METRO

Municipality of Metropolitan Seattle
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December 23, 1991

Jacques Faigenblum, Permit Manager
Washington Department of Ecology
3190 160th Avenue S.E.
Bellevue, Washington 98008-5442

Dear Mr. Faigenblum:

Enclosed is Metro's Annual CSO Report prepared in accordance with the requirements established within NPDES Permit No. WA-002918-1 (M), S11.C.2 and WAC 173-245-090.

The report contains:

- An overview of Metro's CSO Control Program
- The status of projects currently being implemented
- The status of overflow volume and frequency monitoring
- An overview of Metro's CSO Monitoring Program
- Sediment and discharge quality monitoring results for 1990/1991.

Overflow monitoring results indicate that total overflow volumes were slightly higher than baseline. In addition to average rainfall, this volume may be attributed to the fact that most CSO control programs have not been completed and therefore CSO reduction benefits have not yet been realized. With the completion of CATAD modifications and Phase II of the Lander/Bayview portion of the Hanford/Lander/Bayview project in 1992, greater CSO reductions are expected to occur. In addition, reduction benefits from the completed Fort Lawton Parallel Tunnel project, which was activated in the fall of 1991, are expected to be partially reflected in the 1991/1992 CSO Annual Report. All projects are on schedule. Metro is confident that completion of these projects will result in realization of the goal of 75 percent CSO reduction by the year 2005.

Please call me at 684-1236 or Laura Wharton at 684-1238 if you have any questions or concerns.

Sincerely,

Gunars K. Sreibers
Supervisor, Facilities Planning Section

GKS:drc
Enclosure
cc: Laura Wharton, Metro
Ms. Danya Crosby, Metro

ANNUAL CSO REPORT

1990/1991

METRO

DECEMBER 1991

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CSO CONTROL PROGRAM IMPLEMENTATION

Chapter One

COMBINED SEWER OVERFLOW CONTROL PROGRAM IMPLEMENTATION

Introduction

In 1988 the Metro Council adopted a comprehensive combined sewer overflow (CSO) control plan for the Metro system. The plan identified ten separate CSO control projects and an implementation schedule to achieve a 75 percent CSO volume reduction by the year 2005.

CSO Annual Reports are submitted to the Washington Department of Ecology (WDOE) to meet WDOE regulations. The reports provide control program status, overflow volume summary information, monitoring program data, and summaries of data analyses.

Program Schedule	Design Initiation	On-Line
Parallel Fort Lawton Tunnel	1987	1991
CATAD Modifications	1987	1992
Hanford/Bayview/Lander	1986	1992
University Regulator	1986	1993
Carkeek Transfer/CSO Treatment Facility	1988	1994
Alki Transfer/CSO Treatment Facility	1989	1996
Denny Way Separation	1993	1999
Diagonal Separation	1995	1999
Michigan Separation	1991	2003
Kingdome Separation	1991	2006

Status of Initiated CSO Control Projects

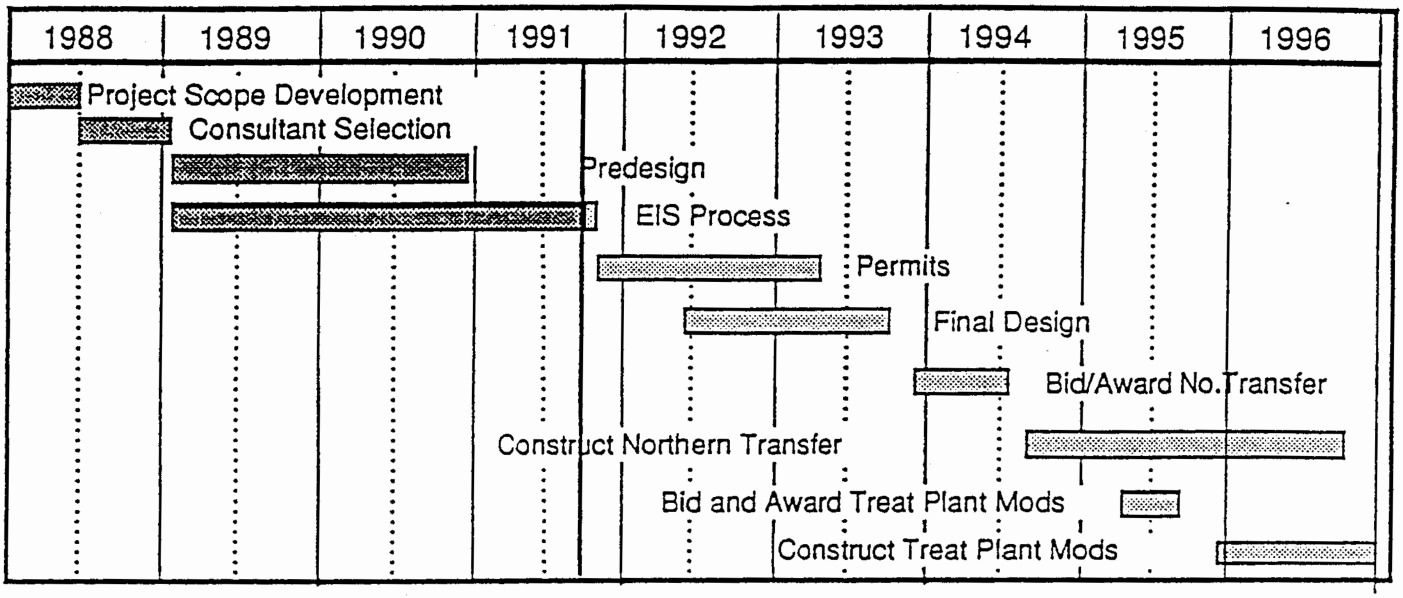
Alki Transfer/CSO Treatment Facility

Scope

The Alki project is designed to transfer base flows (2.25 X AWWF) from the Alki drainage basin to the West Point plant for secondary treatment. Flows above this level, to a maximum of 74 million gallons per day (mgd), will receive primary treatment and disinfection at Alki. The existing facility will be modified to permit intermittent discharges and flows will be discharged from the existing outfall. Specific permit conditions for operation of the Alki stormweather plant have been negotiated with WDOE. Full utilization of this project is contingent on West Point being on-line in 1995.

Status

The following schedule depicts 1988-1996 project tasks:



Predesign was completed in 1990 and writing of the EIS began in September 1991.

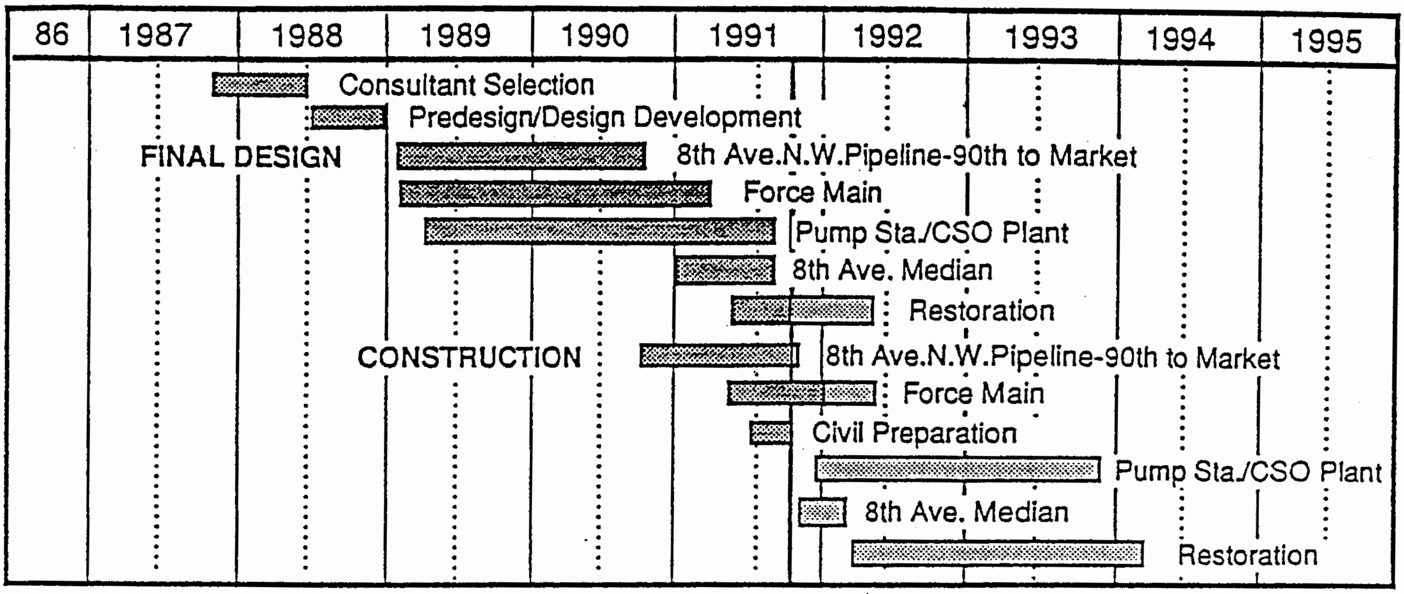
Carkeek Transfer/CSO Treatment Facility

Scope

The Carkeek project is designed to transfer base flows (2.25 X AWWF) from the Carkeek drainage basin to the West Point plant for secondary treatment. Flows above this level, to a maximum of 20 mgd, will receive primary treatment and disinfection at the existing Carkeek treatment plant and be discharged through the existing outfall. The existing facility will undergo minor modifications to allow treatment of peak storm related flows up to 20 mgd. Specific permit conditions for operation of the Carkeek stormweather plant have been negotiated with WDOE.

Status

The following schedule depicts 1987-1994 project tasks:



Construction of the 8th Ave. N.W. pipeline began in late 1990. Final design of all elements will be completed in 1992. Full utilization of this project is contingent on West Point being on-line in 1995.

Computer Augmented Treatment and Disposal (CATAD) System Modifications

Scope

Modifications to the CATAD control system are designed to improve system efficiency by more fully utilizing the storage capacity in existing sewers.

The previous computer control system utilized 17 to 28 million gallons (MG) or 28 to 47 percent of the storage within the system's estimated 60 MG capacity. Planning level estimates anticipate the improvements will increase capture rate to approximately 44 MG or 73 percent and reduce CSO volumes in the West Point service area by about 175 MG annually from the 1981-83 estimated total of 2.4 billion gallons.

Status

-Project Elements

* Hydraulic and hydrological models were completed in 1987.

* Flow forecast programs were completed in 1988.

* Predictive (Adaptive) Control development was completed in 1991.

* Predictive Control testing and tuning began in October 1991 and will continue through March 1992.

* Five new depth sensors were purchased and installed at selected sites in 1991 to increase collection system flow information. Sensor installation was completed in June 1991.

* Five new rain gauges were installed in 1991 to more effectively measure rainfall in the West Point service area.

* Facilities Planning System (FPS) was completed and documented in 1991 and documented. The FPS package allows Metro staff to utilize models and programs developed for the Predictive Control program.

* The system will be fully operational in April 1992.

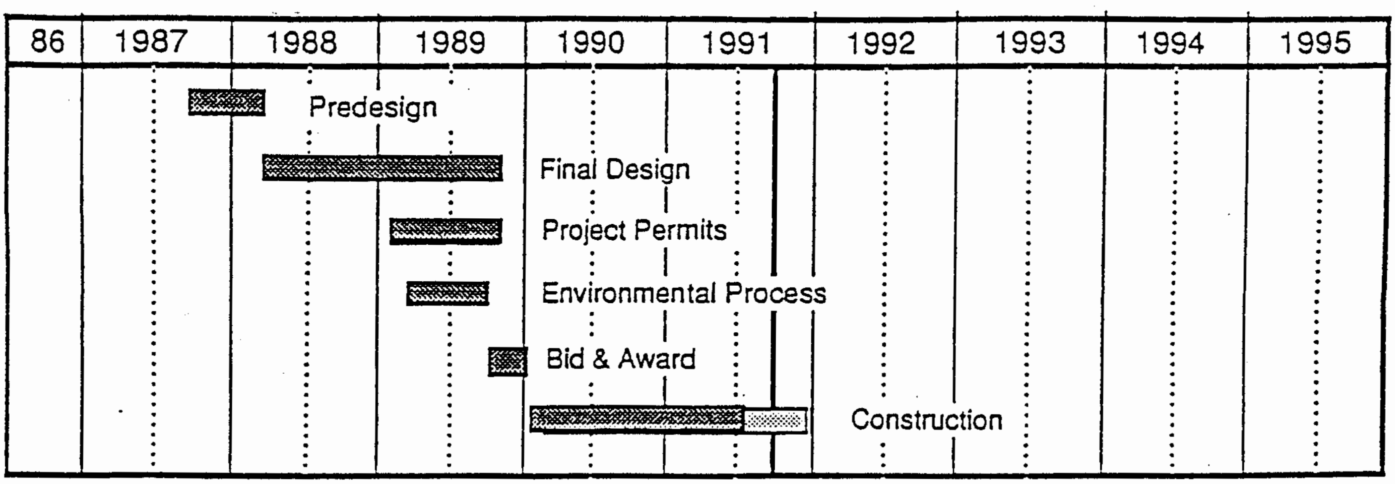
Fort Lawton Parallel Tunnel

Scope

The West Point Secondary Treatment Plant has a peak capacity of 440 mgd. The new parallel tunnel will store and transport 82 mgd of combined sanitary and stormwater flows (over the secondary base flow capacity of 358 mgd) to West Point. When completed this project will provide CSO reduction at the Ballard Regulator and Third Avenue West weir.

Status

The following schedule depicts 1987-1991 project tasks:



Construction was completed in the summer of 1991 and the tunnel was activated in the fall of 1991.

Hanford/Bayview/Lander Sewer Separation

Scope

This project consists of partial separation of the Lander and Hanford drainage basins and activation of the previously abandoned Bayview Tunnel.

Hanford

The Hanford separation project was completed in October 1987. Street storm drains were removed from the sanitary system, partially separating about 1,132 acres of combined sewers upstream of the existing Hanford tunnel. The project also included installation of a new 36-inch sanitary sewer line inside the existing 108-inch Hanford tunnel. The 36-inch line is used to convey partially separated flow to the Elliott Bay Interceptor. The 108-inch tunnel conveys stormwater to the Diagonal Way storm drain and then to the Duwamish River. The project eliminated CSOs from the Hanford No. 1 Regulator.

Lander/Bayview

The Lander Separation Project was conducted in two phases. Phase I provided partial separation of the Lander basin through the installation of a new 96-inch sanitary trunk line and conversion of the existing 84-inch line to convey stormwater. The new 96-inch line provides about 1.4 million gallons of storage capacity. Metro removed 500 tons of debris from the 84-inch line. The City of Seattle will maintain the 84-inch line in the future. Phase II of the project requires installation of a new stormwater collection system in the basin that will be operated and maintained by the City of Seattle. The Bayview Tunnel will be used to divert flows from the Hanford Basin to the 96-inch Lander sanitary trunk line. Overflows will be reduced at Lander as a result of the project. The components of Phases I and II are as follows:

Phase I:

* 96-inch Lander sanitary trunk
* New Lander regulator station

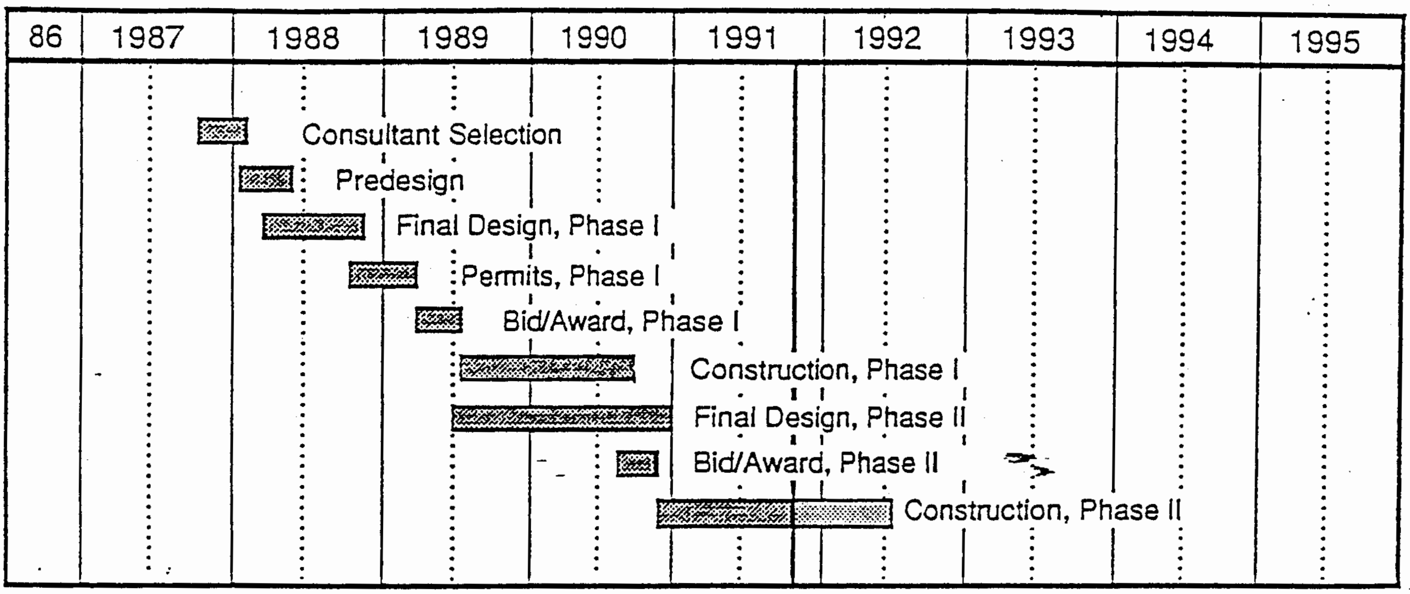
* Elliott Bay Interceptor connection
* Bayview diversion structure
* New stormwater collection system from existing 84-inch Lander trunk to the limits of the Lander street right-of-way
* Connection of existing combined collection system to new 96-inch sanitary trunk through drop manhole structures

Phase II:

* New stormwater collection pipeline in Lander Basin
* Connection of existing street drainage and parking lots to new stormwater collection pipelines within right-of-way limits

Status

The following schedule depicts 1987-1992 project tasks:



Consultant selection, predesign and final design of Phase I occurred in 1988. Phase I construction began on schedule and was completed in October 1990. The 96-inch line is currently conveying sewage to the Elliott Bay Interceptor for conveyance to West Point and eventual secondary treatment. The 84-inch stormwater line will be utilized as needed. Phase II construction began in November 1990 and was substantially completed in September 1991. Administrative project closeout will occur in mid-1992.

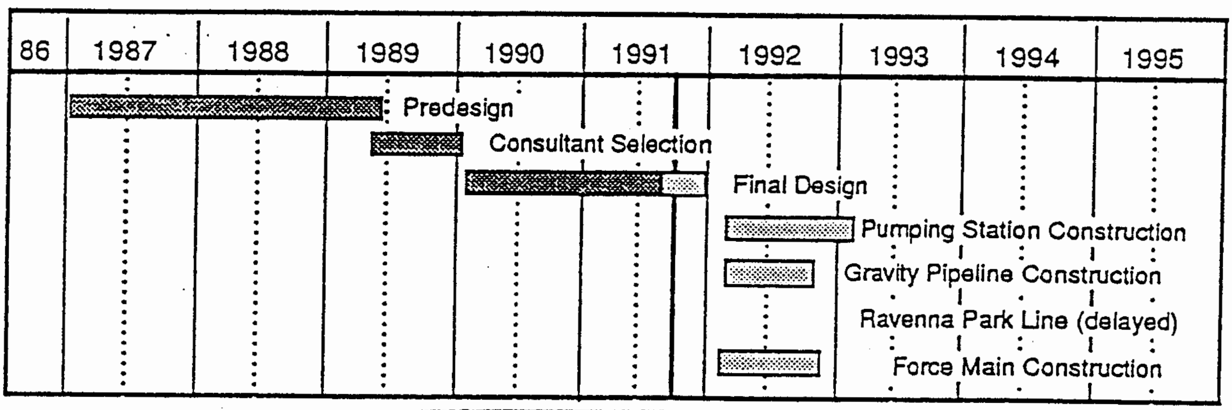
University Regulator

Scope

As a result of the University Regulator Project, storm runoff from the Densmore drain, Interstate-5, and outflow from Green Lake will be diverted from Metro's North Interceptor sanitary sewer system to a new storm drain. CSOs into Portage Bay will be reduced by an estimated 111 million gallons annually.

Status

The following schedule depicts 1987-1993 project tasks.



Metro completed final 90% plans in October 1991. Restoration designs were reviewed with the Department of Natural Resources, Seattle Engineering Department, and the community in September 1991. Construction is scheduled to begin in the first quarter of 1992.

Additional CSO Abatement Projects

Predesign is underway on the Kingdome and Michigan Separation projects. The purpose of predesign is to identify what, if any, project elements should be constructed to avoid conflict with City of Seattle transportation improvement projects. With the exception of the Kingdome separation, there is no indication that substantial savings or avoidance of environmental impacts would be realized by accelerating completion of these projects. Consequently, work on these and other remaining CSO projects is not anticipated until after 1993 based on current scheduling. Remaining projects include the Diagonal, Denny Way, and Michigan separation projects.

Additional CSO Related Projects

Denny Way Sediment Capping Project

Scope

A sediment capping project was conducted offshore of the Denny Way CSO as an experimental demonstration project to evaluate the benefits of capping as a means of improving sediment quality in Elliott Bay. A total of thirteen barge loads of clean dredged sand were delivered and spread over a rectangular capping site (200 ft X 600 ft) in a cooperative effort between the Seattle District, U.S. Army Corps of Engineers (COE) and Metro. In support of the capping operation, Metro conducted pre-dredge testing of capping sediments; dissolved oxygen testing during cap placement; and measured at six diver-installed rods and plates to determine foundation settlement and cap thickness. Metro is currently conducting a five-year post-capping monitoring program that includes surface grab sediment sampling to measure cap chemistry for recontamination and benthic taxonomy for recolonization evaluation; video camera surveying to view overall bottom condition; coring with sediment chemical testing to determine cap effectiveness in isolating chemicals; and preparing reports during the monitoring period.

Status

The capping was completed in March 1990. The monitoring program runs from 1990 to 1995 with monitoring reports scheduled to be completed in 1990, 1991, 1992, and 1994. A 5-year project review will be conducted in 1995.

1990/1991 CSO VOLUME SUMMARY

Chapter Two

1990/1991 CSO VOLUME SUMMARY

Introduction

The volume and frequency of CSOs at 18 regulator stations in the West Point system are monitored by Metro's CATAD system. Metro's West Point system is divided into the Northern Service Area (NSA) and the Southern Service Area (SSA). Overflow reports are generated daily, evaluated by staff and archived for future use. Metro deploys portable flow meters at two stations not currently monitored by CATAD including overflow weirs at Third Avenue West and 11th Ave. N.W.

Discussion of Baseline Conditions

The volume and frequency of CSO will change as the amount of rainfall changes from the average. In order to estimate the variability of CSO volume and frequency, 42 years of hourly rainfall data were entered into a model developed to predict CSOs from the Metro system. The model was used to calculate the annual CSO volume that would have occurred in the collection system as it existed in 1981 to 1983 for the rainfall from each of the years 1943 through 1984. WDOE proposed 1981-1983 CSO conditions as a baseline for judging CSO control. It was found that the 1981-1983 CSO volume and frequency would be exceeded (even if the collection system and all other aspects of the regulators, CATAD, etc., remained unchanged) about once every five years because of year-to-year variations in rainfall. Thus, the baseline condition for 1981-1983 represents the physical characteristics of the collection and CATAD system during this time period, rather than a not-to-be-exceeded CSO volume.

The relationship between CSO volume and rainfall is approximated by the following formulas:

Baseline NSA

CSO Volume(in MG)=(19.3 X Annual Rainfall in inches)-190

Baseline SSA

CSO Volume(in MG)=(66.7 X Annual Rainfall in inches)-460

Baseline Total

Total = Baseline NSA + Baseline SSA

By entering the averaged historical annual rainfall of 36 inches into the above formulas baseline conditions were established as follows:

<u>Baseline NSA</u>

CSO Volume = (19.3 X 36 inches) - 190 = 458 MG

<u>Baseline SSA</u>

CSO Volume = (66.7 X 36 inches) - 460 = 1941 MG

<u>Baseline Total</u> = 2399 MG

While the establishment of baseline conditions identifies average annual volume and frequencies of discharge, year-to-year comparisons to baseline conditions can be misleading. Yearly annual rainfall cannot indicate year-to-year variations in CSO volumes for individual basins as rainfall can be extremely variable in the Seattle area. Individual storm events can disproportionately influence total overflow volume since peak storm events may contribute significant rainfall accumulations in relatively short periods of time resulting in large overflow volumes while storms of low intensity and long duration may be equated with overflows of a lesser volume. Rainfall should ideally be compared by basin to derive an accurate understanding of system response.

Overflow Volume Comparison To Baseline Conditions

A total overflow volume of 2556 MG was recorded for the period June 1990 through May 1991, 157 MG over established baseline conditions. Overflows in the SSA totalled 2029 MG, 88 MG over baseline conditions. Overflows in the NSA totalled 526 MG, 68 MG over baseline conditions as summarized in Table 1.

Table 1

Service Area	1988 CSO Plan	1990/1991
NSA	458 MG	526 MG
SSA	1941 MG	2029 MG
TOTAL	2399 MG	2556 MG

Monthly and total overflows for each station and comparisons to baseline conditions for each station are reported in Table 2 (Page 12).

Peak storm events may have contributed significantly to large overflow volumes. Three storm events alone account for nearly half (48%) of the total overflow volume for the 1990-1991 reporting period. This illustrates the effects of peak storm events that contribute to large volumes of overflow in relatively short periods of time. Table 3 lists the dates of these storm events and corresponding overflow volumes.

Table 3

Storm Date	Associated Overflow Volume
Mar. 01-04 1991	310 MG
Nov. 23-25 1990	395 MG
Apr. 03-06 1991	509 MG

The rainfall for the reporting period was 35.48 inches (Appendix A). As a result of the approximately average rainfall, CSO volumes for June 1990 through May 1991 were average. Because most CSO control programs are not completed, CSO reduction benefits have not yet been realized. Reduction benefits from the Parallel Fort Lawton Tunnel and completed CATAD modifications will be partially reflected in the 1991-1992 CSO Annual Report. As other CSO Control Programs are completed and implemented, greater CSO reductions are expected to occur.

SSA Overflow Volume Discussion

1990/1991 overflows in the SSA were approximately 88 MG over established baseline conditions.

Denny Way overflowed 666 MG compared to a baseline of 370 MG. Metro staff are currently evaluating possible causes of this apparent increase from baseline conditions.

Hanford #2 overflowed 439 MG compared to a baseline of 680 MG, a reduction of 141 MG. This reduction can be attributed to partial completion of the Hanford/Lander/Bayview Sewer Separation Project.

Michigan St. overflowed 37 MG compared to a baseline of 250 MG, a reduction of 213 MG. Lower overflow volumes at the Michigan Regulator may be attributed to higher overflow volumes at the adjacent Brandon and Norfolk Regulators. For these three regulators, the total overflow for 1990/1991 (369 MG) is greater than their total baseline (289 MG).

TABLE 2

1990/1991 Volume Summary by Service Area
(volumes in million gallons)

STATION	June (1990)	July (1990)	Aug. (1990)	Sept. (1990)	Oct. (1990)	Nov. (1990)	Dec. (1990)	Jan. (1991)	Feb. (1991)	March (1991)	April (1991)	May (1991)	1990/1991 TOTAL	CSO PLAN BASELINE
SSA														
Denny Way	23.36	3.36	0.00	0.36	67.64	140.76	43.54	53.88	83.93	134.62	112.66	2.24	666.35	370.00
King St.	5.20	0.62	0.00	0.00	1.54	13.18	10.59	5.26	7.73	12.64	13.45	0.00	70.21	70.00
Connecticut	10.92	1.00	0.11	0.00	4.93	30.02	7.62	12.82	16.43	25.08	34.05	0.13	143.11	90.00
Hanford #2	9.84	0.13	0.00	0.00	3.00	37.10	2.04	83.25	229.83	21.34	52.73	0.00	439.26	680.00
Lander St.	0.00	0.00	0.00	0.00	15.71	55.94	11.52	11.91	10.84	62.26	98.92	0.00	267.10	215.00
Harbor Ave.	2.27	0.28	0.09	0.00	1.60	11.14	2.19	2.06	3.58	3.97	8.60	0.07	35.85	55.00
Chelan	0.00	0.01	0.00	0.00	0.00	5.03	1.24	0.14	2.07	1.29	4.62	0.00	14.40	25.00
West Michigan	0.00	0.02	0.00	0.00	0.00	0.63	0.00	0.01	0.00	0.12	1.01	0.00	1.79	2.00
8th Ave.	0.45	0.00	0.00	0.00	0.00	11.02	0.14	0.00	4.42	0.57	5.97	0.00	22.57	15.00
Brandon St.	4.37	3.29	0.21	0.00	6.74	36.67	17.87	16.53	27.92	25.25	23.90	0.17	162.92	35.00
Michigan St.	3.44	0.73	0.00	0.00	0.22	8.66	0.08	1.43	1.23	7.61	13.11	0.00	36.51	250.00
Norfolk	0.85	0.00	0.00	0.00	3.85	76.85	25.35	6.53	17.17	9.57	28.95	0.00	169.12	4.00
Duwamish P.S.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130.00
												TOTAL SSA	2029.19	1941.00
NSA														
Ballard	0.00	0.00	0.00	0.00	16.80	71.05	12.80	5.51	12.48	6.31	20.64	0.00	145.59	90.00
Dexter	1.05	1.62	0.00	0.00	3.47	11.49	2.79	0.00	1.52	6.20	6.52	0.00	34.66	12.00
University	0.00	0.00	0.00	0.00	0.26	14.55	13.36	0.00	0.00	2.30	45.06	0.00	75.53	211.00
Montlake	0.38	1.12	0.00	0.00	0.00	12.09	9.13	7.82	4.61	13.62	37.75	0.00	86.52	40.00
Canal St.	2.03	0.00	0.00	0.00	2.07	12.67	2.92	1.49	0.61	0.30	0.47	0.00	22.56	0.00
3rd Ave. W.	0.00	0.00	0.00	0.00	11.37	43.86	11.89	10.90	9.50	4.03	38.99	0.00	130.54	105.00
Ballard No. 1 (11th Ave. NW)	1.30	0.14	0.00	0.00	3.90	13.16	4.74	2.40	0.94	4.45	0.00	0.00	31.03	0.00
												TOTAL NSA	526.43	458.00
TOTALS	65.46	12.32	0.41	0.36	143.10	605.87	179.81	221.94	434.81	341.53	547.40	2.61	2555.62	2399.00

Metro staff are currently evaluating possible causes of these fluctuations from baseline conditions.

Duwamish Pump Station recorded zero MG overflow compared to a baseline of 130 MG. Lower overflow volumes at the Duwamish Pump Station may be attributed to a change in operations strategy for this area of the system.

Metro staff will be reviewing operating strategies for all locations that show a significant deviation from baseline conditions.

NSA Overflow Volume Discussion

1990/1991 overflows in the NSA were approximately 68 MG over baseline conditions.

University overflowed 76 MG compared to a baseline of 211 MG. Montlake overflowed 87 MG compared to a baseline of 40 MG.

The discrepancy between baseline conditions and actual recorded overflow volumes for University and Montlake regulator stations was also noted in the 1989/1990 CSO Annual Report. In the 1989/1990 CSO Annual Report, overflow volumes were approximately 50 MG higher at Montlake and 190 MG lower at the University Regulator. As a result of these apparent fluctuations from baseline conditions noted in last year's report, Metro began evaluating possible causes within the scope of the University Regulator CSO Control Project.

After extensive investigation, it was determined that no known fundamental changes to the system explained the discrepancies between baseline conditions and actual University and Montlake overflow volumes. Metro then examined the setpoints for the downstream North Trunk and the University Regulator. It was determined that the programable logic controller (PLC), which controls the interceptor level downstream of the University Regulator, was misprogramed. This allowed the North Trunk to rise an additional 6.5 feet before the University Regulator station allowed a combined sewer overflow to occur. Because more flow was allowed into the downstream North Trunk, there was less capacity for the Montlake flow, thus explaining the doubling of overflow at the Montlake regulator and the decrease of the University Regulator frequency and volume of overflow.

As a result of the misprogramed PLC, flows which normally would have overflowed at University continued to flow into the North Interceptor and increased overflows at Third Avenue West and Canal Street. Third Avenue West overflowed

131 MG compared to a baseline of 105 MG. Canal St. overflowed 23 MG compared to a baseline of 0 MG.

Although the higher than normal downstream trunk levels resulted in an overall decrease in the volume of discharge from CSOs, staff from the University of Washington's medical center complex experienced sewage backup. This was a major reason for resetting the PLC in April 1991.

1990/1991 Frequency of Events Discussion

Frequency of overflow events for 1990/1991 are summarized in Table 4 (Page 15).

As a result of partial completion of the Hanford/Bayview/Lander CSO Control Project, overflows were eliminated from Hanford #1, thus achieving the goal of zero overflow events per year for Hanford #1.

Frequency of overflow events were notably higher than baseline at Norfolk (25 compared to a baseline of 7), Brandon (40 compared to a baseline of 25), Connecticut (37 compared to a baseline of 25), Harbor (59 compared to a baseline of 46), Canal St. (11 compared to a baseline of zero), and Dexter (13 compared to a baseline of 4).

Michigan's frequency of events decreased from baseline (18 compared to a baseline of 31). University's frequency of events also decreased from baseline (5 compared to a baseline of 14). As noted in the NSA Overflow Volume Comparison section, University overflow decreased as a result of a malfunctioning PLC. Canal St., Third Avenue West, and Montlake overflows and frequency of events increased as a result of the misprogramed PLC. The PLC was reset in April 1991.

Metro staff will be reviewing operating strategies for all locations that show a significant deviation from baseline.

TABLE 3

1990-1991 FREQUENCY OF EVENTS

Overflow Location	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total 1990/1991 Station Overflows	CSO Plan Baseline	At 75% Volume Reduction
SSA															
King	5	1	1	0	5	5	4	3	5	2	2	0	33	31	1
Norfolk	3	0	0	0	4	3	4	1	3	5	2	0	25	7	1
West Michigan	0	2	0	0	1	1	0	1	1	1	1	0	8	8	1
Michigan	3	1	0	0	3	3	2	1	2	1	2	0	18	31	1
Duwamish P.S.	0	0	0	0	0	0	0	0	0	0	0	0	---	---	1-2
Brandon	3	2	3	0	7	5	2	4	5	3	4	2	40	25	1-2
Chelan	4	1	0	0	0	1	1	1	1	1	2	0	12	16	2-5
8th Ave.	1	0	0	0	0	3	1	0	2	1	1	0	9	12	2-5
Denny Way	4	2	0	2	7	7	4	3	5	3	4	2	43	51	5-10
Connecticut	4	1	1	1	4	5	4	3	5	3	5	1	37	25	10-25
Harbor	4	3	3	1	8	7	7	5	8	5	6	2	59	46	10-25
Hanford															
Hanford #1	0	0	0	0	0	0	0	0	0	0	0	0	---	27	---
Hanford #2	5	1	0	0	2	3	3	1	5	1	1	0	22	23	10-25
Lander	0	0	0	0	1	3	1	1	2	1	1	0	10	19	10-19*
NSA															
Canal Street	3	0	0	0	1	1	1	1	2	1	1	0	11	---	<1
Ballard	0	0	0	0	4	3	1	1	2	1	1	0	13	13	1-2
Ballard No. 1 (11th Ave. NW)	2	1	0	0	2	4	1	2	1	2	0	0	15	13	5-10
Dexter	2	2	0	0	3	1	1	0	2	1	1	0	13	4	1-2
University	0	0	0	0	1	1	1	0	0	1	1	0	5	14	5-10
Third Avenue West	0	0	0	0	1	1	1	2	2	1	1	0	9	---	1-2
Montlake	1	1	0	0	0	2	1	1	3	1	1	0	11	16	5-10
Total # Events	44	18	8	4	54	59	40	31	56	35	37	7	393	381	

* Volume at Lander will be reduced by 51% and frequency will be reduced to less than 19 events per year.

CSO OVERFLOW MONITORING PROGRAM

Chapter Three

CSO OVERFLOW MONITORING PROGRAM

Introduction

Metro's NPDES sampling program calls for discharge sampling of five CSO sites annually through 1992 to meet requirements of WAC 173-245-040 (2) (a) (i) and condition S11.C1 of the West Point Treatment Plant's National Pollutant Discharge Elimination System (NPDES) permit. Appendix B lists stations, sample numbers, dates when samples were taken, and status of each site in the monitoring program. Nine stations were selected for sediment quality sampling and four discharge samples for each CSO under overflow conditions were to be collected to supplement previous monitoring efforts. Sediment sampling requirements were completed in 1990.

Sediment sampling requirements were completed in 1990. During the period covered in this report discharge samples were collected for Ballard Siphon (W003), Norfolk Street (W044) and Brandon Street (W041). Samples were analyzed for organics, metals, and conventionals. Organics analyses results are presented in Table 5 (Pages 17-20) and Appendix C describes Metro's trace organics analyses procedures. Metals and conventionals results are presented Table 6 (Page 21). A value of zero is assumed for constituents below the detection limit in computing mean values in Table 6. A summary of results follows for each station.

1990/1991 Discharge Sampling Results

Organics Analyses Results Summary

Ballard CSO

No pesticides or PCBs were detected in the Ballard CSO sample. BNA and VOA results were typical of wastewater. Chlorinated solvents, acetone, and xylene were detected in the VOA analysis while phenols, PAHs, and phthalates were present in the BNA analysis. Acetone, a common solvent frequently detected in wastewater, was present at 31 ppb, methylene chloride at 13 ppb, and tetrachloroethylene at 16 ppb. All remaining organics which were detected had concentrations less than 5 ppb.

Brandon CSO

No pesticides or PCBS were detected in the Brandon CSO sample. Volatile organics included low levels of chloroform

TABLE 5A

CSO DISCHARGE DATA

(in ppb or ug/L)			
Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
PRIORITY POLLUTANT ORGANICS			
ACIDS			
PHENOL	1.60		
2-CHLOROPHENOL			
4-CHLORO-3-METHYL PHENOL			
2,4-DICHLOROPHENOL			
2,4,5-TRICHLOROPHENOL			
2,4,6-TRICHLOROPHENOL			
2,3,4,6-TETRACHLOROPHENOL			
PENTACHLOROPHENOL			
2-NITROPHENOL			
4-NITROPHENOL			
2,4-DINITROPHENOL			
2,4-DIMETHYLPHENOL			
4,6-DINITRO-2-METHYLPHENOL			
2-METHYLPHENOL (O-CRESOL)			
3-METHYLPHENOL (M-CRESOL)			
4-METHYLPHENOL (P-CRESOL)	2.30	1.60	
BENZOIC ACID		10.00	
BASES			
N-NITROSODIMETHYLAMINE			
N-NITROSODI-N-PROPYLAMINE			
N-NITROSODIPHENYLAMINE			
BENZIDINE			
3,3-DICHLOROBENZIDINE			
PYRIDINE			
ANALINE			
4-CHLOROANILINE			
2-NITROANILINE			
3-NITROANILINE			
4-NITROANILINE			
NEUTRALS			
1,2-DICHLOROBENZENE			
1,3-DICHLOROBENZENE			
1,4-DICHLOROBENZENE			
1,2,4-TRICHLOROBENZENE			
HEXACHLOROBENZENE			
NITROBENZENE			
HEXACHLOROETHANE			
HEXACHLOROCYCLOPENTADIENE			
HEXACHLOROBUTADIENE			
TRICHLOROBUTADIENE			
TETRACHLOROBUTADIENE			

TABLE 5B

CSO DISCHARGE DATA

(in ppb or ug/L)

Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
NEUTRALS			
PENTACHLOROBUTADIENE			
BIS (2-CHLOROETHYL) ETHER			
BIS (2-CHLOROISOPROPYL) ETHER			
4-CHLOROPHENYL PHENYL ETHER			
4-BROMOPHENYL PHENYL ETHER			
BIS (2-CHLOROETHOXY) METHANE			
2,4-DINITROTOLUENE			
2,6-DINITROTOLUENE			
NAPHTHALENE	0.62		
2-METHYLNAPTHALENE	0.58	0.85	
FLUORENE		0.68	
ACENAPHTHENE			
ACENAPHYTHYLENE			
ANTHRACENE			
PHENANTHRENE	0.46	3.50	
FLUROANTHENE	0.52	5.50	
PYRENE	0.53	2.90	
CHRYSENE	0.33	2.50	
BENZO (A) ANTHRACENE	0.21	1.20	
BENZO (A) PYRENE		1.20	
BENZO (B) FLUORANTHENE		1.60	
BENZO (K) FLUORANTHENE		1.30	
INDENO (1,2,3-C,D)PYRENE		1.10	
DIBENZO (A-H) ANTHRACENE			
BENZO (G,H,I) PERYLENE			
2-CHLORONAPHTHALENE			
DIMETHYL PHTHALATE			
DIETHYL PHTHALATE	0.60		1.30
DI-N-BUTYL PHTHALATE		9.50	
BENZYL BUTYL PHTHALATE	0.76	6.60	0.82
DI-N-OCTYL PHTHALATE			
BIS (2-ETHYLHEXYL) PHTHALATE	5.40	9.80	
BENZYL ALCOHOL	1.20		
DIBENZOFURAN			
1-2, DIPHENYLHYDRAZINE			
ISOPHORONE			
PCBS AND PESTICIDES			
TOTAL PCBs			
AROCLOR 1016			
AROCLOR 1221			
AROCLOR 1232			
AROCLOR 1242			
AROCLOR 1248			

TABLE 5C

CSO DISCHARGE DATA

(in ppb or ug/L)			
Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
PCBS AND PESTICIDES			
AROCLOR 1254			
AROCLOR 1260			
ALPHA-BHC			
BETA-BHC			
DELTA-BHC			
GAMMA-BHC (LINDANE)			
4,4-DDE			
4,4-DDD			
4,4-DDT			
ALDRIN			
DIELDRIN			
ENDRIN			
ENDRIN ALDEHYDE			
CHLORDANE			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
METHOXYCHLOR			
ENDOSULFAN I			
ENDOSULFAN II			
ENDOSULFAN SULFATE			
TOXAPHENE			
2,3,7,8-TCDD			
DEMETON			
GUTHION			
MALATHION			
MIREX			
PARATHION			
VOLATILES			
METHYL CHLORIDE			
METHYLENE CHLORIDE	13.00		
CHLOROFORM		1.40	
CHLOROMETHANE			
CHLOROETHANE			
1,1-DICHLOROETHANE			
1,2-DICHLOROETHANE			
1,1,1-TRICHLOROETHANE	1.90	15.00	
1,1,2-TRICHLOROETHANE			
1,1,1,2-TETRACHLOROETHANE			
1,1,2,2-TETRACHLOROETHANE			
VINYL CHLORIDE			
1,1-DICHLOROETHYLENE			
TRANS-1,2-DICHLOROETHYLENE			
CIS-1,2-DICHLOROETHYLENE			

TABLE 5D

CSO DISCHARGE DATA

(in ppb or ug/L)

Sample #	8909776	9000289	9000887
Station	Ballard Siphon	Brandon St.	Norfolk St.
NPDES Serial Number	WOO3	WO41	WO44
VOLATILES			
TRICHLOROETHYLENE			
TETRACHLOROETHYLENE	16.00		6.20
1,1,2-TRICHLOROETHYLENE	1.10		
1,2-DICHLOROPROPANE			
CIS-1,3-DICHLOROPROPENE			
TRANS-1,3-DICHLOROPROPENE			
METHYL BROMIDE			
DICHLOROBROMOMETHANE			
CHLORODIBROMOMETHANE			
BROMOFROM			
DICHLORODIFLUOROMETHANE			
TRICHLOROFLUOROMETHANE			
ACROLEIN			
ACRYLONITRILE			
CARBON TETRACHLORIDE			
BENZENE			
TOLUENE			
ETHYLBENZENE			
BIS (CHLOROMETHYL) ETHER			
2-CHLOROETHYL VINYL ETHER			
CARBON DISULFIDE			
ISOBUTANOL			
ACETONE	31.00		20.00
VINYL ACETATE			
2-BUTANONE (MEK)			
4-METHYL-2-PENTANONE (MIBK)			
2-HEXANONE			
TOTAL XYLENE	2.40		
STRYENE			

TABLE 6

CSO DISCHARGE DATA

NPDES#	WOO3 Ballard				WO41 Brandon St. Outfall				WO44 Norfolk Reg.				
METALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
ALUMINUM	4/4	1.3000	1.5000	1.3500	4/4	1.5000	9.5000	4.9750	4/4	2.8000	3.7000	3.4250	4.600000
ARSENIC	1/3	0.0020	0.0020	0.0020	3/4	0.0040	0.0080	0.0060	1/4	0.0040	0.0040	0.0040	0.010000
BERYLLIUM	0/4				0/4				0/4				0.000067
CADMIUM	0/4				0/4				0/4				0.002800
CHROMIUM	4/4	0.0060	0.0100	0.0075	4/4	0.0100	0.0600	0.0275	4/4	0.0070	0.0100	0.0090	0.033000
COPPER	4/4	0.0270	0.0480	0.0365	4/4	0.0290	0.0860	0.0565	4/4	0.0200	0.0440	0.0333	0.072400
IRON	4/4	1.5000	1.9000	1.7000	4/4	2.2000	14.0000	7.0000	4/4	3.5000	5.1000	4.5250	3.700000
LEAD	4/4	0.0600	0.0700	0.6250	4/4	0.0400	0.1000	0.0750	3/4	0.0300	0.0400	0.0333	0.140000
MANGANESE	4/4	0.0410	0.0590	0.0478	4/4	0.0490	0.3200	0.1780	4/4	0.1000	0.1500	0.1375	0.100000
MERCURY	2/4	0.0003	0.0003	0.0003	2/4	0.0002	0.0004	0.0003	4/4	0.0002	0.0007	0.0004	0.000260
NICKEL	0/4				4/4	0.0200	0.0500	0.0350	2/4	0.0100	0.0100	0.0100	0.034000
SELENIUM	0/3				2/4	0.0070	0.0070	0.0070	1/4	0.0100	0.0100	0.0100	
SILVER	0/4				2/4	0.0060	0.0070	0.0060	0/4				0.005000
ZINC	4/4	0.1400	0.2200	0.1700	4/4	0.1300	0.3400	0.2350	4/4	0.0870	0.1500	0.1143	0.210000

NPDES#	WOO3 Ballard				WO41 Brandon St. Outfall				WO44 Norfolk Reg.				
CONVENTIONALS	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	N1/N2	MIN VALUE (MG/L)	MAX VALUE (MG/L)	MEAN VALUE (MG/L)	TYPICAL CSO VALUES (TPPS REPORT) (MG/L)
BOD	4/4	22.00	35.00	27.75	4/4	7.40	22.00	15.35	4/4	35.00	60.00	49.00	60.00
COD	4/4	64.00	115.00	89.75	4/4	66.00	176.00	105.50	4/4	73.00	190.00	133.25	140.00
TOTAL-SS	4/4	58.14	84.00	71.79	4/4	72.00	300.00	169.29	3/3	139.00	218.00	179.67	112.00
VOLATILE-SS	4/4	23.26	37.33	31.15	4/4	27.00	68.00	43.25	3/3	52.00	74.00	60.00	60.00
OIL-GREASE	3/4	5.70	8.00	6.93	2/4	12.00	12.00	12.00	3/4	6.10	12.00	8.97	8.60

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED and 1,1,1-trichloroethane. BNAs included low levels of polycyclic aromatic hydrocarbons (PAHs), phthalates, methylphenol, and benzoic acid. The highest concentration noted was 15 ppb of 1,1,1-trichloroethane and BNAs did not exceed 10 ppb.

Norfolk St. CSO

Very few organics were detected in the Norfolk CSO sample. No pesticides or PCBs were present. Volatile organics detected in the Norfolk sample included low levels of tetrachloroethylene and acetone. Semivolatile organics for the Norfolk sample included traces of two phthalates.

Metals and Conventionals Analyses Results Summary

Metals and conventionals analyses results were compared to typical CSO pollutant levels (see Metro's Toxicant Pretreatment Planning Study Technical Report A2: Collection System Evaluation, 1984) in Table 6 (Page 21). The typical CSO pollutant level is not available for selenium.

The mercury mean constituent level was above the typical CSO pollutant level in the Ballard CSO sample.

Aluminum, iron, manganese, nickel, silver, zinc, total suspended solids, and oil-grease mean constituent levels were above the typical CSO pollutant levels in the Brandon CSO sample.

Iron, total suspended solids, and oil-grease mean constituent levels were above the typical CSO pollutant levels in the Norfolk CSO sample.

All other mean constituent concentrations were at or below typical CSO pollutant levels.

APPENDICES

CITY OF SEATTLE RAINFALL
6/90 - 5/91

Total rainfall for each gauge shown in hundredths of inches

Average over entire city shown in inches
Average taken without respect to representative areas

City of Seattle Gauge numbers

Month	1	2	3	4	5	7	8	9	10	11	12	14	15	16	17	18	20	Average
June, 1990	234	254	214	288	211	256	231	216	264	225	216	263	233	204	410	232	377	2.55"
July, 1990	99	98	70	111	48	65	60	67	80	48	58	58	80	65	58	70	105	0.73"
August, 1990	55	48	39	54	61	48	54	48	96	34	57	76	57	56	123	62	93	0.62"
September, 1990	1	2	1	4	4	2	2	5	2	0	3	3	3	3	7	3	1	0.03"
October, 1990	486	498	361	508	416	524	446	111	501	415	407	493	433	448	820	498	388	4.56"
November, 1990	572	601	536	635	573	601	626	511	855	533	626	751	699	539	1431	762	325	6.57"
December, 1990	365	379	327	391	200	379	354	329	230	263	354	325	315	289	193	299	164	3.03"
January, 1991	261	326	298	329	298	326	338	265	380	274	223	349	327	275	642	364	183	3.21"
February, 1991	439	411	363	445		214	464	201	424	367	436	508	423	369	765	474	126	4.01"
March, 1991	361	1095	326	385		134	441	104	409	314	389	383	382	400	735	456	75	3.99"
April, 1991	450	469	428	542		106	466	402	604	390	561	542	514	537	943	568	513	5.02"
May, 1991	133	123	89	88		94	135	136	136	28		123	117	115	171	132	126	1.16"

METRO

Appendix A

NPDES CSO MONITORING PROGRAM CHECKLIST

DISCHARGE MONITORING

CSO	NPDES #	DATE	SAMPLE #	STATUS OF PROGRAM
MICHIGAN	W039	03/26/88	8800300	PERMIT REQUIREMENTS MET
LANDER	W030	03/26/88	8800301	PERMIT REQUIREMENTS MET
DENNY	W027	03/25/88	8800302	PERMIT REQUIREMENTS MET
E. BALLARD #1	W004	02/22/89	8900177	PERMIT REQUIREMENTS MET
		04/06/88	8800352	
		01/14/88	8800052	
		11/02/88	8802026	
3RD AVE.W. (EWING)	W008	02/22/89	8900174	PERMIT REQUIREMENTS MET
		01/14/88	8800053	
		03/26/88	8800303	
		11/02/89	8802027	
BALLARD SIPHON	W003	12/02/89	8909776	PERMIT REQUIREMENTS MET
		03/09/90	9000286	
		10/04/90	9000880	
		01/06/90	9000002	
CONNECTICUT	W029	08/22/89	8900832	PERMIT REQUIREMENTS MET
		10/22/89	8909689	
		04/23/90	9000394	
		02/07/90	9000215	
BRANDON ST.	W041	03/14/90	9000289	PERMIT REQUIREMENTS MET
		06/03/90	9000510	
		10/04/90	9000881	
		12/04/90	9010003	
NORFOLK ST.	W044	10/14/90	9000887	PERMIT REQUIREMENTS MET
		06/06/90	9000524	
		04/03/91	9100612	
		12/04/90	9010006	
EIGHTH AVE.	W040			SAMPLING IN 1992
CHELAN AVE.	W036			SAMPLING IN 1992
DEXTER AVE.	W009			SAMPLING IN 1992/1993
MONTLAKE AVE.	W014	04/03/91	9100609	ADDITIONAL SAMPLING IN 1992
		12/04/90	9010009	
S.W. MICHIGAN	W042	01/12/91	9100012	ADDITIONAL SAMPLING IN 1992
		04/03/91	9100613	

SEDIMENTS	NPDES#	DATE	SAMPLE #	STATUS OF PROGRAM
BALLARD SIPHON	W003	05/30/89	8900560	PERMIT REQUIREMENTS MET
EAST BALLARD #1	W004	05/30/89	8900561	PERMIT REQUIREMENTS MET
3RD AVE. WEST	W008	05/30/89	8900563	PERMIT REQUIREMENTS MET
DEXTER AVENUE	W009	05/30/89	8900565	PERMIT REQUIREMENTS MET
MONTLAKE OVER.	W014	05/30/89	8900564	PERMIT REQUIREMENTS MET
EIGHTH AVE.	W040	05/23/90	9006690	PERMIT REQUIREMENTS MET
BRANDON ST.	W041	05/23/90	9006687	PERMIT REQUIREMENTS MET
S.W. MICHIGAN	W042	05/23/90	9006691	PERMIT REQUIREMENTS MET
NORFOLK ST.	W044	05/23/90	9006688	PERMIT REQUIREMENTS MET

Appendix ~~A~~ B

QA/QC Procedures for Metro's Trace Organics Analyses

Metro's Trace Organics QA/QC consists of reagent water blank, duplicate matrix spikes, and surrogates. Reagent water blanks are run to ensure that laboratory contaminants or artifacts are not reported for the samples. A matrix spike consists of an actual sample spiked with a representative group of the compounds being analyzed for by the various procedures. By running the matrix spike in duplicate, variability is monitored and a relative percent difference (RPD) is calculated in addition to the percent recovery of the spikes.

Surrogate spikes are compounds that are added to every sample prior to extraction. After analysis, the percent recovery of the surrogates are calculated and this data is used to monitor extraction efficiency. The surrogates are compounds not generally found in environmental samples and are often isotopically labelled analogs of the compounds of analysis for GC/MS work. These compounds would be expected to behave similiarly to the analytes but do not interfere with analysis.

For extractable samples consisting of base/neutral/acids (BNAs) and pesticides/PCBs a minimum of ten percent QC is run. For every ten extractions, blank and duplicate matrix spikes are analyzed in addition to the surrogate. More than ten percent QC is frequently run as often there are not ten samples to run at a time. A set is done for every group of extractions. For volatile organics, surrogates are added to every sample, daily reagent water blanks are analyzed, and duplicate matrix spikes are run for every fifteen analyses. Fewer duplicate matrix spikes are run for volatiles as there is less variability than for extractables.

EPA Methods 608, 624, and 625 recommend five percent QC. While Metro's QC is consistent with these methods, it goes beyond EPA requirements by performing more than the prescribed amount of QC and is more similiar to that recommended by the EPA Contract Laboratory Program (CLP). Metro also routinely performs various tasks to ensure that instruments are functioning and calibrated properly. A three- to five- point curve is initially run to calibrate instruments and daily standards are analyzed. The GC/MS systems are tuned to EPA specifications for DFTPP for BNAs and BFB for volatiles and the tune is checked on a daily basis.