ANNUAL CSO REPORT

1988/1989

METRO

DECEMBER 1989

CSO CONTROL PROGRAM IMPLEMENTATION

In 1988 the Metro Council adopted a comprehensive CSO control plan for the Metro system. This plan which was subsequently approved by DOE, calls for a 75 percent CSO volume reduction from baseline conditions over the next 20-year period. Ten separate CSO control projects were identified within the plan as was a proposed schedule for their implementation. That schedule is as follows:

Project	Year of Design Initiation	Year On-Line
Hanford/Bayview/Lander	1986	1992
CATAD Modifications	1987	1991
Parallel Fort Lawton Tunnel	1987	1993
Carkeek Transfer/CSO Treatment Facility	1988	1992
University Regulator (Green Lake/ Portage Bay Water Quality Project)	1986	1992
Alki Transfer/CSO Treatment Facility	1989	1995
Denny Partial Separation	1993	1999
Diagonal Total Separation	1995	1999
Michigan Total Separation	1997	2003
Kingdome Total Separation	2000	2006

Recognizing the need to fine tune the proposed project schedule to maximize opportunities to achieve a 75 percent CSO volume reduction, the plan as adopted requires a routine re-evaluation of projects and schedules at a minimum of five-year intervals.

STATUS OF CURRENT CSO CONTROL PROJECTS

CSO abatement projects undertaken in 1989 and planned for 1990 are summarized as follows:

Hanford/Bayview/Lander

Scope

This project consist of a partial separation of the Lander and Hanford basins and was the most cost-effective CSO control alternative investigated for the basins.

Hanford: The Hanford separation project was on-line in October 1987. The project involved the installation of a new 36-inch sanitary sewer inside an existing 108-inch tunnel that was used to convey combined flows from Rainier Valley to the Elliott Bay Interceptor. The 36-inch line is used to convey partially separated flow to the Elliott Bay Interceptor and the 108-inch tunnel is used to convey storm water to the Diagonal Way storm drain and then to the Duwamish River. The project partially separated about 1,132 combined acres upstream of the tunnel and eliminated CSOs from the Hanford No. 1 Regulator.

<u>Lander/Bayview</u>: The Lander Separation Project consists of two phases, the first of which is currently under way. Phase 1 provides partial separation of the Lander basin through the installation of a new 96-inch sanitary trunk line to convey flows from the existing combined collection system to the Elliott Bay Interceptor. The existing 84-inch line will be used for storm water. The new 96-inch line will provide about 1.4 million gallons of storage capacity. The project also requires the installation of a new storm water collection system in the basin that will ultimately be owned and operated by the City of Seattle. The Bayview Tunnel will be used to divert flows from the Hanford Basin to the Lander sanitary trunk line. The components of Phase 1 and 2 are as follows:

Phase 1:

- o 96-inch Lander sanitary trunk.
- o New Lander regulator.
- o Elliott Bay Interceptor connection.
- o Bayview diversion structure.
- o New storm water collection system from existing 84-inch Lander trunk to the limits of the Lander Street right-of-way.
- o Connection of existing combined collection system to new 96-inch sanitary trunk through drop manhole structures.

Phase 2:

- o New storm water collection pipeline in Lander Basin.
- o Connect existing street drainage and parking lots to new storm water collection pipelines within right-of-way limits.

Status

The following schedule depicts tasks for 1987 through 1991.

1988 1989 1990 1991

--- Predesign

---- Final Design Phase 1

-- Permits, Phase 1

-- Bid/Award, Phase 1

------------- Construction, Phase 1

----------- Final Design, Phase 2

1988	1989	1990	1991	
		--- Permits, Phase 2		
		-- Bid/Award, Phase 2		
		------------ Construction, Phase 2		

Consultant selection, predesign and final design of Phase 1 occurred in 1988. Final design has been completed and construction began on schedule and is currently under way. Final design of Phase 2 will be complete by the end of 1989. The project is on schedule.

CATAD Modifications

Scope

Modifications to the CATAD control system will improve the system's efficiency by more fully utilizing the storage capacity in existing sewers.

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

Status

The project consists of two elements: software development/testing and flow sensors installation. The schedule for implementation is as follows:

	1986	1987	1988	1989	1990
Software Development & Testing	--------	--------	--------	--------	
Flow Sensors		-------	-------		

Development of adaptive control software will improve the use of collection system pipe storage for reducing combined sewer overflows in the West Point collection system. Hydraulic and hydrological models were complete in 1987. Forecast programs were completed at the end of 1988. Control strategies, adaptive control development, and the testing of adaptive control are scheduled to be complete by the end of 1989. Control strategies tuning is scheduled to occur in fall 1989.

Selection, purchase and installation of new flow sensors in the collection system will provide more accurate calibration of software and improvement of storage control. The flow sensors were installed in early 1989.

All elements of the project are on schedule.

Parallel Fort Lawton Tunnel

Scope

The new parallel tunnel will accommodate an additional capacity of 82 mgd for combined sewer flows over the secondary base flow capacity of 358 mgd. The combined sewer flows will receive treatment at West Point. This project will provide CSO relief in the Ship Canal, especially at the Ballard regulator and Third Ave. West Weir.

Status

The project schedule through completion of construction is as follows:

```
1987    1988    1989    1990    1991
    ---- Predesign
       ------ Final Design
             --- Project Permits
                ----- Bid & Award
                    ---------------- Construction
```

Predesign was completed in 1988. Tasks for 1990 include final design, obtaining project permits and construction. The project is well ahead of schedule on its original completion date of 1993.

Carkeek Transfer/CSO Treatment Facility

Scope

The Carkeek project is designed to transfer 2.25 times AWWF flows from the Carkeek drainage basin to the West Point plant where they will receive secondary treatment. Flows above this will receive treatment and disinfection at the existing Carkeek Treatment Plant. The present facilities will undergo minor modifications to enable the intermittent treatment of peak storm related flows. Specific permit conditions for operation of the Carkeek stormweather plant will be negotiated with DOE.

Status

The project schedule from consultant selection through start-up is as follows:

```
1988     1989     1990     1991     1992     1993
  ---- Predesign/Design Development
    ---------- Final Design
                ------------------------- Construction
                                   -------- Start-up
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Consultant selection was completed in early 1988 and predesign/design development was completed in December 1988. Final design will occur through 1989 and will be completed in early 1990. The project is on schedule.

University Regulator (Green Lake/Portage Bay Water Quality Project)

Scope

Storm runoff from the Densmore drain, Interstate-5, Ravenna Park, and outflow from Green Lake will be diverted from the North Interceptor system to a new storm drain. The results of this project will be a reduction of CSOs into Portage Bay and ultimately to the Ship Canal-Lake Union system by an estimated 150 million gallons annually.

Status

The project schedule is briefly summarized below.

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1987    1988    1989    1990    1991    1992    1993    1994    1995
  -------------- Predesign
                ---------- Final Design
                         --------------- Construction
```

Predesign occurred through 1988 and was completed in June 1989. Final design will commence in early 1990 and continue through August 1990. The project remains on schedule for completion in late 1992.

Alki Transfer/CSO Treatment Facility

Scope

The Alki project is designed to transfer 2.25 x AWWF flows from the Alki drainage basin to the West Point plant where it will receive secondary treatment. Flows above this level and up to a maximum of 74 mgd will receive treatment and disinfection at the existing facility which will be modified to permit intermittent operation. Specific permit conditions for operation of the Alki stormweather plant will be negotiated with DOE.

Status

The project schedule from project scope development through construction completion is as follows:

```
1988    1989    1990    1991    1992    1993    1994
      -------- Predesign
      ---- EIS Process
            --- Design Development
                ------------------- Final Design
                  ----------------- Permit Process
                            --------------Transfer System Const.
                                     ------------- Storm Weather
                                                        Const.
```

Predesign will be completed in 1990 and final design will begin in June 1991. The project is on schedule.

<u>Other CSO Abatement Projects</u>

Work on the remaining CSO projects, Denny Partial Separation, the Diagonal, Michigan and Kingdome separation projects is not anticipated until after 1993 based on current scheduling.

OVERFLOW VOLUME COMPARISON WITH BASELINE CONDITIONS

As a component of this annual CSO Report, data is to be provided that documents the frequency and volume of CSOs in the Metro system for the period from June 1988 to May 1989. Comparison of this information with baseline conditions would then be utilized to assess Metro's progress in reducing CSOs as a result of ongoing CSO projects and control strategies. As noted in last year's report, our capabilities for the 1988-89 reporting period were limited by the unavailability of volume and frequency data due to the decommissioning of the CATAD system. The CATAD upgrade has resulted in an improved control system for the regulation of flows to the West Point Treatment Plant and will maximize the use of in-line storage to efficiently reduce CSOs. This system, now known as SCADA for Supervisory Control and Data Acquisition, became operational in June of 1989 and is effectively compiling volume and frequency reports for Metro CSOs. A copy of the CSO report produced by SCADA for a recent storm is attached. These individual reports then will be compiled to assess the overall volume and frequency of CSOs. We will be able to provide CSO volume and frequency information for the 1989-90 reporting period now that the system is operational.

1989 CSO SEDIMENT SAMPLING RESULTS

Attached to this section are the results from the 1989 CSO sediment sampling efforts.

The CSO sediment sampling program for 1989 consisted of taking composite samples from sediments at the Ballard Regulator (W003), East Ballard (W004), 3rd and Ewing (W008), Montlake (W014) and Dexter (W009) CSOs.

Samples were analyzed and reported with appropriate detection limits for each element or compound. ND indicates that the compounds or elements analyzed were below the detection limit. Duplicate samples for the East Ballard CSO were analyzed to provide an indication of pollutant variability between samples for a specific location. As expected, variability in pollutant concentrations exist for the replicate samples at the East Ballard CSO, however, general trends indicate that the samples correspond well.

To provide an indication of the relative magnitude of the pollutant concentrations in the sediments, results from the 1989 sediment sampling efforts were compared with data obtained from the University Regulator CSO Control Project Predesign efforts (attached), where sediments were sampled at stations in Lake Washington, Union Bay and Lake Union. Comparing metals as tracer elements, concentrations at the CSO sediment locations with the Lake Washington reference sediments indicate that pollutant concentrations are generally higher for arsenic, chromium, copper, iron, lead and zinc, approximately equivalent for cadmium and nickel, and generally lower for aluminum, silver, and manganese. Considering that the Lake Washington reference station is free from direct discharge impacts, the slightly elevated pollutant loadings at the CSO sediment stations do not represent heavy pollutant loadings. In addition, numerous historical industrial and storm drain discharges have certainly contributed to the sediment pollutant loadings in Lake Union sediments. In fact, comparison of sediment metals concentrations taken from the center of Lake Union show that without exception, the metals concentrations were higher at the center of Lake Union than at the CSO stations.

The data that has been included in this report will be supplemented by the results of the 1990-1991 CSO sediment and discharge efforts. Upon completion of our sampling efforts, the data will be fully analyzed and consolidated as a complete report such that we may present a comprehensive overview of the results of our CSO sampling program.

CSO SEDIMENT SAMPLING QUALITY DATA, 1989

	BALLARD (W003)		EAST BALLARD (W004)		EAST BALLARD (W004)		3RD AND EWING (W008)		MONTLAKE (W014)		DEXTER (W009)	
COMPOUND	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)
ALPHA-BHC	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
BETA-BHC	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
DELTA-BHC	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
GAMMA-BHC (LINDANE)	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
HEPTACHLOR	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ALDRIN	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
HEPTACHLOR EPOXIDE	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ENDOSULFAN I	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
DIELDRIN	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
4,4-DDE	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ENDRIN	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ENDOSULFAN II	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
4,4-DDD	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ENDRIN ALDEHYDE	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
ENDOSULFAN SULFATE	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
4,4-DDT	27.00	ND	46.00	ND	6.00	ND	7.40	ND	4.30	ND	11.00	ND
METHOXYCHLOR	130.00	ND	230.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
CHLORDANE	130.00	ND	230.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
TOXAPHENE	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1016	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1221	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1232	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1242	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1248	270.00	ND	460.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
AROCHLOR 1254	270.00	250.00	460.00	1000.00	60.00	86.00	74.00	63.00	43.00	ND	110.00	ND
AROCHLOR 1260	270.00	250.00	460.00	1000.00	60.00	100.00	74.00	79.00	43.00	30.00	110.00	ND

GCMS METHOD 624 VOLATILES ORGANIC ANALYSIS REPORT

COMPOUND	BALLARD (W003) DL	BALLARD (W003) CONC. (PPB)	EAST BALLARD (W004) DL	EAST BALLARD (W004) CONC. (PPB)	EAST BALLARD (W004) DL	EAST BALLARD (W004) CONC. (PPB)	3RD AND EWING (W008) DL	3RD AND EWING (W008) CONC. (PPB)	MONTLAKE (W014) DL	MONTLAKE (W014) CONC. (PPB)	DEXTER (W009) DL	DEXTER (W009) CONC. (PPB)
CHLOROMETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
VINYL CHLORIDE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
BROMOMETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
CHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
TRICHLOROFLUOROMETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
ACROLEIN	200.00	ND	86.00	ND	89.00	ND	110.00	ND	65.00	ND	170.00	ND
1,1-DICHLOROETHYLENE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
METHYLENE CHLORIDE	200.00	150.00	86.00	ND	89.00	250.00	110.00	130.00	65.00	79.00	170.00	ND
ACRYLONITRILE	200.00	ND	86.00	ND	89.00	ND	110.00	ND	65.00	ND	170.00	ND
TRANS-1,2-DICHLOROETHYLENE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
1,1-DICHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
CHLOROFORM	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	16.00	33.00	ND
1,1,1-TRICHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
CARBON TETRACHLORIDE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
BENZENE	40.00	ND	17.00	30.00	18.00	ND	22.00	ND	13.00	ND	33.00	ND
1,2-DICHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
1,1,2-TRICHLOROETHYLENE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
1,2-DICHLOROPROPANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
BROMODICHLOROMETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
2-CHLOROETHYLVINYLETHER	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
TRANS-1,3-DICHLOROPROPENE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
TOLUENE	40.00	110.00	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
CIS-1,3-DICHLOROPROPENE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	220.00
1,1,2-TRICHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
TETRACHLOROETHYLENE	40.00	ND	17.00	15.00	18.00	14.00	22.00	ND	13.00	ND	33.00	ND

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COMPOUND	BALLARD (W003)		EAST BALLARD (W004)		EAST BALLARD (W004)		3RD AND EWING (W008)		MONTLAKE (W014)		DEXTER (W009)	
	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)
CHLORODIBROMOMETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	60.00
CHLOROBENZENE	40.00	ND	17.00	1000.00	18.00	45.00	22.00	ND	13.00	7.70	33.00	ND
ETHYL BENZENE	40.00	26.00	17.00	ND	18.00	27.00	22.00	ND	13.00	ND	33.00	11026.00
BROMOFORM	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
1,1,2,2-TETRACHLOROETHANE	40.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
ACETONE	200.00	550.00	86.00	350.00	89.00	180.00	110.00	230.00	65.00	ND	170.00	280.00
CARBON DISULFIDE	40.00	ND	17.00	12.00	18.00	12.00	22.00	ND	13.00	ND	33.00	ND
VINYL ACETATE	200.00	ND	86.00	ND	89.00	ND	110.00	ND	65.00	ND	170.00	ND
2-BUTANONE (MEK)	200.00	ND	86.00	ND	89.00	ND	110.00	180.00	65.00	110.00	170.00	ND
4-METHYL-2-PENTANONE (MIBK)	200.00	ND	86.00	ND	89.00	ND	110.00	ND	65.00	ND	170.00	ND
2-HEXANONE	200.00	ND	86.00	ND	89.00	ND	110.00	ND	65.00	ND	170.00	ND
TOTAL XYLENE	40.00	89.00	17.00	14.00	18.00	26.00	22.00	ND	13.00	ND	33.00	610.00
STYRENE	40.00	ND	17.00	ND	18.00	14.00	22.00	ND	13.00	ND	33.00	ND

GCMS METHOD 625 SEMI-VOLATILES ORGANIC ANALYSIS REPORT

	BALLARD (W003)		EAST BALLARD (W004)		EAST BALLARD (W004)		3RD AND EWING (W008)		MONTLAKE (W014)		DEXTER (W009)	
COMPOUND	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)	DL	CONC. (PPB)
N-NITROSODIMETHYLAMINE	800.00	ND	170.00	ND	180.00	ND	220.00	ND	130.00	ND	330.00	ND
PHENOL	800.00	ND	170.00	ND	180.00	ND	220.00	ND	130.00	ND	330.00	ND
BIS(2-CHLOROETHYL)ETHER	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
2-CHLOROPHENOL	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
1,3-DICHLOROBENZENE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
1,4-DICHLOROBENZENE	130.00	ND	29.00	480.00	30.00	46.00	37.00	ND	22.00	43.00	56.00	ND
1,2-DICHLOROBENZENE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
BIS(2-CHLOROISOPROPYL)ETHER	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
N-NNITROSODI-N-PROPYLAMINE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
HEXACHLOROETHANE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
NITROBENZENE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
ISOPHORONE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
2-NITROPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
2,4-DIMETHYLPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
BIS(2-CHLOROETHOXY)METHANE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
2,4-DICHLOROPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
1,2,4-TRICHLOROBENZENE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
NAPTHALENE	400.00	260.00	86.00	130.00	89.00	100.00	110.00	570.00	65.00	ND	170.00	160.00
HEXACHLOROBUTADIENE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
4-CHLORO-3-METHYLPHENOL	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
HEXACHLOROCYCLOPENTADIENE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
2,4,6-TRICHLOROPHENOL	1100.00	ND	230.00	ND	240.00	ND	300.00	ND	170.00	ND	440.00	ND
2-CHLORONAPTHALENE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
ACENAPTHYLENE	130.00	77.00	29.00	59.00	30.00	ND	37.00	190.00	22.00	ND	56.00	37.00
DIMETHYL PHTHALATE	80.00	300.00	17.00	42.00	18.00	930.00	22.00	1100.00	13.00	ND	33.00	ND
2,6-DINITROTOLUENE	110.00	ND	23.00	ND	24.00	ND	30.00	ND	17.00	ND	44.00	ND

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COMPOUND	BALLARD (W003) DL	BALLARD (W003) CONC. (PPB)	EAST BALLARD (W004) DL	EAST BALLARD (W004) CONC. (PPB)	EAST BALLARD (W004) DL	EAST BALLARD (W004) CONC. (PPB)	3RD AND EWING (W008) DL	3RD AND EWING (W008) CONC. (PPB)	MONTLAKE (W014) DL	MONTLAKE (W014) CONC. (PPB)	DEXTER (W009) DL	DEXTER (W009) CONC. (PPB)
ACENAPHTHENE	110.00	520.00	23.00	370.00	24.00	280.00	30.00	1000.00	17.00	14.00	44.00	1900.00
2,4-DINITROPHENOL	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
4-NITROPHENOL	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
2,4-DINITROTOLUENE	110.00	ND	23.00	ND	24.00	ND	30.00	ND	17.00	ND	44.00	ND
FLUORENE	130.00	780.00	29.00	400.00	30.00	290.00	30.00	520.00	22.00	36.00	56.00	2200.00
DIETHYL PHTHALATE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
4-CHLORPHENYL PHENYL ETHER	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
4,6-DINITO-O-CRESOL	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
N-NITROSODIPHENYLAMINE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
1,2-DIPHENYLHYDRAZINE	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
4-BROMOPHENYL PHENYL ETHER	80.00	ND	17.00	ND	18.00	ND	22.00	ND	13.00	ND	33.00	ND
HEXACHLOROBENZENE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
PENTACHLOROPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
PHENANTHRENE	130.00	5700.00	29.00	2300.00	30.00	2000.00	37.00	3900.00	22.00	310.00	56.00	7300.00
ANTHRACENE	130.00	940.00	29.00	440.00	30.00	410.00	37.00	1100.00	22.00	270.00	56.00	1300.00
DI-N-BUTYLPHTHALATE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	2300.00
FLUORANTHENE	160.00	10000.00	34.00	2300.00	36.00	1400.00	44.00	4200.00	26.00	750.00	67.00	4800.00
BENZIDENE	6400.00	ND	1400.00	ND	1400.00	ND	1800.00	ND	1000.00	ND	2700.00	ND
PYRENE	130.00	6800.00	29.00	1700.00	30.00	2700.00	37.00	8600.00	22.00	870.00	56.00	5700.00
BENZYL BUTYL PHTHALATE	130.00	8100.00	29.00	260.00	30.00	400.00	37.00	ND	22.00	ND	56.00	450.00
BENZO(A)ANTHRACENE	130.00	3200.00	29.00	910.00	30.00	710.00	37.00	3100.00	22.00	360.00	56.00	1800.00
CHRYSENE	130.00	5000.00	29.00	1100.00	30.00	940.00	37.00	4200.00	22.00	420.00	56.00	2300.00
3,3'-DICHLOROBENZIDENE	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
BIS(2-ETHYLHEXYL)PHTHALATE	130.00	26000.00	29.00	3100.00	30.00	2700.00	37.00	1500.00	22.00	510.00	56.00	7600.00
DI-N-OCTYL PHTHALATE	130.00	ND	29.00	ND	30.00	ND	37.00	ND	22.00	ND	56.00	ND
BENZO(B)FLUORANTHENE	400.00	5000.00	86.00	1000.00	89.00	890.00	110.00	3600.00	65.00	260.00	170.00	2200.00
BENZO(K)FLUORANTHENE	400.00	5500.00	86.00	970.00	89.00	790.00	110.00	3900.00	65.00	340.00	170.00	2300.00
BENZO(A)PYRENE	270.00	4700.00	57.00	880.00	60.00	780.00	74.00	4600.00	43.00	200.00	110.00	1800.00

..continued

COMPOUND	BALLARD (W003) DL	CONC. (PPB)	EAST BALLARD (W004) DL	CONC. (PPB)	EAST BALLARD (W004) DL	CONC. (PPB)	3RD AND EWING (W008) DL	CONC. (PPB)	MONTLAKE (W014) DL	CONC. (PPB)	DEXTER (W009) DL	CONC. (PPB)
INDENO(1,2,3-CD)PYRENE	270.00	1400.00	57.00	340.00	60.00	370.00	74.00	1900.00	43.00	110.00	110.00	800.00
DIBENZO(A,H)ANTHRACENE	400.00	ND	86.00	140.00	89.00	210.00	110.00	950.00	65.00	ND	170.00	ND
BENZO(G,H,I)PERYLENE	270.00	1800.00	57.00	410.00	60.00	330.00	74.00	2100.00	43.00	110.00	110.00	950.00
HAZARDOUS SUBSTANCES LIST												
ANILINE	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
BENZYL ALCOHOL	270.00	ND	57.00	ND	60.00	230.00	74.00	ND	43.00	ND	110.00	ND
2-METHYLPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	ND	110.00	ND
4-METHYLPHENOL	270.00	ND	57.00	ND	60.00	ND	74.00	ND	43.00	95.00	110.00	ND
BENZOIC ACID	800.00	ND	170.00	ND	180.00	290.00	220.00	ND	130.00	75.00	330.00	ND
4-CHLOROANILINE	530.00	ND	110.00	ND	120.00	ND	150.00	ND	87.00	ND	220.00	ND
2-METHYLNAPTHALENE	400.00	1200.00	86.00	470.00	89.00	100.00	110.00	300.00	65.00	ND	170.00	730.00
2,4,5-TRICHLOROPHENOL	1100.00	ND	230.00	ND	240.00	ND	300.00	ND	170.00	ND	440.00	ND
2-NITROANILINE	800.00	ND	170.00	ND	180.00	ND	220.00	ND	130.00	ND	330.00	ND
3-NITROANILINE	800.00	ND	170.00	ND	180.00	ND	220.00	ND	130.00	ND	330.00	ND
DIBENZOFURAN	270.00	310.00	57.00	160.00	60.00	170.00	74.00	1800.00	43.00	ND	110.00	1400.00
4-NITROANILINE	800.00	ND	170.00	ND	180.00	ND	220.00	ND	130.00	ND	330.00	ND

OTHER	BALLARD (W003) (MG/K)	EAST BALLARD (W004) (MG/K)	EAST BALLARD (W004) (MG/K)	3RD AND EWING (W008) (MG/K)	MONTLAKE (W014) (MG/K)	DEXTER (W009) (MG/K)
COD	640000.00	210000.00	250000.00	270000.00	160000.00	530000.00
						450000.00
CYANIDE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
pH	6.78	6.82	7.15	7.10	6.74	6.97
TOTAL SOLIDS	250000.00	580000.00	560000.00	450000.00	770000.00	300000.00
TOTAL VOLATILE SOLIDS	64000.00	53000.00	20000.00	25000.00	19000.00	32000.00
TOC	8.5 ppm	3.7 ppm	2.0 ppm	2.2 ppm	1.1 ppm	3.5 ppm
SULFIDES	303.0 ppm	157.0 ppm	16.8 ppm	85.8 ppm	3.1 ppm	382.0 ppm

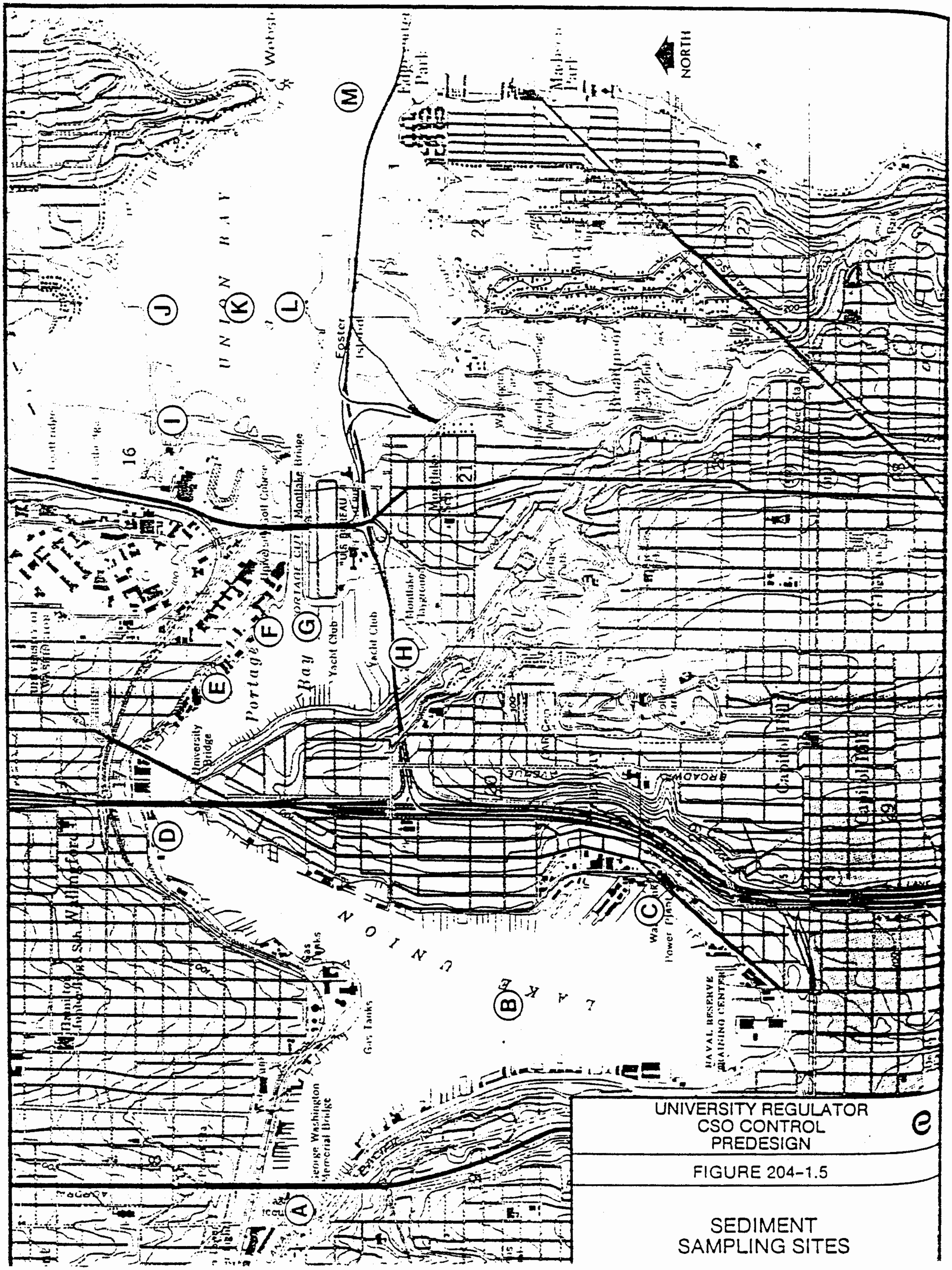
OIL AND GREASE (MG/K) DRY	TS(%)	(MG/K)	TS(%)	(MG/K)	TS(%)	(MG/K)	TS(%)	(MG/K)	TS(%)	(MG/K)	TS(%)	(MG/K)
OIL	25.00	26000.00	58.00	4400.00	N.A.	N.A.	56.00	2500.00	77.00	410.00	30.00	20000.00
							45.00	1800.00			31.00	20000.00
OIL(P)	25.00	1800.00	58.00	620.00	N.A.	N.A.	56.00	260.00	77.00	100.00	30.00	12000.00
							45.00	320.00			31.00	11000.00
OIL(NP)	25.00	24000.00	58.00	3800.00	N.A.	N.A.	56.00	2200.00	77.00	310.00	30.00	8500.00

METALS		BALLARD (W003) (MG/K)	EAST BALLARD (W004) (MG/K)	EAST BALLARD (W004) (MG/K)	3RD AND EWING (W008) (MG/K)	MONTLAKE (W014) (MG/K)	DEXTER (W009) (MG/K)
Ag	SILVER	< 0.4	2.24	< 0.18	< 2.00	< 0.13	< .33
Al	ALUMINUM	12400.00	10793.10	7392.90	10177.80	6246.80	20266.00
As	ARSENIC	31.64	44.48	56.79	13.93	7.46	27.83
Ba	BARIUM	113.20	127.76	104.82	52.44	23.51	160.00
Be	BERYLLIUM	0.16	0.35	0.14	0.22	0.13	0.67
Ca	CALCIUM	5920.00	7327.60	6392.90	4533.30	4298.70	11433.30
Cd	CADMIUM	3.60	2.76	1.43	0.44	< 0.12	2.33
Cr	CHROMIUM	80.40	68.10	124.82	44.44	17.40	78.67
Cu	COPPER	361.20	182.76	426.79	105.78	20.78	750.00
Fe	IRON	37680.00	33965.50	77857.10	19000.00	9116.90	28700.00
Hg	MERCURY	0.84	0.64	0.36	0.47	0.05	2.70
Mg	MAGNESIUM	5400.00	5448.30	3696.40	5555.60	3090.90	9566.70
Mn	MANGANESE	356.80	382.76	887.50	218.67	140.26	393.33
Na	SODIUM	1772.00	396.60	298.20	580.00	255.80	1916.70
Ni	NICKEL	56.00	63.79	119.64	37.78	15.58	66.67
Pb	LEAD	520.00	470.69	244.64	142.22	81.82	1173.33
Sb	ANTIMONY	0.36	0.86	1.61	0.67	0.13	1.00
Se	SELINIUM	< .232	< 0.104	< 0.154	< .119	< 0.057	< .180
Tl	THALLIUM	1.60	0.86	0.54	0.89	0.39	1.00
Zn	ZINC	856.00	539.66	373.21	222.22	62.99	540.00

UNIVERSITY REGULATOR CSO CONTROL PROJECT

SEDIMENT SAMPLING RESULTS FOR METALS

STATION		UNION BAY	OUTER UNION BAY	LAKE WASHINGTON	LAKE UNION
MAP KEY		K	L	M	B
METAL (MG/KG)					
Ag	SILVER	4.50	2.30	3.10	6.70
Al	ALUMINUM	7318.20	9000.00	15435.00	27600.00
As	ARSENIC	10.60	4.60	12.20	40.00
Cd	CADMIUM	3.00	1.50	2.60	4.00
Cr	CHROMIUM	28.80	22.30	50.10	82.70
Cu	COPPER	48.50	21.50	62.30	346.00
Fe	IRON	9757.60	11538.50	18178.00	39866.70
Mn	MANGANESE	272.70	286.90	451.20	439.30
Ni	NICKEL	60.60	30.80	52.30	80.00
Pb	LEAD	75.80	38.50	152.70	680.00
Zn	ZINC	100.00	52.30	144.20	572.70



UNIVERSITY REGULATOR
CSO CONTROL
PREDESIGN

FIGURE 204-1.5

SEDIMENT
SAMPLING SITES