A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Stormwater Sediment Trap Monitoring of Discharges to Thea Foss Waterway

Summary

In-line sediment traps were successfully deployed between September 1996 and January 1997 in three major stormwater discharges to Thea Foss Waterway (Foss Waterway) located in Commencement Bay, Tacoma, Washington. The primary objective of this investigation was to determine contaminant concentrations associated with particulates entering the waterway. These data are needed to refine source loading terms for Water Quality Analysis Simulation Program (WASP) modeling which is being conducted to evaluate the potential for recontamination of bottom sediments in Foss Waterway.

Data collected indicated that concentrations of nineteen individual chemicals exceeded the Commencement Bay Sediment Quality Objectives in the trapped particulates. The majority of the measured exceedances were for polynuclear aromatic hydrocarbons (especially HPAH) and phthalates. The greatest number of exceedances (20) were measured in the 15th Street drain which discharges to the central portion of the waterway.

Recommendations for follow-up actions are listed on page 20.

by Dale Norton
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◊ Installation of the sediment traps was performed by Jeff McVicker and J.R. Wikane with the City of Tacoma, Plant Maintenance Division.

◊ Coordination of the sampling crews and field support was provided by Troy Naccarato with the City of Tacoma, Sewer Utilities Division.

◊ Analytical services at the City of Tacoma Laboratory were coordinated by Chris Getchell. Pam Covey coordinated analysis at the contract laboratory and the Ecology/EPA Manchester Laboratory.

◊ The project was initiated by Dave Smith and Joyce Mercuri with the Commencement Bay Urban Bay Action Team.

◊ Joyce Mercuri, Troy Naccarato, Chris Flint, Beth Schmoyer and Larry Goldstein reviewed the report and provided many valuable comments.

Background

Water Quality Analysis Simulation Program (WASP) modeling conducted for the Thea Foss Waterway Round 2 Data Evaluation Report indicated that very low concentrations of several contaminants in storm drain discharges could cause recontamination of bottom sediments in the waterway to unacceptable levels following cleanup activities. The primary contaminants of concern -- mercury, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), phthalates, chlorinated aromatics, DDD, and DDE -- are all considered hydrophobic compounds which tend to partition onto particulates.

The City of Tacoma has been collecting whole water samples from a number of stormwater discharges for the purpose of calculating problem chemical loadings to Foss Waterway for use in the WASP model. Unfortunately, detection limits achievable in whole water samples using existing analytical methods are inadequate to determine what actual chemical concentrations are in the discharges. For some chemicals, loadings were calculated using 1/2 the detection limit achievable in water samples. These calculations indicated that recontamination of bottom sediments was likely to occur. Collection and analysis of particulate samples from selected discharges to the waterway were needed to refine source loading terms for the WASP model and more accurately evaluate the potential for recontamination of bottom sediments in the waterway.

Survey Plan

The City of Tacoma and the Washington State Department of Ecology (Ecology) collaborated on a study to collect particulate data from several high priority Foss Waterway storm drains. Responsibilities of each agency have been previously described in the *Foss Waterway Storm Drain Particulates - Quality Assurance Project Plan* (Norton, 1996) and a letter of agreement for the project (Mercuri, 1996).

The primary objective of this study was to determine contaminant levels associated with particulates being discharged from high priority storm drains (East and West Twin 96" and 15th Street drains) to Foss Waterway. Secondary objectives of the study were to: 1) evaluate contaminant levels associated with particulates derived from highway runoff; and 2) determine background particulate concentrations entering the Nalley Valley drainage system.

Data generated from this study will be used with existing flow and total suspended solids information to calculate contaminant loadings entering Foss Waterway from the drains sampled. This empirical loading information can then be compared to theoretical loading estimates previously used in the WASP model to evaluate the potential for sediment recontamination in the waterway. If appropriate, the WASP model can then be re-run with the empirical data.

Methods

Site Selection

Sampling sites were located near the mouths of the three major stormwater discharges to the waterway (#237B-East Twin 96", #237A-West Twin, and #230-15th Street Drain) at the first access point upstream from tidal influence. In several instances it was necessary to install traps in lateral branches of the system to capture drainage from the entire system. The data reported represents contaminant levels associated with particulates entering Foss Waterway from the entire drainage basin of each system. Foss Waterway and the relative discharge point for each drain are shown in Figure 1.

Two additional locations were sampled as part of this study. The first located at Hosmer and South Tacoma Way was used to evaluate contaminant levels associated with particulates in highway runoff (primarily Interstate-5). The second site at South 18th and Cedar Street was used to characterize background levels (primarily residential stormwater) upstream in the Nalley Valley system (237A). A summary of sampling locations for the Foss Waterway Stormwater Particulates Study is listed in Appendix A, Table A1.

Sampling Procedures

Particulate samples were collected with the use of in-line stormwater sediment traps. Construction details and performance of these traps are described in *Stormwater Sediment Trap Pilot Study* (Wilson and Norton, 1996). A diagram of the construction details of the traps is included in Appendix A, Figure A1.

Sampling was conducted between September 5, 1996 and January 10, 1997. Weather conditions dictated the exact timing of deployment and retrieval of the traps. Specific deployment periods for each of the sediment traps are listed in Appendix A, Table A1. At each location an attempt was made to install two independent traps. The traps were installed near the bottom of junction boxes where possible. Alternately, the traps were mounted where eddies occurred within a pipe. Under the guidance of Ecology's project lead, City of Tacoma Sewer Utility Crews certified for confined space entry installed the traps at each of the sampling locations.

At the end of the deployment period the collection bottles were removed from the mounting brackets, capped with screw closures, packaged and placed in coolers on ice for transport the Ecology Headquarters Building. All samples were held frozen pending processing.

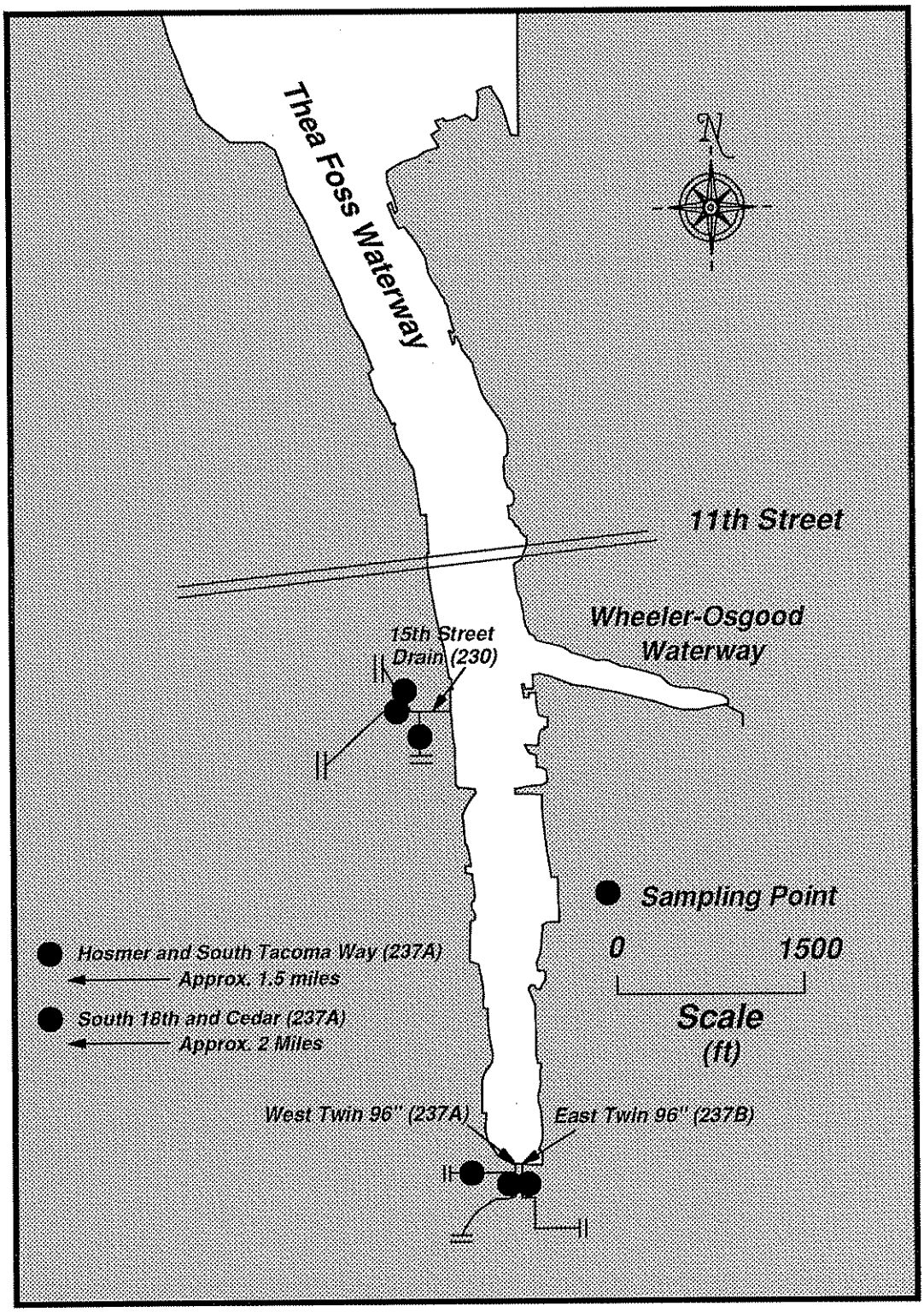

Figure 1: Stormwater Sediment Trap Monitoring Stations in Discharges to Thea Foss Waterway.

Processing consisted of first decanting off a portion of the overlaying water, then centrifuging the remaining slurry to isolate the particulate fraction. Manipulation of the samples during processing was accomplished using stainless steel utensils. All utensils were cleaned prior to use with sequential washes with hot tap water/liquinox® detergent, 10% HNO_3, distilled/deionized water, and acetone. The utensils were then dried in an oven to remove any solvent residual.

After processing, all replicates from individual sites, plus lateral line samples if applicable, were composited into a single sample for analysis. The following samples were submitted for analysis: FD1, FD2 (includes FD2-A), FD3 (includes FD3-A and FD3-B), FD4, and FD5. In addition to the composite samples described above, individual samples from each of the sampling points were submitted for phthalates analysis.

All sample containers were glass jars with Teflon lid liners, cleaned to EPA Quality Assurance/Quality Control (QA/QC) specifications (EPA, 1990).

Quality Assurance

A summary of analytical methods and laboratories conducting analysis for the project is presented in Table 1. All samples were processed at the Ecology Headquarters Laboratory prior to being delivered to each of the laboratories for analysis. A summary of the amount of material collected by the sediment traps at each of the sampling locations is included in Appendix A, Table A2.

Quality of the data set was assessed with the following sample types: field and laboratory duplicates, matrix spikes, internal standards, surrogate spikes, method blanks, and laboratory control samples. Staff at the City of Tacoma Sewer Utility Laboratory performed a detailed quality assurance review of the data package produced. A copy of the case narrative of this review is included in Appendix B.

Overall precision (sampling + laboratory analysis) of the data set was evaluated by calculating the relative percent difference (range in concentrations/mean concentration expressed in percent) between field duplicates (a single sample homogenized and split in the field). These data (Appendix B, Table B1) indicate that precision of the data set was relatively good, being within a factor of 2 in most instances. The highest variability was associated with the mercury analysis which varied by approximately an order of magnitude.

In general, no major analytical problems were encountered in the analysis of samples for the project, with the exceptions noted below. Consequently the data generated are considered acceptable for use with the qualifiers listed in the data tables.

Table 1: Summary of Analytical Methods and Laboratories Conducting Analysis for the Foss Waterway Stormdrain Particulates Study.

Analysis	Method	Reference	Laboratory
Conventionals (%)			
Percent Solids	Dry @ 104°C	PSEP, 1986	City of Tacoma
Total Organic Carbon	Combustion/CO_2 Measureme	PSEP, 1986	Ecology/EPA
Grain Size	Seive and Pipet	PSEP, 1986	Columbia Analytical
Metals (mg/kg, dry)			
Lead	ICP	PSEP, 1986	City of Tacoma
Mercury	CVAA	PSEP, 1986	City of Tacoma
Zinc	ICP	PSEP, 1986	City of Tacoma
Organics (ug/kg, dry)			
Semivolatiles	GC/MS #8270	EPA, 1995	City of Tacoma
PAHs			
Chlorinated Aromatics	GC/MS-SIM		
Phthalates			
PCBs	GC/ECD #8080	EPA, 1995	City of Tacoma
Aroclors			
Organochlorine Pesticide	GC/ECD #8080	EPA, 1995	City of Tacoma
DDD/DDE/DDT			

ICP= Inductively Coupled Plasma
CVAA= Cold Vapor Atomic Absorption
GC/MS= Gas Chromatography/Mass Spectroscopy
GC/MS-SIM= Gas Chromatography/Mass Spectroscopy- Selective Ion Monitoring
GC/ECD= Gas Chromatography/Electron Capture Detector

Lead and mercury results were qualified as estimated values due to high matrix spike recoveries. High molecular weight polynuclear aromatic hydrocarbon (HPAH) and several phthalate results were also qualified as estimated values based on low recoveries of internal standards. Low recoveries for these compounds are most likely the result of matrix interferences. Finally DDT concentrations are considered estimated values based on an evaluation of continuing calibration data. None of the above mentioned problems appears to severely compromise the usefulness of the data.

Unless otherwise noted all concentrations in this document are reported on a dry weight basis. For reference, sample tracking numbers (Table C1) and copies of the laboratory report sheets are included in Appendix C.

Results

Contaminant Distribution

Sampling was conducted between September 4, 1996 and January 10, 1997. Data on the amount of material collected by the sediment traps at each location are summarized in Appendix A, Table A2. Sample amounts were somewhat variable, ranging from 71.3 grams (dry) in the north lateral of the 15th Street drain (FD-3B) to 620 grams at the background site (FD-5). The median amount of material collected was 186 grams.

Rainfall records from the National Weather Service meteorological station located at the Tacoma Central Treatment Plant are shown in Figure 2. Measurable rainfall was recorded on 81 out of 128 days during the deployment period. Total precipitation for the sampling period was 26.9 inches. Average annual rainfall for the period of record (September 1958 to March 1997) at this station was 38.19 inches (Creamer, 1997). These data indicate that approximately 70% of the average annual rainfall fell during the sampling period.

Results of analysis of sediment particulate matter (SPM) collected from several discharges to Foss Waterway are summarized in Table 2. Total organic carbon (TOC) concentrations were fairly consistent in all discharges ranging from 1.0% at the background site to 3.8% in the Nalley Valley drain. Grain size results (Figure 3) indicated that the samples collected were predominantly composed of sand size particles.

Lead (50-220 mg/kg) and mercury (0.021-0.23) concentrations were relatively low at all locations. The highest zinc concentrations were present in the twin 96" drains at the head of the waterway and the 15th Street drain. The lowest metals concentrations were consistently measured upstream in the Nalley Valley drain (#237A) at the background site.

Thirty semivolatile organics, primarily PAHs and phthalates, were detected in SPM. The highest PAH levels were measured in the 15th Street drain. The distribution of low molecular weight PAHs (LPAH) and HPAH in storm drain SPM is shown in Figure 4. In all instances, the sum of HPAH exceeded the sum of LPAH. This enrichment of HPAH relative to LPAH is commonly observed in environmental samples since weathering processes such as evaporation, photochemical oxidation, dissolution, and microbial degradation can preferentially remove PAHs with molecular weights less than that of Fluoranthene (Merrill and Wade, 1985). The distribution of PAHs observed in the Foss storm drains indicates that the particulates present in each of the discharges sampled have had time to undergo some weathering.

Concentrations of most of the organic compounds other than PAHs were typically less than 1000 ug/kg, dry. Exceptions were noted for carbazole (500 - 1300 ug/kg), di-n-octyl phthalate (210 - 2200 ug/kg), butyl benzyl phthalate (640 - 4400 ug/kg), and bis (2-ethyl hexyl) phthalate (3200 - 24000 ug/kg). The distribution of butyl benzyl

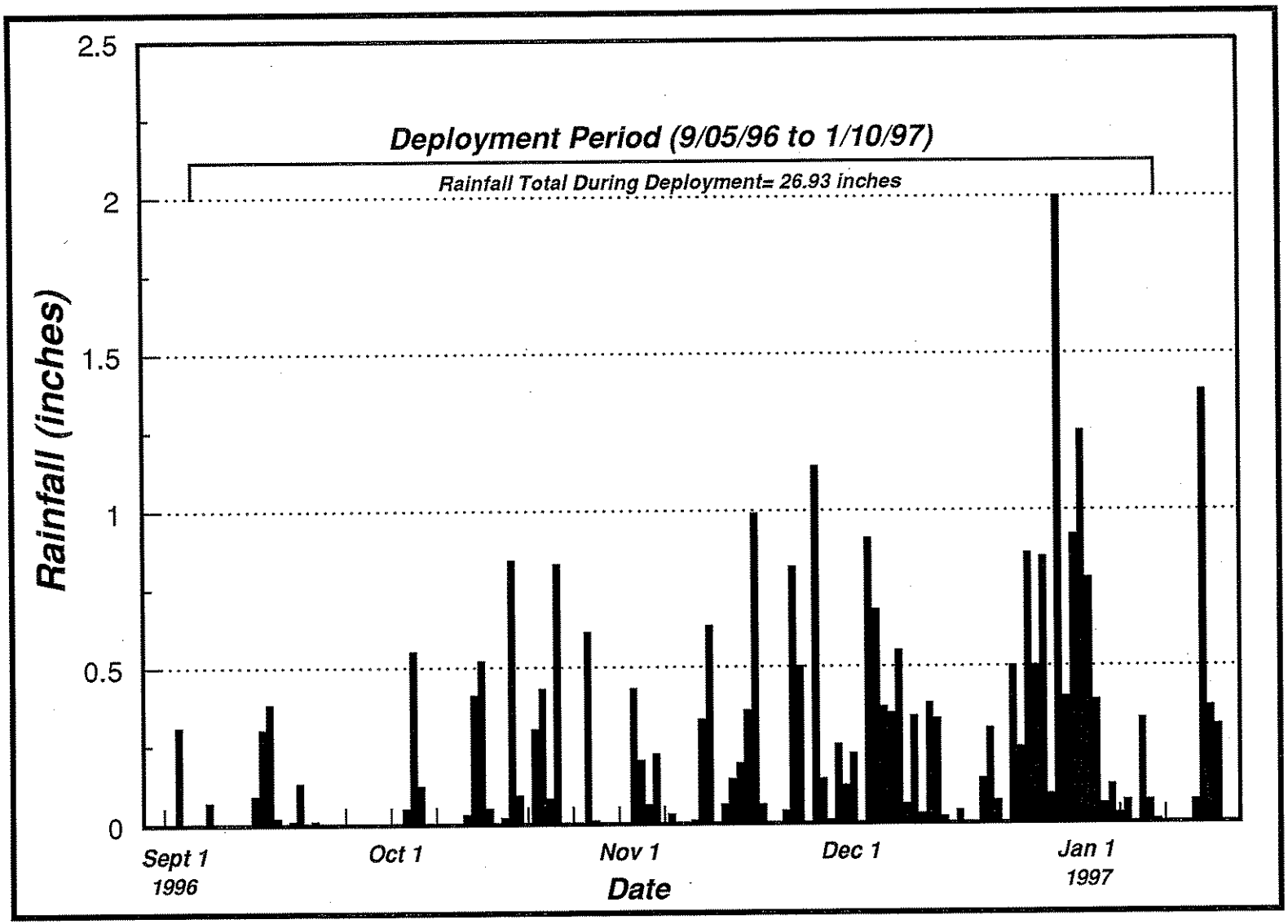

Figure 2: Precipitation Recorded at the Tacoma Central Treatment During Sediment Trap Monitoring of Foss Stormdrains.

Table 2: Summary of compounds detected in particulate samples from discharges to Foss Waterway.

Location	East Twin 96"		West Twin 96"		-		15th Street		Hosmer and S. Tacoma		Background	
Drain No.	237B		237A		-		230		-		-	
Station ID	FD-1		FD-2		FD-2 (dup)		FD-3		FD-4		FD-5	
Sample No. 3-	8488		8490		8493		8494		8498		8499	
Conventionals (%)												
Total Solids	66.8		79.5		74.2		73.0		69.5		82.4	
TOC	3.8		3.7		3.9		3.6		2.4		1.0	
Grain Size												
Gravel (>2mm)	4.8		15.8		13.5		12.5		6.2		15.2	
Sand (2mm-62um)	70.1		77.2		79.8		81.4		73.6		82.8	
Fines (<62um)	25.1		7.0		6.7		6.2		20.2		2.0	
Metals (mg/kg, dry)												
Lead	190	j	160	j	220	j	170	j	89	j	50	j
Mercury	0.13		0.073		0.23		0.19		0.15		0.021	
Zinc	340	j	330	j	320	j	420	j	170	j	99	j
Semivolatiles (ug/kg, dry)												
Acenaphthene	300		290		160		490		180		150	
Acenaphthylene	99	u	97	u	98	u	99	u	98	u	96	u
Naphthalene	120		120		130		320		98	u	96	u
Fluorene	450		450		280		640		280		270	
Anthracene	720		750		430		1100		550		480	
Phenanthrene	5800		4900		4600		7200		4200		3500	
Sum LPAH	7400		6500		5600		9800		5200		4400	
Fluoranthene	6100		5600		5400		7100		4200		4400	
Benzo(a)anthracene	3700	j	3500	j	2300	j	4500	j	3000	j	2600	j
Chrysene	4800	j	4200	j	3900	j	5500	j	3700	j	3200	j
Pyrene	23000	j	17000	j	18000	j	25000	j	16000	j	13000	j
Benzofluoranthenes	10000	j	8500	j	5300	j	11000	j	7100	j	5800	j
Benzo(a)pyrene	3900	j	3600	j	2000	j	4600	j	3100	j	2600	j
Dibenzo(a,h)anthracene	610	j	510	j	300	j	700	j	520	j	440	j
Indeno(1,2,3-cd)pyrene	2100	j	1600	j	1000	j	2400	j	1700	j	1500	j
Benzo(g,h,i)perylene	2900	j	1800	j	1200	j	3000	j	1900	j	1800	j
Sum HPAH	57000	j	46000	j	39000	j	64000		41000	j	35000	j
Total PAH	65000	j	53000	j	45000	j	74000	j	46000	j	40000	j
2-methylnaphthalene	120		120		160		550		98	u	96	u
Dibenzofuran	240		200		120		310		150		96	u
Carbazole	1100		870		720		1300		700		500	
Dibenzothiophene	290		250		240		370		200		170	
Benzyl alcohol	20	u	38		53		31		20	u	19	u
Benzoic acid	490	u	490	u	490	u	530		490	u	480	u
N-nitrosodiphenylamine	99	u	34		20	u	20	u	20	u	19	u
4-methylphenol	570		550		760		690		100		96	u
Pentachlorophenol	190	j	150	j	120	u	120	u	190	j	120	u
Diethyl phthalate	99	u	97	u	98	u	99	u	98	u	96	u
Dimethyl phthalate	100		310		98	u	99	u	98	u	96	u
Butyl benzyl phthalate	1000	j	4200	j	1800	j	970	j	640	j	4400	j
Di-n-butyl phthalate	270		490		310		870		160		96	u
Di-n-octyl phthalate	2200	j	650	j	580	j	730	j	890	j	210	j
Bis(2EH)phthalate	24000	j	5600	j	7800	j	23000	j	15000	j	3200	j
Chlorinated Pesticides/PCBs (ug/kg, dry)												
4,4' DDD	7.7	u	8	u	7.6	u	16		7.6	u	7.4	u
4,4' DDT	7.7	uj	8	u	7.6	u	320	j	18	j	7.4	u
Arochlor 1254	63	j	54	j	59	j	130		19	j	11	j

u= Not detected at detection limit shown

j= Estimated concentrations

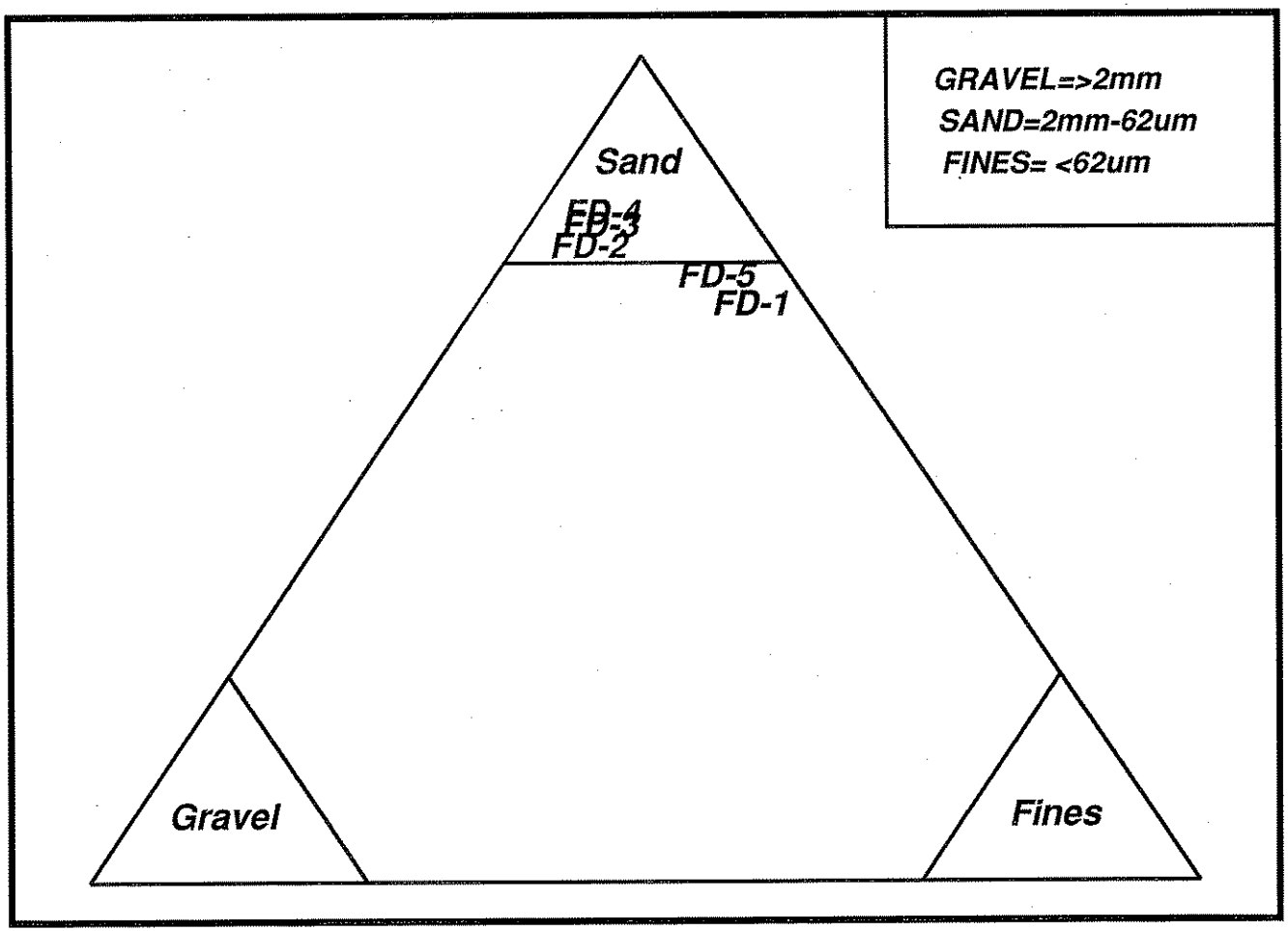

Figure 3: Grain Size Composition of Particulate Samples from Foss Stormdrains.

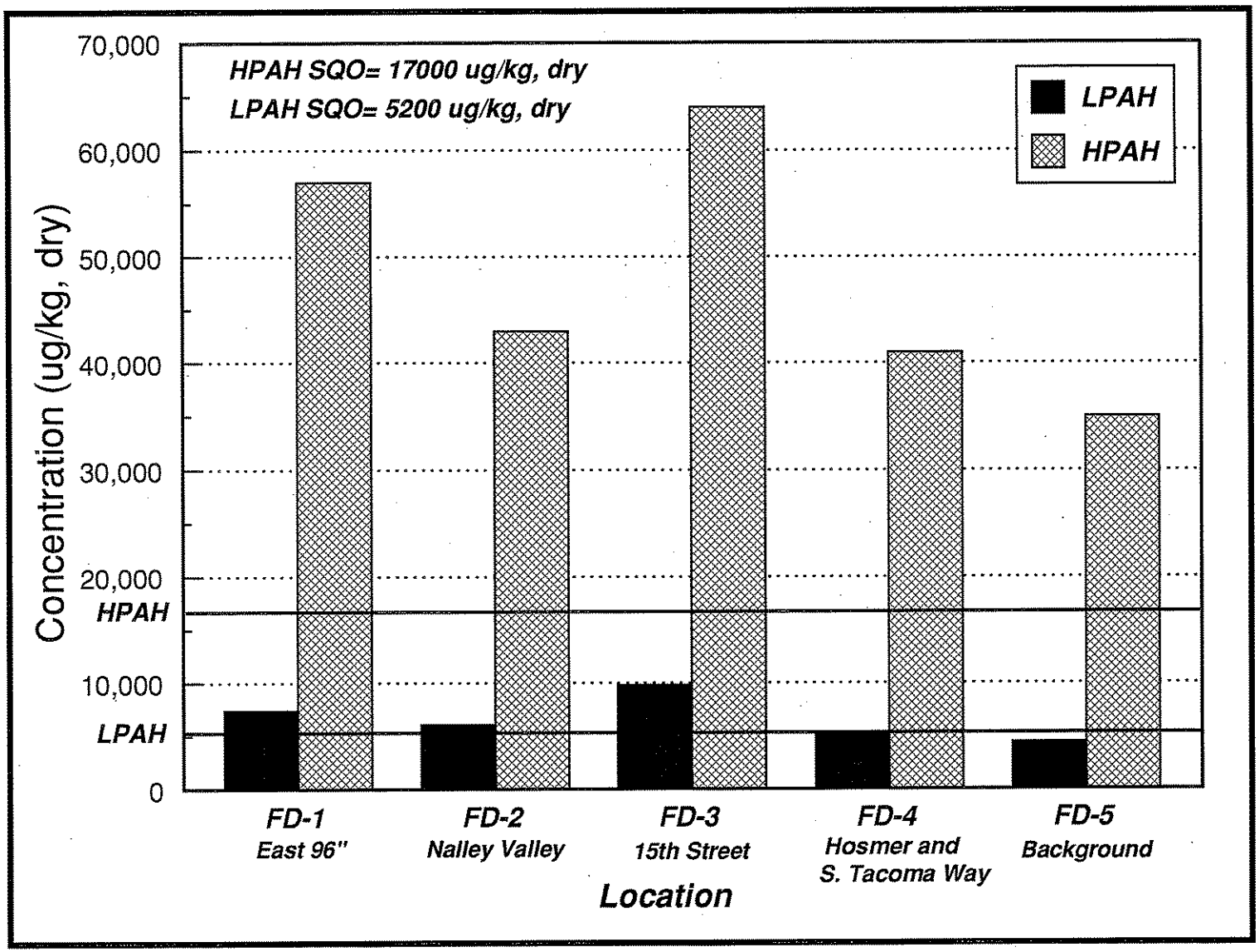

Figure 4: Comparison of LPAH and HPAH Concentrations in Stormdrain Particulates.

phthalate and bis (2 ethyl hexyl) phthalate in SPM are shown in Figure 5. Bis (2 ethyl hexyl) phthalate levels were somewhat variable in the discharges, with the highest concentrations measured in the East 96" drain. Butyl benzyl phthalate levels were more consistent between discharges. The highest concentrations for this compound were measured at the background site. As was the case for metals, the lowest concentrations of most organics were typically present at the upstream (background) site in the Nalley Valley drainage system.

Low concentrations of Arochlor 1254 (11 - 130 ug/kg) were present at all sampling sites. DDT was detected in the 15th Street drain (320 ug/kg) and the highway runoff site located at Hosmer and S. Tacoma Way (18 ug/kg).

Comparison to Sediment Quality Objectives

Of particular concern to source control and sediment cleanup activities in Foss Waterway are chemicals which exceed the Commencement Bay Sediment Quality Objectives (SQOs). The SQOs represent contaminant concentrations above which deleterious effects would always be observed in benthic communities (EPA, 1989).

Concentrations of selected chemicals in storm drain SPM are compared to the SQOs in Table 3. Nineteen individual chemicals exceeded the SQOs in SPM. The majority of exceedances were observed for the LPAH (primarily phenanthrene), HPAH (all compounds), and phthalates (dimethyl, butyl benzyl, and bis (2 ethyl hexyl)). In addition zinc, 4-methyl phenol, 4,4'-DDD, and 4,4'-DDT were present at concentrations above the SQOs in the 15th Street drain.

Individual chemicals exceeding the SQOs are listed by station in Table 4. The greatest number of exceedances (20) were present in the 15th Street drain. The highway runoff station located at Hosmer and S. Tacoma Way and the background site had the fewest number of exceedances, with 13 each. The chemicals shown in Table 4 should undergo a loading analysis to evaluate the potential to recontaminate sediments in the waterway. If this analysis and WASP modeling results indicate that recontamination is possible, they should be listed as contaminants of concern for Foss Waterway.

For perspective, concentrations of selected chemicals associated with Foss Waterway storm drain particulates are compared to other data on storm drains in Table 5. TOC and zinc concentrations are presented on a dry weight basis. To reduce the variability associated with differences in TOC content, the organics concentrations are reported on a TOC normalized basis. These data indicate that mean concentrations of zinc, LPAH, and bis (2 ethyl hexyl) phthalate in Foss Waterway drains are similar to concentrations reported for industrial areas in Seattle and Snohomish County. Mean HPAH levels in Foss drains are similar to residential areas in Seattle and Snohomish County. Compared to SPM data from the Lacey area (collected with the use of the stormwater sediment traps), LPAH and HPAH levels in Foss drains are elevated by approximately a factor of 30.

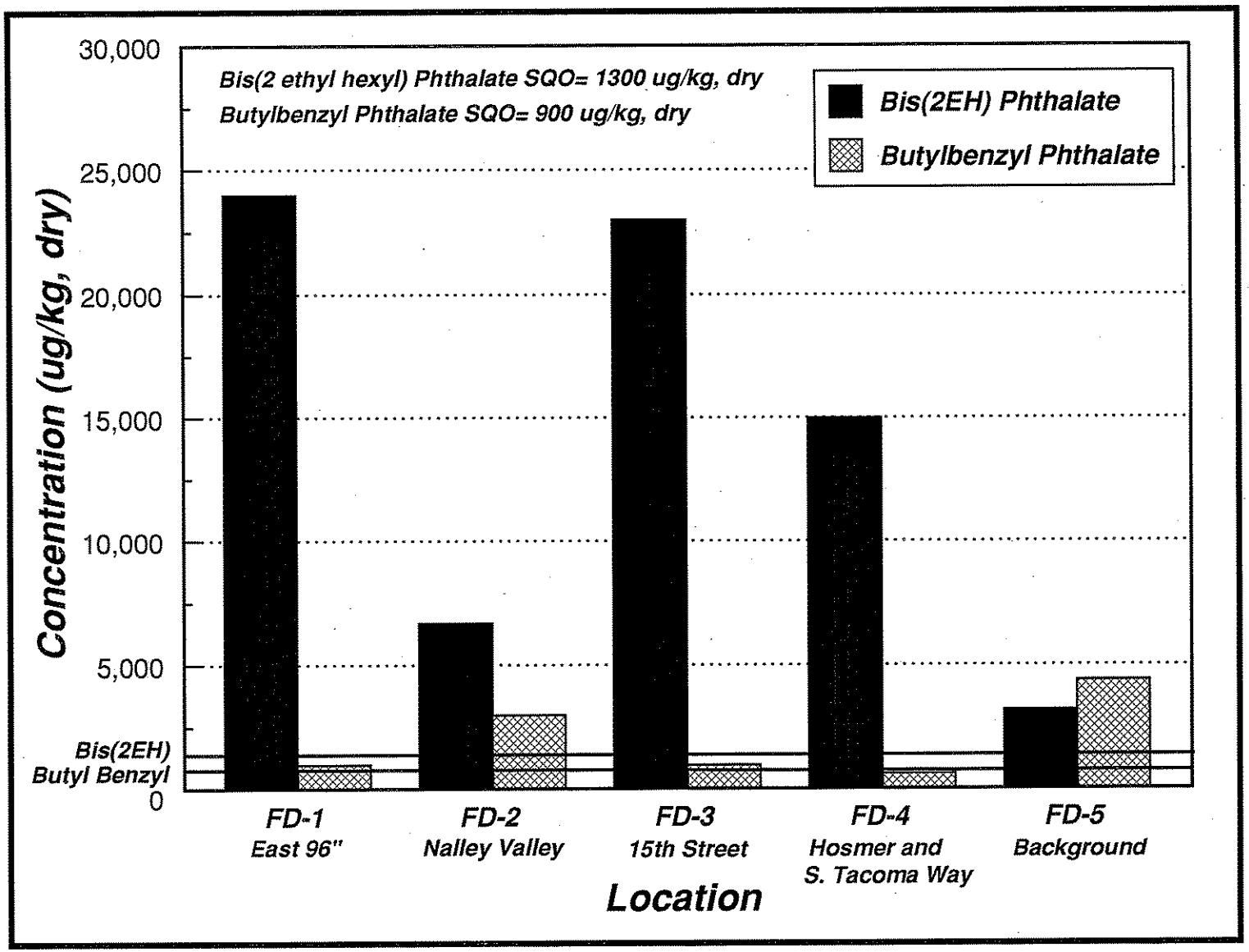

Figure 5: Comparsion of Selected Phthalate Concentrations in Stormdrain Particulates.

Table 3: Comparison of Compounds Exceeding the Commencement Bay Sediment Quality Objectives in Storm Water Particulates.

Location	East Twin 96"		West Twin 96"		15th Street		Hosmer and S. Tacoma		Background		
Drain No.	237B		237A		230		-		-		Commencement
Station ID	FD-1		FD-2		FD-3		FD-4		FD-5		Bay
Sample No. 3-	8488		8490/93*		8494		8498		8499		SQO
Metals (mg/kg, dry)											
Zinc	340	j	330	j	420	j	170	j	99	j	410
Semivolatile organics (ug/kg, dry)											
Fluorene	450		370		640		280		270		540
Anthracene	720		590		1100		550		480		960
Phenanthrene	5800		4800		7200		4200		3500		1500
Sum LPAH	7400		6100		9800		5200		4400		5200
Fluoranthene	6100		5500		7100		4200		4400		2500
Benzo(a)anthracene	3700	j	2900	j	4500	j	3000	j	2600	j	1600
Chrysene	4800	j	4100	j	5500	j	3700	j	3200	j	2800
Pyrene	23000	j	18000	j	25000	j	16000	j	13000	j	3300
Benzofluoranthenes	10000	j	6900	j	11000	j	7100	j	5800	j	3600
Benzo(a)pyrene	3900	j	2800	j	4600	j	3100	j	2600	j	1600
Dibenzo(a,h)anthracene	610	j	410	j	700	j	520	j	440	j	230
Indeno(1,2,3-cd)pyrene	2100	j	1300	j	2400	j	1700	j	1500	j	690
Benzo(g,h,i)perylene	2900	j	1500	j	3000	j	1900	j	1800	j	720
Sum HPAH	57000	j	43000	j	64000		41000	j	35000	j	17000
4-methylphenol	570		660		690		100		96	u	670
Dimethyl phthalate	100		210	j	99	u	98	u	96	u	160
Butyl benzyl phthalate	1000	j	3000	j	970	j	640	j	4400	j	900
Bis(2EH)phthalate	24000	j	6700	j	23000	j	15000	j	3200	j	1300
Chlorinated Pesticides/PCBs (ug/kg, dry)											
4,4' DDD	7.7	u	7.8	u	16		7.6	u	7.4	u	16
4,4' DDT	7.7	uj	7.8	u	320	j	18	j	7.4	u	34

*= Reported as mean of duplicate analysis

u= Not detected at detection limit shown

j= Estimated concentrations

= Concentration exceeds SQO based on environmental risk (EPA, 1989)

Table 4: Summary of Compounds Exceeding the Commencement Bay Sediment Quality Objectives by Station.

FD-1 (East Twin 96")	FD-2 (West Twin 96")	FD-3 (15th Street)	FD-4 (Hosmer and S. Tacoma Way)	FD-5 (Background)
Sum LPAH	**Sum LPAH**	Zinc	**Sum LPAH**	Phenanthrene
Phenanthrene	Phenanthrene	**Sum LPAH**	Phenanthrene	**Sum HPAH**
Sum HPAH	**Sum HPAH**	Flourene	**Sum HPAH**	Flouranthene
Flouranthene	Flouranthene	Anthracene	Flouranthene	Benzo(a)anthracene
Benzo(a)anthracene	Benzo(a)anthracene	Phenanthrene	Benzo(a)anthracene	Chrysene
Chrysene	Chrysene	**Sum HPAH**	Chrysene	Pyrene
Pyrene	Pyrene	Flouranthene	Pyrene	Benzoflouranthenes
Benzoflouranthenes	Benzoflouranthenes	Benzo(a)anthracene	Benzoflouranthenes	Benzo(a)pyrene
Benzo(a)pyrene	Benzo(a)pyrene	Chrysene	Benzo(a)pyrene	Dibenzo(a,h)anthracene
Dibenzo(a,h)anthracene	Dibenzo(a,h)anthracene	Pyrene	Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene
Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	Benzoflouranthenes	Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Benzo(g,h,i)perylene	Benzo(g,h,i)perylene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Butylbenzyl Phthalate
Butylbenzyl Phthalate	Dimethyl Phthalate	Dibenzo(a,h)anthracene	Bis (2 ethyl hexyl) Phthalate	Bis (2 ethyl hexyl) Phthalate
Bis(2 ethyl hexyl) Phthalate	Butylbenzyl Phthalate	Indeno(1,2,3-cd)pyrene		
	Bis(2 ethyl hexyl) Phthalate	Benzo(g,h,i)perylene		
		4-Methyl Phenol		
		Butylbenzyl Phthalate		
		Bis(2 ethyl hexyl) Phthalate		
		4,4' DDD		
		4,4' DDT		
14	15	20	13	13

Sediment Quality Objectives based on environmental risk (EPA, 1989)

Table 5: Comparison of Contaminant Concentrations Associated with Storm Drain Particulates from Foss Waterway Discharges to Other Data on Stormwater Particulates.

Units		%, dry	mg/kg, dry	mg/kg, organic carbon						
Source	Media	TOC	Zinc	LPAH	HPAH	Dimethyl phthalate	Butylbenyl phthalate	Bis(2EH) phthalate	4.4'DDD	4,4'DDT
Present Study	**SPM**	**3.1**	**280**	**260**	**1900**	**4**	**120**	**480**	**0.44**	**4.8**
Lacey Drains[1]	SPM	12	510	9.1	63	na	na	na	na	na
Bellingham Drains[2]	BS	3.8	260	55	100	200	55	nd	na	na
Seattle/Snohomish[3]										
Residential	BS	2.1	120	160	1600	nd	110	290	nd	nd
Industrial	BS	1.7	270	280	940	nd	32	520	nd	nd

Values shown are mean of detected concentrations

SPM= Settling Particulate Matter

BS= Bottom Sediment Collected from Storm Drain Catch Basins

na= Not analyzed

nd= Not detected

References

[1]= Stormwater Sediment Trap Pilot Study (Wilson and Norton, 1996)

[2]= Drainage Basin Tracing Study (Cubbage, 1994)

[3]= Contaminants in Vactor Truck Waste (Serdar, 1993)

Conclusions

In-line sediment traps were successfully deployed between September 1996 and January 1997 in the three major stormwater discharges to Thea Foss Waterway. Results of metals and organics analysis of the trapped particulates indicated that concentrations of 19 individual chemicals exceeded the Commencement Bay Sediment Quality Objectives. The majority of these exceedance were for polynuclear aromatic hydrocarbons (especially HPAH) and phthalates. The greatest number of exceedances (20) were measured in the 15th Street drain which discharges to the central portion of the waterway.

A comparison with other data on storm drain deposits indicates that concentrations of three urban contaminants -- zinc, LPAH, and bis (2 ethyl hexyl) phthalate -- in Foss discharges are similar to levels reported in bottom sediments collected from catch basins in industrial areas of Seattle and Snohomish County.

Recommendations

Based on data collected during the present study, the following recommendations are made:

- Chemicals which exceeded the Commencement Bay Sediment Quality Objectives (SQOs) in trapped particulates should undergo a loading analysis to determine the potential to recontaminate bottom sediments in the waterway. Ideally, the potential for recontamination would be evaluated through the use of the WASP model, calibrated for conditions in Foss Waterway.

- Investigate sources of chemicals exceeding the SQOs in upstream portions of the storm drain system.

- Additional stormwater sediment trap monitoring at some time in the future could assist in determining the effectiveness of source control efforts at reducing contaminant loads to the waterway for these discharges. In addition, installation of the traps at critical points in the system could help prioritize source tracing efforts.

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Contacts

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Appendix A: Field Information

Table A1: Station Locations

Table A2: Sample Weights

Figure A1: Construction Details of the Stormwater Sediment Traps

Table A1: Station Descriptions for the Foss Waterway Stormdrain Evaluation.

Station	Drain No.	Description	Latitude	Longitude	Deployed	Retreived	Days
FD-1	237B	East Twin 96" near Mouth	47.14.45	122.25.81	9/5/96	12/23/96	109
FD-2	237A	Nalley Valley near Mouth	47.14.49	122.25.85	9/5/96	11/22/96	78
FD-2A	237A	Nalley Valley Lateral near Mouth	47.14.47	122.25.84	9/5/96	11/22/96	78
FD-3	230	15th St. Drain @ 15th and A St.	47.14.95	122.26.14	9/5/96	11/22/96	78
FD-3A	230	15th St. Drain North Lateral	47.14.95	122.26.15	9/5/96	11/22/96	78
FD-3B	230	15th St. Drain South Lateral	-	-	9/5/96	11/22/96	78
FD-4	237A	Hosmer and S. Tacoma Way	47.13.95	122.27.71	10/22/96	12/23/96	62
FD-5	237A	South 18th and Cedar St.	47.14.51	122.28.50	10/23/96	1/10/97	79

Latitude and Longitude in Degrees/Minutes

Table A2: Sample weights for the Foss Waterway Storm Water Investigation (grams).

Station	Description	Tare WT	Final Wt	Sample (Wet WT)	Solids (%)	Sample (Dry WT)
FD-1	East Twin (237B)	299	440	141	66.8	94.2
FD-2	West Twin Main (237A)	300	739	439	75.3	331
FD-2A	West Twin Lateral	299	595	296	71.5	212
FD-3	15th Street Main (230)	302	596	294	63.1	186
FD-3A	15th Street South Lateral	300	634	334	66.9	223
FD-3B	15th Street North Lateral	301	395	94	75.9	71.3
FD-4	DOT	299	476	177	69.5	123
FD-5	Background (1of2)	302	1054	752	82.4	620
-	Background (2of2)	306	412	106	82.4	87.3

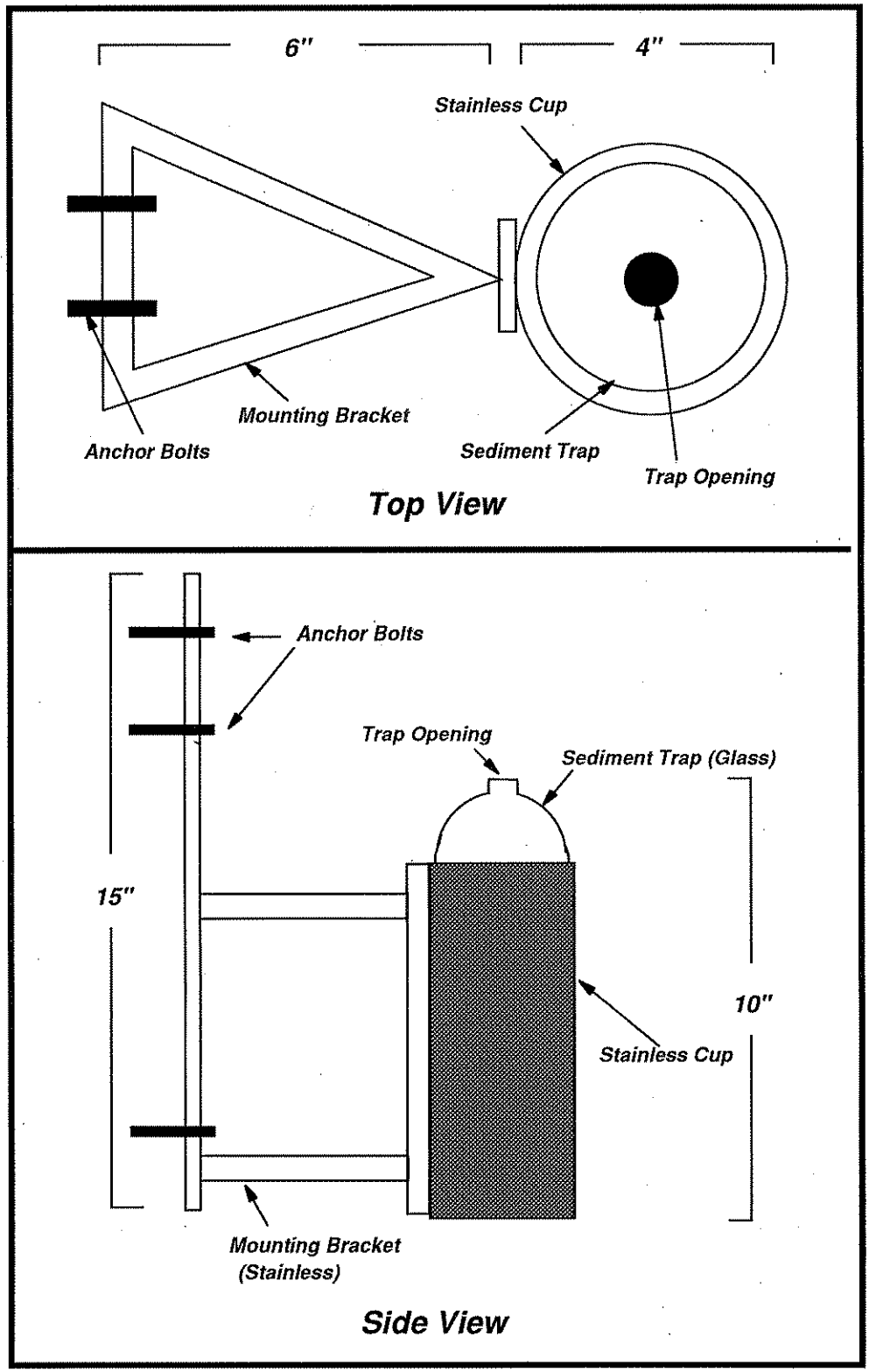

Figure A1: Construction Details of Stormwater Sediment Trap.

Appendix B: Quality Assurance

Table B1: Field Duplicate Results

Case Narratives

Table B1: Summary of field duplicate results for selected chemicals detected in Foss Waterway Stormdrain Particulates.

Chemical	FD-2	FD-2 (dup)	RPD (%)
Conventionals (%)			
Percent Solids	79.5	74.2	6.9
Total Organic Carbon	3.7	3.9	5.3
Grain Size			
Gravel	15.8	13.5	16
Sand	77.2	79.8	3.3
Fines	7.0	6.7	4.4
Metals (mg/kg, dry)			
Lead	160	220	32
Mercury	0.073	0.23	100
Zinc	330	320	3.1
Polynuclear Aromatic Hydrocarbons (ug/kg, dry)			
LPAH	6500	5600	15
HPAH	46000	39000	16
Phthalate Acid Esters (ug/kg, dry)			
Di-n-butyl phthalate	490	310	45
Butylbenzyl phthalate	4200	1800	80
Di-n-octyl phthalate	650	580	11
Bis(2-ethyl hexyl) phthalate	5600	7800	33
Polychlorinated Biphenyls (ug/kg, dry)			
PCB 1254	54	59	8.8

RPD= Relative Percent Difference= (range of concentrations/mean concentration)*100

Washington State Department of Ecology
Manchester Laboratory

March 9, 1997

TO: Dale Norton

FROM: Debbie Lacroix, Chemist

SUBJECT: General Chemistry Quality Assurance memo for the Foss Storm Drains Project

SUMMARY

The data generated by the analysis of these samples can be used without qualification.

SAMPLE INFORMATION

Samples 97038488-99 from the Foss Stormdrains project were received by the Manchester Laboratory on 1-21-97 in good condition. Samples were immediately frozen upon arrival.

HOLDING TIMES

Analysis was performed within all applicable EPA holding times.

ANALYSIS PERFORMANCE

Instrument Calibration

Where applicable, instrument calibration was performed before each analysis and verified by initial and verification standards and blanks. All initial and continuing calibration verification standards were within the relevant EPA control limits. A correlation of 0.995 or greater was met as stated in CLP calibration requirements. All balances are calibrated yearly with calibration verification occurring monthly.

Procedural Blanks

All procedural blanks were within acceptable limits.

Precision Data

The results of the duplicate analysis of samples were used to evaluate the precision on this sample set. The Relative Percent Differences (RPD) were within their acceptance windows of +/- 20 %.

Laboratory Control Sample (LCS) Analyses

LCS analysis were within their acceptance windows of +/- 20 %.

Please call Debbie Lacroix at SCAN 871-8812 with any questions or concerns about this project.

cc: Project File

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

February 24, 1997

Project: Foss Stormdrains

Samples: 03-8488, 90, 93, 94, 98, 99

Laboratory: Columbia Analytical

By: Pam Covey

Case Summary

These samples required six (6) Grain Size analyses on sediment using Puget Sound Estuary Protocol (PSEP) method.

The samples were received at the Manchester Environmental Laboratory on January 21, 1997 and transported to Columbia Analytical on January 23, 1997 for Grain Size analyses.

The analyses were reviewed for qualitative and quantitative accuracy, validity and usefulness.

The results are acceptable for use as reported.

Quality Control Data Review

TO: Christopher L. Getchell, Source Control Supervisor

FROM: Lori A. Zboralski, Senior Laboratory Analyst

DATE: February 7, 1997

SAMPLES

This report concerns the following samples associated with **Foss Remedial Investigation WO# AK80B9:**

Sample Description	Lab ID#	Date Sampled
FD-1C 237B Composite, #38488	970115063	01/14/97
FD-2C 237A Composite, #38490	970115064	01/14/97
FD-2 237A Main, #38491	970115065	01/14/97
FD-2A 237 Lateral, #38492	970115066	01/14/97
FD-2CD 237A Composite, #38493	970115067	01/14/97
FD-3C 15th St. Composite, #38494	970115068	01/14/97
FD-3 15th St. Main, #38495	970115069	01/14/97
FD-3A 15th St. S. Lateral, #38496	970115070	01/14/97
FD-3B 15th St. N. Lateral, #38497	970115071	01/14/97
FD-4 DOT, #38498	970115072	01/14/97
FD-5 Background, #38499	970115073	01/14/97

HOLDING TIMES

These samples were prepared within the 10 days required for Pesticide/PCBs and Semi-Volatile Organics and analyzed within the required holding times of 7 days for Solids, 28 days for Mercury, 40 days for extracted Pesticide/PCBs and Semi-Volatile Organics, and 180 days for Total Metals.

METHODS

The analysis follows CLP Statements of Work ILM03.0 and OLM01.8 and Public Works Utility Services Laboratory SOPs.

DAILY INSTRUMENT PERFORMANCE STANDARDS

The mass Spectrometer was tuned following CLP Statement of Work, DFTPP Key Masses and Abundance Criteria. The criteria for the spectrum of Decafluoro-triphenylphosphine (DFTPP) was met for the twelve hour sequence when these samples were run. Therefore,

the spectra generated by the mass spectrometer can be considered in control for all these analyses.

PESTICIDE/PCB SEQUENCE REQUIREMENTS

The initial calibration sequence was in accordance of SOW guidelines except that calibration was performed at 1000 ug/L instead of 100 ug/L. The Resolution Check Mixtures showed acceptable resolution (greater than 60%) and the Performance Evaluation Mixtures met degradation acceptance criteria (less than 20% for DDT and Endrin respectively, but less than 30% combined). The DDT degradations ranged from 0.9 to 17.3%. Endrin degradations ranged from 0 to 10.2%. All PEM degradations met the method requirements.

CALIBRATION AND VERIFICATION

According to SOW for Organics OLM3.0, all reported Pesticide compounds from the column used for quantitation in the Initial Calibration are to have updated relative response factors (RRF) with relative percent differences (%RSD) of less than 20% when compared to the average RRF, alpha-BHC and delta-BHC must be less than 25%.

All response factors (RRF) with (%RSD) of greater than 20% are outlined in the following table:

Initial Calibration Compound	Dates %RSD Out - (%RSD)
Endosulfan I	**02/03-21.75;**
4,4'-DDT	**02/03-22.55;**

All reported Semi-Volatile Organic compounds in the Initial Calibration are to have updated relative response factors (RRF) with percent relative standard deviations (%RSD) of less than 30% when compared to the average RRF. The minimum RRFs must be greater or equal than 0.05.

All response factors (RRF) with (%RSD) of greater than 30% are outlined in the following table:

Initial Calibration Compound	Dates %RSD Out - (%RSD)
Pentachlorophenol (SIM)	**02/03-37.64;**

The RRFs for this compound were greater than 0.05. Samples 970115063, 970115064, 970115072 are qualified J based on initial calibration failure.

All reported Pesticide compounds from the column used for quantitation in the Continuing Calibration are to have updated relative response factors (RRF) with percent differences (%D) of less than 25% when compared to the average RRF. **The compound which**

exceeded these limits is listed in the following table:

Compound	Standard	Dates %D Out - (%D)
4,4'-DDT	INDABCC3	02/03-29.7;

Sample 970115072 is qualified J for 4,4'-DDT based on continuing calibration.
Sample 970115073 is qualified UJ for 4,4'-DDT based on continuing calibration.

Continuing Calibration response factors for Semi-Volatile Organics are to have percent differences of less than 25% from the average response factor from the initial calibration. There were no compounds that exceeded this criteria.

The ICP and FIAS calibrations met method requirements for linearity and accuracy. FIAS calibration linearity was verified with the correlation coefficient of greater than 0.995. Sensitivity was verified by analysis of a standard at or near the contract required detection limits. The recoveries ranged from 63.5 to 103% and all were within laboratory established 50-200% limits.

Calibration accuracy was monitored by analyzing an independent mid-range standard (ICV and CCV). Acceptable recoveries for ICP must be with 90-110%, FIAS recoveries must be within 80-120%. All ICVs and CCVs had recoveries within acceptable limits and ranged from 90.5 to 108%.

ICP INTERFERING ELEMENT CHECK STANDARDS

ICP Interference Check Samples (ICS) verify the laboratory's inter-element and background correction factors. All ICS's were analyzed at the required frequency and met the 80-120% recovery limits.

GPC CALIBRATION

The GPC calibration check mixture had acceptable recoveries between 80 and 110% for each component.

FLORISIL CLEANUP ACCEPTANCE CRITERIA

Each batch of florisil cartridges must have one analyzed for performance. The cartridge performance check solution must have recoveries of all pesticide compounds between 80 and 120%, less than 5% recovery of trichlorophenol, and no peaks interfering with the target analytes. Ten of eleven compounds met the recovery requirements. Alpha-BHC had a recovery of 70%. The recovery of trichlorophenol was 20.7%, however there were no apparent interfering peaks.

METHOD AND CALIBRATION BLANKS

A matrix specific method blank is extracted daily for Semi-volatile Organics and Pesticides/PCBs. There were four method blanks associated with these samples, 970117QCBS, 970118QCBS, 970121QCPBS and 970130QCBS. There were no target compounds found in these blanks, or their amounts were well below reporting limits. Instrument Blanks must be analyzed for Pesticide/PCBs initially at the beginning of each 12-hour sequence and every 12 hours after the initial. These instrument blanks were analyzed at the required frequency and no target compounds were detected. Method and calibration blanks for metals were analyzed at the required frequencies for the methods. The concentrations of these blanks were less than 1/5th the amount found in the samples or the detection limit at all times.

SYSTEM MONITORING COMPOUNDS

These methods adds 8 system monitoring compounds (SMC) for Semi-Volatile Organics and 2 compounds for Pesticide/PCBs. These surrogates and their recovery limits (as determined by the SOW) are: Tetrachloro-m-xylene (soil: 30-150), decachlorobiphenyl (soil: 30-150), 2-Fluorophenol (soil: 25-121), Nitrobenzene-d5 (soil: 23-120), Phenol-d5 (soil: 24-113), 2-Chlorophenol-d4 (soil: 20-130), 1,2-Dichlorobenzene-d4 (soil: 20-130), 2-Fluorobiphenyl (soil: 30-115), 2,4,6-Tribromophenol (soil: 19-122) and Terphenyl-d14 (soil: 18-137). The method allows for 1 acid and / or one base/neutral SMC to be outside the QC limits. The SMC recoveries ranged from 40 to 254% and 99 of the 110 SMC recoveries met the QC criteria. Terphenyl-d14 exhibited high recoveries in all of the samples due to matrix interferences causing low internal standard areas.

LABORATORY CONTROL SAMPLES

Laboratory Control Samples (LCS) monitor the analytical system by carrying a standard through every step of the analytical method including extraction or digestion. All metals LCS recoveries were within laboratory established control limits of 80-120% recovery.

DUPLICATE SAMPLE ANALYSIS

All Duplicate samples had differences of less than 2 times the CRDL for analytes with concentrations less than 5 times the contract required detection limit or less than 35% for analytes with concentrations greater than 5 times the CRDL. No data was qualified based on duplicate analysis.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE ANALYSES

Sample 970115073 had 11 Semi-Volatile Organic target compounds and 6 Pesticide compounds added to two aliquots (matrix spike/matrix spike duplicate). These compounds and their percent recoveries (%R) limits and the relative percent differences (RPDs) limits

are: gamma-BHC (soil: 46-127 /50), Heptachlor (soil: 35-130 /31), Aldrin (soil: 34-132 /43), Dieldrin (soil: 31-134 /38), Endrin (soil: 42-139 /45), 4,4'-DDT (soil: 23-134 /50), Acenaphthene (soil: 31-137 /19), 2-Chlorophenol (soil: 25-102 /50), 4-Chloro-3-methylphenol (soil: 26-103 /33), 1,4-Dichlorobenzene (soil: 28-104 /27), 2,4-Dinitrotoluene (soil: 28-89 /47), 4-Nitrophenol (soil: 11-114 /50), N-Nitroso-di-n-propylamine (soil: 41-126 /38), Pentachlorophenol (soil: 17-109 /47), Phenol (soil: 26-90 /35), Pyrene (soil: 35-142 /36) and 1,2,4-Trichlorobenzene (soil: 38-107 /23). The actual recoveries ranged from 0 to 103% and 32 out of 34 spike recoveries were within method specified limits. There was no recovery for Pyrene in the matrix spike and the matrix spike duplicate samples. No data is qualified, however because the sample concentration greatly exceeded the amount of spike added. The RPDs ranged from 0 to 11 and all were within acceptable limits.

A Matrix spike sample was analyzed for metals. **The recoveries ranged from 87.7 to 252%. Lead and Zinc had recoveries higher than the upper acceptance limit of 125%. The samples are qualified J for Lead and Zinc based on matrix spike analysis.**

A Matrix spike sample was analyzed for PCBs. Aroclor 1254 was added to one aliquot of sample 970115073. The spike recovery was 67% and was within acceptable limits.

ICP SERIAL DILUTIONS

Serial dilution of samples analyzed by ICP provides information about physical or chemical interferences that may exist due to sample matrix.

Sample 970115068 was analyzed at a five fold dilution. All ICP elements were within 10% of the undiluted sample for analyte concentrations greater than 50 times the IDL.

INTERNAL STANDARDS

Performance of the Internal Standards (IS) monitors GC/MS sensitivity and stability during each analysis. Internal Standards must no vary more than -50% to +100% from the continuing calibration response and be within +/- 30 seconds from the continuing calibration retention time.

Internal Standards used in this Semi-VOA analysis include 1,4-Dichlorobenzene-d4, Naphthalene-d8, Acenaphthene-d10, Phenanthrene-d10, Chrysene-d12, and Perylene-d12. **Chrysene-d12 and Perylene-d12 had low recoveries. The table below outlines the samples, the compounds, and the data qualifiers assigned based on these low internal standard areas.**

Sample	Compound	Data Qualifier
970115063	Pyrene	J
38488	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ

Sample	Compound	Data Qualifier
970115063	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115064	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
38490	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115065	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115066	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J

Sample	Compound	Data Qualifier
970115066	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115067	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
38493	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115068	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
38494	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115069	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115070	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J

Sample	Compound	Data Qualifier
970115070	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115071	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115072	Pyrene	J
	Butyl Benzyl Phthalate	J
	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
38498	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J
970115073	Pyrene	J
	Butyl Benzyl Phthalate	J
38499	3,3'-Dichlorobenzidine	UJ
	bis(2-Ethylhexyl)phthalate	J
	Benzo(a)anthracene	J
	Chrysene	J
	Di-n-octyl phthalate	J
	Benzo(b,k)fluoranthenes	J
	Benzo(a)pyrene	J
	Indeno(1,2,3-c,d)pyrene	J
	Dibenz(a,h)anthracene	J
	Benzo(g,h,i)perylene	J

DATA ASSESSMENT

The qualifiers assigned to these samples include the following:

U indicates that the analysis of the parameter did not detect a positive hit above the Contract Required Detection Limit.

UJ indicates that the analysis of the parameter did not detect a positive hit above the Contract Required Detection Limit but the value should be considered estimated.

J Indicates the associated value should be considered estimated.

All data (including) qualified values are acceptable for use.

Appendix C: Laboratory Data

Table C1: Sample Tracking Numbers

Laboratory Results

Table C1: Samples submitted for Analysis January 1997 for the Foss Waterway Stormdrain Project.

Station	Sample #	Description	% Solids	Cl Pest/PCBs	Semivolatiles*	Phthalates Only	Hg	TOC	Pb/Zn	Grain Size
FD-1C	38488	237B Composite	X	X	X		X	X	X	X
FD-2C	38490	237A Composite	X	X	X		X	X	X	X
FD-2	38491	237A Main	X			X				
FD-2A	38492	237 Lateral	X			X				
FD-2CD	38493	237A (dup of 38490)	X	X	X		X	X	X	X
FD-3C	38494	15th St Composite	X	X	X		X	X	X	X
FD-3	38495	15th St Main	X			X				
FD-3A	38496	15th St S. Lateral	X			X				
FD-3B	38497	15th St N. Lateral	X			X				
FD-4	38498	Hosmer & S. Tacoma Wy	X	X	X		X	X	X	X
FD-5	38499	Background	X	X	X		X	X	X	X

*Semivolatiles= Target Compounds include PAH, phthalates, and chlorinated aromatics

- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 12, 1997

Lab#: 970115063 (38488)
Sample ID: FD-1C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	66.8	per cent
CV		
Mercury	0.128	mg/Kg
GC/ECD		
4,4-DDD	7.7 U	ug/Kg
4,4-DDE	7.7 U	ug/Kg
4,4-DDT	7.7 U J	ug/Kg
Aldrin	7.7 U	ug/Kg
alpha-BHC	7.7 U	ug/Kg
alpha-Chlordane	7.7 U	ug/Kg
Aroclor-1016	77 U	ug/Kg
Aroclor-1221	77 U	ug/Kg
Aroclor-1232	77 U	ug/Kg
Aroclor-1242	77 U	ug/Kg
Aroclor-1248	77 U	ug/Kg
Aroclor-1254	63 J	ug/Kg
Aroclor-1260	77 U	ug/Kg
beta-BHC	7.7 U	ug/Kg
delta-BHC	7.7 U	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115063
Sample ID: FD-1C
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result	Units
	Dieldrin	7.7 U	ug/Kg
	Endosulfan I	7.7 U J	ug/Kg
	Endosulfan sulfate	7.7 U	ug/Kg
	Endosulfan-II	7.7 U	ug/Kg
	Endrin	7.7 U	ug/Kg
	Endrin aldehyde	7.7 U	ug/Kg
	Endrin ketone	7.7 U	ug/Kg
	gamma-BHC (Lindane)	7.7 U	ug/Kg
	gamma-Chlordane	7.7 U	ug/Kg
	Heptachlor	7.7 U	ug/Kg
	Heptachlor epoxide	7.7 U	ug/Kg
	Methoxychlor	39 U	ug/Kg
	Toxaphene	190 U	ug/Kg
GC/MS-BNA			
	1,2,4-Trichlorobenzene	20 U	ug/Kg
	1,2-Dichlorobenzene	20 U	ug/Kg
	1,2-Diphenylhydrazine	99 U	ug/Kg
	1,3-Dichlorobenzene	99 U	ug/Kg
	1,4-Dichlorobenzene	99 U	ug/Kg
	2,2-oxybis(1-Chloropropane)	99 U	ug/Kg
	2,4,5-Trichlorophenol	99 U	ug/Kg
	2,4,6-Trichlorophenol	99 U	ug/Kg
	2,4-Dichlorophenol	99 U	ug/Kg
	2,4-Dimethylphenol	20 U	ug/Kg
	2,4-Dinitrophenol	490 U	ug/Kg
	2,4-Dinitrotoluene	99 U	ug/Kg
	2,6-Dinitrotoluene	99 U	ug/Kg
	2-Chloronaphthalene	99 U	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115063
Sample ID: FD-1C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Chlorophenol	99	U	ug/Kg
2-Methyl-4,6-dinitrophenol	490	U	ug/Kg
2-Methylnaphthalene	120		ug/Kg
2-Methylphenol	20	U	ug/Kg
2-Nitroaniline	99	U	ug/Kg
2-Nitrophenol	99	U	ug/Kg
3,3-Dichlorobenzidine	490	U J	ug/Kg
3-Nitroaniline	99	U	ug/Kg
4-Bromophenyl-phenylether	99	U	ug/Kg
4-Chloro-3-methylphenol	99	U	ug/Kg
4-Chloroaniline	99	U	ug/Kg
4-Chlorophenyl-phenylether	99	U	ug/Kg
4-Methylphenol	570		ug/Kg
4-Nitroaniline	99	U	ug/Kg
4-Nitrophenol	490	U	ug/Kg
Acenaphthene	300		ug/Kg
Acenaphthylene	99	U	ug/Kg
Aniline	99	U	ug/Kg
Anthracene	720		ug/Kg
Benzidine	490	U	ug/Kg
Benzo(a)anthracene	3700	J	ug/Kg
Benzo(a)pyrene	3900	J	ug/Kg
Benzo(g,h,i)perylene	2900	J	ug/Kg
Benzofluoranthenes	10000	J	ug/Kg
Benzoic Acid	490	U	ug/Kg
Benzyl Alcohol	20	U	ug/Kg
Biphenyl	99	U	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115063
Sample ID: FD-1C EAST 96=2
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
bis(2-Chloroethoxy)methane	99	U	ug/Kg
bis(2-Chloroethyl)ether	99	U	ug/Kg
bis(2-Ethylhexyl)phthalate	24000	J	ug/Kg
Butylbenzylphthalate	1000	J	ug/Kg
Carbazole	1100		ug/Kg
Chrysene	4800	J	ug/Kg
Di-n-butylphthalate	270		ug/Kg
Di-n-Octyl phthalate	2200	J	ug/Kg
Dibenz(a,h)anthracene	610	J	ug/Kg
Dibenzofuran	240		ug/Kg
Dibenzothiophene	290		ug/Kg
Diethylphthalate	99	U	ug/Kg
Dimethyl phthalate	100		ug/Kg
Fluoranthene	6100		ug/Kg
Fluorene	450		ug/Kg
Hexachlorobenzene	99	U	ug/Kg
Hexachlorobutadiene	99	U	ug/Kg
Hexachlorocyclopentadiene	99	U	ug/Kg
Hexachloroethane	99	U	ug/Kg
Indeno(1,2,3-cd)pyrene	2100	J	ug/Kg
Isophorone	99	U	ug/Kg
N-Nitroso-di-n-propylamine	99	U	ug/Kg
N-Nitrosodimethylamine	99	U	ug/Kg
N-Nitrosodiphenylamine	20	U	ug/Kg
Naphthalene	120		ug/Kg
Nitrobenzene	99	U	ug/Kg
Pentachlorophenol	190	J	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115063
Sample ID: FD-1C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Phenanthrene	5800		ug/Kg
Phenol	99	U	ug/Kg
Pyrene	23000	J	ug/Kg
ICP			
Lead	192	J	mg/Kg
Zinc	335	J	mg/Kg

Reviewed By: Lori A. Zboralski 2/12/97

U indicates not detected at the associated value
B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits
J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 12, 1997

Lab#: 970115064 (38490)
Sample ID: FD-2C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	79.5	per cent
CV		
Mercury	0.073	mg/Kg
GC/ECD		
4,4-DDD	8.0 U	ug/Kg
4,4-DDE	8.0 U	ug/Kg
4,4-DDT	8.0 U J	ug/Kg
Aldrin	8.0 U	ug/Kg
alpha-BHC	8.0 U	ug/Kg
alpha-Chlordane	8.0 U	ug/Kg
Aroclor-1016	80 U	ug/Kg
Aroclor-1221	80 U	ug/Kg
Aroclor-1232	80 U	ug/Kg
Aroclor-1242	80 U	ug/Kg
Aroclor-1248	80 U	ug/Kg
Aroclor-1254	54 J	ug/Kg
Aroclor-1260	80 U	ug/Kg
beta-BHC	8.0 U	ug/Kg
delta-BHC	8.0 U	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115064
Sample ID: FD-2C
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result	Units
	Dieldrin	8.0 U	ug/Kg
	Endosulfan I	8.0 U J	ug/Kg
	Endosulfan sulfate	8.0 U	ug/Kg
	Endosulfan-II	8.0 U	ug/Kg
	Endrin	8.0 U	ug/Kg
	Endrin aldehyde	8.0 U	ug/Kg
	Endrin ketone	8.0 U	ug/Kg
	gamma-BHC (Lindane)	8.0 U	ug/Kg
	gamma-Chlordane	8.0 U	ug/Kg
	Heptachlor	8.0 U	ug/Kg
	Heptachlor epoxide	8.0 U	ug/Kg
	Methoxychlor	40 U	ug/Kg
	Toxaphene	200 U	ug/Kg
GC/MS-BNA			
	1,2,4-Trichlorobenzene	20 U	ug/Kg
	1,2-Dichlorobenzene	20 U	ug/Kg
	1,2-Diphenylhydrazine	97 U	ug/Kg
	1,3-Dichlorobenzene	97 U	ug/Kg
	1,4-Dichlorobenzene	97 U	ug/Kg
	2,2-oxybis(1-Chloropropane)	97 U	ug/Kg
	2,4,5-Trichlorophenol	97 U	ug/Kg
	2,4,6-Trichlorophenol	97 U	ug/Kg
	2,4-Dichlorophenol	97 U	ug/Kg
	2,4-Dimethylphenol	20 U	ug/Kg
	2,4-Dinitrophenol	490 U	ug/Kg
	2,4-Dinitrotoluene	97 U	ug/Kg
	2,6-Dinitrotoluene	97 U	ug/Kg
	2-Chloronaphthalene	97 U	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115064
Sample ID: FD-2C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Chlorophenol	97 U		ug/Kg
2-Methyl-4,6-dinitrophenol	490 U		ug/Kg
2-Methylnaphthalene	120		ug/Kg
2-Methylphenol	20 U		ug/Kg
2-Nitroaniline	97 U		ug/Kg
2-Nitrophenol	97 U		ug/Kg
3,3-Dichlorobenzidine	490 U	J	ug/Kg
3-Nitroaniline	97 U		ug/Kg
4-Bromophenyl-phenylether	97 U		ug/Kg
4-Chloro-3-methylphenol	97 U		ug/Kg
4-Chloroaniline	97 U		ug/Kg
4-Chlorophenyl-phenylether	97 U		ug/Kg
4-Methylphenol	550		ug/Kg
4-Nitroaniline	97 U		ug/Kg
4-Nitrophenol	490 U		ug/Kg
Acenaphthene	290		ug/Kg
Acenaphthylene	97 U		ug/Kg
Aniline	97 U		ug/Kg
Anthracene	750		ug/Kg
Benzidine	490 U		ug/Kg
Benzo(a)anthracene	3500	J	ug/Kg
Benzo(a)pyrene	3600	J	ug/Kg
Benzo(g,h,i)perylene	1800	J	ug/Kg
Benzofluoranthenes	8500	J	ug/Kg
Benzoic Acid	490 U		ug/Kg
Benzyl Alcohol	38		ug/Kg
Biphenyl	97 U		ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115064
Sample ID: FD-2C WEST 96E
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
bis(2-Chloroethoxy)methane	97	U	ug/Kg
bis(2-Chloroethyl)ether	97	U	ug/Kg
bis(2-Ethylhexyl)phthalate	5600	J	ug/Kg
Butylbenzylphthalate	4200	J	ug/Kg
Carbazole	870		ug/Kg
Chrysene	4200	J	ug/Kg
Di-n-butylphthalate	490		ug/Kg
Di-n-Octyl phthalate	650	J	ug/Kg
Dibenz(a,h)anthracene	510	J	ug/Kg
Dibenzofuran	200		ug/Kg
Dibenzothiophene	250		ug/Kg
Diethylphthalate	97	U	ug/Kg
Dimethyl phthalate	310		ug/Kg
Fluoranthene	5600		ug/Kg
Fluorene	450		ug/Kg
Hexachlorobenzene	97	U	ug/Kg
Hexachlorobutadiene	97	U	ug/Kg
Hexachlorocyclopentadiene	97	U	ug/Kg
Hexachloroethane	97	U	ug/Kg
Indeno(1,2,3-cd)pyrene	1600	J	ug/Kg
Isophorone	97	U	ug/Kg
N-Nitroso-di-n-propylamine	97	U	ug/Kg
N-Nitrosodimethylamine	97	U	ug/Kg
N-Nitrosodiphenylamine	34		ug/Kg
Naphthalene	120		ug/Kg
Nitrobenzene	97	U	ug/Kg
Pentachlorophenol	150	J	ug/Kg

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J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115064
Sample ID: FD-2C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Phenanthrene	4900		ug/Kg
Phenol	97	U	ug/Kg
Pyrene	17000	J	ug/Kg
ICP			
Lead	163	J	mg/Kg
Zinc	334	J	mg/Kg

Reviewed By: Lori A. Zboralski 2/12/97

U indicates not detected at the associated value
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J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 07, 1997

Lab#: 970115065 (38491)
Sample ID: FD-2
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	75.3	per cent
GC/MS-BNA		
1,2,4-Trichlorobenzene	100 U	ug/Kg
1,2-Dichlorobenzene	100 U	ug/Kg
1,2-Diphenylhydrazine	100 U	ug/Kg
1,3-Dichlorobenzene	100 U	ug/Kg
1,4-Dichlorobenzene	100 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	100 U	ug/Kg
2,4,5-Trichlorophenol	100 U	ug/Kg
2,4,6-Trichlorophenol	100 U	ug/Kg
2,4-Dichlorophenol	100 U	ug/Kg
2,4-Dimethylphenol	100 U	ug/Kg
2,4-Dinitrophenol	500 U	ug/Kg
2,4-Dinitrotoluene	100 U	ug/Kg
2,6-Dinitrotoluene	100 U	ug/Kg
2-Chloronaphthalene	100 U	ug/Kg
2-Chlorophenol	100 U	ug/Kg
2-Methyl-4,6-dinitrophenol	500 U	ug/Kg
2-Methylnaphthalene	110	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115065
Sample ID: FD-2 WEST 96ER
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Methylphenol	100 U		ug/Kg
2-Nitroaniline	100 U		ug/Kg
2-Nitrophenol	100 U		ug/Kg
3,3'-Dichlorobenzidine	500 U	J	ug/Kg
3-Nitroaniline	100 U		ug/Kg
4-Bromophenyl-phenylether	100 U		ug/Kg
4-Chloro-3-methylphenol	100 U		ug/Kg
4-Chloroaniline	100 U		ug/Kg
4-Chlorophenyl-phenylether	100 U		ug/Kg
4-Methylphenol	700		ug/Kg
4-Nitroaniline	100 U		ug/Kg
4-Nitrophenol	500 U		ug/Kg
Acenaphthene	170		ug/Kg
Acenaphthylene	100 U		ug/Kg
Aniline	100 U		ug/Kg
Anthracene	640		ug/Kg
Benzidine	500 U		ug/Kg
Benzo(a)anthracene	3100	J	ug/Kg
Benzo(a)pyrene	3100	J	ug/Kg
Benzo(g,h,i)perylene	1700	J	ug/Kg
Benzofluoranthenes	7500	J	ug/Kg
Benzoic Acid	500 U		ug/Kg
Benzyl Alcohol	210		ug/Kg
Biphenyl	100 U		ug/Kg
bis(2-Chloroethoxy)methane	100 U		ug/Kg
bis(2-Chloroethyl)ether	100 U		ug/Kg
bis(2-Ethylhexyl)phthalate	33000	J	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115065
Sample ID: FD-2
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Butylbenzylphthalate	1300	J	ug/Kg
Carbazole	890		ug/Kg
Chrysene	4100	J	ug/Kg
Di-n-butylphthalate	210		ug/Kg
Di-n-Octyl phthalate	1300	J	ug/Kg
Dibenz(a,h)anthracene	450	J	ug/Kg
Dibenzofuran	140		ug/Kg
Dibenzothiophene	210		ug/Kg
Diethylphthalate	170		ug/Kg
Dimethyl phthalate	110		ug/Kg
Fluoranthene	5300		ug/Kg
Fluorene	280		ug/Kg
Hexachlorobenzene	100	U	ug/Kg
Hexachlorobutadiene	100	U	ug/Kg
Hexachlorocyclopentadiene	100	U	ug/Kg
Hexachloroethane	100	U	ug/Kg
Indeno(1,2,3-cd)pyrene	1500	J	ug/Kg
Isophorone	100	U	ug/Kg
N-Nitroso-di-n-propylamine	100	U	ug/Kg
N-Nitrosodimethylamine	100	U	ug/Kg
N-Nitrosodiphenylamine	100	U	ug/Kg
Naphthalene	100	U	ug/Kg
Nitrobenzene	100	U	ug/Kg
Pentachlorophenol	500	U	ug/Kg
Phenanthrene	4200		ug/Kg
Phenol	100	U	ug/Kg
Pyrene	16000	J	ug/Kg

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B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115065
Sample ID: FD-2
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units

Reviewed By: Lori A. Zboralski 2/7/96

U indicates not detected at the associated value
B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits
J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 07, 1997

Lab#: 970115066 (38492)
Sample ID: FD-2A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	71.5	per cent
GC/MS-BNA		
1,2,4-Trichlorobenzene	99 U	ug/Kg
1,2-Dichlorobenzene	99 U	ug/Kg
1,2-Diphenylhydrazine	99 U	ug/Kg
1,3-Dichlorobenzene	99 U	ug/Kg
1,4-Dichlorobenzene	99 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	99 U	ug/Kg
2,4,5-Trichlorophenol	99 U	ug/Kg
2,4,6-Trichlorophenol	99 U	ug/Kg
2,4-Dichlorophenol	99 U	ug/Kg
2,4-Dimethylphenol	99 U	ug/Kg
2,4-Dinitrophenol	490 U	ug/Kg
2,4-Dinitrotoluene	99 U	ug/Kg
2,6-Dinitrotoluene	99 U	ug/Kg
2-Chloronaphthalene	99 U	ug/Kg
2-Chlorophenol	99 U	ug/Kg
2-Methyl-4,6-dinitrophenol	490 U	ug/Kg
2-Methylnaphthalene	120	ug/Kg

U indicates not detected at the associated value

B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115066
Sample ID: FD-2A PUMP STATION VAULT
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
2-Methylphenol	99 U	ug/Kg
2-Nitroaniline	99 U	ug/Kg
2-Nitrophenol	99 U	ug/Kg
3,3'-Dichlorobenzidine	490 U J	ug/Kg
3-Nitroaniline	99 U	ug/Kg
4-Bromophenyl-phenylether	99 U	ug/Kg
4-Chloro-3-methylphenol	99 U	ug/Kg
4-Chloroaniline	99 U	ug/Kg
4-Chlorophenyl-phenylether	99 U	ug/Kg
4-Methylphenol	610	ug/Kg
4-Nitroaniline	99 U	ug/Kg
4-Nitrophenol	490 U	ug/Kg
Acenaphthene	120	ug/Kg
Acenaphthylene	99 U	ug/Kg
Aniline	99 U	ug/Kg
Anthracene	190	ug/Kg
Benzidine	490 U	ug/Kg
Benzo(a)anthracene	800 J	ug/Kg
Benzo(a)pyrene	770 J	ug/Kg
Benzo(g,h,i)perylene	520 J	ug/Kg
Benzofluoranthenes	1900 J	ug/Kg
Benzoic Acid	490 U	ug/Kg
Benzyl Alcohol	250	ug/Kg
Biphenyl	99 U	ug/Kg
bis(2-Chloroethoxy)methane	99 U	ug/Kg
bis(2-Chloroethyl)ether	99 U	ug/Kg
bis(2-Ethylhexyl)phthalate	6400 J	ug/Kg

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UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115066
Sample ID: FD-2A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Butylbenzylphthalate	1000	J	ug/Kg
Carbazole	240		ug/Kg
Chrysene	1200	J	ug/Kg
Di-n-butylphthalate	160		ug/Kg
Di-n-Octyl phthalate	680	J	ug/Kg
Dibenz(a,h)anthracene	120	J	ug/Kg
Dibenzofuran	99	U	ug/Kg
Dibenzothiophene	99	U	ug/Kg
Diethylphthalate	99	U	ug/Kg
Dimethyl phthalate	99	U	ug/Kg
Fluoranthene	1600		ug/Kg
Fluorene	180		ug/Kg
Hexachlorobenzene	99	U	ug/Kg
Hexachlorobutadiene	99	U	ug/Kg
Hexachlorocyclopentadiene	99	U	ug/Kg
Hexachloroethane	99	U	ug/Kg
Indeno(1,2,3-cd)pyrene	410	J	ug/Kg
Isophorone	99	U	ug/Kg
N-Nitroso-di-n-propylamine	99	U	ug/Kg
N-Nitrosodimethylamine	99	U	ug/Kg
N-Nitrosodiphenylamine	99	U	ug/Kg
Naphthalene	110		ug/Kg
Nitrobenzene	99	U	ug/Kg
Pentachlorophenol	2800		ug/Kg
Phenanthrene	1500		ug/Kg
Phenol	99	U	ug/Kg
Pyrene	4000	J	ug/Kg

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Lab#: 970115066
Sample ID: FD-2A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units

Reviewed By: Lori A. Zboralski 2/7/97

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J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 12, 1997

Lab#: 970115067 (38493)
Sample ID: FD-2CD
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	74.2	per cent
CV		
Mercury	0.234	mg/Kg
GC/ECD		
4,4-DDD	7.6 U	ug/Kg
4,4-DDE	7.6 U	ug/Kg
4,4-DDT	7.6 U J	ug/Kg
Aldrin	7.6 U	ug/Kg
alpha-BHC	7.6 U	ug/Kg
alpha-Chlordane	7.6 U	ug/Kg
Aroclor-1016	76 U	ug/Kg
Aroclor-1221	76 U	ug/Kg
Aroclor-1232	76 U	ug/Kg
Aroclor-1242	76 U	ug/Kg
Aroclor-1248	76 U	ug/Kg
Aroclor-1254	59 J	ug/Kg
Aroclor-1260	76 U	ug/Kg
beta-BHC	7.6 U	ug/Kg
delta-BHC	7.6 U	ug/Kg

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J indicates the associated value is estimated

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Lab#: 970115067
Sample ID: FD-2CD
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result	Units
	Dieldrin	7.6 U	ug/Kg
	Endosulfan I	7.6 U J	ug/Kg
	Endosulfan sulfate	7.6 U	ug/Kg
	Endosulfan-II	7.6 U	ug/Kg
	Endrin	7.6 U	ug/Kg
	Endrin aldehyde	7.6 U	ug/Kg
	Endrin ketone	7.6 U	ug/Kg
	gamma-BHC (Lindane)	7.6 U	ug/Kg
	gamma-Chlordane	7.6 U	ug/Kg
	Heptachlor	7.6 U	ug/Kg
	Heptachlor epoxide	7.6 U	ug/Kg
	Methoxychlor	38 U	ug/Kg
	Toxaphene	1900 U	ug/Kg
GC/MS-BNA			
	1,2,4-Trichlorobenzene	20 U	ug/Kg
	1,2-Dichlorobenzene	20 U	ug/Kg
	1,2-Diphenylhydrazine	98 U	ug/Kg
	1,3-Dichlorobenzene	98 U	ug/Kg
	1,4-Dichlorobenzene	98 U	ug/Kg
	2,2-oxybis(1-Chloropropane)	98 U	ug/Kg
	2,4,5-Trichlorophenol	98 U	ug/Kg
	2,4,6-Trichlorophenol	98 U	ug/Kg
	2,4-Dichlorophenol	98 U	ug/Kg
	2,4-Dimethylphenol	20 U	ug/Kg
	2,4-Dinitrophenol	490 U	ug/Kg
	2,4-Dinitrotoluene	98 U	ug/Kg
	2,6-Dinitrotoluene	98 U	ug/Kg
	2-Chloronaphthalene	98 U	ug/Kg

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Lab#: 970115067
Sample ID: FD-2CD
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Chlorophenol	98 U		ug/Kg
2-Methyl-4,6-dinitrophenol	490 U		ug/Kg
2-Methylnaphthalene	160		ug/Kg
2-Methylphenol	20 U		ug/Kg
2-Nitroaniline	98 U		ug/Kg
2-Nitrophenol	98 U		ug/Kg
3,3-Dichlorobenzidine	490 U	J	ug/Kg
3-Nitroaniline	98 U		ug/Kg
4-Bromophenyl-phenylether	98 U		ug/Kg
4-Chloro-3-methylphenol	98 U		ug/Kg
4-Chloroaniline	98 U		ug/Kg
4-Chlorophenyl-phenylether	98 U		ug/Kg
4-Methylphenol	760		ug/Kg
4-Nitroaniline	98 U		ug/Kg
4-Nitrophenol	490 U		ug/Kg
Acenaphthene	160		ug/Kg
Acenaphthylene	98 U		ug/Kg
Aniline	98 U		ug/Kg
Anthracene	430		ug/Kg
Benzidine	490 U		ug/Kg
Benzo(a)anthracene	2300	J	ug/Kg
Benzo(a)pyrene	2000	J	ug/Kg
Benzo(g,h,i)perylene	1200	J	ug/Kg
Benzofluoranthenes	5300	J	ug/Kg
Benzoic Acid	490 U		ug/Kg
Benzyl Alcohol	53		ug/Kg
Biphenyl	98 U		ug/Kg

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Lab#: 970115067
Sample ID: FD-2CD
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
bis(2-Chloroethoxy)methane	98	U	ug/Kg
bis(2-Chloroethyl)ether	98	U	ug/Kg
bis(2-Ethylhexyl)phthalate	7800	J	ug/Kg
Butylbenzylphthalate	1800	J	ug/Kg
Carbazole	720		ug/Kg
Chrysene	3900	J	ug/Kg
Di-n-butylphthalate	310		ug/Kg
Di-n-Octyl phthalate	580	J	ug/Kg
Dibenz(a,h)anthracene	300	J	ug/Kg
Dibenzofuran	120		ug/Kg
Dibenzothiophene	240		ug/Kg
Diethylphthalate	98	U	ug/Kg
Dimethyl phthalate	98	U	ug/Kg
Fluoranthene	5400		ug/Kg
Fluorene	280		ug/Kg
Hexachlorobenzene	98	U	ug/Kg
Hexachlorobutadiene	98	U	ug/Kg
Hexachlorocyclopentadiene	98	U	ug/Kg
Hexachloroethane	98	U	ug/Kg
Indeno(1,2,3-cd)pyrene	1000	J	ug/Kg
Isophorone	98	U	ug/Kg
N-Nitroso-di-n-propylamine	98	U	ug/Kg
N-Nitrosodimethylamine	98	U	ug/Kg
N-Nitrosodiphenylamine	20	U	ug/Kg
Naphthalene	130		ug/Kg
Nitrobenzene	98	U	ug/Kg
Pentachlorophenol	120	U	ug/Kg

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Lab#: 970115067
Sample ID: FD-2CD
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Phenanthrene	4600		ug/Kg
Phenol	98	U	ug/Kg
Pyrene	18000	J	ug/Kg
ICP			
Lead	220	J	mg/Kg
Zinc	321	J	mg/Kg

Reviewed By: Lori A. Zboralski 2/12/97

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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 11, 1997

Lab#: 970115068 (38494)
Sample ID: FD-3C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	73.0	per cent
CV		
Mercury	0.188	mg/Kg
GC/ECD		
4,4'-DDD	16	ug/Kg
4,4'-DDE	7.7 U	ug/Kg
4,4'-DDT	320 J	ug/Kg
Aldrin	7.7 U	ug/Kg
alpha-BHC	7.7 U	ug/Kg
alpha-Chlordane	7.7 U	ug/Kg
Aroclor-1016	77 U	ug/Kg
Aroclor-1221	77 U	ug/Kg
Aroclor-1232	77 U	ug/Kg
Aroclor-1242	77 U	ug/Kg
Aroclor-1248	77 U	ug/Kg
Aroclor-1254	130	ug/Kg
Aroclor-1260	77 U	ug/Kg
beta-BHC	7.7 U	ug/Kg
delta-BHC	7.7 U	ug/Kg

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J indicates the associated value is estimated

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Lab#: 970115068
Sample ID: FD-3C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
Dieldrin	7.7 U	ug/Kg
Endosulfan I	7.7 U J	ug/Kg
Endosulfan sulfate	7.7 U	ug/Kg
Endosulfan-II	7.7 U	ug/Kg
Endrin	7.7 U	ug/Kg
Endrin aldehyde	7.7 U	ug/Kg
Endrin ketone	7.7 U	ug/Kg
gamma-BHC (Lindane)	7.7 U	ug/Kg
gamma-Chlordane	7.7 U	ug/Kg
Heptachlor	7.7 U	ug/Kg
Heptachlor epoxide	7.7 U	ug/Kg
Methoxychlor	39 U	ug/Kg
Toxaphene	190 U	ug/Kg
GC/MS-BNA		
1,2,4-Trichlorobenzene	20 U	ug/Kg
1,2-Dichlorobenzene	20 U	ug/Kg
1,2-Diphenylhydrazine	99 U	ug/Kg
1,3-Dichlorobenzene	99 U	ug/Kg
1,4-Dichlorobenzene	99 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	99 U	ug/Kg
2,4,5-Trichlorophenol	99 U	ug/Kg
2,4,6-Trichlorophenol	99 U	ug/Kg
2,4-Dichlorophenol	99 U	ug/Kg
2,4-Dimethylphenol	20 U	ug/Kg
2,4-Dinitrophenol	500 U	ug/Kg
2,4-Dinitrotoluene	99 U	ug/Kg
2,6-Dinitrotoluene	99 U	ug/Kg
2-Chloronaphthalene	99 U	ug/Kg

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Lab#: 970115068
Sample ID: FD-3C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Chlorophenol	99 U		ug/Kg
2-Methyl-4,6-dinitrophenol	500 U		ug/Kg
2-Methylnaphthalene	550		ug/Kg
2-Methylphenol	20 U		ug/Kg
2-Nitroaniline	99 U		ug/Kg
2-Nitrophenol	99 U		ug/Kg
3,3'-Dichlorobenzidine	500 U	J	ug/Kg
3-Nitroaniline	99 U		ug/Kg
4-Bromophenyl-phenylether	99 U		ug/Kg
4-Chloro-3-methylphenol	99 U		ug/Kg
4-Chloroaniline	99 U		ug/Kg
4-Chlorophenyl-phenylether	99 U		ug/Kg
4-Methylphenol	690		ug/Kg
4-Nitroaniline	99 U		ug/Kg
4-Nitrophenol	500 U		ug/Kg
Acenaphthene	490		ug/Kg
Acenaphthylene	99 U		ug/Kg
Aniline	99 U		ug/Kg
Anthracene	1100		ug/Kg
Benzidine	500 U		ug/Kg
Benzo(a)anthracene	4500	J	ug/Kg
Benzo(a)pyrene	4600	J	ug/Kg
Benzo(g,h,i)perylene	3000	J	ug/Kg
Benzofluoranthenes	11000	J	ug/Kg
Benzoic Acid	530		ug/Kg
Benzyl Alcohol	31		ug/Kg
Biphenyl	99 U		ug/Kg

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Lab#: 970115068
Sample ID: FD-3C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
bis(2-Chloroethoxy)methane	99	U	ug/Kg
bis(2-Chloroethyl)ether	99	U	ug/Kg
bis(2-Ethylhexyl)phthalate	23000	J	ug/Kg
Butylbenzylphthalate	970	J	ug/Kg
Carbazole	1300		ug/Kg
Chrysene	5500	J	ug/Kg
Di-n-butylphthalate	870		ug/Kg
Di-n-Octyl phthalate	730	J	ug/Kg
Dibenz(a,h)anthracene	700	J	ug/Kg
Dibenzofuran	310		ug/Kg
Dibenzothiophene	370		ug/Kg
Diethylphthalate	99	U	ug/Kg
Dimethyl phthalate	99	U	ug/Kg
Fluoranthene	7100		ug/Kg
Fluorene	640		ug/Kg
Hexachlorobenzene	99	U	ug/Kg
Hexachlorobutadiene	99	U	ug/Kg
Hexachlorocyclopentadiene	99	U	ug/Kg
Hexachloroethane	99	U	ug/Kg
Indeno(1,2,3-cd)pyrene	2400	J	ug/Kg
Isophorone	99	U	ug/Kg
N-Nitroso-di-n-propylamine	99	U	ug/Kg
N-Nitrosodimethylamine	99	U	ug/Kg
N-Nitrosodiphenylamine	20	U	ug/Kg
Naphthalene	320		ug/Kg
Nitrobenzene	99	U	ug/Kg
Pentachlorophenol	120	U	ug/Kg

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Lab#: 970115068
Sample ID: FD-3C
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Phenanthrene	7200		ug/Kg
Phenol	99	U	ug/Kg
Pyrene	25000	J	ug/Kg
ICP			
Lead	172	J	mg/Kg
Zinc	420	J	mg/Kg

Reviewed By: Lori A. Zboralski 2/11/97

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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 07, 1997

Lab#: 970115069 (38495)
Sample ID: FD-3
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	63.1	per cent
GC/MS-BNA		
1,2,4-Trichlorobenzene	97 U	ug/Kg
1,2-Dichlorobenzene	97 U	ug/Kg
1,2-Diphenylhydrazine	97 U	ug/Kg
1,3-Dichlorobenzene	97 U	ug/Kg
1,4-Dichlorobenzene	97 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	97 U	ug/Kg
2,4,5-Trichlorophenol	97 U	ug/Kg
2,4,6-Trichlorophenol	97 U	ug/Kg
2,4-Dichlorophenol	97 U	ug/Kg
2,4-Dimethylphenol	97 U	ug/Kg
2,4-Dinitrophenol	480 U	ug/Kg
2,4-Dinitrotoluene	97 U	ug/Kg
2,6-Dinitrotoluene	97 U	ug/Kg
2-Chloronaphthalene	97 U	ug/Kg
2-Chlorophenol	97 U	ug/Kg
2-Methyl-4,6-dinitrophenol	480 U	ug/Kg
2-Methylnaphthalene	1300	ug/Kg

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J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115069
Sample ID: FD-3 15TH & 4 ST.
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Methylphenol	97 U		ug/Kg
2-Nitroaniline	97 U		ug/Kg
2-Nitrophenol	97 U		ug/Kg
3,3'-Dichlorobenzidine	480 U	J	ug/Kg
3-Nitroaniline	97 U		ug/Kg
4-Bromophenyl-phenylether	97 U		ug/Kg
4-Chloro-3-methylphenol	97 U		ug/Kg
4-Chloroaniline	97 U		ug/Kg
4-Chlorophenyl-phenylether	97 U		ug/Kg
4-Methylphenol	1000		ug/Kg
4-Nitroaniline	97 U		ug/Kg
4-Nitrophenol	480 U		ug/Kg
Acenaphthene	320		ug/Kg
Acenaphthylene	97 U		ug/Kg
Aniline	97 U		ug/Kg
Anthracene	790		ug/Kg
Benzidine	480 U		ug/Kg
Benzo(a)anthracene	3300	J	ug/Kg
Benzo(a)pyrene	3600	J	ug/Kg
Benzo(g,h,i)perylene	2800	J	ug/Kg
Benzofluoranthenes	8000	J	ug/Kg
Benzoic Acid	660		ug/Kg
Benzyl Alcohol	430		ug/Kg
Biphenyl	97 U		ug/Kg
bis(2-Chloroethoxy)methane	97 U		ug/Kg
bis(2-Chloroethyl)ether	97 U		ug/Kg
bis(2-Ethylhexyl)phthalate	29000	J	ug/Kg

U indicates not detected at the associated value
B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits
J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115069
Sample ID: FD-3
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Butylbenzylphthalate	1700	J	ug/Kg
Carbazole	810		ug/Kg
Chrysene	4700	J	ug/Kg
Di-n-butylphthalate	1100		ug/Kg
Di-n-Octyl phthalate	530	J	ug/Kg
Dibenz(a,h)anthracene	620	J	ug/Kg
Dibenzofuran	230		ug/Kg
Dibenzothiophene	300		ug/Kg
Diethylphthalate	97	U	ug/Kg
Dimethyl phthalate	110		ug/Kg
Fluoranthene	4900		ug/Kg
Fluorene	470		ug/Kg
Hexachlorobenzene	97	U	ug/Kg
Hexachlorobutadiene	97	U	ug/Kg
Hexachlorocyclopentadiene	97	U	ug/Kg
Hexachloroethane	97	U	ug/Kg
Indeno(1,2,3-cd)pyrene	2100	J	ug/Kg
Isophorone	97	U	ug/Kg
N-Nitroso-di-n-propylamine	97	U	ug/Kg
N-Nitrosodimethylamine	97	U	ug/Kg
N-Nitrosodiphenylamine	97	U	ug/Kg
Naphthalene	730		ug/Kg
Nitrobenzene	97	U	ug/Kg
Pentachlorophenol	480	U	ug/Kg
Phenanthrene	5500		ug/Kg
Phenol	97	U	ug/Kg
Pyrene	20000	J	ug/Kg

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Lab#: 970115069
Sample ID: FD-3
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units

Reviewed By: Lori A. Zboralski 2/7/96

U indicates not detected at the associated value
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J indicates the associated value is estimated
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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 07, 1997

Lab#: 970115070 (38496)
Sample ID: FD-3A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	66.9	per cent
GC/MS-BNA		
1,2,4-Trichlorobenzene	95 U	ug/Kg
1,2-Dichlorobenzene	95 U	ug/Kg
1,2-Diphenylhydrazine	95 U	ug/Kg
1,3-Dichlorobenzene	95 U	ug/Kg
1,4-Dichlorobenzene	95 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	95 U	ug/Kg
2,4,5-Trichlorophenol	95 U	ug/Kg
2,4,6-Trichlorophenol	95 U	ug/Kg
2,4-Dichlorophenol	95 U	ug/Kg
2,4-Dimethylphenol	95 U	ug/Kg
2,4-Dinitrophenol	470 U	ug/Kg
2,4-Dinitrotoluene	95 U	ug/Kg
2,6-Dinitrotoluene	95 U	ug/Kg
2-Chloronaphthalene	95 U	ug/Kg
2-Chlorophenol	95 U	ug/Kg
2-Methyl-4,6-dinitrophenol	470 U	ug/Kg
2-Methylnaphthalene	230	ug/Kg

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B indicates the value is greater than the detection limits of the method, however it is lower than the Contract Required Detection Limits

J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115070
Sample ID: FD-3A VAULT 15TH & 4
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Methylphenol	95 U		ug/Kg
2-Nitroaniline	95 U		ug/Kg
2-Nitrophenol	95 U		ug/Kg
3,3'-Dichlorobenzidine	470 U	J	ug/Kg
3-Nitroaniline	95 U		ug/Kg
4-Bromophenyl-phenylether	95 U		ug/Kg
4-Chloro-3-methylphenol	95 U		ug/Kg
4-Chloroaniline	95 U		ug/Kg
4-Chlorophenyl-phenylether	95 U		ug/Kg
4-Methylphenol	680		ug/Kg
4-Nitroaniline	95 U		ug/Kg
4-Nitrophenol	470 U		ug/Kg
Acenaphthene	630		ug/Kg
Acenaphthylene	95 U		ug/Kg
Aniline	95 U		ug/Kg
Anthracene	1800		ug/Kg
Benzidine	470 U		ug/Kg
Benzo(a)anthracene	6800	J	ug/Kg
Benzo(a)pyrene	6000	J	ug/Kg
Benzo(g,h,i)perylene	3300	J	ug/Kg
Benzofluoranthenes	15000	J	ug/Kg
Benzoic Acid	470 U		ug/Kg
Benzyl Alcohol	95 U		ug/Kg
Biphenyl	95 U		ug/Kg
bis(2-Chloroethoxy)methane	95 U		ug/Kg
bis(2-Chloroethyl)ether	95 U		ug/Kg
bis(2-Ethylhexyl)phthalate	13000	J	ug/Kg

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J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115070
Sample ID: FD-3A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Butylbenzylphthalate	1200	J	ug/Kg
Carbazole	1700		ug/Kg
Chrysene	7700	J	ug/Kg
Di-n-butylphthalate	120		ug/Kg
Di-n-Octyl phthalate	470	J	ug/Kg
Dibenz(a,h)anthracene	980	J	ug/Kg
Dibenzofuran	450		ug/Kg
Dibenzothiophene	550		ug/Kg
Diethylphthalate	95	U	ug/Kg
Dimethyl phthalate	95	U	ug/Kg
Fluoranthene	14000		ug/Kg
Fluorene	970		ug/Kg
Hexachlorobenzene	95	U	ug/Kg
Hexachlorobutadiene	95	U	ug/Kg
Hexachlorocyclopentadiene	95	U	ug/Kg
Hexachloroethane	95	U	ug/Kg
Indeno(1,2,3-cd)pyrene	3000	J	ug/Kg
Isophorone	95	U	ug/Kg
N-Nitroso-di-n-propylamine	95	U	ug/Kg
N-Nitrosodimethylamine	95	U	ug/Kg
N-Nitrosodiphenylamine	95	U	ug/Kg
Naphthalene	520		ug/Kg
Nitrobenzene	95	U	ug/Kg
Pentachlorophenol	470	U	ug/Kg
Phenanthrene	12000		ug/Kg
Phenol	95	U	ug/Kg
Pyrene	36000	J	ug/Kg

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Lab#: 970115070
Sample ID: FD-3A
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units

Reviewed By: Lori A. Zboralski 2/7/96

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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP
Date: February 07, 1997

Lab#: 970115071 (3 8497)
Sample ID: FD-3B
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	75.9	per cent
GC/MS-BNA		
1,2,4-Trichlorobenzene	110 U	ug/Kg
1,2-Dichlorobenzene	110 U	ug/Kg
1,2-Diphenylhydrazine	110 U	ug/Kg
1,3-Dichlorobenzene	110 U	ug/Kg
1,4-Dichlorobenzene	110 U	ug/Kg
2,2'-oxybis(1-Chloropropane)	110 U	ug/Kg
2,4,5-Trichlorophenol	110 U	ug/Kg
2,4,6-Trichlorophenol	110 U	ug/Kg
2,4-Dichlorophenol	110 U	ug/Kg
2,4-Dimethylphenol	110 U	ug/Kg
2,4-Dinitrophenol	550 U	ug/Kg
2,4-Dinitrotoluene	110 U	ug/Kg
2,6-Dinitrotoluene	110 U	ug/Kg
2-Chloronaphthalene	110 U	ug/Kg
2-Chlorophenol	110 U	ug/Kg
2-Methyl-4,6-dinitrophenol	550 U	ug/Kg
2-Methylnaphthalene	470	ug/Kg

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Lab#: 970115071
Sample ID: FD-3B VAULT PACIFIC # 4002
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Methylphenol	110	U	ug/Kg
2-Nitroaniline	110	U	ug/Kg
2-Nitrophenol	110	U	ug/Kg
3,3'-Dichlorobenzidine	550	U J	ug/Kg
3-Nitroaniline	110	U	ug/Kg
4-Bromophenyl-phenylether	110	U	ug/Kg
4-Chloro-3-methylphenol	110	U	ug/Kg
4-Chloroaniline	110	U	ug/Kg
4-Chlorophenyl-phenylether	110	U	ug/Kg
4-Methylphenol	120		ug/Kg
4-Nitroaniline	110	U	ug/Kg
4-Nitrophenol	550	U	ug/Kg
Acenaphthene	920		ug/Kg
Acenaphthylene	110	U	ug/Kg
Aniline	110	U	ug/Kg
Anthracene	1500		ug/Kg
Benzidine	550	U	ug/Kg
Benzo(a)anthracene	3900	J	ug/Kg
Benzo(a)pyrene	3600	J	ug/Kg
Benzo(g,h,i)perylene	2200	J	ug/Kg
Benzofluoranthenes	8000	J	ug/Kg
Benzoic Acid	550	U	ug/Kg
Benzyl Alcohol	200		ug/Kg
Biphenyl	110	U	ug/Kg
bis(2-Chloroethoxy)methane	110	U	ug/Kg
bis(2-Chloroethyl)ether	110	U	ug/Kg
bis(2-Ethylhexyl)phthalate	18000	J	ug/Kg

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Lab#: 970115071
Sample ID: FD-3B
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Butylbenzylphthalate	2700	J	ug/Kg
Carbazole	1000		ug/Kg
Chrysene	4400	J	ug/Kg
Di-n-butylphthalate	210		ug/Kg
Di-n-Octyl phthalate	930	J	ug/Kg
Dibenz(a,h)anthracene	590	J	ug/Kg
Dibenzofuran	560		ug/Kg
Dibenzothiophene	450		ug/Kg
Diethylphthalate	110	U	ug/Kg
Dimethyl phthalate	110	U	ug/Kg
Fluoranthene	6200		ug/Kg
Fluorene	1200		ug/Kg
Hexachlorobenzene	110	U	ug/Kg
Hexachlorobutadiene	110	U	ug/Kg
Hexachlorocyclopentadiene	110	U	ug/Kg
Hexachloroethane	110	U	ug/Kg
Indeno(1,2,3-cd)pyrene	1800	J	ug/Kg
Isophorone	110	U	ug/Kg
N-Nitroso-di-n-propylamine	110	U	ug/Kg
N-Nitrosodimethylamine	110	U	ug/Kg
N-Nitrosodiphenylamine	110	U	ug/Kg
Naphthalene	470		ug/Kg
Nitrobenzene	110	U	ug/Kg
Pentachlorophenol	550	U	ug/Kg
Phenanthrene	8200		ug/Kg
Phenol	110	U	ug/Kg
Pyrene	19000	J	ug/Kg

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Lab#: 970115071
Sample ID: FD-3B
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units

Reviewed By: Lori A. Zboralski 2/7/96

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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 12, 1997

Lab#: 970115072 (38498)
Sample ID: FD-4
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	69.5	per cent
CV		
Mercury	0.154	mg/Kg
GC/ECD		
4,4-DDD	7.6 U	ug/Kg
4,4-DDE	7.6 U	ug/Kg
4,4-DDT	18 J	ug/Kg
Aldrin	7.6 U	ug/Kg
alpha-BHC	7.6 U	ug/Kg
alpha-Chlordane	7.6 U	ug/Kg
Aroclor-1016	76 U	ug/Kg
Aroclor-1221	76 U	ug/Kg
Aroclor-1232	76 U	ug/Kg
Aroclor-1242	76 U	ug/Kg
Aroclor-1248	76 U	ug/Kg
Aroclor-1254	19 J	ug/Kg
Aroclor-1260	76 U	ug/Kg
beta-BHC	7.6 U	ug/Kg
delta-BHC	7.6 U	ug/Kg

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Lab#: 970115072
Sample ID: FD-4
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result	Units
	Dieldrin	7.6 U	ug/Kg
	Endosulfan I	7.6 U J	ug/Kg
	Endosulfan sulfate	7.6 U	ug/Kg
	Endosulfan-II	7.6 U	ug/Kg
	Endrin	7.6 U	ug/Kg
	Endrin aldehyde	7.6 U	ug/Kg
	Endrin ketone	7.6 U	ug/Kg
	gamma-BHC (Lindane)	7.6 U	ug/Kg
	gamma-Chlordane	7.6 U	ug/Kg
	Heptachlor	7.6 U	ug/Kg
	Heptachlor epoxide	7.6 U	ug/Kg
	Methoxychlor	38 U	ug/Kg
	Toxaphene	190 U	ug/Kg
GC/MS-BNA			
	1,2,4-Trichlorobenzene	20 U	ug/Kg
	1,2-Dichlorobenzene	20 U	ug/Kg
	1,2-Diphenylhydrazine	98 U	ug/Kg
	1,3-Dichlorobenzene	98 U	ug/Kg
	1,4-Dichlorobenzene	98 U	ug/Kg
	2,2-oxybis(1-Chloropropane)	98 U	ug/Kg
	2,4,5-Trichlorophenol	98 U	ug/Kg
	2,4,6-Trichlorophenol	98 U	ug/Kg
	2,4-Dichlorophenol	98 U	ug/Kg
	2,4-Dimethylphenol	20 U	ug/Kg
	2,4-Dinitrophenol	490 U	ug/Kg
	2,4-Dinitrotoluene	98 U	ug/Kg
	2,6-Dinitrotoluene	98 U	ug/Kg
	2-Chloronaphthalene	98 U	ug/Kg

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Lab#: 970115072
Sample ID: FD-4
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
2-Chlorophenol	98 U	ug/Kg
2-Methyl-4,6-dinitrophenol	490 U	ug/Kg
2-Methylnaphthalene	98 U	ug/Kg
2-Methylphenol	20 U	ug/Kg
2-Nitroaniline	98 U	ug/Kg
2-Nitrophenol	98 U	ug/Kg
3,3-Dichlorobenzidine	490 U J	ug/Kg
3-Nitroaniline	98 U	ug/Kg
4-Bromophenyl-phenylether	98 U	ug/Kg
4-Chloro-3-methylphenol	98 U	ug/Kg
4-Chloroaniline	98 U	ug/Kg
4-Chlorophenyl-phenylether	98 U	ug/Kg
4-Methylphenol	100	ug/Kg
4-Nitroaniline	98 U	ug/Kg
4-Nitrophenol	490 U	ug/Kg
Acenaphthene	180	ug/Kg
Acenaphthylene	98 U	ug/Kg
Aniline	98 U	ug/Kg
Anthracene	550	ug/Kg
Benzidine	490 U	ug/Kg
Benzo(a)anthracene	3000 J	ug/Kg
Benzo(a)pyrene	3100 J	ug/Kg
Benzo(g,h,i)perylene	1900 J	ug/Kg
Benzofluoranthenes	7100 J	ug/Kg
Benzoic Acid	490 U	ug/Kg
Benzyl Alcohol	20 U	ug/Kg
Biphenyl	98 U	ug/Kg

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Lab#: 970115072
Sample ID: FD-4 HOSMER & ETW
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
bis(2-Chloroethoxy)methane	98	U	ug/Kg
bis(2-Chloroethyl)ether	98	U	ug/Kg
bis(2-Ethylhexyl)phthalate	15000	J	ug/Kg
Butylbenzylphthalate	640	J	ug/Kg
Carbazole	700		ug/Kg
Chrysene	3700	J	ug/Kg
Di-n-butylphthalate	160		ug/Kg
Di-n-Octyl phthalate	890	J	ug/Kg
Dibenz(a,h)anthracene	520	J	ug/Kg
Dibenzofuran	150		ug/Kg
Dibenzothiophene	200		ug/Kg
Diethylphthalate	98	U	ug/Kg
Dimethyl phthalate	98	U	ug/Kg
Fluoranthene	4200		ug/Kg
Fluorene	280		ug/Kg
Hexachlorobenzene	98	U	ug/Kg
Hexachlorobutadiene	98	U	ug/Kg
Hexachlorocyclopentadiene	98	U	ug/Kg
Hexachloroethane	98	U	ug/Kg
Indeno(1,2,3-cd)pyrene	1700	J	ug/Kg
Isophorone	98	U	ug/Kg
N-Nitroso-di-n-propylamine	98	U	ug/Kg
N-Nitrosodimethylamine	98	U	ug/Kg
N-Nitrosodiphenylamine	20	U	ug/Kg
Naphthalene	98	U	ug/Kg
Nitrobenzene	98	U	ug/Kg
Pentachlorophenol	190	J	ug/Kg

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Lab#: 970115072
Sample ID: FD-4
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
Phenanthrene	4200		ug/Kg
Phenol	98	U	ug/Kg
Pyrene	16000	J	ug/Kg
ICP			
Lead	89.2	J	mg/Kg
Zinc	174	J	mg/Kg

Reviewed By: Lori A. Zbiralski 2/2/97

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- City of Tacoma -

Utility Services Laboratory

To: Christopher L. Getchell, Source Control Supervisor

Foss
AK80B9HRP

Date: February 12, 1997

Lab#: 970115073 (38499)
Sample ID: FD-5
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
CONVENTIONAL		
Solids	82.4	per cent
CV		
Mercury	0.021	mg/Kg
GC/ECD		
4,4-DDD	7.4 U	ug/Kg
4,4-DDE	7.4 U	ug/Kg
4,4-DDT	7.4 U J	ug/Kg
Aldrin	7.4 U	ug/Kg
alpha-BHC	7.4 U	ug/Kg
alpha-Chlordane	7.4 U	ug/Kg
Aroclor-1016	74 U	ug/Kg
Aroclor-1221	74 U	ug/Kg
Aroclor-1232	74 U	ug/Kg
Aroclor-1242	74 U	ug/Kg
Aroclor-1248	74 U	ug/Kg
Aroclor-1254	11 J	ug/Kg
Aroclor-1260	74 U	ug/Kg
beta-BHC	7.4 U	ug/Kg
delta-BHC	7.4 U	ug/Kg

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Lab#: 970115073
Sample ID: FD-5
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result	Units
	Dieldrin	7.4 U	ug/Kg
	Endosulfan I	7.4 U J	ug/Kg
	Endosulfan sulfate	7.4 U	ug/Kg
	Endosulfan-II	7.4 U	ug/Kg
	Endrin	7.4 U	ug/Kg
	Endrin aldehyde	7.4 U	ug/Kg
	Endrin ketone	7.4 U	ug/Kg
	gamma-BHC (Lindane)	7.4 U	ug/Kg
	gamma-Chlordane	7.4 U	ug/Kg
	Heptachlor	7.4 U	ug/Kg
	Heptachlor epoxide	7.4 U	ug/Kg
	Methoxychlor	37 U	ug/Kg
	Toxaphene	180 U	ug/Kg
GC/MS-BNA			
	1,2,4-Trichlorobenzene	19 U	ug/Kg
	1,2-Dichlorobenzene	19 U	ug/Kg
	1,2-Diphenylhydrazine	96 U	ug/Kg
	1,3-Dichlorobenzene	96 U	ug/Kg
	1,4-Dichlorobenzene	96 U	ug/Kg
	2,2-oxybis(1-Chloropropane)	96 U	ug/Kg
	2,4,5-Trichlorophenol	96 U	ug/Kg
	2,4,6-Trichlorophenol	96 U	ug/Kg
	2,4-Dichlorophenol	96 U	ug/Kg
	2,4-Dimethylphenol	19 U	ug/Kg
	2,4-Dinitrophenol	480 U	ug/Kg
	2,4-Dinitrotoluene	96 U	ug/Kg
	2,6-Dinitrotoluene	96 U	ug/Kg
	2-Chloronaphthalene	96 U	ug/Kg

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J indicates the associated value is estimated

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Lab#: 970115073
Sample ID: FD-5
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result		Units
2-Chlorophenol	96 U		ug/Kg
2-Methyl-4,6-dinitrophenol	480 U		ug/Kg
2-Methylnaphthalene	96 U		ug/Kg
2-Methylphenol	19 U		ug/Kg
2-Nitroaniline	96 U		ug/Kg
2-Nitrophenol	96 U		ug/Kg
3,3-Dichlorobenzidine	480 U	J	ug/Kg
3-Nitroaniline	96 U		ug/Kg
4-Bromophenyl-phenylether	96 U		ug/Kg
4-Chloro-3-methylphenol	96 U		ug/Kg
4-Chloroaniline	96 U		ug/Kg
4-Chlorophenyl-phenylether	96 U		ug/Kg
4-Methylphenol	96 U		ug/Kg
4-Nitroaniline	96 U		ug/Kg
4-Nitrophenol	480 U		ug/Kg
Acenaphthene	150		ug/Kg
Acenaphthylene	96 U		ug/Kg
Aniline	96 U		ug/Kg
Anthracene	480		ug/Kg
Benzidine	480 U		ug/Kg
Benzo(a)anthracene	2600	J	ug/Kg
Benzo(a)pyrene	2600	J	ug/Kg
Benzo(g,h,i)perylene	1800	J	ug/Kg
Benzofluoranthenes	5800	J	ug/Kg
Benzoic Acid	480 U		ug/Kg
Benzyl Alcohol	19 U		ug/Kg
Biphenyl	96 U		ug/Kg

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J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115073
Sample ID: FD-5 So . 18TH CEDAR
Sample Type: Sediment
Sample Date: 1/14/97

Test	Result	Units
bis(2-Chloroethoxy)methane	96 U	ug/Kg
bis(2-Chloroethyl)ether	96 U	ug/Kg
bis(2-Ethylhexyl)phthalate	3200 J	ug/Kg
Butylbenzylphthalate	4400 J	ug/Kg
Carbazole	500	ug/Kg
Chrysene	3200 J	ug/Kg
Di-n-butylphthalate	96 U	ug/Kg
Di-n-Octyl phthalate	210 J	ug/Kg
Dibenz(a,h)anthracene	440 J	ug/Kg
Dibenzofuran	96 U	ug/Kg
Dibenzothiophene	170	ug/Kg
Diethylphthalate	96 U	ug/Kg
Dimethyl phthalate	96 U	ug/Kg
Fluoranthene	4400	ug/Kg
Fluorene	270	ug/Kg
Hexachlorobenzene	96 U	ug/Kg
Hexachlorobutadiene	96 U	ug/Kg
Hexachlorocyclopentadiene	96 U	ug/Kg
Hexachloroethane	96 U	ug/Kg
Indeno(1,2,3-cd)pyrene	1500 J	ug/Kg
Isophorone	96 U	ug/Kg
N-Nitroso-di-n-propylamine	96 U	ug/Kg
N-Nitrosodimethylamine	96 U	ug/Kg
N-Nitrosodiphenylamine	19 U	ug/Kg
Naphthalene	96 U	ug/Kg
Nitrobenzene	96 U	ug/Kg
Pentachlorophenol	120 U	ug/Kg

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J indicates the associated value is estimated

UJ indicates not detected at the associated value, however the value should be considered estimated

Lab#: 970115073
Sample ID: FD-5
Sample Type: Sediment
Sample Date: 1/14/97

	Test	Result		Units
	Phenanthrene	3500		ug/Kg
	Phenol	96	U	ug/Kg
	Pyrene	13000	J	ug/Kg
ICP				
	Lead	50.2	J	mg/Kg
	Zinc	99.0	J	mg/Kg

Reviewed By: Lori A. Zboralski 2/12/97

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J indicates the associated value is estimated
UJ indicates not detected at the associated value, however the value should be considered estimated