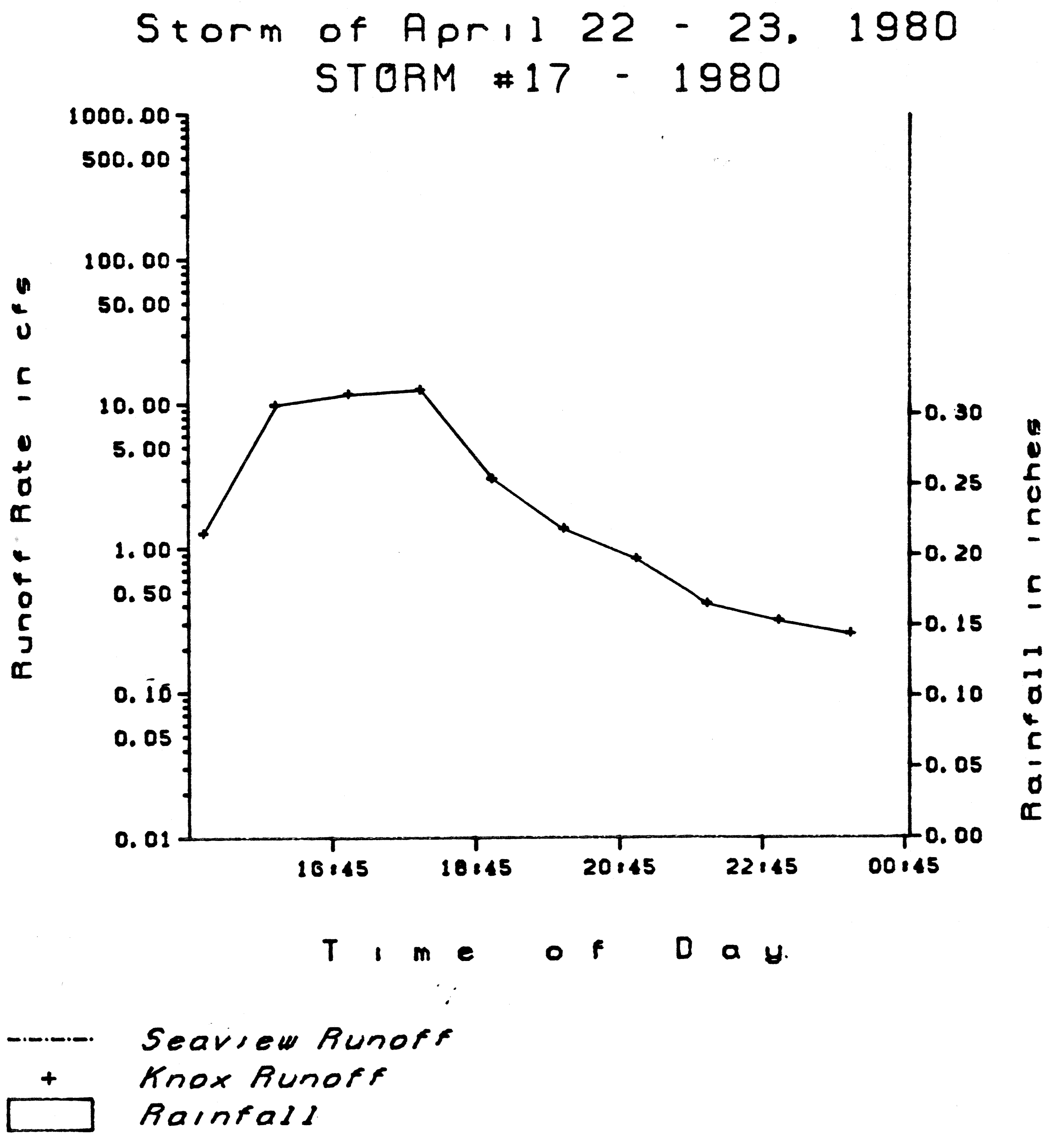


Figure 5-30

COMPARATIVE STREET CLEANER TEST DATA

BASIC DATA FOR LOWER TEST AREA I

Days Since Last Cleaned	Mechanical Performance: Before Loading (Lbs/curb mi.) Cars/Mi.	Mechanical Performance: After Loading (Lbs/curb mi.)	Mechanical Performance: Lbs/curb mi. Removed	Mechanical Performance: % Removed	Regenerative Air Performance: Before Loading (Lbs/curb mi.) Cars/Mi.	Regenerative Air Performance: After Loading (Lbs/curb mi.)	Regenerative Air Performance: Lbs/curb.mi. Removed	Regenerative Air Performance: % Removed
8	671 10/mi.	506	165	25	1388 16/mi.	707	681	49
3	544 20/mi.	192	352	65	1160 21/mi.	89	1070	92
4	377 23/mi.	155	222	59	645 23/mi.	523	123	19
2	319 16/mi.	175	144	45	320 17/mi.	123	197	62
5	228 12/mi.	293	-65	-29	385 14/mi.	138	246	64

Days Since Last Cleaned	Mechanical Performance: Before Loading (Lbs/curb mi.) Cars/Mi.	Mechanical Performance: After Loading (Lbs/curb mi.)	Mechanical Performance: Lbs/curb mi. Removed	Mechanical Performance: % Removed	Regenerative Air Performance: Before Loading (Lbs/curb mi.) Cars/Mi.	Regenerative Air Performance: After Loading (Lbs/curb mi.)	Regenerative Air Performance: Lbs/curb.mi. Removed	Regenerative Air Performance: % Removed
2	888 38/mi.	230	659	74	909	171	738	81
4	523 16/mi.	189	333	64	1260 32/mi.	101	1161	92
2	244 60/mi.	135	108	45	296 32/mi.	96	200	68

BASIC DATA FOR MIDDLE TEST AREA I

	Mechanical Performance				Regenerative Air Performance			
Days Since Last Cleaned	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb mi. Removed	% Removed	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb.mi. Removed	% Removed
8	533 19/mi.	178	355	67	1080 16/mi.	431	648	60
3	174 15/mi.	137	37	21	295 13/mi.	213	82	28
4	163 19/mi.	113	50	31	183 16/mi.	151	32	18
2	175 10/mi.	121	54	31	124 13/mi.	92	32	26
5	104 9/mi.	118	-14	-13	189 16/mi.	110	79	42

BASIC DATA FOR MIDDLE TEST AREA II

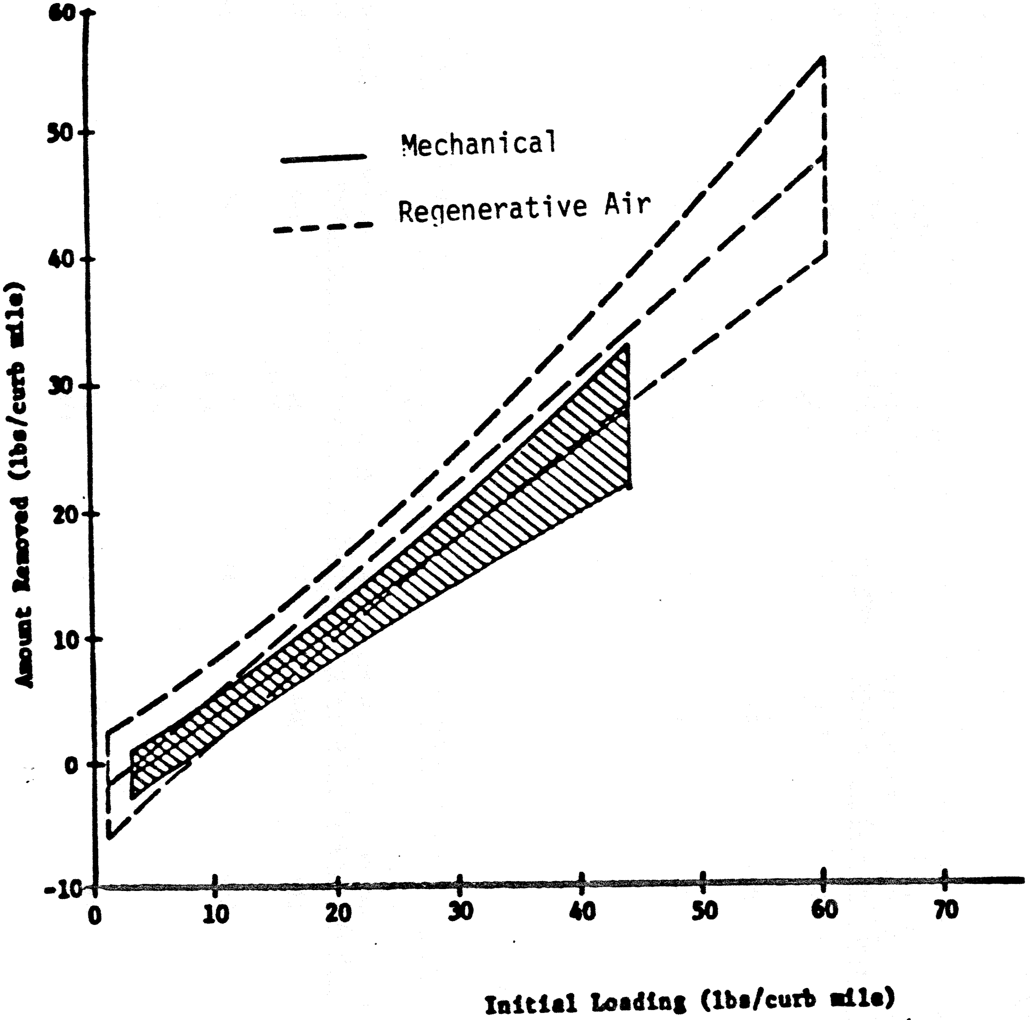
	Mechanical Performance				Regenerative Air Performance			
Days Since Last Cleaned	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb mi. Removed	% Removed	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb.mi. Removed	% Removed
10	323 19/mi.	143	180	56	592 25/mi.	127	465	79
2	1499 11/mi.	117	33	22	242 14/mi.	64	178	74
4	104 23/mi.	92	12	12	149 16/mi.	50	99	67
2	70 29/mi.	70	0	0	121 29/mi.	42	79	65

3. BASIC DATA FOR UPPER TEST AREA I

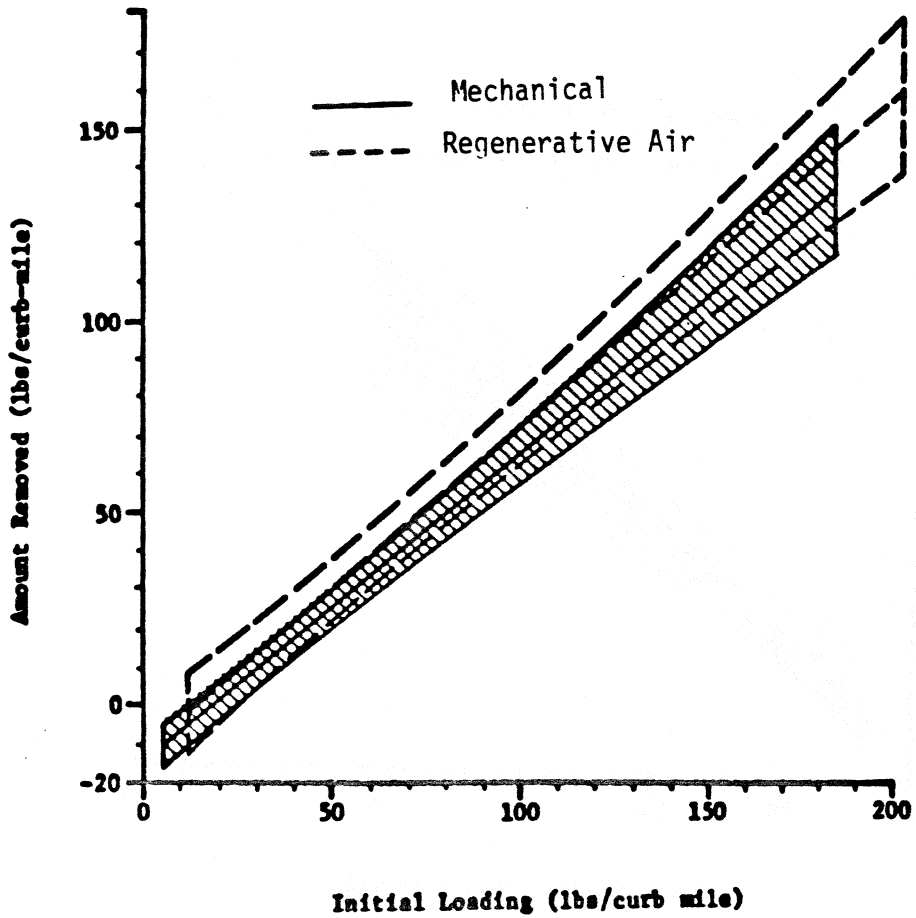
of t		Mechanical Performance				Regenerative Air Performance			
	Days Since Last Cleaned	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb mi. Removed	% Removed	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb.mi. Removed	% Removed
79	8	278 17/mi.	163	115	41	159 17/mi.	44	115	73
	7	140 15/mi.	93	46	33	99 8/mi.	48	51	52
	5	120 14/mi.	93	26	22	151 19/mi.	45	105	70

BASIC DATA FOR UPPER TEST AREA II

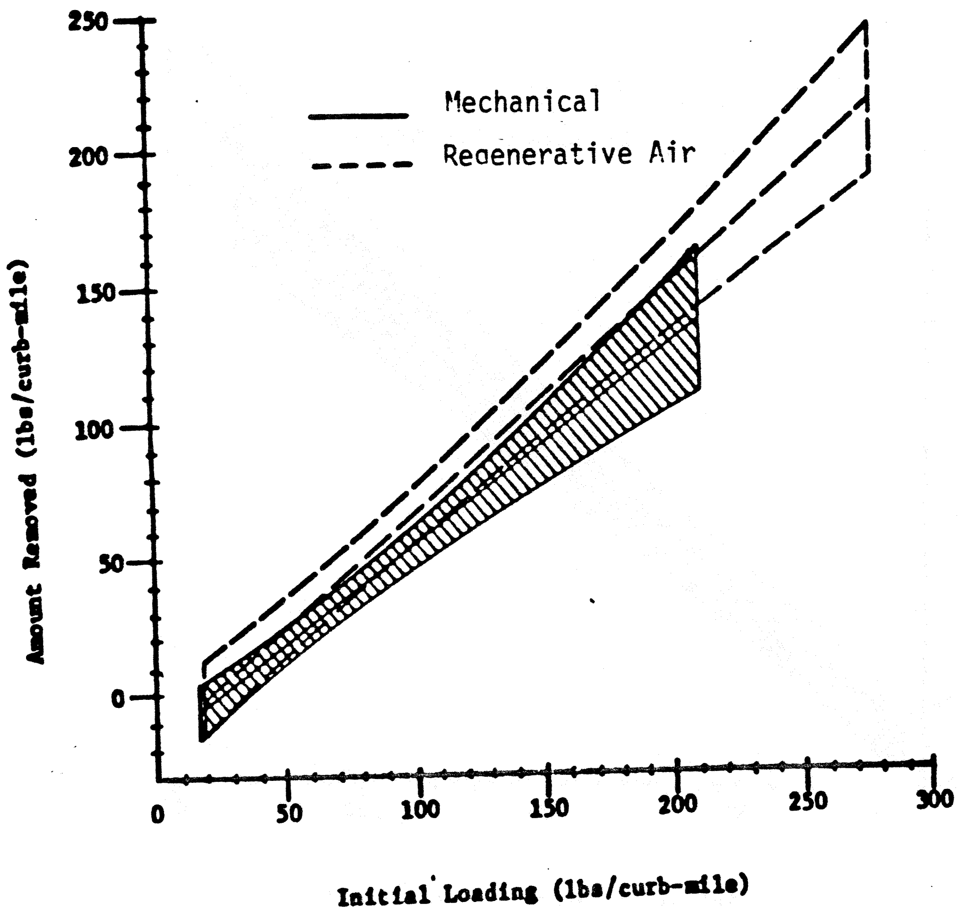
of st		Mechanical Performance				Regenerative Air Performance			
	Days Since Last Cleaned	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb mi. Removed	% Removed	Before Loading (Lbs/curb mi.) Cars/Mi.	After Loading (Lbs/curb mi.)	Lbs/curb.mi. Removed	% Removed
779	10	492 7/mi.	118	374	76	349 7/mi.	298	51	15
	2	276 4/mi.	144	132	48	231 4/mi.	115	116	50
	4	262 6/mi.	271	-9	-4	214 2/mi.	144	70	33
	2	165 14/mi.	113	51	31	199 15/mi.	115	84	42



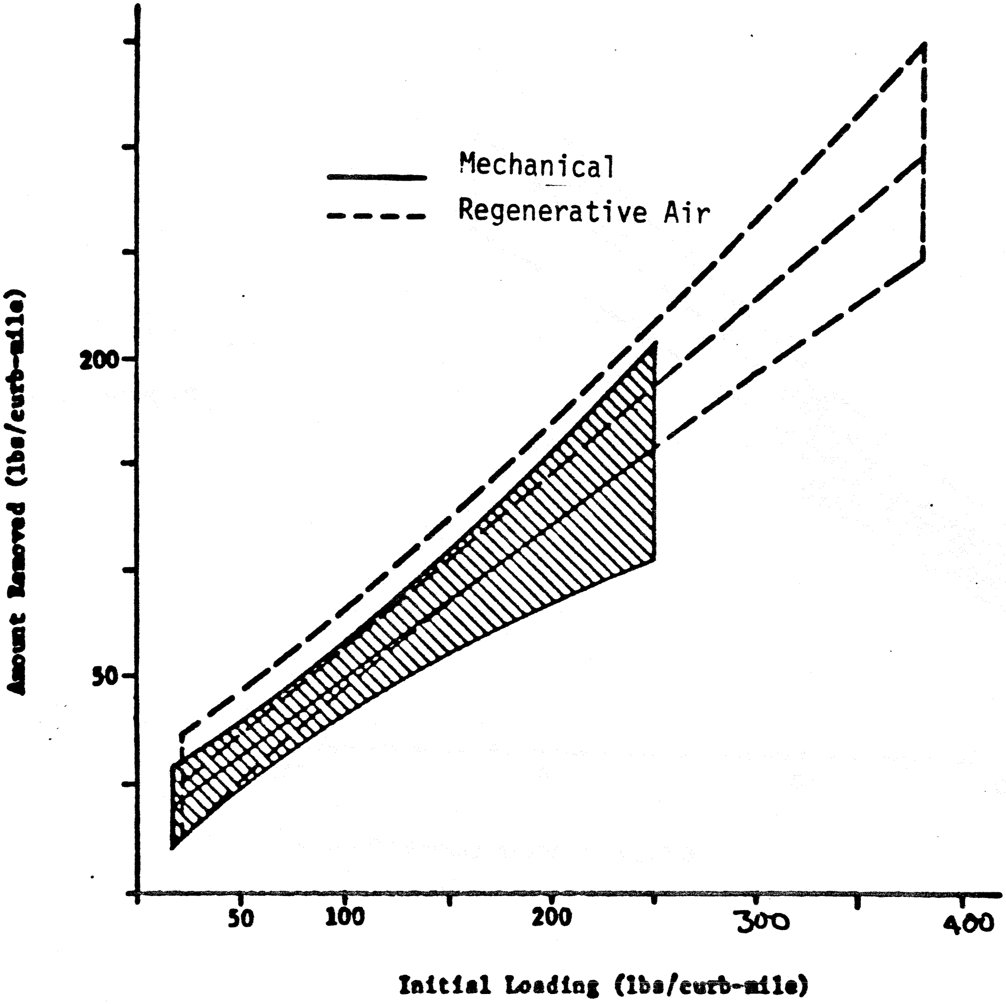
Mechanical
Regenerative Air
Amount Removed (lbs/curb mile)
60
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
70
Initial Loading (lbs/curb mile)



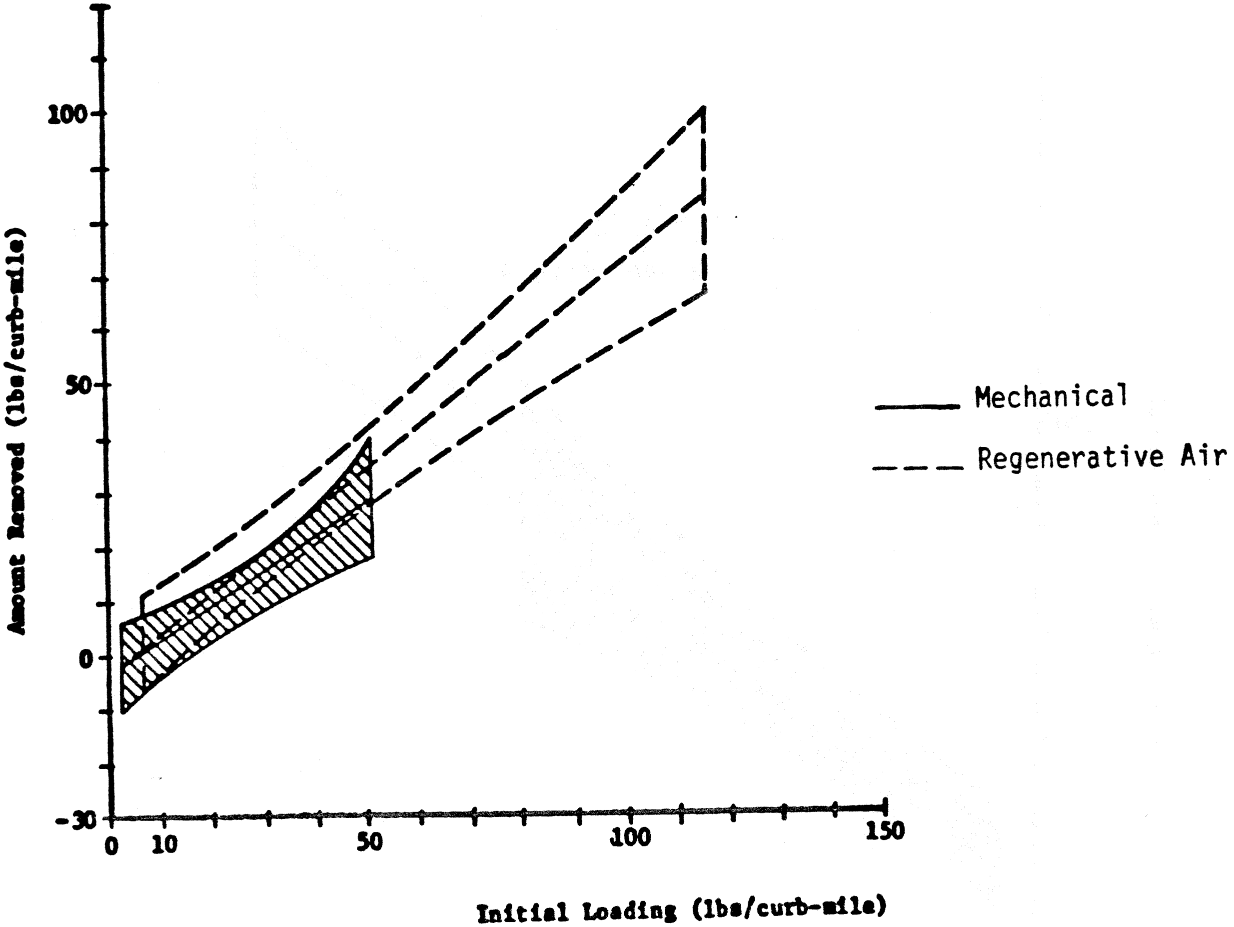
Mechanical
Regenerative Air
Amount Removed (lbs/curb-mile)
150
100
50
0
-20
0
50
100
150
200
Initial Loading (lbs/curb mile)



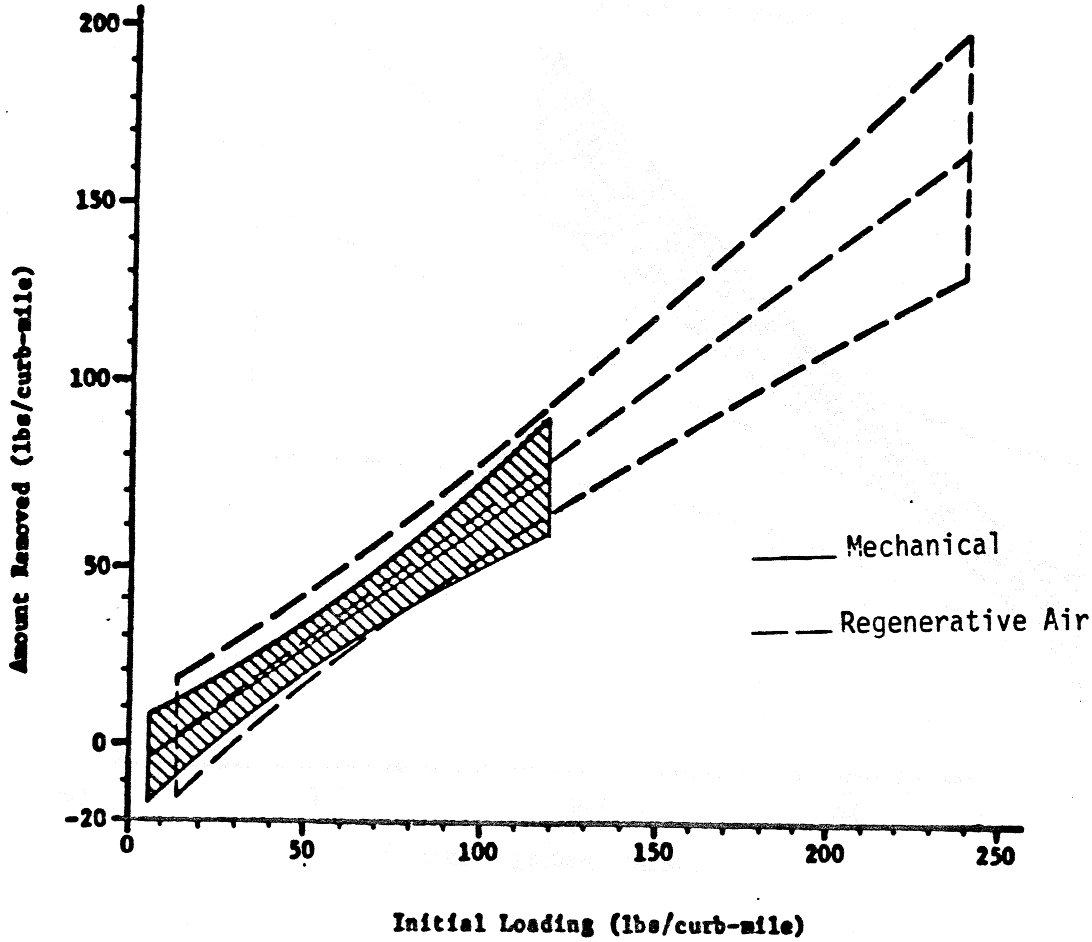
Mechanical
Regenerative Air
250
200
150
100
50
0
0
50
100
150
200
250
300
Amount Removed (lbs/curb-mile)
Initial Loading (lbs/curb-mile)



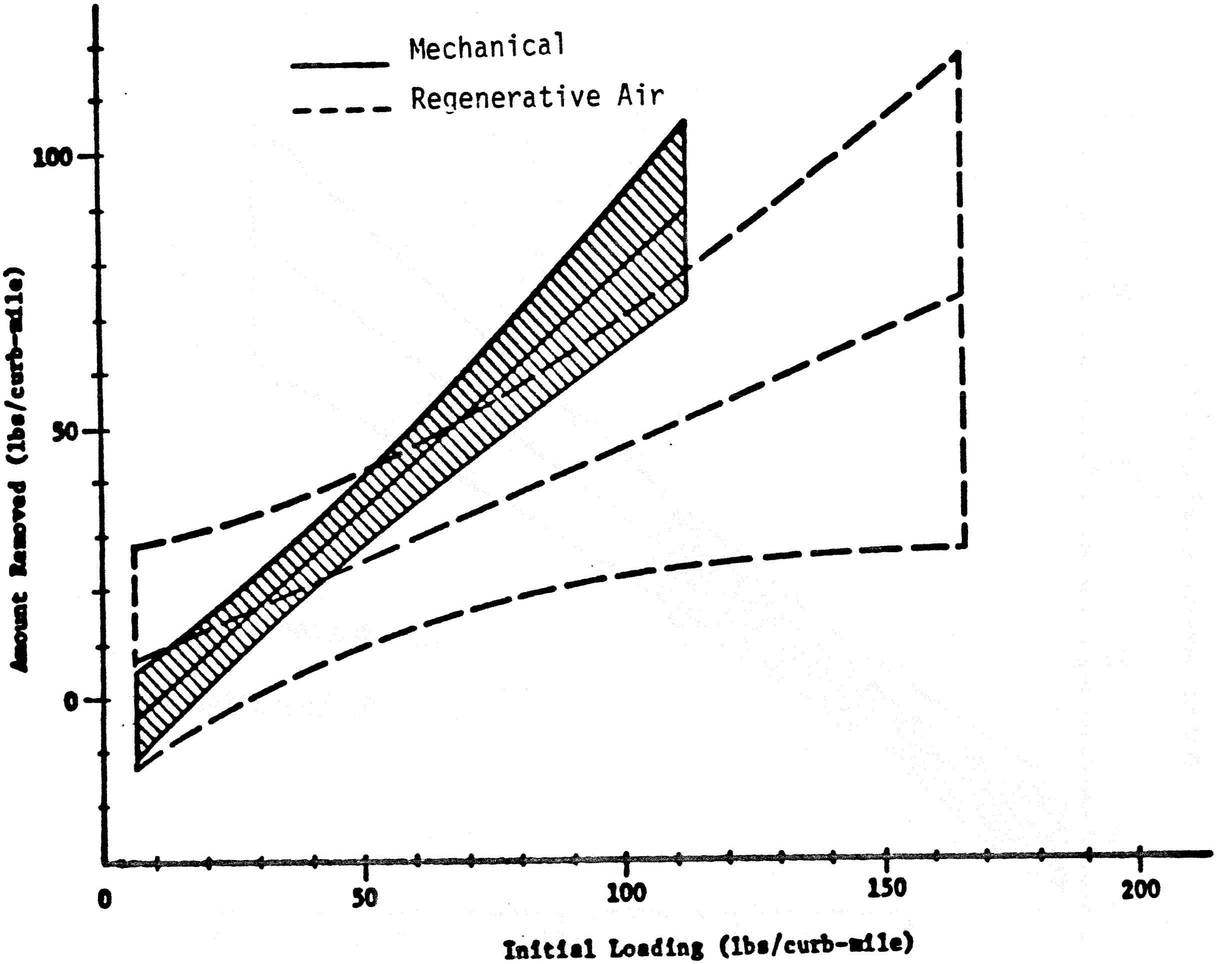
Mechanical
Regenerative Air
Amount Removed (lbs/curb-mile)
200
50
50
100
200
300
400
Initial Loading (lbs/curb-mile)

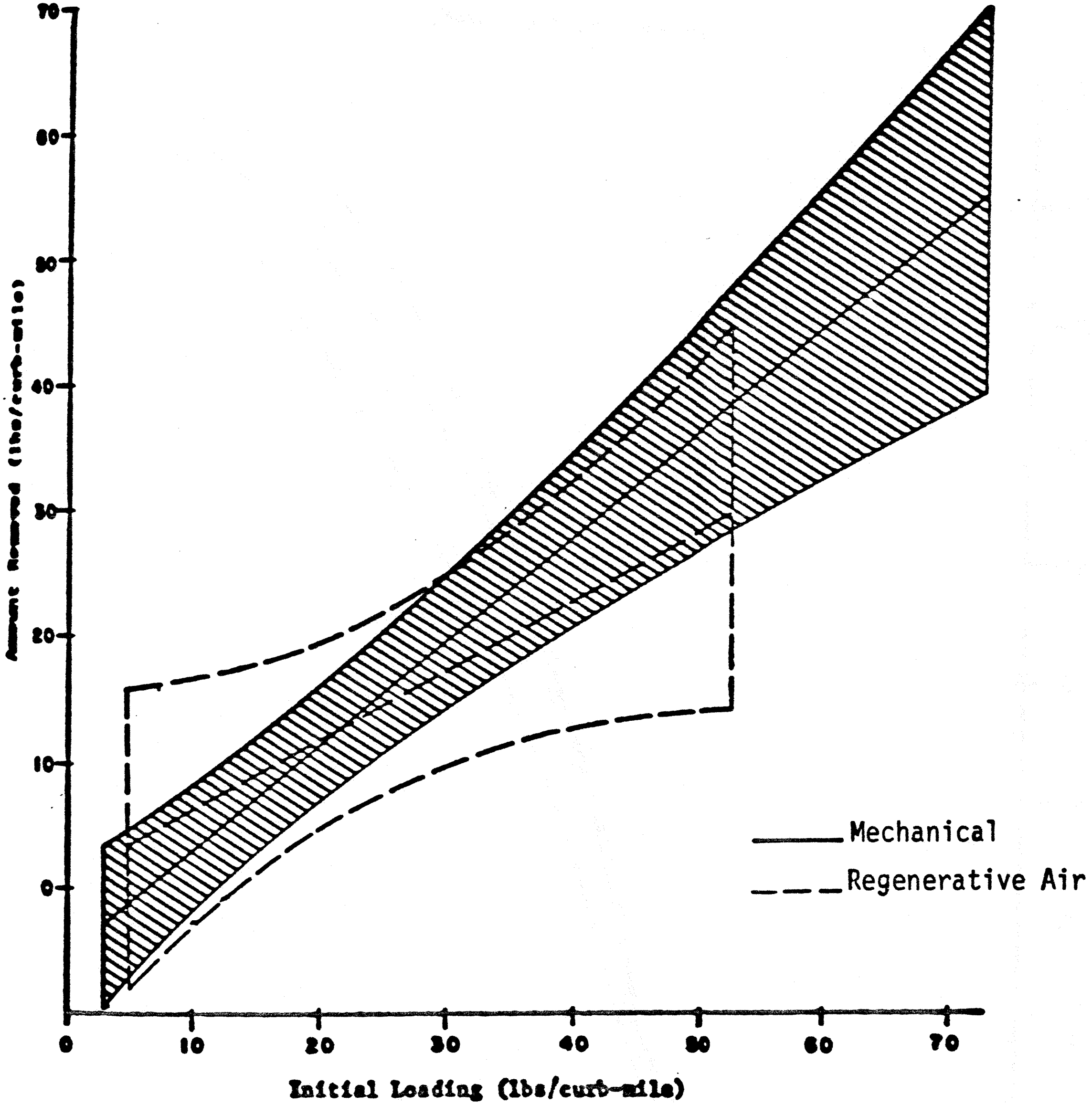


100
50
0
-30
Amount Removed (lbs/curb-mile)
0
10
50
100
150
Initial Loading (lbs/curb-mile)
Mechanical
Regenerative Air



200
150
100
50
0
-20
Amount Removed (lbs/curb-mile)
0
50
100
150
200
250
Initial Loading (lbs/curb-mile)
Mechanical
Regenerative Air


Mechanical
Regenerative Air
100
50
0
Amount Removed (lbs/curb-mile)
0
50
100
150
200
Initial Loading (lbs/curb-mile)


Mechanical
Regenerative Air
Initial Loading (lbs/curb-mile)
0
10
20
30
40
50
60
70

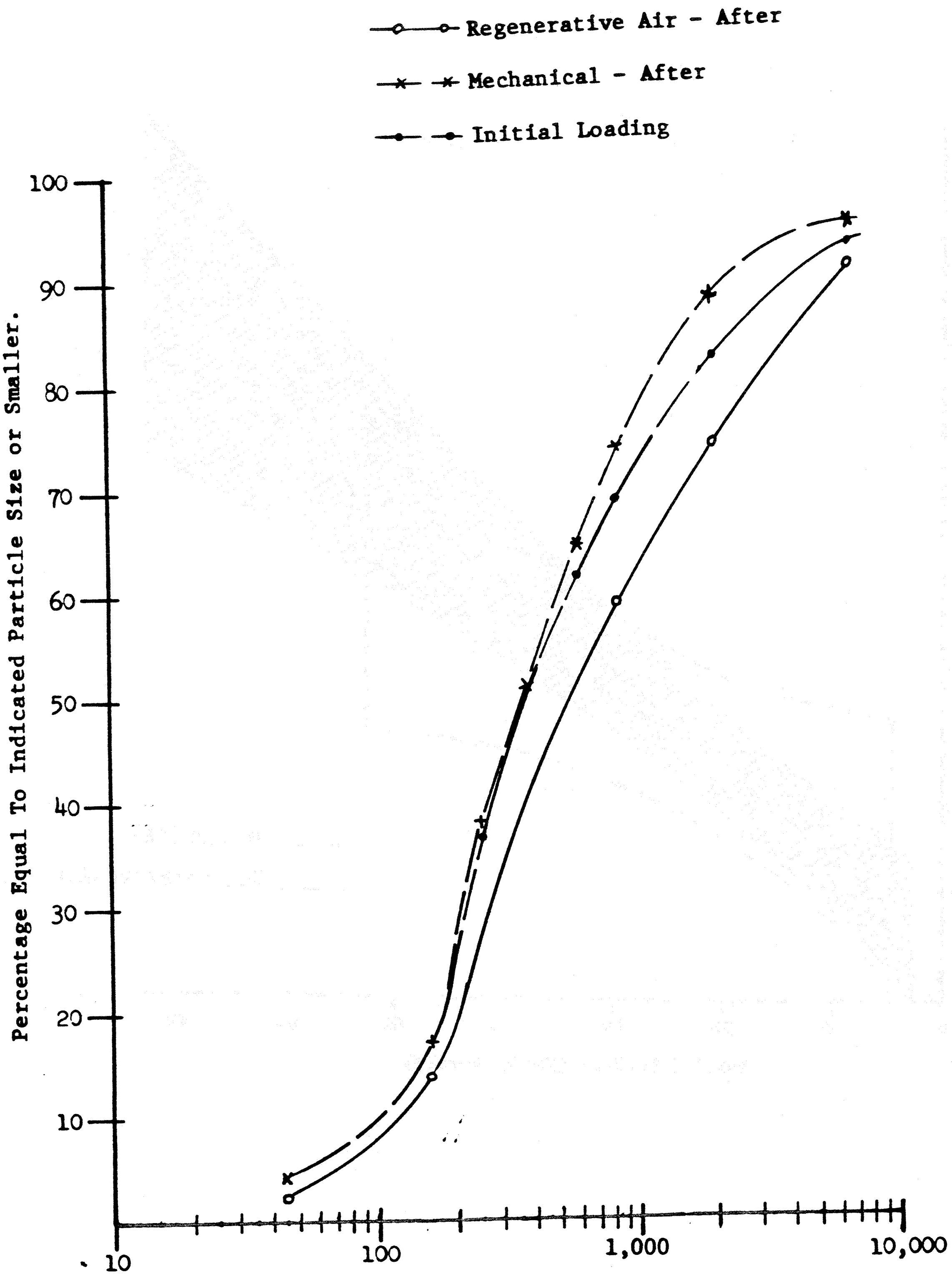

Regenerative Air - After
Mechanical - After
Initial Loading
Percentage Equal To Indicated Particle Size or Smaller.
100
90
80
70
60
50
40
30
20
10
10
100
1,000
10,000

TABLE G-1. UNIT STREET DIRT REMOVAL AND RUNOFF CONTROL COSTS FOR VARIOUS CLEANING FREQUENCIES

Cleaning Frequency	Passes Per Year	Annual Costs ($/curb mi)	Annual Removal (lbs/curb mi)	Unit Removal Costs ($/lb)	Annual Runoff Yield Savings: Annual Total Watershed (lb/yr)	Annual Runoff Yield Savings: Per Curb mile (lb/curb mi)	Annual Runoff Yield Savings: Portion of runoff Controlled (%)	Annual Runoff Yield Savings: Unit Savings Cost ($/lb Saved From receiving water)	Annual Runoff Yield Savings: Ratio (lb/ Removal to lb/ saved
Copper									
Quarterly	4	$ 60	0.053	$1,100	0	0	0	$ 0	0
Monthly	12	180	0.16	1,100	0	0	0	0	0
2X/Month	24	360	0.32	1,100	0	0	0	0	0
Weekly	52	780	0.63	1,200	0.30	0.006	<1	130,000	110
2X/Week	104	1,560	1.0	1,600	2.7	0.05	3	32,000	20
3X/Week	156	2,340	1.3	1,800	5.0	0.10	7	24,000	14
5X/Week	260	3,900	1.9	2,100	6.0	0.12	8	34,000	17
10X/Week	520	7,800	2.4	3,300	6.0	0.12	8	68,000	20
Lead									
Quarterly	4	$ 60	1.0	$ 60	0	0	0	$ 0	0
Monthly	12	180	3.1	60	0.3	0.005	<1	36,000	620
2X/Month	24	360	6.1	60	5.0	0.1	1	3,800	64
Weekly	52	780	12	65	46	0.9	9	860	13
2X/Week	104	1,560	20	78	130	2.4	26	660	8.4
3X/Week	156	2,340	26	90	180	3.4	36	680	7.6
5X/Week	260	3,900	37	110	210	4.0	43	960	9.2
10X/Week	520	7,800	46	170	210	4.0	43	1,900	11

TABLE G-2. UNIT STREET DIRT REMOVAL AND RUNOFF CONTROL COSTS FOR VARIOUS CLEANING FREQUENCIES

Total Kjeldahl Nitrogen

Cleaning Frequency	Passes Per Year	Annual Costs ($/curb mi)	Annual Removal (lbs/curb mi)	Unit Removal Costs ($/lb)	Annual Runoff Yield Savings: Annual Total Watershed (lb/yr)	Per Curb mile (lb/curb mi)	Portion of runoff Controlled (%)	Unit Savings Cost ($/lb Saved From receiving water)	Ratio (lb/ Removal to lb/ saved
Quarterly	4	$ 60	1.0	$ 60	0	0	0	0	0
Monthly	12	180	3.1	60	0	0	0	0	0
2X/Month	24	360	6.2	60	2.6	0.05	<1	$7,200	120
Weekly	52	780	12	65	15	0.30	1	2,600	42
2X/Week	104	1,560	20	78	42	0.80	2	2,000	26
3X/Week	156	2,340	26	90	60	1.2	3	2,000	22
5X/Week	260	3,900	37	110	65	1.3	3	3,200	30
10X/Week	520	7,800	47	170	65	1.3	3	6,200	38

Arsenic

Cleaning Frequency	Passes Per Year	Annual Costs ($/curb mi)	Annual Removal (lbs/curb mi)	Unit Removal Costs ($/lb)	Annual Total Watershed (lb/yr)	Per Curb mile (lb/curb mi)	Portion of runoff Controlled (%)	Unit Savings Cost ($/lb Saved From receiving water)	Ratio (lb/ Removal to lb/ saved
Quarterly	4	$ 60	0.01	$ 6,000	0	0	0	0	0
Monthly	12	180	0.03	6,000	0	0	0	0	0
2X/Month	24	360	0.06	6,000	0.05	0.001	1	$360,000	60
Weekly	52	780	0.11	7,100	0.35	0.007	6	110,000	16
2X/Week	104	1,560	0.18	8,700	0.85	0.017	15	94,000	11
3X/Week	156	2,340	0.24	9,800	1.2	0.023	21	100,000	10
5X/Week	260	3,900	0.34	11,000	1.3	0.024	22	160,000	14
10X/Week	520	7,800	0.42	19,000	1.3	0.024	22	330,000	18

TABLE G-3. UNIT STREET DIRT REMOVAL AND RUNOFF CONTROL COSTS FOR VARIOUS CLEANING FREQUENCIES

TOTAL PHOSPHOROUS

					Annual Runoff Yield Savings				
Cleaning Frequency	Passes Per Year	Annual Costs ($/curb mi)	Annual Removal (lbs/curb mi)	Unit Removal Costs ($/lb)	Annual Total Watershed (lb/yr)	Per Curb mile (lb/curb mi)	Portion of runoff Controlled (%)	Unit Savings Cost ($/lb Saved From receiving water)	Ratio (lb/ Removal to lb/ saved
Quarterly	4	$ 60	0.32	$190	19	0.36	3	$ 170	0.9
Monthly	12	180	0.94	190	20	0.38	3	480	2.6
2X/Month	24	360	1.9	190	21	0.40	3	900	4.8
Weekly	52	780	3.8	210	28	0.55	4	1,400	7.0
2X/Week	104	1,560	6.1	260	43	0.90	7	1,700	6.8
3X/Week	156	2,340	8.0	290	60	1.2	10	2,000	6.6
5X/Week	260	3,900	11	350	60	1.2	10	3,200	9.2
10X/Week	520	7,800	14	560	60	1.2	10	6,600	12

ORTHO PHOSPHATES

Quarterly	4	$ 60	0.020	$3,000	0.16	0.003	<<1	$20,000	6.6
Monthly	12	180	0.060	3,000	0.34	0.007	<<1	28,000	9.2
2X/Month	24	360	0.12	3,000	0.55	0.011	<<1	34.000	11
Weekly	52	780	0.24	3,300	1.3	0.025	<1	32,000	9.6
2X/Week	104	1,560	0.39	4,000	2.3	0.044	<1	36,000	9.0
3X/Week	156	2.340	0.51	4,600	3.0	0.055	<1	42,000	9.2
5X/Week	260	3,900	0.72	5,400	3.2	0.060	<1	66,000	12
10X/Week	520	7,800	0.90	8,700	3.2	0.060	<1	130,000	15

TABLE G-4. UNIT STREET DIRT REMOVAL AND RUNOFF CONTROL COSTS FOR VARIOUS CLEANING FREQUENCIES

			Zinc		Annual Runoff Yield Savings				
Cleaning Frequency	Passes Per Year	Annual Costs ($/curb mi)	Annual Removal (lbs/curb mi)	Unit Removal Costs ($/lb)	Annual Total Watershed (lb/yr)	Per Curb mile (lb/curb mi)	Portion of runoff Controlled (%)	Unit Savings Cost ($/lb Saved From receiving water)	Ratio (lb/ Removal to lb/ saved
Quarterly	4	$ 60	0.16	370	8.5	0.16	2	$ 380	1.0
Monthly	12	180	0.49	370	9.5	0.19	2	980	2.6
2X/Month	24	360	0.98	370	10	0.20	3	1,800	5.0
Weekly	52	780	2.0	390	17	0.33	4	2,400	6.0
2X/Week	104	1560	3.2	490	30	0.55	8	2,800	5.8
3X/Week	156	2340	4.2	560	38	0.75	10	3,200	5.6
5X/Week	260	3900	5.9	660	40	0.80	10	4,800	7.4
10X/Week	520	7800	7.4	1100	40	0.80	10	9,800	9.2