King County and Seattle Public Utilities Source Control Program for the Lower Duwamish Waterway

January 2005 Progress Report

King County

Department of Natural Resources and Parks
Wastewater Treatment Division

Seattle Public Utilities

KING COUNTY AND SEATTLE PUBLIC UTILITIES SOURCE CONTROL PROGRAM FOR THE LOWER DUWAMISH WATERWAY

January 2005 Progress Report

Prepared for:

U.S. Environmental Protection Agency, Region 10
Seattle, WA

And

Washington State Department of Ecology
Bellevue, WA

Prepared by:

Seattle Public Utilities
700 5th Ave, Suite 4900
PO Box 34018
Seattle, WA 98124

And

King County Industrial Waste
130 Nickerson St, #200
Seattle, WA 98109

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

INTRODUCTION

This report describes the status of source control activities completed by King County and Seattle Public Utilities (SPU) from June 2004 through December 2004 as part of the Lower Duwamish Waterway (LDW) Superfund cleanup. Unlike last reporting period, where work focused on a single geographic area (Diagonal/Duwamish early action site), during the current reporting period, work occurred in multiple areas:

- Diagonal/Duwamish early action site
- Slip 4 early action site
- T117 early action site
- Former Slip 5 (early action site at river mile 3.8) and Slip 6 drainage basins
- East Waterway operable unit of the Harbor Island sediment cleanup site.

Source control activities conducted during this reporting period are summarized below:

- In the Diagonal Ave S CSO/SD service area (discharges to the Diagonal/Duwamish early action site), conducted initial inspections and completed follow-up inspections to ensure that businesses have made the corrections required during the first round of inspections that was completed during the last reporting period.
- Inspected businesses in the areas draining to the Slip 4 early action site, as well as other businesses located on the King County airport property in areas that drain to the former Slip 5 and Slip 6.
- Inspected businesses located in areas that discharge to the East Waterway via storm drains and combined sewer overflows. The East Waterway is outside the Lower Duwamish Waterway study area. King County and SPU are conducting source control work to support the Port of Seattle's ongoing sediment cleanup project in the East Waterway. Results from business inspections conducted in the East Waterway are presented in Appendix D.
- Deployed sediment traps in the Diagonal Ave S CSO/SD storm drain system, collected key manhole samples from the sanitary sewer, and collected sediment samples from catch basins on business sites and in public rights-of way to assist in tracing chemicals to their source.
- Conducted research and testing to identify methods for evaluating atmospheric deposition as a potential source of phthalates in stormwater runoff.
- Completed the removal of sediment from the Diagonal Ave CSO/SD.
- Conducted an interim cleanup to control PCBs found in street dirt and catch basin sediment in the roadways adjacent to the T117 early action site (Dallas Ave S cleanup project).

This progress report is organized by geographic area. The first section provides an overall summary of work completed during the June 1, 2004 to December 31, 2004 reporting period and describes Lower Duwamish Waterway wide activities such as the phthalate source study. Subsequent sections describe source control activities in each of the 5 geographic areas where work occurred this reporting period.

OVERVIEW OF LOWER DUWAMISH WATERWAY-WIDE SOURCE CONTROL ACTIVITIES

To support Lower Duwamish Waterway (LDW) sediment remediation efforts, King County and SPU are working together to reduce the amount of pollution discharged to public storm drains and sanitary/combined sewers that discharge to the waterway. The purpose of this source control program is to reduce the potential for waterway sediment to become recontaminated following cleanup. King County and SPU are key members of the Lower Duwamish Source Control Working Group because each manages a portion of the public stormwater and wastewater systems that discharge to the Lower Duwamish Waterway.

King County operates the large interceptor sewers that convey municipal and industrial wastewater to the treatment plant located at West Point and the storm drain system in unincorporated King County. Seattle operates the local sanitary/combined sewers that collect wastewater and route it to the King County interceptor system and the storm drains within the City of Seattle. The sanitary/combined sewer and storm drain service areas that discharge to the Lower Duwamish Waterway are shown in Figure 1. The sanitary/combined sewer and storm drains serve an area of about 19,800 and 9,100 acres, respectively.

As shown in Figure 2, a number of both public and private outfalls discharge to the LDW. Outfalls can generally be divided into the following categories.

- Public storm drains. Public storm drain systems collect and convey stormwater runoff from roadways and upland properties to the waterway.
- Private storm drains. Waterfront properties are generally served by private onsite drainage systems that discharge directly to the waterway. These systems are generally smaller than public storm drains and are owned and maintained by the private property owner.
- Combined sewer overflows (CSO). CSOs are located on the combined sewer system to release excess flows that occur during large storm events. Combined sewers collect both stormwater runoff and municipal/industrial wastewater. During large storm events, the capacity of the collection pipes can be exceeded due to the large amount of stormwater runoff entering the system. Overflow points are provided to prevent stormwater and wastewater from backing up and flooding roadways and local properties. CSOs can discharge directly to the waterway via a dedicated outfall pipe or via a shared outfall with a nearby storm drain system.
- Emergency overflows. Like CSOs, emergency overflows are relief points in the sanitary/combined sewer system. However, emergency overflows are not related to storm events. Instead, these overflows function to relieve backups that occur as a result of a pump station failure or obstruction in the conveyance system.
- Unknown outfalls. A number of piped outfalls of unknown origin discharge to the LDW. These outfalls are most likely private storm drains that serve waterfront properties, but may also include other systems such as industrial discharges.

Business Inspections

King County Industrial Waste and SPU are co-leads in the joint King County-Seattle program to inspect businesses in areas that discharge to the LDW through either the City-owned storm drain system or the combined sanitary/storm sewer system. Early action sites have the highest priority and within each early action site, inspections focus first on the separated storm drain basin followed by the combined sewer service area. The goal is to complete the business inspections before sediment cleanup begins. Separated storm drain basins are prioritized because storm drains discharge to the LDW on a regular basis (i.e., every time it rains), whereas combined sewer overflows discharge much less frequently, typically only during large storm events. The following agencies are participating on this project:

- King County Industrial Waste (KCIW): Wastewater Treatment Division.
- Seattle Public Utilities (SPU)
- King County Local Hazardous Waste Management: Water and Land Resources Division (KCHW)
- King County Local Hazardous Waste Management: Seattle-King County Public Health (KCPH)

Inspectors that worked on the project during the June 2004 through December 2004 reporting period are listed in below:

Seattle Public Utilities
Tasha Bassett
Ellen Stewart
Tanya Treat
Savina Uzunow
Ryean-Marie Woods

King County Industrial Waste
Lydia Eng
Arnaud Girard
Dave Haberman
Patricia Magnuson
Jim Sifford

King County Public Health
Diane Agasid

King County Hazardous Waste
Sue Hamilton
Lisa Niehaus
Ann Peacock
Emmanuel Rivera

Inspections are being conducted under existing King County and Seattle code authorities. King County has primary authority in the industrial waste and hazardous waste areas and with the exception of the stormwater discharges to the combined sewer. SPU has primary authority to regulate stormwater discharges. Code authority to regulate stormwater discharges to the combined sewer is shared by King County and Seattle. Because of overlapping and different authorities between the City and County regarding discharges to combined areas, project staff developed specific guidance for inspecting businesses in the combined areas. The goal for inspecting stormwater dischargers in combined areas is to minimize discharge of chemicals of

concern to the combined sewer by preventing the accidental or deliberate discharge of concentrated products or wastes to the combined sewer. Inspection procedures are described in Appendix A.

Summary for the June 2004-December 2004 Reporting Period

A total of 209 businesses were inspected between June 1, 2004 and December 31, 2004. Of these, 22 (16 percent) were screening visits, 116 (84 percent) were full site inspections, and 71 were follow-up inspections to verify compliance with corrective actions requested during the previous reporting period. Inspection locations are shown in Figure 3. A list of all sites inspected is provided in Appendix B, Table B-1. All of the follow-up inspections occurred in the Diagonal Ave S CSO/SD basin. Results are described in the section on the Diagonal/Duwamish early action area.

Corrective actions were required at 63 of the 116 sites (54 percent) where full inspections were conducted (see Table B-2 in Appendix B for details). As of December 31, 2004, 30 of these sites (48 percent) have made the required changes. A breakdown of all corrective actions requested within each program area (i.e., stormwater, industrial waste, hazardous waste, and spill prevention) is provided in Appendix B, Table B-3 and a list of numbers of corrective actions at each site by program area is provided in Table B-4. A detailed list of corrective actions requested for each site is provided in Table B-5.

Table 1 summarizes the percentage of total corrective actions by individual program areas. Problems with spill prevention and control were most common (59 percent) this reporting period followed by stormwater (26 percent), hazardous waste (14 percent), and industrial waste (1 percent). This is different than the previous reporting period where stormwater-related problems (50 percent) occurred most frequently, followed by spill prevention/cleanup (30 percent), hazardous waste (24 percent), and industrial waste (3 percent). The relative number of spill prevention/cleanup problems increased because the majority of the inspections this reporting period were conducted at the King County airport. Inspectors generally found that drainage facilities were well maintained by the airport. Most of the spill-related problems were fairly minor and were typically associated with tenant operations such as small hangar facilities and air transport facilities that lacked proper documentation of spill response protocols. Inspectors found that tenants generally did a good job cleaning up small spills that occurred at their facilities and were well informed about airport spill procedures. However, they often lacked a written spill plan. The most frequently requested corrective actions are summarized in Table 2.

Illicit Connections and Discharges

Three illicit connections and one illicit discharge were discovered during this reporting period. All were located on the portion of the King County airport that drains to the former Slip 5. Details are provided in the section on Slip 5.

Industrial Wastewater Discharge Authorizations

All business inspections include a review of wastewater/process water production and disposal. Businesses discharging wastewater to the sanitary sewer without proper authorization from King County are referred to KCIW for additional review and issuance of a discharge authorization, as necessary. KCIW can issue four types of discharge authorizations depending on the type of

business, the volume and characteristics of wastewater, and the potential risk to the wastewater collection and treatment system:

- Significant discharge: >25,000 gallons per day or federally regulated facility
- Major discharge: Generally 5,000 – 25,000 gallons per day and facility is not a federally regulated industry
- Minor discharge: Generally 1,000 – 5,000 gallons per day and facility is not a federally regulated industry
- Letter of authorization: Generally <1,000 gallons per day and facility is not a federally regulated industry.

All of the sites inspected during this reporting period had the proper authorization to discharge to the sanitary sewer, as appropriate. No sites were referred to KCIW for review and issuance of a discharge authorization.

Surface Water Quality Complaints

As shown in Table 3, between June 2004 and December 2004 SPU inspectors responded to 26 surface water quality complaints in the Lower Duwamish Waterway Basin (6 complaints in the storm drainage basin and 20 complaints in the combined sewer service area). Complaints are registered either from SPU's hotline number for citizens, or from internal or external agencies. The most common complaint involved automobile related fluids such as gasoline, diesel, and oil (8). The remaining complaints involved a variety of materials including wash water, sewage, and general flooding. Twenty-five of these complaints were resolved successfully, but the source of the problem could not be found for one complaint.

Construction Projects

There were 45 major construction sites in the Lower Duwamish Waterway that had active grading permits between June 2004 and December 2004 (Table 4). Major sites are defined as those with a cost of greater than $5M reported to the Seattle Department of Planning and Development (DPD). Five sites are located in the storm drain portion of the Diagonal Ave S CSO/SD service area, the largest of which is Sound Transit's Light Rail transit facility located on Airport Way S. Thirty-eight of the remaining sites are located in the combined sewer service area and two are located in the Lower Duwamish surface drainage basin (16th Ave SW and West Marginal Way S).

Spill Kit Pilot Incentive Program

In 2004, SPU began a pilot program offering free spill kits to local businesses that manufacture, store, use, or transport liquids as an incentive to improve onsite spill prevention and cleanup practices. The kits contain two absorbent booms, sorbent pads, and a drain cover, as well as personal protective equipment. The program is being administered by the Resource Venture, a program of the Greater Seattle Chamber of Commerce and the Environmental Coalition of South Seattle (ECOSS). Participating businesses fill out a standard spill response plan available online at www.resourceventure.org/spillkit.htm and receive a standard spill kit or a rebate coupon for up to 60 percent off a customized spill kit. The spill plan contains information about business activities that have the potential to contaminate stormwater, contact names for staff responsible

for responding to spills, and basic instructions about spill notification, response, cleanup, and disposal procedures. After the spill plan is completed, ECOSS delivers a spill kit to the business, offers technical assistance, and provides a laminated copy of the spill plan, facility map showing where the spill kit is stored, and a diagram showing how to dispose of hazardous and non-hazardous materials. The incentive program is available to all qualifying businesses in the City.

Source Tracing

Source tracing and identification sampling activities are being performed to support the source control efforts. Source tracing sampling is designed to identify sources by strategically collecting samples at key locations within the drainage/combined sewer service areas. Source identification sampling focuses on product testing to determine whether specific products contain chemicals that are a concern for waterway sediments.

Samples are collected at the following locations to identify sources of the chemicals of concern in the waterway sediment:

- Key manholes in the sanitary/combined sewer
- In-line sediment traps installed in the storm drain system
- Onsite catch basins
- Catch basins in the public right-of-way.

With the exception of the key manhole samples, sediment rather than whole water samples are being collected. Sediment samples offer a number of advantages. First, because sediment is the affected media in the waterway, analysis of sediment source material is key to understanding how pollutants are transported to the waterway. Second, sediment that accumulates in the drainage system provides a measure of pollutant contributions over a longer time period (what has been deposited since the system was last cleaned), whereas water samples provide only a snapshot of a single storm event. Also, unlike whole water samples, sediment samples do not usually present detection limit problems for the analytical laboratory. Contaminants present in the sediment can usually be quantified, which makes it easier to evaluate and interpret the sample results. Finally, sediment samples are generally easier and less expensive to collect than whole water samples.

Key Manhole Samples

KCIW regularly samples wastewater at key locations in the collection system. Twenty-four hour composite samples are collected over a 7-day period twice per year, once during the wet season and once during the dry season. Samples are normally analyzed for a suite of metals. In 2003, KCIW began analyzing samples for phthalates to provide a better understanding of the fate of phthalates in the LDW study area and as a possible tool to trace pollutant sources in the system. Figure 4 shows sampling stations located within the combined sewer service area discharging to the Lower Duwamish Waterway.

The first two sets of samples were collected in September 2003 (dry season) and April 2004 (wet season). Test results were provided in the previous progress report (King County and SPU,

2004). Another set of dry weather samples was collected during this reporting period (September 2004). Phthalate results for all samples are summarized in Table 5. For comparison purposes, Table 5 also presents results from stormwater samples collected from storm drains in Tacoma, SR-520, and the Diagonal Ave S CSO/SD, and wastewater samples collected from the plant influent at King County's Renton and West Point wastewater treatment plants.

Concentrations of bis(2-ethylhexyl)phthalate (BEHP) in the wet weather samples collected in April 2004 at the East Marginal and Duwamish pump stations (2-14 ug/L) are generally within the range of concentrations observed in stormwater samples (1-16 ug/L). However, BEHP concentrations in the West Marginal samples (13-52 ug/L) are greater than the stormwater samples and are similar to the concentrations measured in treatment plant influent (5-37 ug/L). The cause of the higher BEHP concentrations at the West Marginal station is unknown. Source investigations have not yet begun in this area. Further investigation will be conducted when source-tracing efforts expand into the west side of the Duwamish.

The dry weather samples collected at the East Marginal and Duwamish pump stations in September 2004 (5-40 ug/L), exhibit a broader range in BEHP concentrations than those collected in September 2003 (4-12 ug/L) and were also higher than the wet weather samples collected in April 2004 (2-14 ug/L). However, the average concentrations are fairly similar (6-15 ug/L in the dry weather samples versus 6 to 21 ug/L in the wet weather samples). In September 2003, one of the dry weather samples collected from the West Marginal pump station contained a significantly higher BEHP concentration (148 ug/L) than the other stations. However, this pattern was not observed in the samples collected in September 2004 (9-20 ug/L).

Phthalates other than BEHP that were detected in the key manhole samples include butylbenzylphthalate (100 percent), diethylphthalate (97 percent), di-*n*-butylphthalate (25 percent), dimethylphthalate (1 percent).

Sediment Trap Samples

In-line sediment traps consist of a small bracket mounted inside the collection system pipe that holds a wide-mouth sample bottle. The traps are installed for a period of 4 to 6 months to passively collect suspended particulate that passes by the site. Traps have been installed in the storm drain systems that discharge to Diagonal/Duwamish and Slip 4 early action sites, but at this time, results are only available for the Diagonal/Duwamish traps. Sampling results are discussed in the following sections for each individual geographic area.

Catch Basin Samples

Catch basin samples are grab samples of sediment that has accumulated in the catch basin sump. A catch basin is a storm drain structure that contains a sump to capture sediment and other debris before it can enter the collection system. Because many pollutants present in stormwater runoff tend to adhere to sediment, catch basins can also trap pollutants. The quality of sediment that accumulates in catch basins provides a measure of the quality of the stormwater runoff discharged to the drainage system since the catch basin was last cleaned. Catch basins must be cleaned on a regular basis to maintain their capacity to trap sediment and associated pollutants and prevent these materials from discharging to the downstream receiving water body. During this reporting period, sediment samples were collected from 9 onsite (1 in the Diagonal Ave S CSO/SD, 2 in T117, and 6 in the Slip 4 basin), and 8 right-of-way catch basins (in the Diagonal

Ave S CSO/SD basin). Sample locations are shown in Figure 5. To date, a total of 43 onsite and 39 right-of-way catch basin samples have been collected. Sample results are provided in Tables 6 and 7.

Sediment and soil samples were collected from an additional 85 locations in the public right-of-way near the T117 early action site. Samples included catch basin sediment, street dust, and soil samples from the public right-of-way and adjacent yards. Results for these samples are described in the section on T117.

Like storm drain sediment traps, there are currently no standards that apply specifically to catch basin sediment. For this analysis, results are compared to the state sediment management standards and the Washington State Model Toxics Control Act (MTCA) Method A cleanup levels. If catch basin sediment samples are below the sediment management standards, there is little chance of recontamination. However, an exceedance of a sediment management standard does not necessarily indicate that the sediment offshore of the outfall will exceed the standards, because particulates discharged from storm drains will mix with sediment in the waterway. Total petroleum hydrocarbon (TPH) results are compared to the MTCA cleanup levels to aid in assessing disposal options for sediment once it is removed from the catch basin.

Onsite Catch Basins

Onsite catch basin samples have been collected at sites of interest identified during the business inspections or simply at sites where sufficient sediment was available for chemical analysis. Most inspections during this reporting period were on the King County Airport property. The airport sweeps the roadways and tarmac areas at the airport on a daily basis to control foreign objects and debris (FOD) that could damage aircraft engines. As a result, most catch basins on the airport were clean and there was little opportunity for inspectors to collect samples.

Sampling locations are shown in Figure 5 and sample results for all samples collected to date are shown in Table 6. Key findings are summarized below:

- Arsenic (<20 – 40 mg/kg) was detected in about 47 percent of the samples. Concentrations were all below the sediment management standards.
- Copper (30-6,300 mg/kg) and lead (10-2,010 mg/kg) exceeded the sediment standards in 6 (15 percent) and 7 (18 percent) of the samples collected, respectively. All of the copper exceedances were above the cleanup screening level (CSL). For lead, five of the samples exceeded the CSL and seven exceeded the sediment quality standard (SQS). Most exceedances occurred in samples collected from automotive-related facilities (e.g., auto repair, gas station, and vehicle wash facilities). Other sites where samples exceeded standards included a manufacturing, a metal finishing, and a medical facility.
- Mercury (<0.06-1.82 mg/kg) was detected in about 72 percent of the samples, but exceeded the sediment management standards (SQS or CSL) in only 7 of the samples (16 percent).
- Zinc (55-2,720 mg/kg) exceeded the CSL in 9 samples (21 percent) and exceeded the SQS in 30 samples (70 percent)

- Polynuclear aromatic hydrocarbon (PAH) concentrations are consistently below the SQS standards. However, TPH-oil (52-77,000 mg/kg) exceeded the MTCA Method A cleanup level in 77 percent of the samples. The highest concentrations were measured at a vehicle steam-cleaning pad and an oil recycling facility. TPH-diesel concentrations (15-34,000 mg/kg) were consistently lower than the oil levels and exceeded the MTCA cleanup level in about 35 percent of the samples.
- PCBs were detected in about 60 percent of the samples, but only two samples exceeded the CSL and three samples exceeded the SQS.
- BEHP (10-2,700 mg/kg OC) exceeded the sediment management standards in all but 10 of the 43 samples collected. Most samples exceeded the CSL; 1 sample exceeded only the SQS. With the exception of the sample collected from the steam cleaning pad (2,700 mg/kg OC), the concentration of BEHP in most samples ranged from about 100-1,000 mg/kg OC.

Right-of Way Samples

Right-of-way samples were collected from catch basins located in a wide variety of roadways to evaluate whether contaminant levels are related to traffic density. Sample locations are shown in Figure 5 and results are presented in Table 7. Results from samples collected during this reporting period were similar to those from the previous reporting period. Zinc, TPH-oil, and BEHP are the contaminants that most frequently exceeded the sediment management standards (or MTCA Method A for TPH). Key findings are summarized below:

- With the exception of zinc, metals concentrations rarely exceeded the sediment management standards. None of the samples exceeded the SQS for copper and only two of the 39 samples collected to date (0.87 and 1.17 mg/kg) have exceeded the SQS for mercury. Mercury was detected in less than half of the samples. Lead concentrations exceeded the CSL in 2 samples. Arsenic was detected in 33 percent of the samples, but did not exceed the sediment management standards. Zinc exceeded the SQS in 12 samples (31 percent), but none of the samples exceeded the CSL.
- PAH concentrations are consistently below the SQS standards. However, TPH-oil (480-11,000 mg/kg) exceeded the MTCA Method A cleanup level for industrial soil in about 60 percent of the samples. One sample collected from an industrial roadway exceeded the MTCA cleanup level for TPH-diesel.
- PCBs were detected in about half the samples. One sample (RCB37) located off of Airport Way S and S Stevens St, exceeded the CSL for PCBs. SPU is currently working with adjacent property owners to investigate possible sources of PCBs in this area.
- Over 60 percent of the right-of-way samples exceeded either the CSL or the SQS for BEHP. The highest BEHP concentrations (460 and 502 mg/kg OC) occurred in two samples, one collected from an industrial roadway (RCB 1) and one from a high traffic arterial (RCB 36). BEHP concentrations were generally lower in samples collected from low to medium traffic roadways (15-110 mg/kg OC) compared to the higher traffic arterials (23-502 mg/kg OC). BEHP concentrations in freeway samples (18-277 mg/kg

OC) were within the range observed in the high traffic arterial samples (23-502 mg/kg OC).

Source Sediment Comparisons

Source to source comparisons are complicated by the limited number of samples collected and possible biases introduced by the different sampling strategies employed for each source type. For example, onsite catch basin samples were collected primarily where problems were suspected either because of the kinds of activities conducted onsite or because of specific problems identified during business inspections. General observations and comparisons are described below:

- Contaminant concentrations were generally higher in samples collected from onsite catch basins compared to right-of-way samples. For example, BEHP concentrations in most of the right-of-way samples ranged from about 15-300 mg/kg OC compared to 12-1,000 mg/kg OC in the onsite samples. As shown in Table 6, exceedances of sediment management standards for metals were also more frequent in the onsite samples.
- Few of the sediment samples collected from onsite (2 of 43 samples) and right-of-way (2 of 40 samples) catch basin samples and inline sediment traps (0 of 11 samples) exceeded the sediment management standards for PCBs and PAHs. Therefore, it is unlikely that these chemicals will be a problem in waterway sediment following cleanup.
- BEHP poses the most serious concern for recontamination in waterway sediment after cleanup. Concentrations frequently exceeded the sediment management standards in all of the samples collected (79 percent, 64 percent, and 83 percent in the onsite catch basins, right-of-way catch basins, and inline sediment traps, respectively (Table 8).

Phthalate Source Study

Phthalates, particularly bis(2-ethylhexyl)phthalate (BEHP), are contaminants of concern in the majority of the early action sites in the Lower Duwamish Waterway. Phthalates are a class of industrial compounds commonly used as softeners in plastics, as solvents, as oil in vacuum pumps and electric capacitors and transformers, and as carriers for fragrances and pesticides. They have also been reported in personal care products (Houlihan et. al., 2002). BEHP is the most prevalent phthalate in the Duwamish sediments, and is a contaminant of concern at the majority of the early action sites, including the Duwamish/Diagonal, former Slip 5 at river mile 3.8, Slip 4, Trotsky, and Norfolk sites. BEHP is also frequently detected in stormwater and catch basin samples (USEPA 1983; Herrera 1998; Tacoma 1990; Tacoma 1999; Tacoma 2002.

Because they are a regional concern extending beyond the Duwamish Waterway, King County and SPU joined with the City of Tacoma in 2003 to test various commonly used products and materials to help identify the source of these chemicals. The intent of that testing was to use information about the phthalate content of common consumer products in conjunction with the source tracing efforts to identify specific sources of phthalates to the storm drains and the sanitary sewer. In addition, project staff hoped to identify specific products low in phthalates that they could recommend as replacement products to businesses and residents.

The results of the first round of product testing were reported in the previous progress report (King County and SPU, 2004). Testing of a variety of liquid and solids products found high levels of phthalates, particularly BEHP in brake pads, serpentine belts, and tires but only low levels of phthalates in liquid products. These solid products may be a source of phthalates to the waterway via either atmospheric deposition or direct deposition of worn product particles onto roadway surfaces and subsequent wash off in stormwater runoff. The literature review also suggests that some vehicle fuel products, such as diesel, contain BEHP that may be released into the atmosphere in the exhaust (California Air Resources Board, 1997). Atmospheric deposition is suggested by the results from sampling phthalates on the Tacoma Dome roof.

To evaluate whether atmospheric deposition is a significant source of phthalates in stormwater runoff in the LDW, work during this reporting period focused on investigating methods for collecting samples of particulate material from air. Efforts have focused on literature review, methods development, selection of sampling locations, and the preparation of a sampling and analysis plan (see Appendix C).

Air deposition of chemicals of concern can occur through either "dry" or "wet" deposition. In dry deposition gaseous or particulate phase contaminants deposit directly on a surface via gravity. In wet deposition gaseous or particulate phase contaminants become dissolved or interspersed in an aqueous suspension that then deposits on a surface via gravity rainfall or snow.

Dry deposition is generally evaluated by use of high-volume (i.e., "Hi-Vol") samplers. Wet deposition is generally evaluated by use of a sampler that only collects precipitation when rainfall is occurring. It is common to find both types of samplers in an air deposition sampling station. A third type of sampler, passive (total) deposition samplers are constantly open to collect rainfall and some atmospheric particulates. Because of the complexity and expense of developing a full sampling station, passive air deposition sampling (i.e., power vacuum is not used to facilitate sample collection) was selected for this initial phase of the project.

Three prototypes of a passive deposition sampler apparatus were tested at the King County Environmental Laboratory (near the Fremont neighborhood in Seattle) from November 23, 2004 to December 7, 2004. Each sampler consisted of a 1.14-ft diameter stainless steel mixing bowl (with drilled hole and welded 3/8" stainless steel union) attached to a 5-gallon glass carboy. The King County Environmental Laboratory analyzed the samples for phthalates.

The levels of bis(2-ethylhexyl)phthalate in the samples (approximately 0.2 to 0.3 µg/L) compare reasonably well with the 0.4 µg/L wet deposition value from a study of the Georgia Basin air shed (Belzer, 2004). The associated blank level for bis(2-ethylhexyl)phthalate is still a concern, but efforts are ongoing at the King County Environmental Laboratory to evaluate the ability of the analytical method to accommodate the extraction of larger volumes of water.

Based on the results from the prototype samplers, the next phase of sampling will involve collecting aqueous samples from sites in the Lower Duwamish Waterway study area using passive deposition samplers. Sampling is expected to last from January 2005 through April 2005. A total of four (4) stations will be used for testing. The Puget Sound Clean Air Agency (PSCAA) owns two of the stations and the Washington State Department of Ecology (Ecology) owns the other two stations:

- Olive Way and Boren Ave

- 15th S & Charlestown on Beacon Hill
- 4752 E Marginal Way S
- 6431 Corson Ave S in the Georgetown neighborhood.

Sites in the South Park Neighborhood are also being investigated for testing.

Samples will be collected from January 2005 to April 2005. Sampling intervals can vary between 2-weeks to 4-weeks, depending on rainfall amounts. The goal is to collect between 4 to 8 liters of precipitation. King County Industrial Waste will monitor the precipitation at SeaTac International Airport and determine when it is time to retrieve the samplers from the stations. Equipment rinsate blanks will be collected for each individual sampler.

DIAGONAL/DUWAMISH EARLY ACTION SITE

The combined sewer service area in the Diagonal/Duwamish basin encompasses about 4,900 acres and the storm drain basin covers about 2,600 acres (Figure 6). Both systems share the same outfall. There are 7 separate combined sewer overflow points in the system, Seattle operates 6 and overflows from the King County system discharge to the Diagonal system at one location. Overflow locations within the Diagonal system are shown on Figure 6.

Locations on Figure 6 where the combined sewer service and storm drain service systems overlap are known as partially separated areas. In these areas, stormwater runoff can discharge to either the separated storm drain system or the combined system, depending how the individual storm drain inlets are plumbed.

Land use in the Diagonal service area is a mix of residential, commercial, and industrial properties. As shown in Figure 7, the western portion of the basin is predominately industrial and the eastern side is mostly residential. Commercial areas are generally located along the major transportation corridors, (e.g., Rainier Ave S and Beacon Ave S). Land use in the basin is summarized in Table 9.

Business Inspections

A total of 25 businesses were inspected in the Diagonal/Duwamish basin between June 1, 2004 and December 31, 2004. Of these, 4 (16 percent) were screening visits and 21 (84 percent) were full site inspections. Inspection locations are shown in Figure 8. A list of all sites inspected is provided in Appendix B, Table B-1. Corrective actions were required at 16 of the sites where full inspections were conducted (76 percent). By December 31, 2004, 9 of the sites where corrective actions requested (56 percent) had achieved compliance.

A breakdown of all corrective actions requested within each program area (i.e., stormwater, industrial waste, hazardous waste, and spill prevention) is provided in Appendix B (Table B-3) and a list of numbers of corrective actions at each site by program area is provided in Table B-4. A detailed list of corrective actions requested for each site is provided in Table B-5.

The most frequently requested corrective actions are shown in Table 2. Lack of onsite materials for controlling and cleaning up spills was the most common problem found during this reporting period (94 percent of the sites where corrective actions requested). Other frequent problems included lack of written spill prevention and cleanup plan (69 percent), inadequate employee training on spill response (63 percent), and need for cleaning of onsite drainage facilities (63 percent).

In addition to the initial site inspections in this basin, 71 follow-up inspections were conducted to verify compliance at sites inspected in the previous reporting period. Of the 65 sites that were out of compliance as of the previous reporting date (June 1, 2004), 50 have achieved overall compliance. Inspectors are currently working with the remaining 15 sites to achieve compliance.

Key Findings

No significant sources of contaminants to the waterway were found during the business inspections. Instead, as described above, many small problems/corrective actions were identified

at numerous businesses throughout the Duwamish Diagonal basin. Key findings related to illicit connections and discharges, unauthorized discharges of industrial wastewater to the sanitary sewer, and presence of elevated levels of contaminants in onsite catch basin samples are described in the following sections.

Illicit Connections and Discharges

No new illicit connections were discovered in the Diagonal Ave S CSO/SD during this reporting period. The four identified during the previous reporting period were corrected as reported in the last progress report (King County and SPU 2004).

SPU is continuing to work with Ralph's Concrete and Pumping where an illicit discharge was discovered during the previous reporting period. Ralph's generally routes water used to rinse concrete trucks through a series of settling trays, trenches, and drums, and then recycles the water back into the concrete trucks. However, SPU discovered that Ralph's occasionally discharges excess concrete wastewater into the public right-of-way and the wastewater then enters the Diagonal drainage system at catch basins on Poplar Place S. SPU issued a Notice of Violation (NOV) to Ralph's on December 15, 2003 and referred the problem to Ecology on May 12, 2004 after 2 additional violations occurred. In December 2004, the City of Seattle filed a lawsuit in Seattle Municipal Court to enforce the NOV. Ralph's Concrete has submitted an application to King County Industrial Waste to discharge wastewater to the sanitary sewer. County staff will review plans and develop discharge requirements before issuing a permit.

Source Sampling and Identification

Source Tracing in the Diagonal Ave S CSO/SD

In October 2004, KCIW conducted a source tracing effort to determine whether contaminated groundwater from a nearby leaking underground storage tank (LUST) site was infiltrating into the storm drain and sewer systems.

Background

The LUST site, located on the Union Pacific Railroad (UPR) property at 4300 Colorado Ave S, was identified when petroleum hydrocarbons were found in the groundwater beneath four underground storage tanks that were removed in 1990-1992. Investigation and clean up began in 1999.

In March 2000, a release of diesel was discovered at the fueling facility. In July, Union Pacific completed the constructed an interceptor trench down gradient of the fueling facility and began pumping operations to recover the diesel material. By August, a total of 21,300 gallons of pure product had been recovered. The groundwater pumping system continued to operate until April 2001. At that time the total volume of diesel fuel recovered by the system was 38,500 gallons.

An air sparging system was constructed in May 2001 to continue remediating groundwater at the site. This system was shut off in May 2004 to correct electrical problems and to allow for an evaluation of natural attenuation of the site in the absence of air injection.

Source Tracing Results

KCIW staff collected samples in both the Diagonal Ave S CSO/SD and the local sanitary sewer to determine if shutdown of the air sparging system had caused petroleum hydrocarbons to infiltrate into utilities in the area. Grab samples were collected October 13, 2004 between 10:00 and 11:00 AM at the following three locations:

- Diagonal Ave S CSO/SD at Diagonal Ave S and Colorado Ave S (D056-136)
- Diagonal Ave S CSO/SD at Diagonal Ave S and Denver Ave S (D056-135)
- 36-inch combined sewer at Diagonal Ave S and Denver Ave S (S056-168).

The tidal height during this time was 3 feet. The weather was clear and dry and there had been no precipitation during the previous 96 hours. Samples were analyzed for diesel and oil range hydrocarbons by the Northwest Total Petroleum Hydrocarbons Diesel-Extended (NWTPH-Dx) method. Sample results are provided in Table 10.

All parameters were at background concentrations for stormwater and sanitary sewage. Although these results did not show infiltration when the samples were collected, changes in the configuration and flow of any diesel plume could cause different results in the future. Source control staff will remain vigilant for any evidence of infiltration in future sampling or inspection events.

In-Line Sediment Traps

Traps are installed at 7 sites in the Diagonal Ave CSO/SD basin (Figure 9). Station locations were selected to isolate individual subbasins within the larger storm drain system. During this reporting period, sediment traps were removed and redeployed in July-August. Only Stations ST1 and ST2 contained sufficient volume of sediment for chemical analyses. The remaining 5 stations could not be analyzed due to insufficient sample volume. A total of three rounds of sediment trap samples have been collected to date:

- Round 1: February 2003 – August 2003
- Round 2: August 2003 – February 2004
- Round 3: February 2004 – August 2004.

It is anticipated that traps will continue to be deployed over the next 2-3 years to track changes in suspended particulate quality that may occur as a result of source control activities. SPU is working to modify trap installations to improve sediment capture.

Results from all three rounds of samples are presented in Table 11. There are no standards for sediment trap samples. For the purpose of this analysis, sample results are compared to the sediment management standards. Particulates discharged from storm drain outfalls are transported and deposited over a large area in the waterway and mix with sediment from other sources (e.g., natural sedimentation and sediment transport processes within the waterway).

Therefore, an exceedance of a sediment management standard in the in-line sediment samples does not necessarily indicate that the sediment offshore of the outfall will exceed the standards.

Key results are summarized below:

- PCBs are infrequently detected and no samples exceed the sediment management standards.
- With the exception of zinc, metals concentrations are generally low. Zinc exceeded the SQS at 3 stations (ST3, ST5, and ST6) during the first two rounds. Station ST1 exceeded the CSL during the first round, but exceeded only the SQS in the samples collected during the second and third rounds.
- BEHP continues to be the primary contaminant of concern in the Diagonal Ave S CSO/SD. Concentrations have exceeded the CSL in all samples collected to date from Stations ST1, ST2, ST3, and ST6. No exceedances were observed in the samples collected from Stations ST5 and ST7. The approximately 300-acre drainage basin upstream of station ST5 is predominately residential. The basin at station ST7 (approximately 200 acres) contains a mixture of residential and industrial properties.
- Polynuclear aromatic hydrocarbon (PAH) concentrations are consistently below the SQS at all trap locations.

Catch Basin Samples

Onsite Catch Basins

One onsite catch basin sample (CB 38) was collected in the Diagonal Ave S CSO/SD basin during this reporting period (Figure 10). As shown in Table 6, concentrations of most chemicals were fairly low. TPH heavy oil (3,300 mg/kg) exceeded the MTCA Level A cleanup level and BEHP (78.1 mg/kg OC) exceeded the SQS.

One of the two catch basins containing elevated concentrations of contaminants that remained to be cleaned from last reporting period has since been cleaned (CB22 cleaned on November 1, 2004). SPU is continuing to work on having the second catch basin cleaned (CB19). Negotiations with the tenant failed and SPU is now working with the property owner to have this catch basin cleaned.

Right-of-Way Catch Basins

Sediment samples were collected from 8 catch basins in the public right-of-way during this reporting period (Figure 10). Two samples RCB36 (mercury) and RCB37 (PCBs and TPH-oil)) contained elevated levels of contaminants. Additional sampling has been conducted in the roadways around RCB37. PCBs appear to be limited to one small drainage system on S Stevens St. SPU is working with adjacent property owners to identify possible sources and will have the system cleaned in 2005.

Source Control Actions

Diagonal Ave S CSO/SD Cleaning

The Diagonal Ave S CSO/SD cleaning project started in 2002 as part of an agreement with the Elliott Bay Duwamish Restoration Panel to eliminate a potential source of contamination to the Duwamish/Diagonal sediment cleanup site, which was dredged and capped by King County in 2002-2003. Initial sampling conducted in 2002, indicated that sediment that had accumulated in the lower section of the Diagonal Ave S CSO/SD contained elevated concentrations of lead, mercury, zinc, total petroleum hydrocarbons (NWTPH-Dx), phthalates, PAH, and PCBs. Sampling station locations are shown on Figure 11 and results are presented in Table 12.

Exceedances of Washington State Sediment Management Standards (SMS) are highligted in Table 12. The SMS do not apply to storm drain sediments, but are used in this report to provide a rough indication of the storm drain sediment quality. Sediments discharged from storm drains are highly dispersed in the receiving environment and mix with sediment from other sources before depositing in the area offshore of the outfall. Therefore, comparison of storm drain sediment to SMS is considered conservative. The SMS establish two levels:

- Sediment quality standards (SQS): Concentrations below the SQS are expected to have no adverse effects on biological resources and no significant human health risk.
- Cleanup screening level (CSL): Minor effects level used to identify areas of potential concern.

There were no exceedances of SMS for metals in the sediment samples collected from the Diagonal 144-inch diameter mainline. Zinc exceeded the SQS (410 mg/kg) in the Duwamish Ave S (460 mg/kg) and Denver Ave S (580 mg/kg) laterals. Lead (538 mg/kg) and mercury (1.02 mg/kg) exceeded the CSL in the Duwamish Ave S lateral. Bis(2-ethylhexyl)phthalate exceeded either the CSL or the SQS in all of the mainline (86-882 mg/kg OC) and laterals (43-278 mg/kg OC). In addition, butylbenzyl phthalate exceeded the SQS in the Duwamish Ave S (8.2 mg/kg OC), Denver Ave S (15.8 mg/kg OC), and 1st Ave S laterals (5.1 mg/kg OC). PCBs (Aroclors 1254 and 1260) exceeded the SQS at one station on the Dakota Ave S lateral (35.6 mg/kg OC).

In 2002, SPU crews cleaned approximately 2,800 feet of pipe in the Denver Ave S and 1st Ave S laterals (Figure 11). In 2003, a contractor cleaned about 2,000 feet of the mainline (from 4th Ave S to Colorado Ave S) and about 500 feet if the S Dakota St lateral (from 5th Ave S and 2nd Ave S), but was unable to complete the work before the winter wet season. The lower portion of the Diagonal system is tidally influenced and was taken out of service for cleaning by closing the shear gate on the outlet structure. Because the gate also prevented stormwater from leaving the pipe, a bypass was installed to divert base flow from the upper end of the Diagonal system. Bypass flow was pumped to the sanitary sewer. Cleaning operations were stopped in September 2003, when weather conditions changed and the drainage system had to be brought back on line. Approximately 270 cubic yards of sediment were removed from the mainline and 16 cubic yards were removed from the S Dakota St lateral. Sections of pipe that were cleaned in 2003 are shown in Figure 11.

In 2004, SPU inspected and collected sediment samples in the sections of the Diagonal system that remained to be cleaned. Two large storm events occurred in October-November 2003 that redistributed sediment in the lower section of the Diagonal system. Only 4 to 6 inches of sediment remained in the 144-inch diameter mainline, but the 54-inch diameter S Dakota lateral was still 25 to 50 percent full of sediment. Concentrations measured in 2 samples collected from the mainline (at E Marginal Way S and near 4th Ave S) were generally lower in 2004 compared to the samples collected in 2002 (see Table 12). For example, sediment collected at the station below E Marginal Way S no longer exceeded SMS for PAH and bis(2-ethylhexyl)phthalate exceeded the SQS, but not the CSL at both stations. Because most of the sediment in the mainline had been flushed out of the drain (and was subsequently removed by King County dredging operations) and because the remaining sediment contained lower concentrations of contaminants, SPU decided to discontinue cleaning operations in the mainline and to focus efforts on cleaning the S Dakota lateral.

In preparation for cleaning, SPU installed a new maintenance hole on the S Dakota St lateral in August 2004 to provide access to the pipe. SPU crews then cleaned the remaining approximately 915 feet in the S Dakota St lateral using a drag line dredge followed by pressure washing. Material removed from the pipe was collected, dewatered, and shipped offsite for disposal. Sediment samples were collected during cleaning operations to characterize sediment removed from the lateral. Sample results are provided in Table 12. BEHP concentrations exceeded the CSL in two of the three samples, mercury exceeded the SQS in two of the three samples, and zinc exceeded the SQS in one sample. PCB concentrations were below the SQS in all three samples.

Approximately 160 cubic yards of sediment was removed from the S Dakota St lateral in 2004. Video inspection conducted following cleanup, indicate that, in places, sediment is still caked on the sidewall of the pipe. SPU plans to jet these sections of the line in early 2005 to remove the remaining sediment. An estimated 5-10 cubic yards of material remains to be cleaned.

SLIP 4 EARLY ACTION SITE

The combined sewer service area in the Slip 4 basin encompasses about 6,200 acres and the storm drain basin covers about 467 acres. There are no storm-related combined sewer overflow discharges to Slip 4. The City (pump station 44) and King County (East Marginal Way pump station) both maintain emergency overflows on pump stations that discharge to Slip 4, but these pump stations overflow infrequently. The City pump station has not overflowed in the past 5 years (when the City started maintaining pump station records) and the King County pump station has not overflowed in the last 20 years. Both pump stations are equipped with emergency generators. Because discharges from the combined sewer service area are infrequent, source control work in Slip 4 focused on the separated drainage system.

Areas draining to Slip 4 are shown in Figure 12. Four public storm drains (Slip 4 SD, Slip 4 CSO/SD, Georgetown flume, and the I-5 storm drain) and ten private storm drains discharge to Slip 4. Land use in the basin is primarily industrial/commercial. The Slip 4 SD, which drains the northern portion of the King County Airport, encompasses a large portion of the Slip 4 drainage area (290 acres). Emergency overflows from City pump station 44 also now discharge to this drain. The drainage system at the airport has been modified numerous times. In about 1985, runoff from approximately 90 acres at the north end of the airport that used to discharge to the Slip 4 CSO/SD was diverted to the Slip 4 SD (Striplin 2004). This diversion also included the emergency overflow from City pump station 44. The Slip 4 CSO/SD now drains only about 3 acres on the north end of the airport.

The Georgetown flume, constructed in the early 1900s, originally discharged cooling water from the Georgetown Steam Plant to the Duwamish Waterway. Cooling water discharges to the flume stopped in the 1960s when the steam plant was shut down (Striplin 2004). Prior to about 1985, numerous storm drains and pipes from adjacent properties were also plumbed to the flume. At one time, runoff from an estimated 90 acres in the north end of the airport (North Boeing Field) as well as industrial wastewater discharged to the flume. In 1985-1987, Seattle City Light plugged all pipes entering the flume, except one 15-inch pipe from a Boeing yard (Striplin 2004). The flume now drains an estimated 3 acres and also continues to receive industrial discharges from Boeing.

The I-5 drain collects runoff from approximately 1.5 miles of I-5 (80 acres), 22 acres of single family residential property located east of I-5, and 1-2 acres on the north end of the King County airport. The small private drains that discharge to Slip 4 also serve mostly industrial and commercial areas immediately adjacent to the slip (approximately 50 acres).

Business Inspections

A total of 46 businesses were inspected in the Slip 4 basin between June 1, 2004 and December 31, 2004. Of these, 8 (17 percent) were screening visits and 38 (83 percent) were full site inspections. To date, all but three of the airport tenants (not including the Boeing-lease facilities) have been inspected. Inspectors could not access Boeing facilities. Inspection locations are shown in Figure 13. A list of all sites inspected is provided in Appendix B, Table B-1. Sixty-three percent of the sites where full inspections were conducted required some type of corrective action (see Table B-2, Appendix B). Three of the sites with full site visits have not yet been

issued corrective actions letters. By December 2004, 67 percent of all sites with corrective actions requested have made the changes that were required.

Most of the problems found in Slip 4 (64 percent) were related to spill prevention and cleanup (see Table 1). A breakdown of all corrective actions requested within each program area (i.e., stormwater, industrial waste, hazardous waste, and spill prevention) is provided in Appendix B (Table B-3).

The most frequently requested corrective actions are summarized in Table 2. Lack of a written spill prevention/cleanup plan and lack of employee training on spill response procedures were the two most frequent problems, occurring at 79 percent and 75 percent, respectively of the sites with corrective actions requested. Other common problems included lack of adequate spill control materials onsite (45 percent) and need for cleaning of onsite drainage facilities (38 percent). A detailed list of corrective actions requested for each site is provided in Table B-5.

Illicit Connections and Discharges

At 7:30 pm on June 11, 2004, an illicit discharge was identified in Slip 4 by King County staff conducting sandpiper surveys in the area. A white foam was observed to be discharging in pulses lasting 3-7 minutes from one of the storm drains at the head of Slip 4 (later identified as the Slip 4 SD, which serves the north end of the King County Airport). King County returned the following day to collect samples while the discharge was still occurring. Samples were collected on an outgoing tide (3 feet) and analyzed for metals, including mercury, and semi-volatile organic compounds. Salmon were visible in the area, but did not appear to be affected.

King County Industrial Waste contacted Boeing North Field to investigate possible sources of the foam and found that Boeing had been conducting an annual fire test at its propulsion engineering laboratory. The foam was an aqueous film forming foam (AFFF) released when a valve was inadvertently left open by a new fire inspector conducting the testing. Boeing estimated that less than three gallons of foam was discharged into the storm system with up to 300 gallons of water (Turner 2004, personal communication).

Samples collected in Slip 4, contained BEHP at 0.609 µg/L and caffeine at 1.01 µg/L. All other semi-volatile organic compounds analyzed were below the method detection limit. Low levels of barium, boron, calcium, iron, magnesium, and sodium were found. All other metals were below reliable or method detection levels. However, the active ingredient of AFFF, perfluoro-octanyl sulfate was not among the parameters tested.

As a result of this incident Boeing North Field has adopted written procedures to prevent future incidents. In addition, King County's Trouble Call Coordinator has added a number for the King County airport to his Trouble Call phone list.

Source Tracing

Sediment Trap Samples

Ten sediment trap-sampling stations have been proposed in the Slip 4 drainage basin (Figure 14). Stations will be located on each of the main drains:

- I-5 storm drain
- Slip 4/King County airport drain, south lateral (upstream and downstream of Boeing lease property)
- Slip 4/King County airport drain, north lateral (upstream and downstream of Boeing lease property)
- Slip4/King County airport drain, central lateral (upstream and downstream of Boeing lease property)
- Slip 4 CSO/SD (currently functions only as a storm drain).

The trap on the I-5 drain was installed in November 2004. Installation of the remaining traps was delayed due to ownership and access issues. The remaining traps will be installed in February-March 2005.

Catch Basin Samples

Sediment samples were collected from four onsite catch basins in the Slip 4 drainage basin (see Figure 5 and Table 6). Two of the sampling stations are located on the King County Airport CB45 and CB46), one is on the Crowley property north of Slip 4 (CB37), and one is in a parking on S Myrtle St (CB44) that drains to the Georgetown flume.

CB45 and CB46 are located on a drain that collects runoff from a small area at the north end of the airport adjacent to the airport maintenance facility and other tenants. These two catch basins may also be affected by dust from the bag filter unit on a metal finishing facility's air filtration system. CB 45 is located immediately adjacent to the bag filter unit. Inspectors observed a fine dust on the ground around the filter unit. Both samples contained elevated concentrations of copper (5,660-6,320 mg/kg), zinc (3,420-3530 mg/kg), and BEHP (90-290 mg/kg OC). Airport maintenance has cleaned onsite catch basins in 1998-1999, 2001, and 2003. The airport has been informed of the test results and has been requested to clean these catch basins. CB45 discharges to the WSDOT storm drain system and CB46 discharges to the King County airport drainage system (Slip 4 SD).

Sediment collected from CB37 at the Crowley property contained elevated concentrations of zinc (1,220 mg/kg). The BEHP concentration (34 mg/kg OC) did not exceed the SQS (47 mg/kg OC).

CB44, located on a storm drain that discharges to the Georgetown Flume, contained low concentrations of all chemicals except zinc (524 mg/kg), which exceeded the SQS.

FORMER SLIP 5 AND SLIP 6

Source control activities during this reporting period also covered areas on the King County Airport that drain to the former Slip 5 (early action site at river mile 3.8) and Slip 6. Inspectors were already working on the airport property for the Slip 4 early action site, therefore King County and SPU elected to inspect all of the airport tenants and facilities at one time. The middle portion of the airport (237 acres) drains to the former Slip 5 via a 48-inch diameter storm drain. This outfall also serves as the emergency overflow for City pump station 45 on the City's sanitary sewer system. Pump station 45 has not overflowed in the last 5 years, since the City started maintaining pump station records. The southern portion of the airport (approximately 70 acres) drains to Slip 6 via a 24-inch diameter storm drain.

Business Inspections

A total of 33 businesses were inspected in the Slip 5 and Slip 6 basins between June 1, 2004 and December 31, 2004. Of these, 2 (6 percent) were screening visits and 31 (96 percent) were full site inspections. Inspection locations are shown in Figure 15. A list of all sites inspected is provided in Appendix B, Table B-1. Thirty-nine percent of the sites where full inspections were conducted required some type of corrective action. Five of the sites with full site visits have not yet been issued corrective actions letters. By December 2004, 67 percent of all sites where corrective actions were requested have achieved compliance.

Most of the problems found in Slip 5 and 6 (84 percent) were related to spill prevention and cleanup (see Table 1). A breakdown of all corrective actions requested within each program area (i.e., stormwater, industrial waste, hazardous waste, and spill prevention) is provided in Appendix B (Table B-3) and a list of numbers of corrective actions at each site by program area is provided in Table B-4. The most frequently requested corrective actions are summarized in Table 2. Lack of onsite materials for controlling and cleaning up spills was the most common problem found during this reporting period (84 percent of the sites where corrective actions requested). A detailed list of corrective actions requested for each site is provided in Table B-5.

Illicit Connections and Discharges

Inspectors discovered three illicit connections at tenant facilities in the portion of the King County Airport that drains to Slip 5 and 6. Two involve interior catch basins located on drainage mainlines that run under the building and cannot be fully sealed. The first tenant had already covered the catch basin with a steel plate. The second tenant discharges process water to the catch basin about twice a year. The discharge consists of about 1,500 gallons of a dilute solution of Immunol (an anti-corrosive agent). The tenant was advised to stop discharging and to cover the catch basin to prevent material from entering the drainage system. The third illicit connection is at a catch basin located off the mainline in an area of the building that is no longer being used, so the risk of material inadvertently entering the catch basin is low. The tenant was advised to totally seal the catch basin by filling it with concrete.

Source Tracing

One sediment sample was collected from a catch basin in the area draining to the former Slip 5 (CB 40) and one sample was collected from the Slip 6 drainage area (CB41b). Sample results

are provided in Table 6 and sampling locations are shown on Figure 5. Results are generally comparable to samples collected from other onsite catch basins. Mercury (0.61 mg/kg), BEHP (185 mg/kg OC), and PCBs (154 mg/kg OC) exceeded the CSL in CB40, while the sample from CB41b exceeded the SQS for zinc (740 mg/kg). The concentration of TPH heavy oil exceeded the MTCA Method A cleanup level for soil in both samples and CB41b also exceeded the soil cleanup for diesel. The King County Airport has been requested to clean these catch basins.

TERMINAL 117 EARLY ACTION SITE

The Terminal 117 (T117) early action site is located in the South Park neighborhood on the west side of the Lower Duwamish Waterway just south of the 16th Ave S Bridge. The upland areas draining to T117 are located in an area of South Park that lacks a formal drainage system. Because the streets were in poor condition, stormwater runoff typically ponded in the right-of-way or ran off onto adjacent properties. The total area draining to the T117 early action site is estimated at about 5 acres and consists of the now vacant Terminal 117 property owned by the Port of Seattle (former Malarkey Asphalt site), 3 small residential properties, an oil recycling facility that is in the process of being demolished (Basin Oil), a chocolate factory, and about 3 blocks of roadway (S Donovan St, 17th Ave S, and Dallas Ave S). The South Park marina is located on the waterfront on the north side of the T117 early action site and the Boeing South Park facility is located on the south side of T117.

Until recently, most of the runoff from the upland area either entered a catch basin at the south end of the Port's T117 property or sheet flowed across T117 and entered the Port's drainage system that discharges to the Duwamish Waterway. As a result of an interim source control action completed by the City of Seattle in December 2004, runoff from most upland areas outside of the Port property is now collected, treated, and discharged to the City's combined sewer system (see section below for complete description of the City's interim cleanup action). Runoff from a portion of the hillside along the south side of S Donovan St continues to discharge to the Port's drainage system.

Business Inspections

In August 2004, SPU conducted a joint inspection with Ecology at the Basin Oil property located directly west of T117 on Dallas Ave S. Basin Oil formerly collected, transported, and marketed used oil, but the facility closed in 2004. All of the tanks and equipment are being removed from the site. Site demolition had not yet begun when the site was inspected. Inspectors found a number of problems at the site, including lack of proper spill prevention and control plan/procedures, improper storage of hazardous products and waste materials, improper waste disposal, and poor overall housekeeping procedures.

The large tank storage areas located on the north and south ends of the property were equipped with secondary containment systems. Water from the containment systems was collected and shipped offsite for disposal. Runoff from the yard area located outside the containment system on the north end of the property was discharged to an oil/water separator (on the east side of the property) and then pumped to the street. Runoff from the south end of the property that is outside the south containment area sheet flowed to the east and discharged to Dallas Ave S (EMR 2001).

SPU collected sediment samples from two structures during the inspection (an area drain located in the containment area at the southwest end of the property [CB42] and the oil/water separator on the east side of the property [CB41]). Zinc concentrations (711-830 mg/kg) exceeded the SQS and BEHP concentrations (622-708 mg/kg OC) exceeded the CSL. In addition, the oil/water separator contained elevated concentrations of TPH diesel (72,000 mg/kg) and TPH heavy oil (77,000 mg/kg). Neither of these structures has been cleaned. Both are expected to be removed during site demolition.

Basin Oil began dismantling the plant in 2004. Demolition work involved removing tanks and associated equipment, as well as demolishing buildings, pavement, and other structures. In December 2004, the Seattle Department of Planning and Development (DPD) issued a stop work order and NOV because site demolition activities were being conducted without a permit. Basin Oil must obtain a permit before continuing demolition operations.

Source Control Actions

Dallas Ave S PCBs Cleanup

In August 2004, SPU discovered elevated concentrations of PCBs (Aroclor 1260) in catch basin sediment and street dirt samples collected from the roadways adjacent to T117. The initial sampling was performed as part of routine source sampling efforts to identify potential sources to the T117 early action site. Subsequent sampling narrowed the contaminated area to the section of Dallas Ave S between 14th Ave S and S Donovan St, 17th Ave S between Dallas Ave S and S Donovan St, and S Donovan St between Dallas Ave S and 17th Ave S.

Sampling locations are shown in Figures 16 and 17 and results are summarized in Table 13. Concentrations in street dirt were as high as 9.2 mg/kg PCBs DW (found in a catch basin located on 17th Ave S). Soil beneath the roadway contained as much as 66 mg/kg PCBs DW and soil collected from the public right-of-way immediately adjacent to the roadway contained up to 93 mg/kg PCBs DW. The cleanup level in soil for unrestricted use under the Washington State Model Toxics Control Act is 1 mg/kg PCBs.

The King County Health Department also collected soil samples in yards in the vicinity of the contaminated roadway areas. Soil sampling locations are also shown in Figure 17 (see "YS" sampling stations). The highest PCB concentrations were found in soil samples collected from the front yards at 8601 (37-47 mg/kg) and 8609 (1.4-3.4 mg/kg) 17th Ave S. All other samples were below 1 mg/kg PCBs.

In November-December 2004, SPU completed a source control action to reduce the exposure of nearby residents to the PCBs present in the public right-of-way and to control roadway runoff. Work included:

- Removing contaminated soil and placing clean gravel on roadway shoulders along Dallas Ave S and 17th Ave S. Approximately 6 to 12 inches of soil was removed and capped with gravel.
- Grading and paving S Donovan St between Dallas Ave S and 17th Ave S, 17th Ave S between S Donovan St and Dallas Ave S, and Dallas Ave S between 17th Ave S and S Donovan St.
- Installing a temporary stormwater collection and treatment system to serve the newly paved roadways.

The stormwater system collects runoff from the public right-of-way and the adjacent Basin Oil property and routes it to a temporary treatment system located on the south side of S Donovan St. It is designed to handle runoff from up to the 10-yr, 24-hr storm event. Runoff is treated via settling and sand, bag, and carbon filters prior to controlled discharge to the combined sewer on S Donovan St at 17th Ave S. Because the existing combined sewer is over capacity, the treated runoff is stored in (5) 18,000-gallon storage tanks (located on 17th Ave S just south of S

Donovan St) to allow runoff to be released to the sewer at a controlled rate. SPU has obtained a discharge authorization from King County Industrial Waste to allow discharge to the sewer and is currently testing all stormwater prior to discharge. PCBs have not been detected (at 0.1 ug/L) any of the samples collected from the treatment system since the plant started operation in mid-December. SPU has also received permission from the Port of Seattle to discharge treated runoff to the Port's drainage system at the south end of T117 under emergency conditions (i.e., existing combined sewer capacity exceeded). As part of the agreement with the Port, SPU also conducted the following work on T117 to prevent the treated runoff from becoming recontaminated prior to discharge to the Duwamish Waterway:

- Cleaned the existing catch basin at the south entrance to T117 (emergency discharge point for treated runoff) and the downstream catch basin adjacent to the waterway, and pressured washed the existing 6-inch PVC drain that crosses T117.
- Extended the existing 6-inch drain (noted above) located on the north side of the T117 south building to the end of the building, installed asphalt berms to direct flow to the downstream catch basin, and paved the planter area adjacent to the building.

SPU is currently working to develop a final cleanup plan for the public right-of-way. Future work will be completed by 2006 when the T117 early action site cleanup is scheduled to occur. Contaminated soil in the yards at 8601 and 8609 17th Ave S will also be removed and the yards will be replanted. Additional sampling to delineate the extent of the soil contamination is scheduled to occur in February and yard cleanup is planned for the spring of 2005.

NEXT STEPS

King County and SPU intend to continue the joint business inspection and source tracing efforts to support the Lower Duwamish Waterway Superfund investigation. SPU and King County Industrial Waste are planning an outreach program to reach businesses in the Diagonal/Duwamish Basin. Potential outreach activities include educational seminars and posters mailed to all businesses inspected. The intent is to provide ongoing reminders to businesses of how their practices can affect the Duwamish Waterway.

Business Inspections

The joint business inspection program has been successful in reaching businesses that discharge to the LDW via the publicly owned storm drain or the combined sewer systems. King County and SPU will have a continuing presence in the Diagonal/Duwamish area, focusing on higher priority businesses and will also expand into other areas to support ongoing and future early action area cleanups.

Diagonal/Duwamish

Inspectors will complete follow-up inspections in the Diagonal/Duwamish early action area to ensure that problems found during previous inspections are corrected. Some businesses in the area (those that were inspected during the early part of the first reporting period) have not been inspected in over a year. Results from previous inspections will be reviewed to identify sites that should be re-inspected. Re-inspections will be conducted by the jurisdiction with lead authority (i.e., KCIW for industrial wastewater discharges and SPU for stormwater discharges).

Slip 4

The Boeing Company owns most of the sites remaining to be inspected in the Slip 4 early action area. Boeing has not allowed county and city inspectors to inspect their facilities and has requested that only Ecology inspectors or other inspectors with direct permit authority inspect Boeing facilities. King County and SPU will support Ecology to facilitate these inspections. The County and City will also conduct follow up inspections at the other businesses in Slip 4 to ensure that all required corrective actions are implemented.

Terminal 117

SPU inspectors will conduct a joint inspection with Ecology at the South Park marina. Runoff from the marina discharges directly to the waterway.

Other Areas in the LDW

During the next reporting period, inspectors will continue working in the East Waterway to support the ongoing cleanup by the Port and will focus on the remaining early action areas in the Lower Duwamish Waterway:

- Early action site at river mile 3.8 in the vicinity of the former Slip 5 (areas outside the King County Airport that have not yet been inspected).

- Trotsky early action site
- Norfolk early action site.

King County, SPU, and other members of the Lower Duwamish source control work group are developing a work plan to coordinate future source control activities. The goals are to support upcoming early action site cleanups by ensuring that the source control work is underway on schedule with cleanup activities, to schedule future work that may be needed outside the existing early action sites, and to identify resources needed for future source control efforts.

Source Sampling

Source Tracing

Source tracing efforts will continue to focus on catch basin and in-line sediment sampling to track sources of contaminants to the waterway sediment. SPU intends to continue sampling the 7 sediment trap installations in the Diagonal Ave S CSO/SD basin. In addition, SPU will collect sediment samples from the other public storm drains discharging in the vicinity of the Diagonal/Duwamish early action site (S Nevada St and the Diagonal Ave S storm drains) to determine whether these drainage systems may be contributing contaminants to the waterway sediment.

To support work in the Slip 4 early action site, additional sediment traps will be installed in 3 of the 4 main drains that discharge to Slip 4 (Slip 4 CSO/SD, I-5 drain, and the King County airport storm drain). Proposed sediment trap locations are shown on Figure 15. Onsite and right-of-way catch basin sampling will be coordinated with the business inspection effort. In addition, SPU is currently working with a contractor to investigate the Georgetown Flume. The scope of work includes surveying the locations of all historic and active outfalls to the flume, video inspecting the piped sections of the flume, and collecting sediment samples from select locations along the flume. Work is scheduled to begin in February 2005.

King County and SPU also plan to begin source sampling/tracing in the areas draining to the East Waterway during the next reporting period.

Phthalate Source Study

The phthalate source study will be continued with future work focusing on evaluating whether atmospheric deposition is a significant source of phthalates to the waterway sediment via either direct deposition on the waterway or via stormwater runoff. The first phase of the atmospheric deposition investigation involving collecting samples of wet deposition at four existing Ecology or PSCAA air monitoring stations will be conducted during the next reporting period. Sampling procedures and protocols are described in sampling and analysis plan provided in Appendix C. If atmospheric deposition is found to be a significant source of phthalates to the LDW, efforts to reduce phthalates in automobile and truck parts at the national level may be necessary.

Site-Specific Source Control Actions

Dallas Ave Cleanup

During the next reporting period, SPU will begin developing plans for the final cleanup of the Dallas Ave site. Cleanup will be conducted under SPU's capital improvement program. Work will involve evaluating cleanup options, working with regulatory agencies, and completing the internal business plan needed to obtain funding for the project.

REFERENCES

Belzer, Wayne. 2004. "Atmospheric Concentrations and Depositions in the Georgia Basin Airshed." *In* T.W. Droscher and D.A. Fraser (eds). Proceedings of the 2003 Georgia Basin/Puget Sound Research Conference. CD-ROM or Online. Available: http://www.psat.wa.gov/Publications/03_proceedings/start.htm [February 2004]

California Air Resources Board. 1997. Toxic air contaminant identification list summaries--Diesel exhaust, Sacramento, CA.

EMR. 2001. Stormwater pollution prevention plan. Prepared for Basin Oil Company by Environmental Management Resources, Inc., Redmond, WA.

Herrera. 1998. Henderson/M.L. King CSO Control Project monitoring report. Prepared by Herrera Environmental Consultants, Inc. for King County Department of Natural Resources Water Pollution Control Division, Seattle, WA.

Houlihan, J., Brody, C., and B. Schwan. 2002. Not too pretty: Phthalates, beauty products, and the FDA. Environmental Working Group, Washington, D.C.

Striplin. 2004. Lower Duwamish Waterway, Slip 4 early action area: Summary of existing information and identification of data gaps. Prepared for Seattle City Light by Striplin Environmental Associates, Olympia, WA.

Tacoma. 1990. Surface water quality study final report. City of Tacoma, Department of Public Works Sewer Utility, Tacoma, WA.

Tacoma. 1999. Round 3 data evaluation and predesign report, Appendix L, Thea Foss and Wheeler-Osgood Waterways, City of Tacoma, WA.

Tacoma. 2002. August 2001-2002 annual report. Thea Foss and Wheeler-Osgood Waterways stormwater monitoring, City of Tacoma, WA.

Tacoma. 2003. Phthalate source study phase II, Thea Foss Waterway sub-watershed sampling and analysis plan. City of Tacoma, Environmental Services, Science & Engineering, Tacoma, WA.

Turner, D. June 17, 2004. Personal communication (phone conversation with Barbara Badger, King County Industrial Waste). The Boeing Company, Seattle, WA.

USEPA. 1983. Final report of the National Urban Runoff Program. U.S. Environmental Protection Agency, Water Planning Division, Washington, D.C.

TABLES

Table 1. Corrective actions requested by program area.
June - December 2004

	Percent of Total Corrective Actions			
	Stormwater	Spill Prevention/ Cleanup	Hazardous Waste	Industrial Waste
Diagonal Ave S CSO/SD				
March 03 - May 04	50	30	24	3
June 04 - December 04	34	42	21	7
Slip 4 drainage basin	24	64	12	0
Slip 5/6 drainage basins	10	84	6	0
East Waterway	31	63	6	0
Overall	26	59	14	1

Table 2. Most frequent corrective actions requested.

June - December 2004

Corrective Action	Percent of sites with corrective actions (June - December 2004 reporting period)					
	Diagonal Ave S CSO/SD		***Slip 4 drainage basin***	***Slip 5/6 drainage basins***	***East Waterway***	***Overall***
	Jan 03-May 04	June - Dec 04				
Drainage facility needs cleaning	41	63	38	8	50	40
Facility lacks proper spill prevention/cleanup plan/procedures	36	69	79	100	70	79
Inadequate spill cleanup materials available onsite	33	94	46	67	60	65
Inadequate employee training on spill prevention/cleanup practices	58	63	75	50	70	67
Improper storage of hazardous products and waste materials	22	38	13	17	10	19
Improper hazardous waste disposal	17	38	17	0	10	16
Improper outdoor storage of non-hazardous materials/products	13	6	13	0	0	5

Table 3. Surface water quality complaints in the Lower Duwamish Waterway.
June - December 2004

Date	Material	Location	Service Area	Status
11/15/2004	Antifreeze	2468 S College St	SD	Resolved
7/2/2004	Auto fluid	6924 Rainier Ave S	CSO	Resolved
10/2/2004	Auto oil	45th Ave S and S Willow St	CSO	Unresolved
12/13/2004	Broken sewer line	Union St and 15th Ave	CSO	Resolved
8/20/2004	Brown water	Diagonal/Duwamish outfall	CSO	Resolved
10/5/2004	Diesel	2460 4th Ave S	CSO	Resolved
6/10/2004	Dirty water	1925 6th Ave	CSO	Resolved
12/6/2004	Granite cutting water	Across from Home Depot at 2701 Utah Ave S	SD	Resolved
09/21/04	Grey Water	11812 57th Av S	CSO	Resolved
12/9/2004	Oil	4735 E Marginal Way S (north)	CSO	Resolved
8/25/2004	Oil	E Marginal Way S and S Spokane St	CSO	Resolved
12/28/2004	Oil and Gas	1922 S Stevens St	SD	Resolved
12/2/2004	Oil spill	1st Ave S and S Lander St (NW corner)	CSO	Resolved
11/9/2004	Possible broken sewer line	3320 Beacon Ave S	SD	Resolved
11/10/2004	Pressure Wash Water	1st Ave S and S Front St	CSO	Resolved
7/12/2004	Sewage or water	4111 42nd Ave S	CSO	Resolved
11/19/2004	Unknown	6924 Rainier Ave S	CSO	Resolved
6/28/2004	Unknown	700 Broadway	CSO	Resolved
11/10/2004	Unknown	8th Ave S and S Monroe St	CSO	Resolved
7/20/2004	Unknown	Between Delta Marine and Duwamish Yatch club	SD	Resolved
8/19/2004	Unknown substance	3223 1st Ave S (parking lot side)	CSO	Resolved
8/23/2004	Water	1422 E Union St	CSO	Resolved
6/2/2004	Water	2122 19th Ave S	SD	Resolved
8/24/2004	Water	4230 Rainier Ave S	CSO	Resolved
10/1/2004	Water	4515 49th Ave S	CSO	Resolved
9/16/2004	Water overflow	3401 25th Ave S	CSO	Resolved

Table 4. Construction projects in the Lower Duwamish Waterway.

June - December 2004

Project	Basin	Permit Issued	Permit Expires	Address	Zoning / Use
2302820	Combined sewer	11/19/2003	5/19/2005	00401 BROADWAY	ADMIN OFFICE, MEDICAL SERVICES
2205112	Combined sewer	1/9/2004	7/9/2005	04515 M L KING JR WY	ADMIN OFFICE/ADULT CARE CENTER
2207885	Combined sewer	4/4/2003	10/4/2004	00401 BROADWAY	ADMINISTRATIVE OFFICE
2207114	Combined sewer	8/27/2003	8/12/2006	03512 S JUNEAU ST	APARTMENT
2105164	Combined sewer	8/5/2003	2/5/2005	03213 HARBOR AV SW	APARTMENT, OFFICE,GARAGE
2306070	Combined sewer	1/13/2004	7/13/2005	03621 33RD AV S	APARTMENT/RETAIL SALES & SVC/CUSTOMER SERVICE OFC
2308375	Combined sewer	5/11/2004	11/11/2005	03512 S JUNEAU ST	APARTMENTS WITH ACCESSORY PARKING
2206001	Combined sewer	12/8/2004	6/8/2006	04408 DELRIDGE WY SW	ARTIST'S STUDIO/DWELLINGS
2206223	Combined sewer	6/20/2003	12/20/2004	00316 BROADWAY	CHILD CARE CENTER
2401584	Combined sewer	9/30/2004	3/30/2006	09401 MYERS WY S	CITY FACILITY
2401582	Combined sewer	7/23/2004	1/23/2006	09401 MYERS WY S	CITY FACILITY (JOINT TRAINING)
2200383	Combined sewer	1/3/2003	7/3/2004	02100 24TH AV S	COMMUNITY CENTER
2204090	Combined sewer	2/10/2003	8/10/2004	04801 35TH AV SW	CONGREGATE RESIDENCE/NURSING HOME
2400239	Combined sewer	8/3/2004	2/3/2006	03642 33RD AV S	CUSTOMER SERVICE OFFICE, APARTMENTS
2301075	Combined sewer	7/16/2003	1/16/2005	00901 12TH AV	EDUCATIONAL MAJOR INSTITUTION
2405843	Combined sewer	9/15/2004	3/15/2006	04418 - 4430 S SHELL ST	GRADING
2304854	Combined sewer	6/28/2004	12/28/2005	06101 S FOUNTAIN ST	GRADING FOR ACCESS ROAD
2209009	Combined sewer	6/28/2004	12/28/2005	05949 S FOUNTAIN ST	GRADING OF ACCESS ROAD
2301526	Combined sewer	4/30/2003	10/30/2004	01300 - 1316 SW WEBSTER ST	GRADING ONLY
2304855	Combined sewer	6/28/2004	12/28/2005	06107 S FOUNTAIN ST	GRADING ONLY
2201895	Combined sewer	6/11/2003	12/11/2004	04500 M L KING JR WY	GRADING/DRAINAGE ONLY
2301344	Combined sewer	9/30/2003	3/30/2005	00917 E YESLER WY	GYM
2207892	Combined sewer	2/6/2004	8/6/2005	00500 17TH AV	LABORATORY
2404017	Combined sewer	7/21/2004	1/21/2006	00201 S MEAD ST	LIGHT MANUFACTURING / ACCESSORY OFFICE
2206147	Combined sewer	2/20/2003	8/20/2004	07501 M L KING JR WY	LOW-INCOME HOUSING
2302552	Combined sewer	8/13/2003	2/13/2005	06550 32ND AV SW	LOW-INCOME HOUSING REDEVELOPMENT
2208351	Combined sewer	9/18/2003	3/18/2005	03815 S OTHELLO ST	MEDICAL SERVICE/RETAIL SALES & SERVICE/APARTMENT
2302636	Combined sewer	3/16/2004	9/16/2005	02916 S COLUMBIAN WY	MIXED USE
9906186	Combined sewer	8/16/2004	8/16/2004	00912 12TH AV	MIXED USE RESIDENTIAL AND CUSTOMER SERVICE OFFICE
2401795	Combined sewer	12/8/2004	6/8/2006	03201 SW GRAHAM ST	MULTI-FAMILY STRUCTURE(APARTMENTS)
2204538	Combined sewer	2/21/2003	8/21/2004	01706 22ND AV	MULTI-PURPOUSE CONV. STORE/RESIDENTIAL/PARKING
2204942	Combined sewer	4/24/2003	10/24/2004	02821 S WALDEN ST	NURSING HOME
2208274	Combined sewer	7/7/2004	1/7/2006	02025 14TH AV S	PUBLIC EDUCATIONAL FACILITY
2208109	Combined sewer	5/8/2003	11/8/2004	06725 45TH AV S	PUBLIC SCHOOL
2207452	Combined sewer	4/23/2003	10/23/2004	02500 SW BARTON ST	REMODEL EXISTING RETAIL & OFFICE SPACE
2204539	Combined sewer	5/19/2003	11/19/2004	01706 22ND AV	RETAIL GROCERY, APARTMENTS & PARKING GARAGE
2305817	Combined sewer	8/4/2004	2/4/2006	07345 DELRIDGE WY SW	RETAIL SALES AND SERVICE
2308483	Combined sewer	6/21/2004	12/21/2005	03701 S KENYON ST	SCHOOL/ GYM
2300675	Combined sewer	3/25/2004	9/25/2005	02600 SW THISTLE ST	SEATTLE PUBLIC SCHOOLS
2301697	Combined sewer	8/5/2003	2/5/2005	02701 15TH AV S	SITE WORK ONLY
2300290	Diagonal SD	6/19/2003	12/19/2004	00833 DAVIS PL S	APARTMENT
2201694	Diagonal SD	2/3/2003	8/3/2004	09050 16TH AV SW	COMMUNITY CENTER
2400594	Diagonal SD	8/27/2004	2/27/2006	04401 4TH AV S	GENERAL PERSONAL & HOUSEHOLD RETAIL SALES & SVC
2308462	Diagonal SD	12/8/2004	6/8/2006	02302 E YESLER WY	LIBRARY

Table 4. Construction projects in the Lower Duwamish Waterway.

June - December 2004

Project	Basin	Permit Issued	Permit Expires	Address	Zoning / Use
2107959	Diagonal SD	9/23/2003	3/23/2005	03407 AIRPORT WY S	LIGHT RAIL TRANSIT FACILITY
2404044	Other storm drain	9/24/2004	3/24/2006	07272 WEST MARGINAL	GENERAL MANUFACTURING
2206735	Other storm drain	7/25/2003	1/25/2005	06000 16TH AV SW	MAJOR INSTITUTION COMMUNITY COLLEGE

Table 5. Phthalates in key manhole samples.

Sta ID	Land Use	n	Bis(2-ethylhexyl)phthalate				Butylbenzylphthalate				Diethylphthalate			
			Mean	Min	Max	Detects	Mean	Min	Max	Detects	Mean	Min	Max	Detects
KEY MH DATA[f]														
Dry Weather (9/04)														
East Marginal pump station		8	11.0	4.7	35	8	1.9	<1	2.7	3	2.9	<9.6	3.9	7
West Marginal pump station		9	13.9	8.67	20.5	9	7.3	<1	7.3	1	5.7	5.1	6.4	8
Duwamish pump station		8	14.6	8.75	39.5	8	24.6	<1	69.8	6	5.3	4.5	6.3	8
Dry Weather (9/03)														
East Marginal pump station		9	5.9	3.9	7.4	9	2.8	1.3	4.0	9	5.3	2.1	8.3	9
West Marginal pump station		10	25.7	9.5	148	10	2.0	<1	3.0	8	8.4	7.0	9.4	10
Duwamish pump station		8	10.6	7.3	12.4	8	1.3	<1	1.8	8	6.0	4.8	7.0	8
Wet Weather (4/04)														
East Marginal pump station		9	6.5	1.6	11.8	9	1.0	<1	1.5	7	4.4	2.0	12.1	9
West Marginal pump station		7	20.8	13.3	52.3	7	2.4	<1	3.4	6	7.7	5.5	8.9	7
Duwamish pump station		8	12.2	10.0	13.7	8	1.8	1.4	2.4	8	6.7	5.1	8.3	8
STORMWATER DATA														
Thea Foss[a]														
SD-230	Comm	11	5.8	1.1	12	9	1.25	1	3	4	0.0	0	0	2
SD-235	Comm	10	5.6	1	16	8	1.26	1	2	4	0.0	0	0.00	5
SD-237A	Mix	10	3.3	1	5.4	6	1.01	1	1.1	2	0.0	0	0	4
SD-237B	Mix	10	2.8	1	4.7	6	1.10	1	2	1	0.0	0	0	1
SD-243	Ind	7	2.6	1.5	5	6	2.06	1	3.9	3	0	0	1	0
SD-245	Ind	10	4.2	2.4	15	8	63	20	130	8	0.0	0	0	4
SD-254	Ind	7	2.4	1.5	3.7	4	2.09	1	6.1	4	0.0	0	0	1
SR-520[b]	Highway	3	12.03	9.49	14.2	3	0.64	0.59	0.71	3	1.1	0.43	2.55	3
Diagonal Ave S CSO/SD[c]														
D057009	Mix	3	6.6	3.48	10.1	3	0.65	0.57	0.79	1	1	1	1	0
D057036	Mix	7	7.1	0.57	14.7	6	0.77	0.57	0.987	3	1	1	1	0
WASTEWATER DATA														
Renton WWTP influent[d]		34	14.2	5.22	37.1	34								
West Point WWTP influent[e]		16	12.8	4.7	33.3	16	1.7	0.6	2.47	6/8	4.5	2.74	5.88	8/8

Units: ug/L

a. Samples collected 2001-2002 by City of Tacoma
b. Samples collected 4/8/03 by King County
c. Samples collected in 1995 by King County (from manholes at S Hinds St and S Horton St)
d. Samples collected 1998-2003 by King County (system fully separated)
e. Samples collected 1998-2003 by King County (system combined)
f. Samples collected 2003-2004 by King County Industrial Waste.

Table 5. Phthalates in key manhole samples.

Sta ID	Land Use	n	Bis(2-ethylhexyl)phthalate				Butylbenzylphthalate				Diethylphthalate			
			Mean	Min	Max	Detects	Mean	Min	Max	Detects	Mean	Min	Max	Detects
KEY MH DATA[f]														
Dry Weather (9/04)														
East Marginal pump station		8	11.0	4.7	35	8	1.9	<1	2.7	3	2.9	<9.6	3.9	7
West Marginal pump station		9	13.9	8.67	20.5	9	7.3	<1	7.3	1	5.7	5.1	6.4	8
Duwamish pump station		8	14.6	8.75	39.5	8	24.6	<1	69.8	6	5.3	4.5	6.3	8
Dry Weather (9/03)														
East Marginal pump station		9	5.9	3.9	7.4	9	2.8	1.3	4.0	9	5.3	2.1	8.3	9
West Marginal pump station		10	25.7	9.5	148	10	2.0	<1	3.0	8	8.4	7.0	9.4	10
Duwamish pump station		8	10.6	7.3	12.4	8	1.3	<1	1.8	8	6.0	4.8	7.0	8
Wet Weather (4/04)														
East Marginal pump station		9	6.5	1.6	11.8	9	1.0	<1	1.5	7	4.4	2.0	12.1	9
West Marginal pump station		7	20.8	13.3	52.3	7	2.4	<1	3.4	6	7.7	5.5	8.9	7
Duwamish pump station		8	12.2	10.0	13.7	8	1.8	1.4	2.4	8	6.7	5.1	8.3	8
STORMWATER DATA														
Thea Foss[a]														
SD-230	Comm	11	5.8	1.1	12	9	1.25	1	3	4	0.0	0	0	2
SD-235	Comm	10	5.6	1	16	8	1.26	1	2	4	0.0	0	0.00	5
SD-237A	Mix	10	3.3	1	5.4	6	1.01	1	1.1	2	0.0	0	0	4
SD-237B	Mix	10	2.8	1	4.7	6	1.10	1	2	1	0.0	0	0	1
SD-243	Ind	7	2.6	1.5	5	6	2.06	1	3.9	3	0	0	1	0
SD-245	Ind	10	4.2	2.4	15	8	63	20	130	8	0.0	0	0	4
SD-254	Ind	7	2.4	1.5	3.7	4	2.09	1	6.1	4	0.0	0	0	1
SR-520[b]	Highway	3	12.03	9.49	14.2	3	0.64	0.59	0.71	3	1.1	0.43	2.55	3
Diagonal Ave S CSO/SD[c]														
D057009	Mix	3	6.6	3.48	10.1	3	0.65	0.57	0.79	1	1	1	1	0
D057036	Mix	7	7.1	0.57	14.7	6	0.77	0.57	0.987	3	1	1	1	0
WASTEWATER DATA														
Renton WWTP influent[d]		34	14.2	5.22	37.1	34								
West Point WWTP influent[e]		16	12.8	4.7	33.3	16	1.7	0.6	2.47	6/8	4.5	2.74	5.88	8/8

Units: ug/L

a. Samples collected 2001-2002 by City of Tacoma
b. Samples collected 4/8/03 by King County
c. Samples collected in 1995 by King County (from manholes at S Hinds St and S Horton St)
d. Samples collected 1998-2003 by King County (system fully separated)
e. Samples collected 1998-2003 by King County (system combined)
f. Samples collected 2003-2004 by King County Industrial Waste.

Table 6. Onsite catch basin sediment sample results.

Source	Sample ID	Date Sampled	Drainage Basin	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)	TPH-Diesel (mg/kg)	PCBs (ug/kg DW)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)
Diagonal basin												
Auto repair	CB7	10/15/03	Diag/Duw	647	1,220	0.1	1,150	9,900	48	0.28	140,000	824
	CB9	01/22/04	Diag/Duw	177	105	0.06 U	294	50 U	97	3.59	2,200	81
	CB13	01/23/04	Diag/Duw	96	127	0.09	432	51	690	20.9	4,500	136
	CB19	02/12/04	Diag/Duw	405	1,530	1.82	1,170	3,500	289	2.63	53,000	482
	CB45	12/22/04	Slip 4	6,320	481	0.3	3,420	950	470	4.83	8,800	90
	CB46	12/22/04	Slip 4	5,660	396	0.2	3,530	1,900	680	6.54	30,000	288
Gas station	CB10	01/22/04	Diag/Duw	87	96	0.07	250	930	17 U	0.11 U	1,500	10
	CB23	03/15/04	Diag/Duw	87	73	0.07 U	501	800	20 U	0.24 U	3,400	40
	CB26	03/15/04	Diag/Duw	184	699	1.7	1,470	8,700	940	3.62	64,000	246
	CB27a	03/15/04	Diag/Duw	92	109	0.1	396	5,200	141	1.66	33,000	388
	CB29	04/07/04	Diag/Duw	261	164	0.09 U	668	5,000	29 J	0.26 J	63,000	558
Grocery stores	CB15	02/09/04	Diag/Duw	142	476	0.06 U	98.3	380	19 U	0.48 U	380	10
	CB18	02/12/04	Diag/Duw	80	55	0.22	359	970	19 U	0.21 U	20,000	225
	CB25	03/15/04	Diag/Duw	187	152	0.2	912	2,900	39	0.24	120,000	750
Vehicle/equip wash	CB2	08/21/03	Diag/Duw	1,520	1,110	0.5	2,720	34,000	20 U	0.53 U	200,000 B	2,667 B
	CB21	03/20/04	Diag/Duw	194	97	0.06 U	305	1,900	19 U	0.40 U	17,000	354
Transportation	CB3	09/05/03	Diag/Duw	30	10	0.05 U	54.9	15	39 U	8.30 U	130	28
	CB8	11/04/03	Diag/Duw	275	205	0.10	603	2,000	1,000	10.87	71,000	772
	CB33	05/24/04	Diag/Duw	118	82	0.09	924	900	58	0.51	9,900	87
	CB34	05/24/04	b	99	110	0.07 U	833	430	16	0.21 U	4,200	45
	CB35	05/24/04	b	79	87	0.1	382	4,000	20 U	0.22 U	11,000	123
	CB36	05/24/04	b	201	152	0.07 U	420	5,300	20 U	0.19 U	24,000	226
	CB41b	09/10/04	Slip 6	92	232	0.17	740	8,000	51 U	0.50 U	3,300	33
	CB37	06/22/04	Slip 4	173	250	0.08	1,220	180	20 U	0.42 U	1,600	34
Misc retail	CB16	02/09/04	Diag/Duw	56	63	0.1	237	1,400	51	1.06	11,000	229
	CB20	02/12/04	Diag/Duw	184	277	1.16	754	2,100	194	1.94	99,000	990
	CB12	01/23/04	Diag/Duw	181	97	0.1	603	41	41	0.61	6,600	99
	CB28	03/26/04	Diag/Duw	254	327	0.2	677	440	18 J	0.13 J	14,000	103
Manufacturing	CB1	08/21/03	Diag/Duw	161	125	0.3	1,100	NA	160	0.62	19,000 B	100 B
	CB22	03/02/04	Diag/Duw	520	151	0.16	433	190	3,200	267	410	34
	CB31	05/06/04	Diag/Duw	186	231	0.12	590	200	128	3.47	460	12
Restaurant	CB27b	03/26/04	Diag/Duw	137	88	0.1 U	537	6,600	68 J	0.47 J	140,000	596
	CB32	05/24/04	Diag/Duw	194	131	0.2 U	874	770	20 U	0.10 U	34,000	164
	CB38	06/25/04	Diag/Duw	66	54	0.08	209	960	220	3.44	5,000	78
Other	CB4	09/08/03	Diag/Duw	135	47	0.08 U	360	1,800	19 U	1.12 U	32,000	941
	CB5	09/10/03	Diag/Duw	147	51	0.2 U	412	2,600	20 U	0.27 U	67,000	447
	CB11	01/23/04	Diag/Duw	325	445	0.68	3,940	370	255 P	4.11 P	6,200	100
	CB24	03/15/04	Diag/Duw	172	299	0.2	699	730	71 Y	0.92 Y	12,000	156
	CB44	12/08/04	Slip 4	142	123	0.12	524	85	180	0.73	10,000	41
	CB30	04/30/04	Diag/Duw	79	2,010	0.84	257	620	259	3.15	11,000	134
	CB40	08/04/04	Slip 5	92	90	0.61	271	600	6,600	154	5,500	185
Oil recycling	CB41	08/19/04	T117	134	428	0.11	711	72,000	350	2.59	84,000	622
	CB42	08/19/04	T117	173	98	0.08	830	3,900	140	2.75	41,000	708
SQS				390	450	0.41	410	NA		12	NA	47
CSL				390	530	0.59	960	NA		65	NA	78
MTCA Method A[c]				NA	250	2	NA	2,000	1,000	NA	NA	NA
MTCA Method A[d]				NA	1,000	2	NA	2,000	10,000			

Table 6. Onsite catch basin sediment sample results.

Source	Sample ID	Date Sampled	Drainage Basin	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)	TPH-Diesel (mg/kg)	PCBs (ug/kg DW)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)
Thea Foss basin (Tacoma)												
Auto repair/supplies (7)				Mean							58,371	
				Range							(2,600 - 340,000)	
				Min							2,600	
				Max							340,000	
				General Tire							23,000	
				Service Master							2,600	
				Eagle Tire							340,000	
				Maaco Autobody							7,200	
				Osborne Cadillac							6,800	UJ
				Tacoma Dodge							19,000	
				Pacific Motoring							10,000	
Fast food (2)				Mean							74,000	
				Range							(48,000 - 100,000)	
				Min							48,000	
				Max							100,000	
				Jack in Box							48,000	
				McDonalds							100,000	
Vehicle/equip wash (1)											24,000	
				Brown Bear							24,000	
Misc retail (3)				Mean							14,100	
				Range							(1,800 - 35,000)	
				Min							1,800	
				Max							35,000	
				Keller plumbing							1,800	
				Washington Floral							5,500	
				American Linen							35,000	
Manufacturing (6)				Mean							106,083	
				Range							(9,100 - 580,000)	
				Min							9,100	
				Max							580,000	
				Pickering							9,400	
				Tacoma News							10,000	
				Atlas Foundry							9,100	
				Totem Marina							580,000	
				United Pipe							13,000	
				Ideal Machine							15,000	

a. Bis(2-ethylhexyl)phthalate
b. Upstream of Lower Duwamish study area.
c. MTCA Method A soil cleanup level for unrestricted use.
d. MTCA Method A soil cleanup level for industrial use.

Exceeds SQS
Exceeds CSL or MTCA Method A Cleanup Level (TPH)

U = Chemical not detected at concentration shown.
Y = Chemical not detected at concentration shown.
Reporting limit raised due to background interference.
J = Concentration is less than the reporting limit.
P = High RPD on dual column analyses, without obvious interference.

Table 7. Right-of-way catch basin sediment sample results.

Road Type	Station ID	Date Sampled	Drainage Basin	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)	TPH-Diesel (mg/kg)	TPH-Oil (mg/kg)	PCBs (ug/kg DW)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)
Diagonal basin													
Freeway	RCB30	05/26/04	LDW	46.2	20	0.06 U	171	130	630	U	0.63 U	3,200	107
Freeway	RCB31	05/26/04	LDW	185	157	0.07	552	150	660	117 Y	4.74 Y	1,100	18
Freeway	RCB32	05/26/04	LDW	97.5	126	0.09 U	305	150	690	138 Y	1.82 Y	21,000	277
High traffic arterial	RCB2	02/22/04	Diag/Duw	40.1	121	0.07 U	137	270	1,600	30	0.55	2,900	53
High traffic arterial	RCB3	02/22/04	Diag/Duw	48.8	78	0.07 U	179	200	1,400	U	0.37 U	2,400	46
High traffic arterial	RCB7	03/03/04	Diag/Duw	55.1	374	0.06 U	142	210	1,600	U	0.83 U	2,100	88
High traffic arterial	RCB10	03/15/04	Diag/Duw	183	109	0.1 U	589	630	4,600	54	1.16	28,000	280
High traffic arterial	RCB11	03/15/04	Diag/Duw	117	92	0.07 U	243	540	3,000	U	0.27 U	3,200	23
High traffic arterial	RCB12	04/07/04	Diag/Duw	112	77	0.1 U	384	540	3,000	50 J	0.51 J	5,600	96
High traffic arterial	RCB13	04/07/04	Diag/Duw	172	163	0.17	567	1,200	7,800	161	1.67	17,000	177
High traffic arterial	RCB15	04/07/04	Diag/Duw	157	145	0.2	781	1,400	9,100	303	3.68	18,000	219
High traffic arterial	RCB17	04/16/04	Diag/Duw	137	146	0.15	534	1,400	7,200	231	3.04	12,000	158
High traffic arterial	RCB18	04/16/04	Diag/Duw	229	137	0.13	575	1,700	8,500	248	2.51	14,000	141
High traffic arterial	RCB19	04/16/04	Diag/Duw	71.9	64	0.05 U	252	470	2,600	64	1.48	5,900	137
High traffic arterial	RCB20	04/16/04	Diag/Duw	164	206	0.2	759	1,800	11,000	187	1.31	24,000	168
High traffic arterial	RCB21	04/16/04	Diag/Duw	38.4	39	0.07 U	132	390	2,500	U	0.31 U	4,300	70
High traffic arterial	RCB27	04/21/04	Diag/Duw	159	111	0.06 U	335	560	2,400	22	0.37	12,000	201
High traffic arterial	RCB33	06/30/04	Diag/Duw	149	60	0.06 U	674	190	1,100	53	1.22	740	31
High traffic arterial	RCB34	06/30/04	Diag/Duw	134	89	0.08	488	1,200	6,100	114	0.63	16,000	152
High traffic arterial	RCB35	06/30/04	Diag/Duw	120	193	0.1	358	420	2,100	142	2.32	8,000	84
High traffic arterial	RCB36	06/30/04	Diag/Duw	751	152	1.17	505	1,800	6,000	639 Y	10.47 Y	48,000	502
High traffic arterial	RCB37	06/30/04	Diag/Duw	58.5	62	0.06 U	189	220	1,200	17,500	202.21	8,300	153
High traffic arterial	RCB39	06/30/04	Diag/Duw	113	61	0.06 U	213	640	3,500	160	3.50	4,400	96
High traffic arterial	RCB40	06/30/04	Diag/Duw	70.4	99	0.04 U	207	140	850	U	0.72 U	980	35
Industrial	RCB1	02/20/04	Diag/Duw	112	1,370	0.87	364	3,500	4,000	670	6.70	46,000	460
Industrial	RCB16	04/07/04	Diag/Duw	154	105	0.19	698	1,400	8,000	293	4.13	14,000	197
Industrial	RCB29	05/07/04	Diag/Duw	134	106	0.26	334	130	480	68	1.53	1,400	32
Low traffic mix	RCB8	03/03/04	Diag/Duw	75.3	54	0.07 U	223	320	3,000	19	0.24	8,600	110
Low traffic mix	ROW24	01/14/05	Diag/Duw	84.4	19	0.06 U	185	6,400	14,000	ROW24 - 011405			
Low traffic res	RCB4	02/22/04	Diag/Duw	167	245	0.30	851	460	1,600	U	0.18 U	3,600	30
Low traffic res	RCB5	02/22/04	Diag/Duw	66.6	197	0.32	362	260	2,400	U	0.18 U	2,400	22
Low traffic res	RCB22	04/16/04	Diag/Duw	97.2	65	0.06 U	176	230	1,500	21 J	0.45 J	3,100	66
Low traffic res	RCB23	04/21/04	Diag/Duw	81.6	180	0.12	277	690	2,500	45	0.22	8,700	81
Low traffic res	RCB28	04/21/04	Diag/Duw	76.9	131	0.2	313	140	910	36	0.29	4,100	33
Medium traffic	RCB6	03/03/04	Diag/Duw	46.4	46	0.06 U	176	380	2,800	U	0.40 U	4,000	85
Medium traffic	RCB9	03/03/04	Diag/Duw	42.5	53	0.04 U	151	160	1,900	U	0.43 U	970	21
Medium traffic	RCB24	04/21/04	Diag/Duw	41.4	316	0.31	226	400	1,400	25	0.34	1,100	15
Medium traffic	RCB25	04/21/04	Diag/Duw	53.1	25	0.07 U	120	290	1,200	U	0.34 U	1,900	34
Medium traffic	RCB26	04/21/04	Diag/Duw	40.2	136	0.06 U	84.7	1,800	4,500	U	0.29 U	1,300	20
Medium traffic	RCB41	06/30/04	Diag/Duw	83.2	120	0.07 U	223	260	1,200	133 J	1.08 J	2,800	27
Thea Foss (Tacoma)													
Residential												4,825	
(8 samples)												(2,000 - 10,000)	
Commercial												21,000	
(5 samples)												(2,100 - 67,000)	
Industrial												13,250	
(14 samples)												(2,300 - 34,000)	
SQS				390	450	0.41	410	NA	NA	NA	12	NA	47
CSL				390	530	0.59	960	NA	NA	NA	65	NA	78
MTCA Level A[b]				NA	250	2	NA	2,000	2,000	1,000	NA	NA	NA
MTCA Level A[c]				NA	1,000	2	NA	2,000	2,000	10,000	NA	NA	NA

a. Bis(2-ethylhexyl)phthalate

b. MTCA Method A soil cleanup level for unrestricted use.

c. MTCA Method A soil cleanup level for industrial use.

Exceeds SQS

Exceeds CSL or MTCA Method A Cleanup Level (TPH)

U = Chemical not detected at concentration shown.

Y = Chemical not detected at concentration shown. Reporting limit raised due to background interference.

J = Concentration is less than the reporting limit.

Table 8. Summary of exceedances of sediment management standards for metals in storm drain sediment samples.

Metal	Onsite catch	Right-of-way	Sediment traps
Copper	14%	0%	0%
Lead	16%	8%	0%
Mercury	16%	5%	0%
Zinc	70%	31%	67%

Table 9. Land use in the Diagonal Ave S CSO/SD service area.

Land Use	Storm drain service area (Ac)	Combined sewer service area (Ac)
Industrial	490	657
Commercial	233	412
Public right-of-way	991	1,432
Single-family residential	487	1,369
Multi-family residential	102	314
Schools	45	116
Open space	124	349
Vacant	128	251
Total	2,600	4,900[a]

Table 10. Petroleum hydrocarbon results from Diagonal Ave S source tracing samples.

Petroleum hydrocarbons	Diagonal Ave S CSO/SD		Sanitary Sewer
(mg/kg)	D056-136	D056-135	S056-168
TPH-diesel	0.22 U	0.22 U	1.9
TPH-heavy oil	0.22 U	1.04	5.59
2-Fluorobiphenyl	0.13	0.138	0.134
Pentacosane	0.166	0.173	0.164

U = Chemical not detected at concentration shown.

D056-136: Diagonal Ave S CSO/SD at Diagonal Ave S and Colorado Ave S.
D056-135: Diagonal Ave S CSO/SD at Diagonal Ave S and Denver Ave S.
S056-168: 36-inch combined sewer at Diagonal Ave S and Denver Ave S.

Table 11. Diagonal Ave S CSO/SD Sediment Trap Results.

	SQS	CSL	ST1 E Marginal/S Oregon	ST1 E Marginal/S Oregon	ST1 E Marginal/S Oregon	ST2 Airport Way/6th Ave S	ST2 Grab in pipe	ST 2 (bottle #1)	ST2 (bottle #2)	ST2 Airport Way/6th Ave S	ST3 S Forest	ST3 S Forest	ST5 S College/Rainier Ave
Date deployed			02/01/03	08/21/03	03/11/04	02/01/03				03/11/04	02/01/03	10/13/03	02/01/03
Date removed			08/21/03	02/18/04	07/30/04	08/21/03	08/21/03	03/11/04	03/11/04	07/30/04	08/21/03	03/11/04	08/21/03
TOC (percent)			17	10	7.81	4.5	2.1	4.6	3.5	7.46	6.7	1.8	13
Metals (mg/kg DW)													
As	57	93	10 U	10 U	20 U	7 U	30 U	50 U	8 U	10 U	9 U	7 U	6 U
Cu	390	390	**298**	**120**	**215**	**89.9**	**78**	**146**	**34.1**	**136**	**138**	**69**	**136**
Pb	450	530	**244**	**121**	**160**	**76**	**100**	**210**	**39**	**41**	**128**	**102**	**175**
Hg	0.41	0.59	**0.3**	**0.20**	**0.20**	0.06 U	0.02 U	0.4 U	0.07 U	0.1 U	**0.07**	0.07 U	**0.10**
Zn	410	960	1,050	**445**	**638**	**282**	**159**	**735**	**162**	**184**	**653**	**433**	**479**
LPAH (mg/kg OC)													
Acenapthene	16	57	11 U	**0.6** J	3 U	2 U	2 U	5 U	3 U	1 U	2 U	4 U	1 U
Acenaphthylene	66	66	11 U	**1.0**	3 U	2 U	2 U	5 U	3 U	1 U	2 U	4 U	1 U
Anthracene	220	1,200	11 U	**0.8** J	3 U	**6**	2 U	5 U	3 U	**2**	**3**	4 U	1 U
Fluorene	23	79	11 U	**0.8** J	3 U	**2**	2 U	5 U	3 U	1 U	2 U	4 U	1 U
Naphthalene	99	170	11 U	**1.0**	3 U	2 U	2 U	5 U	3 U	1 U	**9**	4 U	1 U
Phenanthrene	100	4,480	**19**	**5.9**	**22**	**36**	**6**	**22**	**12**	**17**	**16**	**11**	**4**
HPAH (mg/kg OC)													
Benzo(a)anthracene	110	270	11 U	**3.4**	**11**	**24**	**5**	**18**	**8**	**10**	**11**	**6**	**3**
Dibenzo(a,h)anthracene	12	33	11 U	**1.0**	3 U	2 U	2 U	5 U	**3**	1 U	2 U	4 U	1 U
Chrysene	110	460	**18**	**6.1**	**23**	**29**	**6**	**30**	**12**	**15**	**15**	**11**	**4**
Fluoranthene	160	1,200	**35**	**11.0**	**29**	**60**	**10**	**65**	**25**	**27**	**24**	**22**	**8**
Benzo(b)fluoranthene[a]	230	450	**14**	**6.3**	**15**	**40**	**6**	**24**	**9**	**11**	**6**	**7**	**6**
Benzo(k)fluoranthene			**14**	**3.4**	**15**	**40**	**5**	**24**	**9**	**11**	**5**	**7**	**4**
Benzo(g,h,i)perylene	31	78	11 U	**1.6**	**9**	**3**	2 U	**10**	**5**	**5**	2 U	**5**	**2**
Benzo(a)pyrene	99	210	**11**	**3.7**	**13**	**24**	**4**	**20**	**9**	**10**	2 U	**6**	**4**
Pyrene	1,000	1,400	**32**	**9.5**	**31**	**53**	**10**	**30**	**13**	**21**	**24**	**11**	**7**
Indeno(1,2,3-c,d)pyrene	34	88	11 U	**1.7**	**8**	**5**	**2**	**10**	**6**	**5**	2 U	**4** J	**4**
Phthalates (mg/kg OC)													
Bis(2-ethylhexyl)phthalate	47	78	**394**	**87**	**294**	**400** E	**133**	**283**	**40**	**113**	**269** E	**256**	**68**
Butylbenzylphthalate	4.9	64	**17**	**3.9**	**23**	**27**	2 U	10	**4**	1 U	**30**	**7**	**3**
Diethylphthalate	61	110	11 U	1.0 U	3 U	2 U	2 U	5 U	3 U	1 U	2 U	4 U	1 U
Dimethylphthalate	53	53	11 U	1.0 U	3 U	**2**	2 U	5 U	3 U	1 U	**2**	**15**	**2**
Di-n-butylphthalate	220	1,700	11 U	**1.3**	**5**	**2**	2 U	5 U	**3**	1 U	2 U	4 U	**6**
Di-n-octylphthalate	58	4,500	**21**	**7.1**	**22**	**8**	2 U	**19**	**4**	1 U	**58** M	**23**	**3**
PCBs (mg/kg OC)	12	64											
Aroclor 1016			0.12 U	0.2 U	0.26 U	0.53 U	0.90 U	0.43 U	0.57 U	0.27 U	0.30 U	1.11 U	0.15 U
Aroclor 1242			0.12 U	0.2 U	0.26 U	0.53 U	0.90 U	0.43 U	0.57 U	0.27 U	0.30 U	1.11 U	0.15 U
Aroclor 1248			0.12 U	0.2 U	0.26 U	0.53 U	0.90 U	**1.48** P	**1.71** P	0.27 U	0.30 U	1.11 U	0.15 U
Aroclor 1254			**0.50**	**2.3**	**0.85**	**2.13**	**1.71**	**0.98**	**0.60** J	**0.29**	**1.94**	**2.78**	**1.00**
Aroclor 1260			0.12 U	**6.3**	**1.04**	0.53 U	0.90 U	0.67	**0.40** J	0.27 U	0.30 U	**1.28** J	0.15 U
Aroclor 1221			0.24 U	0.2 U	0.26 U	1.09 U	1.81 U	0.43 U	0.57 U	0.27 U	0.58 U	1.11 U	0.30 U
Aroclor 1232			0.12 U	0.2 U	0.26 U	0.53 U	0.90 U	0.43 U	0.57 U	0.27 U	0.30 U	1.11 U	0.15 U
Total PCBs			**0.50**	**8.6**	**1.88**	**2.13**	**1.71**	**0.98**	**2.71**	**0.29**	**1.94**	**4.06**	**1.00**
TPH (mg/kg)													
Diesel		2000[b]	620		**840**	88	50	370	87 U	**32**	560	380	600
Motor Oil		2000[b]	1,100		**3,200**	230	110	2,400	570	**120**	1,400	1,200	1,200

Exceeds CSL or MTCA Method A Cleanup level

Exceeds SQS

a. SMS for total benzofluoranthenes

b. MTCA Method A cleanup level for unrestricted/industrial

U = Chemical not detected at concentration shown.

Y = Chemical not detected at concentration shown.

Reporting limit raised due to background interference.

J = Concentration is less than the reporting limit.

Table 11. Diagonal Ave S CSO/SD Sediment Trap Results.

	SQS	CSL	**ST6** S Bush Pl/Rainier Ave	**ST7** S Dakota/6th Ave S
Date deployed			02/01/03	10/13/03
Date removed			08/21/03	02/18/04
TOC (percent)			12	6.9
Metals (mg/kg DW)				
As	57	93	8 U	**9**
Cu	390	390	**231**	**62.6**
Pb	450	530	**200**	**61**
Hg	0.41	0.59	**0.25**	0.06 U
Zn	410	960	**944**	**262**
LPAH (mg/kg OC)				
Acenapthene	16	57	9 U	1 J
Acenaphthylene	66	66	9 U	1 U
Anthracene	220	1,200	9 U	1 U
Fluorene	23	79	9 U	1 J
Naphthalene	99	170	9 U	1 U
Phenanthrene	100	4,480	**49**	**4**
HPAH (mg/kg OC)				
Benzo(a)anthracene	110	270	**27**	**2**
Dibenzo(a,h)anthracene	12	33	**9**	1 U
Chrysene	110	460	**42**	**3**
Fluoranthene	160	1,200	**76**	**6**
Benzo(b)fluoranthene[a]	230	450	**39**	**2**
Benzo(k)fluoranthene			**39**	**2**
Benzo(g,h,i)perylene	31	78	**14**	**1** J
Benzo(a)pyrene	99	210	**28**	**2**
Pyrene	1,000	1,400	**68**	**4**
Indeno(1,2,3-c,d)pyrene	34	88	**16**	**1** J
Phthalates (mg/kg OC)				
Bis(2-ethylhexyl)phthalate	47	78	**350**	**35**
Butylbenzylphthalate	4.9	64	**28**	**3**
Diethylphthalate	61	110	9 U	1 U
Dimethylphthalate	53	53	**9**	1 U
Di-n-butylphthalate	220	1,700	9 U	1 U
Di-n-octylphthalate	58	4,500	**31**	**3**
PCBs (mg/kg OC)	12	64		
Aroclor 1016			0.16 U	0.28 U
Aroclor 1242			0.16 U	0.28 U
Aroclor 1248			0.16 U	0.28 U
Aroclor 1254			**0.70**	**1.42**
Aroclor 1260			0.16 U	0.28 U
Aroclor 1221			0.32 U	0.28 U
Aroclor 1232			0.16 U	0.28 U
Total PCBs			**0.70**	**1.42**
TPH (mg/kg)				
Diesel		2000[b]		
Motor Oil		2000[b]		

Table 12. Diagonal Ave S CSO/SD inline sediment sample results.

Sampling Station			Mainline Stations																	
			M1		M2		M2		MH15		MH16		M3		M4		M5		MH14	
Location			Mainline w of E Marginal		Mainline at E Marginal Way S		Dupe of M2		Mainline at E Marginal Way S--WQ mon site		Dupe of MH15		Mainline at Colorado Ave S		Mainline at 2nd Ave S		Mainline at 4th Ave S		Mainline at SCL yard	
Structure No.			D056-125		D056-126		D056-126		D056-126		D056-126		D056-136		D057-176		D057-088		D057-088	
Compound	SQS	CSL	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)
Date			1/25/2002		1/25/2002		1/25/2002		2/18/2004		2/18/2004		1/28/2002		1/25/2002		1/28/2002		2/18/2004	
Total organic carbon (percent)				0.38		0.58		0.54		1.3		0.96		0.54		0.38		0.63		0.63
LPAH	370	780	**993**	**262**	**449**	**78**	**843**	**157**	**709**	**55**	**379**	**39**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Naphthalene	99	170	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Acenaphthylene	66	66	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Acenaphthene	16	57	**91**	24	78 U	13 U	79 U	15 U	**43** J	**3** J	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Fluorene	23	79	**92**	24	78 U	13 U	79 U	15 U	**53** J	**4** J	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Phenanthrene	100	480	**660**	**174**	**360**	**62**	**760**	**142**	**560**	**43**	**330**	**34**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Anthracene	220	1200	**150**	**40**	**89**	**15**	**83**	**15**	**53** J	**4** J	**49** J	**5** J	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
2-Methylnaphthalene	38	64	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
HPAH	960	5,300	**3,460**	**913**	**10,190**	**1,763**	**3,680**	**685**	**2,623**	**202**	**2,356**	**245**	**578**	**107**	78 U	20 U	**549**	**87**	**143**	**23**
Fluoranthene	160	1,200	**820**	**216**	**900**	**156**	**920**	**171**	**810**	**62**	**650**	**68**	**150**	**28**	78 U	20 U	**130**	**21**	**52** J	**8** J
Pyrene	1,000	1,400	**630**	**166**	**810**	**140**	**750**	**140**	**490**	**38**	**390**	**41**	**160**	**30**	78 U	20 U	**130**	**21**	**49** J	**8** J
Benzo(a)anthracene	110	270	**340**	**90**	**770**	**133**	**270**	**50**	**220**	**17**	**200**	**21**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Chrysene	110	460	**380**	**100**	**1,100**	**190**	**410**	**76**	**280**	**22**	**260**	**27**	**100**	**19**	78 U	20 U	**94**	**15**	**42** J	**7** J
Benzo(b)fluoranthene	230		**300**	**79**	**1,500**	**260**	**350**	**65**	**230**	**18**	**250**	**26**	**82**	**15**	78 U	20 U	**110**	**18**	78 U	12 U
Benzo(k)fluoranthene	230		**360**	**95**	**1,300**	**225**	**370**	**69**	**200**	**15**	**210**	**22**	**86**	**16**	78 U	20 U	**85**	**14**	78 U	12 U
Benzo(a)pyrene	99	210	**330**	**87**	**1,700**	**294**	**320**	**60**	**200**	**15**	**210**	**22**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Indeno(1,2,3,c-d)pyrene	34	88	**160**	**42**	**1,000**	**173**	**160**	**30**	**110**	**8**	**98**	**10**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Dibenzo(a,h)anthracene	12	33	78 U	21 U	**210**	**36**	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Benzo(g,h,i)perylene	31	78	**140**	**37**	**900**	**156**	**130**	**24**	**83**	**6**	**88**	**9**	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Total Benzofluoranthenes	230	450	**660**	**174**	**2,800**	**484**	**720**	**134**	**430** U	**33** U	**460**	**48**	**168**	**31**	78 U	20 U	**195**	**31**	78 U	12 U
Phthalates																				
Dimethyl phthalate	53	53	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Diethyl phthalate	61	110	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Di-n-butyl phthalate	220	1,700	78 U	21 U	78 U	13 U	79 U	15 U	79 U	6 U	79 U	8 U	79 U	15 U	78 U	20 U	77 U	12 U	78 U	12 U
Butyl Benzyl phthalate	4.9	64	78 U	20.6 U	78 U	13.5 U	79 U	14.7 U	**530**	**40.8**	79 U	8 U	79 U	14.7 U	78 U	20.4 U	77 U	12.3 U	78 U	12 U
Bis(2-ethylhexyl)phthalate	47	78	**1,000**	**264**	**5,100**	**882**	**860**	**160**	**630**	**48.5**	**580**	**60**	**670**	**125**	**330**	**86**	**710**	**113**	**390**	**62**
Di-n-octyl phthalate	58	4,500	78 U	21 U	**120**	**21**	79 U	15 U	79 U	6 U	79 U	8 U	**130**	**24**	78 U	20 U	77 U	12 U	78 U	12 U
PCBs																				
Aroclor 1016	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1221	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1232	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1242	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1248	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1254	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Aroclor 1260	12		62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U
Total PCBs	12	65	62 U	16 U	61 U	11 U	63 U	12 U	19 U	5 U	19 U	2 U	60 U	11 U	59 U	15 U	56 U	9 U	20 U	3 U

a. Located in section of line that has not been cleaned
U = Not detected at concentration shown.
J = Concentration less than the reporting limit.
SQS = Sediment quality standard
CSL = Cleanup screening level

Exceeds SQS
Exceeds CSL

Table 12. Diagonal Ave S CSO/SD inline sediment sample results.

Sampling Station			Lateral Stations																			
			T2		T2B		MH21		SED1		SED2		SED3		T3A		MH18		T6B	
Location			Dakota lateral at 2nd Ave S		Dakota lateral at 4th Ave S		Dakota lateral below 2nd Ave S		Sediment removed (vactor pit sample)		Sediment removed (vactor pit sample)		Sediment removed (vactor pit sample)		Duwamish lateral at RR		Duw lateral at 6th and Snoqualmie		Denver lateral at S Alaska St	
Structure No.			D057-271		D057-272										D057-180		D057-190		D064-071	
Compound	SQS	CSL	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)
Date				2/28/2002			10/29/2004		11/1/2004		11/1/2004		11/1/2004		2/28/2002		2/18/2004		2/28/2002	
Total organic carbon (percent)				0.54		2.64		4.16		6.74		5.64		9.61		7.33		9.5		5.70
LPAH	370	780	**54**	**10**	**470**	**18**									**910**	**12**	**2,011**	**21**	**790**	**14**
Naphthalene	99	170	20 U	4 U	110 U	4 U	NA		140 U	2 U	**120**	2	57 U	1 U	290 U	4	**41**	**0.4**	230 U	4 U
Acenaphthylene	66	66	20 U	4 U	110 U	4 U	NA		140 U	2 U	75 U	1 U	57 U	1 U	290 U	4	79 U	1	230 U	4 U
Acenaphthene	16	57	20 U	4 U	110 U	4 U	NA		140 U	2 U	**76**	1	57 U	1 U	290 U	4	**140**	**1**	230 U	4 U
Fluorene	23	79	20 U	4 U	110 U	4 U	NA		140 U	2 U	**89**	2	57 U	1 U	290 U	4	**140**	**1**	230 U	4 U
Phenanthrene	100	480	**54**	**10**	**470**	**18**	NA		**720**	**11**	**610**	**11**	**200**	**2**	**910**	**12**	**1,400**	**15**	**790**	**14**
Anthracene	220	1200	20 U	4 U	110 U	4 U	NA		140 U	2 U	**98**	2	57 U	1 U	290 U	4	**250**	**3**	230 U	4 U
2-Methylnaphthalene	38	64	20 U	4 U	110 U	4 U	NA		**230**	**3**	91	**2**	**58**	**1**	290 U	4	**40 J**	**0.4**	230 U	4 U
HPAH	960	5,300	**408**	**76**	**4,810**	**182**	NA								**7,530**	**103**	**8,220**	**87**	**5,870**	**103**
Fluoranthene	160	1,200	**74**	**14**	**1,300**	**49**	NA		**1,000**	**15**	**760**	**13**	**270**	**3**	**1,400**	**19**	**2,100**	**22**	**1,600**	**28**
Pyrene	1,000	1,400	**71**	**13**	**810**	**31**	NA		**1,400**	**21**	**900**	**16**	**340**	**4**	**1,400**	**19**	**1,600**	**17**	**980**	**17**
Benzo(a)anthracene	110	270	**31**	**6**	**300**	**11**	NA		**380**	**6**	**270**	**5**	**83**	**1**	**530**	**7**	**750**	**8**	**490**	**9**
Chrysene	110	460	**54**	**10**	**590**	**22**	NA		**620**	**9**	**430**	**8**	**160**	**2**	**880**	**12**	**950**	**10**	**810**	**14**
Benzo(b)fluoranthene	230		**41**	**8**	**630**	**24**	NA		**800**	**12**	**350**	**6**	**220**	**2**	**1,000**	**14**	**740**	**8**	**780**	**14**
Benzo(k)fluoranthene	230		**56**	**10**	**410**	**16**	NA		**590**	**9**	**200**	**4**	**160**	**2**	**840**	**11**	**840**	**9**	**660**	**12**
Benzo(a)pyrene	99	210	**37**	**7**	**410**	**16**	NA		**370**	**5**	**300**	**5**	**100**	**1**	**670**	**9**	**730**	**8**	**550**	**10**
Indeno(1,2,3,c-d)pyrene	34	88	**23**	**4**	**170**	**6**	NA		**310**	**5**	**220**	**4**	**86**	**1**	**370**	**5**	**280**	**3**	230 U	4 U
Dibenzo(a,h)anthracene	12	33	20 U	4 U	110 U	4 U	NA		140 U	2 U	75 U	1 U	57 U	1 U	290 U	4	79 U	1	230 U	4 U
Benzo(g,h,i)perylene	31	78	**21**	**4**	**190**	7	NA		**390**	**6**	**230**	**4**	**120**	**1**	**440**	**6**	**230**	**2**	230 U	4 U
Total Benzofluoranthenes	230	450	**97**	**18**	**1,040**	**39**	NA		**1,390**	**21**	**550**	**10**	**380**	**4**	**1,840**	**25**	**1,580**	**17**	**1,440**	**25**
Phthalates																				
Dimethyl phthalate	53	53	**140**	**26**	110 U	4 U	NA		140 U	2 U	75 U	1 U	57 U	1	290 U	4	79 U	1	230 U	4 U
Diethyl phthalate	61	110	20 U	4 U	110 U	4 U	NA		140 U	2 U	75 U	1 U	57 U	1	290 U	4	79 U	1	230 U	4 U
Di-n-butyl phthalate	220	1,700	20 U	4 U	110 U	4 U	NA		**420**	**6**	75 U	1 U	57 U	1	290 U	4	**2,200**	**23**	230 U	4 U
Butyl Benzyl phthalate	4.9	64	**23**	**4.3**	110 U	4.2 U	NA		**1,900**	**28**	**160**	**3**	**61**	**1**	**600**	**8.2**	**230**	**2**	**900**	**15.8**
Bis(2-ethylhexyl)phthalate	47	78	**230**	**43**	**3,800**	**144**	NA		**9,800**	**145**	**5,300**	**94**	**3,400**	**35**	**8900**	**121**	**3,100**	**33**	**5,300**	**93**
Di-n-octyl phthalate	58	4,500	20 U	4 U	**230**	**9**			**1,800**	**27**	**290**	**5**	**170**	**2**	**690**	**9**	**700**	**7**	**780**	**14**
PCBs																				
Aroclor 1016	12		60 U	11 U	79 U	3 U	20 U	0.5 U	38 U	1 U	36 U	1 U	11 U	0.1 U	0.12 U	2	19 U	0.2	0.072 U	1 U
Aroclor 1221	12		60 U	11 U	79 U	3 U	39 Y	0.9 Y	13 U	0 U	36 U	1 U	11 U	0.1 U	0.12 U	2	19 U	0.2	0.072 U	1 U
Aroclor 1232	12		60 U	11 U	79 U	3 U	98 Y	2.4 Y	13 U	0.2 U	36 U	1 U	11 U	0.1 U	0.12 U	2	19 U	0.2	0.072 U	1 U
Aroclor 1242	12		60 U	11 U	79 U	3 U	98 Y	2.4 Y	13 U	0.2 U	36 U	1 U	11 U	0.1 U	0.12 U	2	19 U	0.2	0.072 U	1 U
Aroclor 1248	12		60 U	11 U	79 U	3 U	91	**2.2**	**24**	**0.4**	36 U	1 U	11 U	0.1 U	0.12 U	2	**290** Y	**3.1**	**370**	**6.5**
Aroclor 1254	12		60 U	11 U	**620**	**23.5**	98 Y	2.4 Y	**58**	**1**	110 Y	2 Y	**17**	0.2	**220**	**3.0**	**180**	**1.9**	0.072 U	1 U
Aroclor 1260	12		60 U	11 U	**320**	**12.1**	39 Y	0.9 Y	**35**	**1**	**140**	**2**	11 U	0.1 U	**160**	**2.2**	73 U	0.8	**110**	**1.9**
Total PCBs	12	65	60 U	11 U	**940**	**35.6**	**91**	**2.2**	**117**	**2**	**140**	**2**	**17**	0.2	**380**	**5.2**	**470**	**4.9**	**480**	**8.4**

a. Located in section of line that has not been cleaned
U = Not detected at concentration shown.
J = Concentration less than the reporting limit.
SQS = Sediment quality standard
CSL = Cleanup screening level

Table 12. Diagonal Ave S CSO/SD inline sediment sample results.

Sampling Station			Lateral Stations			
			MH17		T8B	
Location			1st Ave S lateral at RR		1st Ave S lateral at S Andover St	
Structure No.			D057-229		D057-283	
Compound	SQS	CSL	DW (ug/kg)	OC (mg/kg)	DW (ug/kg)	OC (mg/kg)
Date			2/18/2004		2/28/2002	
Total organic carbon (percent)				4.1		1.98
LPAH	370	780	**461**	**11**	**490**	**25**
Naphthalene	99	170	**50** J	**1**	98 U	5 U
Acenaphthylene	66	66	79 U	2	98 U	5 U
Acenaphthene	16	57	**120**	**3**	98 U	5 U
Fluorene	23	79	**81**	**2**	98 U	5 U
Phenanthrene	100	480	**210**	**5**	**490**	**25**
Anthracene	220	1200	79 U	2	98 U	5 U
2-Methylnaphthalene	38	64	79 U	2	98 U	5 U
HPAH	960	5,300	**1,671**	**41**	**4,840**	**244**
Fluoranthene	160	1,200	**470**	**11**	**1,200**	**61**
Pyrene	1,000	1,400	**340**	**8**	**680**	**34**
Benzo(a)anthracene	110	270	**110**	**3**	**400**	**20**
Chrysene	110	460	**200**	**5**	**590**	**30**
Benzo(b)fluoranthene	230		**180**	**4**	**570**	**29**
Benzo(k)fluoranthene	230		**120**	**3**	**630**	**32**
Benzo(a)pyrene	99	210	**130**	**3**	**470**	**24**
Indeno(1,2,3,c-d)pyrene	34	88	**60** J	**1**	**150**	**8**
Dibenzo(a,h)anthracene	12	33	79 U	2	98 U	5 U
Benzo(g,h,i)perylene	31	78	**61** J	**1**	**150**	**8**
Total Benzofluoranthenes	230	450	**300**	**7**	**1,200**	**61**
Phthalates						
Dimethyl phthalate	53	53	**44** J	**1**	98 U	5 U
Diethyl phthalate	61	110	79 U	2	98 U	5 U
Di-n-butyl phthalate	220	1,700	79 U	2	98 U	5 U
Butyl Benzyl phthalate	4.9	64	**73** J	**2**	**100**	**5.1**
Bis(2-ethylhexyl)phthalate	47	78	**2,500**	**61**	**5,500**	**278**
Di-n-octyl phthalate	58	4,500	**110**	**3**	**700**	**35**
PCBs						
Aroclor 1016	12		20 U	0.5	67 U	3 U
Aroclor 1221	12		20 U	0.5	67 U	3 U
Aroclor 1232	12		20 U	0.5	67 U	3 U
Aroclor 1242	12		20 U	0.5	67 U	3 U
Aroclor 1248	12		20 U	0.5	67 U	3 U
Aroclor 1254	12		20 U	0.5	67 U	3 U
Aroclor 1260	12		20 U	0.5	67 U	3 U
Total PCBs	12	65	20.0 U	0.5	67 U	3 U

a. Located in section of line that has not been cleaned
U = Not detected at concentration shown.
J = Concentration less than the reporting limit.
SQS = Sediment quality standard
CSL = Cleanup screening level

Table 13: Dallas Ave S and Vicinity Sample Results.

Map Label	Sample ID	Sample Date	Location	Sample Depth (ft)	TOC (%)	TPH-Diesel (mg/kg)	TPH-Oil (mg/kg)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)	PCBs (ppm)
Dirt Collected From Roadway Surface and Catch Basins											
SD1	ROWT1	7/22/2004	W edge of Dallas Ave S at OWSEP1	0	0.78	180	730	33	800	103	0.26
SD2	ROWT2	7/22/2004	E edge of Dallas Ave S at entrance to T117	0	2.18	1,200	4,200	73	N/A	N/A	1.6
SD3	ROWT3	7/22/2004	CB on Dallas Ave S at NW corner of Port bldg at S end T117	0	7.37	4,600	9,500	95	N/A	N/A	7
SD4	ROWT4	7/22/2004	5-pt composite from storage area in ROW S of S Donovan St	0	2.82	3,200	8,300	78	N/A	N/A	2.2
SD5	ROWT5	7/22/2004	N edge of S Donovan St at SE corner of Basin Oil prop	0	1.84	55	310	261	N/A	N/A	4.8
SD6	ROWT6	7/22/2004	NW corner of S Donovan St and 17th Ave S	0	1.01	34	190	47	N/A	N/A	0.47
SD7	ROWT7	7/22/2004	5-pt composite along east edge of 17th Ave S between	0	3.36	370	2,200	182	N/A	N/A	6.1
SD8	ROWT8	7/22/2004	CB on west side of 17th Ave S at #8609	0	4.35	650	3,000	211	990	23	9.2
SD9	ROWT9	7/22/2004	2-pt composite N and S edge of Dallas Ave S and W of 17th Ave S	0	2.14	88	790	89	N/A	N/A	1.9
SD10	ROWT10	9/23/2004	Inlet at SE corner of 14th Ave S and S Trenton St	0	5.80	N/A	N/A	0.48	N/A	N/A	0.028
SD11	ROWT11	9/23/2004	Composite of street dust and dirt from inlet on S Cloverdale St on E side 14th Ave S	0	6.48	N/A	N/A	9	N/A	N/A	0.58
SD12	ROWT12	9/23/2004	Composite of street dust and dirt from inlet on S Donovan St just east of 14th Ave S	0	4.08	N/A	N/A	11	N/A	N/A	0.46
SD13	ROWT13	9/23/2004	Duplicate of 12	0	4.57	N/A	N/A	10	N/A	N/A	0.46
SD14	ROWT14	9/23/2004	Inlet at SE corner of 14th Ave S and Dallas Ave S	0	9.41	N/A	N/A	1.8	N/A	N/A	0.17
SD15	ROWT15	9/23/2004	Composite of street dust on N and S side of Dallas Ave	0	1.38	N/A	N/A	225	N/A	N/A	3.1
SD16	ROWT16	9/23/2004	CB sample at SE corner of 16th Ave S and S Cloverdale St	0	3.67	N/A	N/A	10	N/A	N/A	0.36
SD17	ROWT17	9/23/2004	Composite of street dust on N side of S Donovan St just west of 16th Ave S	0	2.59	N/A	N/A	13	N/A	N/A	0.34
SD18	ROWT18	9/23/2004	Catch basin at 17th Ave S and S Donovan St	0	2.88	N/A	N/A	13	N/A	N/A	0.36
SD19	ROWT19	10/26/2004	Road shoulder in front of 8523 Dallas Ave S	0							0.163
SD20	ROWT20	10/27/2004	Road shoulder across street from 8525 Dallas Ave S	0							1.3
SD21	ROWT21	10/27/2004	Road shoulder in front of 8519 Dallas Ave S	0							0.075
SD22	ROWT22	10/27/2004	Road shoulder in front driveway at 1437 S Donovan St	0							0.028
SD25	ROWT25	12/8/2004	CB at SE Corner of S Cloverdale St and 10th Ave S	0	8.35						<0.04
SD27	ROWT27	12/8/2004	CB at SW Corner of S Sullivan St and 8th Ave S	0	6.01						<0.05
SD28	ROWT28	12/8/2004	CB at NE corner of S Sullivan St and 12th Ave S	0	7.44						<0.02
SD29	ROWT29	12/8/2004	CB at NW corner of S Cloverdale St and 12th Ave S	0	0.00						<0.039
SD30	ROWT30	12/8/2004	CB at SW corner of S Donovan St and 12th Ave S	0	0.00						0.82
Soil Samples from Right-of-Way											
TP1	TP1-0.5	11/16/2004	Dallas Ave S at W edge 17th Ave S	0.5'							9.8
TP1	TP1-1.0	11/16/2004	Dallas Ave S at W edge 17th Ave S	1'							1.1
TP2	TP2-0.5	11/16/2004	Dallas Ave S and 17th Ave S	0.5'							7
TP2	TP2-1.0	11/16/2004	Dallas Ave S and 17th Ave S	1'							0.36
TP3	TP3-0.5	11/16/2004	17th Ave S at S edge Dallas Ave S	0.5'							4.7
TP3	TP3-1.0	11/16/2004	17th Ave S at S edge Dallas Ave S	1'							1.7
TP4	TP4-0.5	11/16/2004	17th Ave S at #8609	0.5'							38
TP4	TP4-1.0	11/16/2004	17th Ave S at #8609	1'							0.28
TP5	TP5-1.0	11/16/2004	17th Ave S at S edge #8609	1'							0.47
TP5	TP5-2.0	11/16/2004	17th Ave S at S edge #8609	2'							0.038
TP5	TP5-3.0	11/16/2004	17th Ave S at S edge #8609	3'							0.055

Table 13: Dallas Ave S and Vicinity Sample Results.

Map Label	Sample ID	Sample Date	Location	Sample Depth (ft)	TOC (%)	TPH-Diesel (mg/kg)	TPH-Oil (mg/kg)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)	PCBs (ppm)
TP5	TP5-4.0	11/16/2004	17th Ave S at S edge #8609	4'							<0.04
TP5	TP5-5.0	11/16/2004	17th Ave S at S edge #8609	5'							<0.039
TP6	TP6-1.0	11/16/2004	Dallas Ave S at BO1	1'							12
TP6	TP6-2.0	11/16/2004	Dallas Ave S at BO1	2'							0.34
TP6	TP6-3.0	11/16/2004	Dallas Ave S at BO1	3'							0.1
TP7	TP7-1.0	11/17/2004	Dallas Ave S at BO2	1'							7.5
TP7	TP7-2.0	11/17/2004	Dallas Ave S at BO2	2'							0.59
TP7	TP7-3.0	11/17/2004	Dallas Ave S at BO2	3'							0.15
TP8	TP8-1.0	11/17/2004	Dallas Ave S at BO3	1'							11
TP8	TP8-2.0	11/17/2004	Dallas Ave S at BO3	2'							0.24
TP8	TP8-3.0	11/17/2004	Dallas Ave S at BO3	3'							0.045
TP9	TP9-1.0	11/17/2004	Dallas Ave S at S Donovan St	1'							18
TP9	TP9-2.0	11/17/2004	Dallas Ave S at S Donovan St	2'							21
TP9	TP9-3.0	11/17/2004	Dallas Ave S at S Donovan St	3'							<0.042
TP10	TP10-1.0	11/17/2004	CB at Dallas Ave S and S Donovan St	1'							2.6
TP10	TP10-2.0	11/17/2004	CB at Dallas Ave S and S Donovan St	2'							0.17
TP10	TP10-3.0	11/17/2004	CB at Dallas Ave S and S Donovan St	3'							0.046
TP10	TP10-4.0	11/17/2004	CB at Dallas Ave S and S Donovan St	4'							0.031
TP10	TP10-5.0	11/17/2004	CB at Dallas Ave S and S Donovan St	5'							0.031
TP11	TP11-1.0	11/17/2004	S Donovan St1	1'							1.9
TP11	TP11-2.0	11/17/2004	S Donovan St1	2'							0.15
TP11	TP11-3.0	11/17/2004	S Donovan St1	3'							0.082
TP12	TP12-1.0	11/17/2004	S Donovan St2	1'							46
TP12	TP12-2.0	11/17/2004	S Donovan St2	2'							7.6
TP12	TP12-3.0	11/17/2004	S Donovan St2	3'							0.36
TP13	TP13-1.0	11/17/2004	S Donovan St3	1'							18
TP13	TP13-2.0	11/17/2004	S Donovan St3	2'							0.81
TP13	TP13-3.0	11/17/2004	S Donovan St3	3'							0.2
TP14	TP14-1.0	11/17/2004	S Donovan St4	1'							0.41
TP14	TP14-2.0	11/17/2004	S Donovan St4	2'							0.12
TP14	TP14-3.0	11/17/2004	S Donovan St4	3'							0.059
TP15	17-C-0.5	11/3/2004	17th Ave S and S Donovan St center	0.5'							3.3
TP15	17-C-1.0	11/3/2004	17th Ave S and S Donovan St center	1'							5.5
TP16	17-C2-0.5	11/3/2004	17th Ave S @ 8617 center	0.5'							0.94
TP16	17-C2-1.0	11/3/2004	17th Ave S @ 8617 center	1'							0.16
TP17	17-C3-0.5	11/4/2004	17th Ave S road end center	0.5'							0.014
TP17	17-C3-1.0	11/4/2004	17th Ave S road end center	1'							0.016
TP18	17-E1-0.5	11/3/2004	17th Ave S @ 8620 east	0.5'							1.5
TP18	17-E1-1.0	11/3/2004	17th Ave S @ 8620 east	1'							0.94
TP19	17-E2-0.5	11/3/2004	17th Ave S @ N end Basin oil east	0.5'							14
TP19	17-E2-1.0	11/3/2004	17th Ave S @ N end Basin oil east	1'							11
TP19	17-E2-2.0	11/3/2004	17th Ave S @ N end Basin oil east	2'							12
TP20	17-W1-0.5	11/2/2004	17th Ave S @ 8609 west	0.5'							6.3
TP20	17-W1-1.0	11/2/2004	17th Ave S @ 8609 west	1'							4.5
TP20	17-W1-2.0	11/2/2004	17th Ave S @ 8609 west	2'							1.6
TP21	17-W2-0.5	11/2/2004	17th Ave S @ 8601 west	0.5'							8.6
TP21	17-W2-1.0	11/2/2004	17th Ave S @ 8601 west	1'							0.88
TP21	17-W2-2.0	11/2/2004	17th Ave S @ 8601 west	2'							1.2
TP22	17-W3-0.5	11/3/2004	17th Ave S @ 8620 west	0.5'							0.12
TP22	17-W3-1.0	11/3/2004	17th Ave S @ 8620 west	1'							0.09

Table 13: Dallas Ave S and Vicinity Sample Results.

Map Label	Sample ID	Sample Date	Location	Sample Depth (ft)	TOC (%)	TPH-Diesel (mg/kg)	TPH-Oil (mg/kg)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)	PCBs (ppm)
TP23	D-C1-0.5	11/3/2004	Dallas Ave S across from Basin Oil entrance center	0.5'							4.9
TP23	D-C1-1.0	11/3/2004	Dallas Ave S across from Basin Oil entrance center	1'							1.7
TP24	D-E1-0.5	11/4/2004	Dallas Ave S @ T117 south entrance	0.5'							7
TP24	D-E1-1.0	11/4/2004	Dallas Ave S @ T117 south entrance	1'							1.9
TP25	D-E2-0.5	11/2/2004	E side Dallas Ave S @ T117 (mid)	0.5'							6.8
TP25	D-E2-1.0	11/2/2004	E side Dallas Ave S @ T117 (mid)	1'							6.5
TP26	D-E3-0.5	11/2/2004	E side Dallas Ave S @ center entrance	0.5'							66
TP26	D-E3-1.0	11/2/2004	E side Dallas Ave S @ center entrance	1'							13
TP27	D-N2-0.5	11/4/2004	N side Dallas Ave S @ marina N entrance	0.5'							0.66
TP27	D-N2-1.0	11/4/2004	N side Dallas Ave S @ marina N entrance	1'							0.1
TP28	D-S1-0.5	11/2/2004	S side Dallas Ave S W of 17th Ave S	0.5'							9.5
TP28	D-S1-1.0	11/2/2004	S side Dallas Ave S W of 17th Ave S	1'							8.7
TP29	D-S2-0.5	11/3/2004	S side Dallas Ave S W of 16th Ave S	0.5'							18
TP29	D-S2-1.0	11/3/2004	S side Dallas Ave S W of 16th Ave S	1'							3.6
TP30	D-S3-0.5	11/3/2004	S side Dallas Ave S @ marina N entrance	0.5'							0.3
TP30	D-S3-1.0	11/3/2004	S side Dallas Ave S @ marina N entrance	1'							0.13
TP31	TP31-0.5	12/7/2004	8523 Dallas Ave S (base of 6" excavation)	0.5							0.82
TP32	TP32-0.5	12/7/2004	8525 Dallas Ave S (base of 6" excavation)	0.5							0.019
TP33	TP33-0.5	12/8/2004	8529 Dallas Ave S (base of 6" excavation)	0.5							0.02
TP34	TP34-0.5	12/8/2004	Dupe of TP33	0.5							0.02
TP35	TP35-1.0	12/8/2004	1440 S Cloverdale (base of 12" excavation)	1							0.46
TP36	TP36-0.5	12/9/2004	S Park Marina east (base of 6" excavation)	0.5							0.02
TP37	TP37-0.5	12/9/2004	Dallas Ave across from boat storage yard (base of 6" exc	0.5							5.8
TP39	TP39-0.5	12/9/2004	S Park Marina west (base of 6" excavation)	0.5							0.44
TP40	TP40-0.5	12/10/2004	8601 17th Ave S (Dallas side #1)-base of 6" excavation	0.5							480
TP40	TP40-1.0	12/10/2004	8601 17th Ave S (Dallas side #1)	1							0.68
TP40	TP40-2.0	12/10/2004	8601 17th Ave S (Dallas side #1)	2							0.34
TP41	TP41-0.5	12/10/2004	Dallas Ave S at boat storage yard--base of 6" excavation	0.5							140
TP41	TP41-1.0	12/10/2004	Dallas Ave S at boat storage yard	1							12
TP41	TP41-2.0	12/10/2004	Dallas Ave S at boat storage yard	2							5.9
TP42	TP42-0.5	12/10/2004	8601 17th Ave S (Dallas side #2-in front of garage)--base	0.5							100
TP42	TP42-1.0	12/10/2004	8601 17th Ave S (Dallas side #2-in front of garage)	1							0.57
TP42	TP42-2.0	12/10/2004	8601 17th Ave S (Dallas side #2-in front of garage)	2							0.28
TP43	TP43-1.0	12/12/2004	8601 17th Ave S (17th side #1)--base of 12" excavation	1							0.019
TP43	TP43-2.0	12/12/2004	8601 17th Ave S (17th side #1)	2							0.02
TP44	TP44-1.0	12/12/2004	8601 17th Ave S (17th side #2)--base of 12" excavation	1							0.02
TP44	TP44-2.5	12/12/2004	8601 17th Ave S (17th side #2)	2.5							0.02
TP45	ROWS0-1	10/26/2004	Outside fence at 8609 17th Ave S	0							4.9
TP45	ROWS6-1	10/26/2004	Outside fence at 8609 17th Ave S	6"							3.6
TP46	ROWS0-2	10/26/2004	Outside fence at 8601 17th Ave S	0							21
TP46	ROWS6-2	10/26/2004	Outside fence at 8601 17th Ave S	6"							93
TP47	ROWS0-3	10/26/2004	Outside fence at 1440 S Cloverdale (Dallas ave side)	0							6.2
TP47	ROWS6-3	10/26/2004	6-in depth at 1440	6"							2.8
TP48	ROWS0-4	10/26/2004	Surface soil next to sidewalk at 8529 Dallas Ave S	0							2.2
TP48	ROWS6-4	10/26/2004	8529 Dallas Ave S	6"							0.99
TP49	ROWS0-5	10/27/2004	Surface soil next to sidewalk at 8523 Dallas Ave S	0							1.2
TP49	ROWS6-5	10/27/2004	6-in depth at 8523	6"							0.85
TP49	ROWS0-6	10/27/2004	Dupe of ROWS0-5	0							1.1

Table 13: Dallas Ave S and Vicinity Sample Results.

Map Label	Sample ID	Sample Date	Location	Sample Depth (ft)	TOC (%)	TPH-Diesel (mg/kg)	TPH-Oil (mg/kg)	PCBs (mg/kg OC)	BEHP[a] (ug/kg DW)	BEHP[a] (mg/kg OC)	PCBs (ppm)
TP50	ROWS0-7	10/27/2004	Front yard at 8519 Dallas Ave S	0							0.32
TP50	ROWS6-7	10/27/2004	6-in depth at 8519	6"							0.066
Yard Samples											
YS1	8519-1	11/17/2004	8519 Dallas Ave S (west side front yard)	2"							0.097
YS1	8519-2	11/17/2004	8519 Dallas Ave S (west side front yard)	4"							0.087
YS2	8519-3	11/17/2004	8519 Dallas Ave S (east side front yard)	2"							0.091
YS2	8519-4	11/17/2004	8519 Dallas Ave S (east side front yard)	4"							0.086
YS3	8525-1	11/17/2004	8525 Dallas Ave S (east side of house)	2"							0.2
YS3	8525-2	11/17/2004	8525 Dallas Ave S (east side of house)	4"							0.22
YS4	8525-3	11/17/2004	8525 Dallas Ave S (backyard by alley)	2"							0.15
YS4	8525-4	11/17/2004	8525 Dallas Ave S (backyard by alley)	4"							0.14
YS5	8529-1	11/17/2004	8529 Dallas Ave S (west of entry walk)	2"							0.34
YS5	8529-2	11/17/2004	8529 Dallas Ave S (west of entry walk)	4"							0.34
YS6	8529-3	11/17/2004	8529 Dallas Ave S (east of driveway)	2"							0.13
YS6	8529-4	11/17/2004	8529 Dallas Ave S (east of driveway)	4"							0.18
YS7	8529-5	11/17/2004	8529 Dallas Ave S (backyard)	2"							0.15
YS8	1440-7	11/17/2004	1440 S Cloverdale St (west end garden)	2"							<0.067
YS8	1440-8	11/17/2004	1440 S Cloverdale St (west end garden)	4"							<0.067
YS9	1440-5	11/17/2004	1440 S Cloverdale St (adj to pond)	2"							0.43
YS9	1440-6	11/17/2004	1440 S Cloverdale St (adj to pond)	4"							0.2
YS10	1417-1	11/17/2004	1417 S Cloverdale St (front yard)	2"							0.088
YS11	1417-2	11/17/2004	1417 S Cloverdale St (garden in backyard)	2"							0.15
YS12	1412-1	11/17/2004	1412 S Donovan St (garden in front yard)	2"							0.073
YS13	1412-2	11/17/2004	1412 S Donovan St (garden in backyard)	2"							0.083
YS14	8609-5	11/17/2004	8609 17th Ave S (garden in backyard)	2"							<0.058
YS15	8523-3	11/17/2004	8523 Dallas Ave S (front yard)	2"							0.22
YS15	8523-4	11/17/2004	8523 Dallas Ave S (front yard)	4"							0.11
YS16	8523-1	11/17/2004	8523 Dallas Ave S (front yard)	2"							0.12
YS16	8523-2	11/17/2004	8523 Dallas Ave S (front yard)	4"							0.097
YS17	8601-1	10/27/2004	8601 17th Ave S (front yard)	1"							37
YS17	8601-2	10/27/2004	8601 17th Ave S (front yard)	4"							46
YS18	8609-1	10/27/2004	8609 17th Ave S (next to sump)	1"							3.4
YS18	8609-2	10/27/2004	8609 17th Ave S (next to sump)	4"							1.4
YS19	8609-3	10/27/2004	8609 17th Ave S (just north of sidewalk entrance)	1"							0.85
YS19	8609-4	10/27/2004	8609 17th Ave S (just north of sidewalk entrance)	4"							0.53
YS20	1440-3	10/27/2004	1440 S Cloverdale St (west end garden)	4"							0.99
YS21	1440-4	10/27/2004	1440 S Cloverdale St (east end garden)	4"							0.17
YS22	1440-1	10/27/2004	1440 S Cloverdale (next to sidewalk on Dallas Ave S)	1"							ND
YS22	1440-2	10/27/2004	1440 S Cloverdale (next to sidewalk on Dallas Ave S)	4"							ND

Exceeds state cleanup level for unrestricted land use (1 ppm PCBs)

FIGURES

Lower Duwamish Waterway

Figure 1

Lower Duwamish Waterway Study Area

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- Lower Duwamish Surface Drainage Basin
- Combined Sewer Service Area w/in Lower Duwamish

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

Harbor Island

Lake Washington

Puget Sound

E CHERRY ST

S JACKSON ST

SW 116TH ST

S 112TH ST

SW 128TH ST

5

90

E MARGINAL WY S

6TH AV S

4TH AV S

1ST AV S

15TH AV S

BEACON AV S

50TH AV S

RAINIER AV S

M'L KING JR WY S

AIRPORT WY S

PACIFIC HY S

W MARGINAL WY SW

35TH AV SW

DELRIDGE WY SW

16TH AV SW

9TH AV SW

Lower Duwamish Waterway

Figure 2

Outfalls in the Lower Duwamish Waterway

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Utilities
- Storm drain
- Sanitary sewer
- Combined sewer
- King County interceptor

- King County CSO
- City CSO/SD
- City/County CSO/SD
- County storm drain
- City storm drain
- Private storm drain
- Unknown piped outfall
- WSDOT storm drain
- Port storm drain
- Seep
- Channel/ditch

0.2 0 0.2 Miles

Produced by the City of Seattle

Lower Duwamish Waterway

Figure 3
Businesses Inspected
June - December 2004

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- Screening visit
- Full inspection
- Follow-up inspection

- Lower Duwamish Surface Drainage Basin
- Combined Sewer Service Area w/in Lower Duwamish
- Diagonal combined sewer service area

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay
Harbor Island
Lake Washington
Puget Sound
Turning Basin
E MADISON ST
E CHERRY ST
S JACKSON ST
1ST AV S
4TH AV S
6TH AV S
E MARGINAL WY S
RAINIER AV S
15TH AV S
M L KING JR WY S
BEACON AV S
50TH AV S
35TH AV SW
W MARGINAL WY SW
DELRIDGE WY SW
16TH AV SW
9TH AV SW
AIRPORT WY S
S 112TH ST
SW 116TH ST
SW 128TH ST
PACIFIC HY S
5
90
99
509

Lower Duwamish Waterway

Figure 4

King County Key Manhole Sampling Stations

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

Key Manhole (at County Pump Station)

- Lower Duwamish Surface Drainage Basin
- Diagonal CSO Basin
- Combined Sewer Service Area w/in Lower Duwamish
- Diagonal Drainage Basin
- King County Sewer

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

Harbor Island

Duwamish PS

West Marginal PS

East Marginal PS

Lake Washington

Puget Sound

E CHERRY ST
S JACKSON ST
E MARGINAL WY S
4TH AV S
6TH AV S
1ST AV S
15TH AV S
RAINIER AV S
BEACON AV S
50TH AV S
M L KING JR WY S
AIRPORT WY S
W MARGINAL WY SW
35TH AV SW
DELRIDGE WY SW
16TH AV SW
9TH AV SW
S 112TH ST
SW 116TH ST
SW 128TH ST
1ST AV S
PACIFIC HY S
99

Lower Duwamish Waterway

Figure 5

Catch Basin Sample Locations

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- Onsite catch basin June-04 reporting period
- Onsite catch basin Jan-05 reporting period
- Right-of-way catch basin June-04 reporting period
- Right-of-way catch basin Jan 05 reporting period

- Lower Duwamish Surface Drainage Basin
- Combined Sewer Service Area w/in Lower Duwamish
- Diagonal Storm Drain Basin
- Diagonal combined sewer service area
- Slip 4 storm drain basin
- T117 storm drain basin
- Slip 5 storm drain basin

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

Harbor Island

Lake Washington

Puget Sound

Turning Basin

RCB27 CB28 CB27b CB26 CB27a RCB28 RCB26 CB30 CB29 E CHERRY ST RCB6 S JACKSON ST RCB25 RCB23 CB5 CB10 CB4 RCB24 CB13 RCB7 RCB10 CB7 RCB8 RCB22 CB14 RCB9 RCB30 CB15 RCB37 CB21 RCB39 CB1 RCB41 RCB5 CB12 CB9 CB33 RCB29 CB31 RCB2 CB25 CB32 RCB19 RCB12 RCB17 RCB40 RCB33 RCB35 CB2 RCB13 CB20 CB3 RCB34 RCB1 RCB36 CB24 RCB16 RCB21 CB23 RCB3 CB16 RCB4 RCB20 CB11 CB22 CB19 CB18 CB8 RCB15 RCB31 CB46 CB45 CB44 CB37 CB39 CB42 CB41 CB41b RCB32 CB34 CB35 CB 36

1ST AV S 4TH AV S 6TH AV S 15TH AV S E MARGINAL WY S RAINIER AV S BEACON AV S M L KING JR WY S AIRPORT WY S PACIFIC HY S S 112TH ST SW 116TH ST SW 128TH ST

35TH AV SW 16TH AV SW W MARGINAL WY SW 9TH AV SW DELRIDGE WY SW

Lower Duwamish Waterway

Figure 6

Diagonal Ave S CSO/SD Drainage Basin Boundary

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- City combined sewer overflow location
- County combined sewer overflow location

- Lower Duwamish Surface Drainage Basin
- Diagonal combined sewer service area
- Diagonal Storm Drain Basin
- Storm drain
- County sewer

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

East Waterway

Lake Washington

TAYLOR AV N
DEXTER AV N
BROADWAY E
E JOHN ST
E DENNY WY
19TH AV
23RD AV
15TH AV
E PIKE ST
E UNION ST
M L KING JR WY
BOREN AV
MADISON ST
5TH AV
9TH AV
12TH AV
E CHERRY ST
E JEFFERSON ST
CHERRY ST
BOREN AV S
14TH AV S
8TH AV
YESLER WY
E YESLER WY
S JACKSON ST
ALASKAN WY S
7TH AV S
S DEARBORN ST
RAINIER AV S
20TH AV S
23RD AV S
LAKESIDE AV S
S ROYAL BROUGHAM WY
S ATLANTIC ST
6TH AV S
12TH AV S
14TH AV S
S JUDKINS ST
S MASSACHUSETTS ST
S HOLGATE ST
4TH AV S
AIRPORT WY S
17TH AV S
S COLLEGE ST
31ST AV S
ALASKAN WY VI NB
1ST AV S
S LANDER ST
S FOREST ST
S HANFORD ST
S MC CLELLAN ST
S MOUNT BAKER BV
HUNTER BV S
S SPOKANE ST
12TH AVE S
S INDUSTRIAL WY
BEACON AV S
S GENESEE ST
S COLUMBIAN WY
S ALASKA ST
50TH AV S
LAKE WASHINGTON BV S
S HUDSON ST
15TH AV S
S DAWSON ST
M L KING JR WY S
S LUCILE ST
W MARGINAL WY SW
S ORCAS ST
SEWARD PARK AV S
S MICHIGAN ST
CORSON AV S
S ALBRO PL
S GRAHAM ST
ELLIS AV S
S MYRTLE ST
S OTHELLO ST
S WEBSTER ST
HIGHLAND PARK
2ND AV SW

Lower Duwamish Waterway

Figure 7

Land Use in Diagonal Ave S CSO/SD Service Area

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Land Use Types
- Commercial
- Industrial
- Multi-Family
- Open Space
- Schools
- Single Family
- Vacant

Diagonal Storm Drainage Basin Boundary

Diagonal Combined Sewer Service Area

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

East Waterway

Lake Washington

DEXTER AV N
E JOHN ST
E DENNY WY
15TH AV
19TH AV
23RD AV
M L KING JR WY
E PIKE ST
E UNION ST
BOREN AV
BROADWAY
MADISON ST
5TH AV
9TH AV
12TH AV
E CHERRY ST
E JEFFERSON ST
14TH AV S
CHERRY ST
YESLER WY
E YESLER WY
S JACKSON ST
ALASKAN WY S
7TH AV S
S DEARBORN ST
BEACON AV S
20TH AV S
23RD AV S
LAKESIDE AV S
36TH AV S
S ROYAL BROUGHAM WY
S ATLANTIC ST
6TH AV S
12TH AV S
14TH AV S
S JUDKINS ST
90
S MASSACHUSETTS ST
S HOLGATE ST
4TH AV S
AIRPORT WY S
17TH AV S
S COLLEGE ST
31ST AV S
ALASKAN WY VI NB
S LANDER ST
1ST AV S
S FOREST ST
S MC CLELLAN ST
S HANFORD ST
S MOUNT BAKER BV
HUNTER BV S
S SPOKANE ST
S INDUSTRIAL WY
S GENESEE ST
S COLUMBIAN WY
S ALASKA ST
50TH AV S
LAKE WASHINGTON BV S
S HUDSON ST
15TH AV S
S LUCILE ST
S DAWSON ST
M L KING JR WY S
S ORCAS ST
W MARGINAL WY SW
S MICHIGAN ST
S ALBRO PL
CORSON AV S
ELLIS AV S
S GRAHAM ST
SEWARD PARK AV S
S MYRTLE ST
S OTHELLO ST
2ND AV SW
S WEBSTER ST

Lower Duwamish Waterway

Figure 8

Business Inspections in the Diagonal Ave S CSO/SD Basin

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- Diagonal combined sewer service area
- Diagonal Storm Drain Basin

March 2003 - May 2004
- Follow-up inspection
- Full inspection
- Screening inspection

June - December 2004
- Follow-up inspection
- Full inspection
- Screening inspection

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

East Waterway

Lake Washington

TAYLOR AV N
DEXTER AV N
BROADWAY E
E JOHN ST
E DENNY WY
15TH AV
19TH AV
23RD AV
M L KING JR WY
E PIKE ST
E UNION ST
11TH AV
BOREN AV
BROADWAY
5TH AV
MADISON ST
9TH AV
E CHERRY ST
12TH AV
E JEFFERSON ST
CHERRY ST
BOREN AV S
14TH AV S
8TH AV
YESLER WY
E YESLER WY
S JACKSON ST
ALASKAN WY S
S DEARBORN ST
7TH AV S
20TH AV S
23RD AV S
S ROYAL BROUGHAM WY
12TH AV S
S JUDKINS ST
S ATLANTIC ST
6TH AV S
14TH AV S
S MASSACHUSETTS ST
S HOLGATE ST
AIRPORT WY S
17TH AV S
S COLLEGE ST
ALASKAN WY VI NB
4TH AV S
31ST AV S
S LANDER ST
1ST AV S
S FOREST ST
S MC CLELLAN ST
S HANFORD ST
HUNTER BV S
S SPOKANE ST
INDUSTRIAL WY
BEACON AV S
S GENESEE ST
S COLUMBIAN WY
50TH AV S
S ALASKA ST
LAKE WASHINGTON BV S
S HUDSON ST
15TH AV S
S DAWSON ST
W MARGINAL WY SW
S LUCILE ST
M L KING JR WY S
S ORCAS ST
S MICHIGAN ST
CORSON AV S
S GRAHAM ST
ELLIS AV S
HIGHLAND PARK
2ND AV SW
E ST

Lower Duwamish Waterway

Figure 8

Business Inspections in the Diagonal Ave S CSO/SD Basin

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Streams
- Culvert
- Open Channel

- Diagonal combined sewer service area
- Diagonal Storm Drain Basin

March 2003 - May 2004
- Follow-up inspection
- Full inspection
- Screening inspection

June - December 2004
- Follow-up inspection
- Full inspection
- Screening inspection

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

East Waterway

Lake Washington

TAYLOR AV N
DEXTER AV N
BROADWAY E
E JOHN ST
E DENNY WY
15TH AV
19TH AV
23RD AV
M L KING JR WY
E PIKE ST
E UNION ST
11TH AV
BOREN AV
BROADWAY
5TH AV
MADISON ST
9TH AV
E CHERRY ST
12TH AV
E JEFFERSON ST
CHERRY ST
BOREN AV S
14TH AV S
8TH AV
YESLER WY
E YESLER WY
S JACKSON ST
ALASKAN WY S
S DEARBORN ST
7TH AV S
20TH AV S
23RD AV S
S ROYAL BROUGHAM WY
12TH AV S
S JUDKINS ST
S ATLANTIC ST
6TH AV S
14TH AV S
S MASSACHUSETTS ST
S HOLGATE ST
AIRPORT WY S
17TH AV S
S COLLEGE ST
ALASKAN WY VI NB
4TH AV S
31ST AV S
S LANDER ST
1ST AV S
S FOREST ST
S MC CLELLAN ST
S HANFORD ST
HUNTER BV S
S SPOKANE ST
INDUSTRIAL WY
BEACON AV S
S GENESEE ST
S COLUMBIAN WY
50TH AV S
S ALASKA ST
LAKE WASHINGTON BV S
S HUDSON ST
15TH AV S
S DAWSON ST
W MARGINAL WY SW
S LUCILE ST
M L KING JR WY S
S ORCAS ST
S MICHIGAN ST
CORSON AV S
S GRAHAM ST
ELLIS AV S
HIGHLAND PARK
2ND AV SW
E ST

Lower Duwamish Waterway

Figure 9

Diagonal CSO/SD sediment trap locations

Legend

Streets

- Arterials
- Streets
- State Highway
- Interstate Freeway

- Sediment trap
- SPU storm drain mainline

- Storm drain trib to ST 2
- Storm drain trib to ST 3
- Storm drain trib to ST 5
- Storm drain trib to ST 6
- Storm drain trib to ST 7

Diagonal Ave S CSO/SD storm drain basin

400 0 400 800 Feet

Produced by the City of Seattle

ST1
ST2
ST3
ST4
ST5
ST6
ST7

East Waterway

BROADWAY
BOREN AVE S
14TH AVE
E 23RD AVE
M L KING JR WAY
E YESLER WAY
S JACKSON ST
S DEARBORN ST
7TH AVE S
RAINIER AVE S
20TH AVE S
S JUDKINS ST
12TH AVE S
S MASSACHUSETTS ST
S HOLGATE ST
6TH AVE S
1ST AVE S
17TH AVE S
S COLLEGE ST
31ST AVE S
S LANDER ST
S FOREST ST
S MCCLELLAN ST
4TH AVE S
EAST MARGINAL WAY S
S HANFORD ST
S SPOKANE ST
M L KING JR WAY S
S INDUSTRIAL WAY
15 SB
15 NB
BEACON AVE S
S COLUMBIAN WAY
S ALASKA ST
S HUDSON ST
15TH AVE S
S LUCILE ST
5
90

Lower Duwamish Waterway

Figure 10

Catch Basin Samples Collected in Diagonal Ave S CSO/SD Basin

Legend

Streets
- Arterials
- State Highway
- Interstate Freeway

Diagonal combined sewer service area

Diagonal storm drain Basin

- Onsite catch basin June-04 reporting period
- Onsite catch basin Jan-05 reporting period
- Right-of-way catch basin June-04 reporting period
- Right-of-way catch basin Jan 05 reporting period

Note: Locations where dots and solid colors overlap are in the partially separated drainage/sewer system.

N W E S

0.2 0 0.2 0.4 0.6 0.8 1 Miles

Produced by the City of Seattle

Elliott Bay

East Waterway

Lake Washington

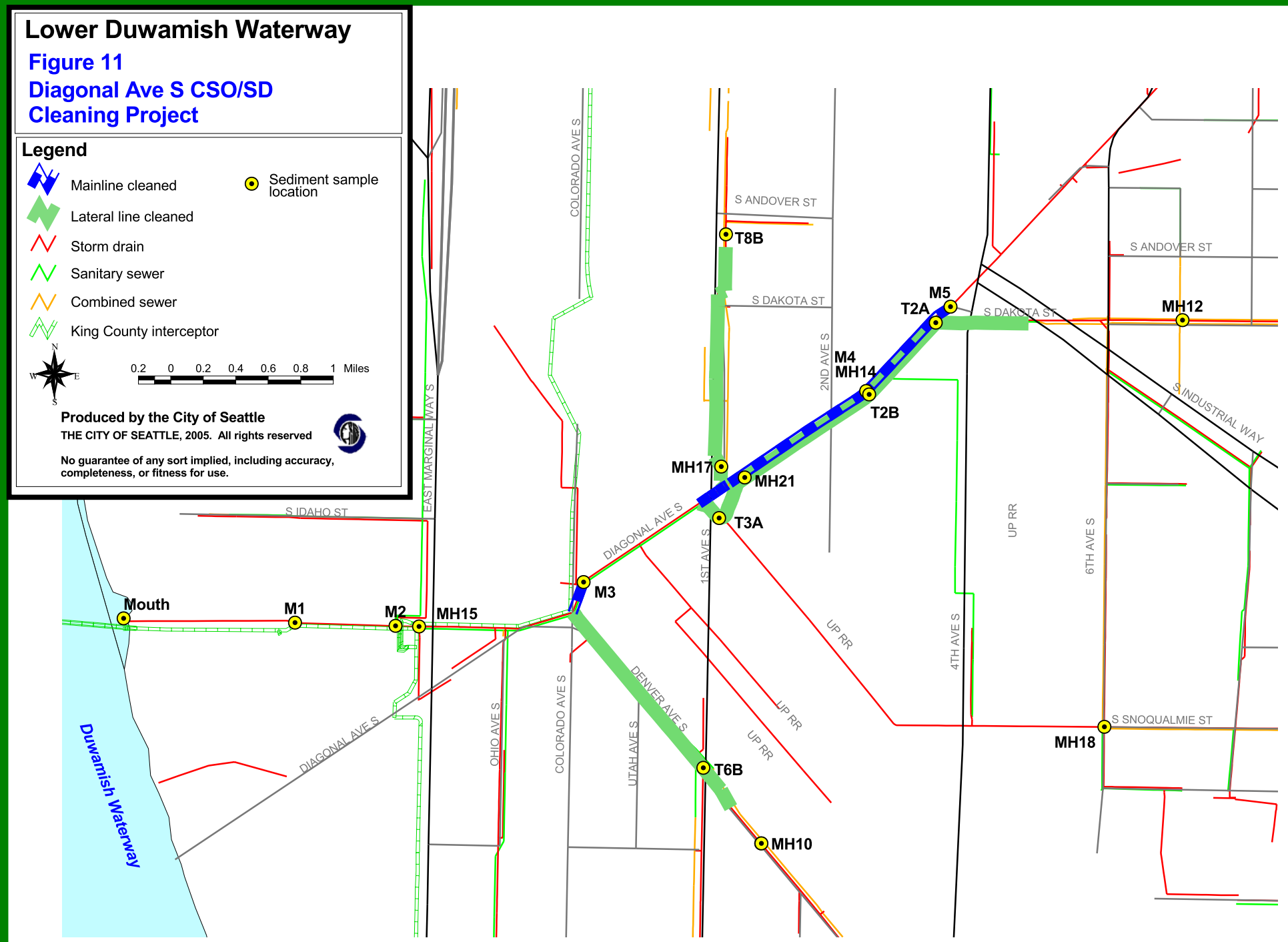
RCB27 CB26 CB27a CB27b CB28 RCB26 RCB28 CB30 CB29 RCB6 RCB25 RCB23 RCB24 CB5 CB10 CB4 CB13 RCB10 RCB7 RCB8 CB7 RCB22 RCB9 RCB30 CB14 CB38 CB15 RCB37 CB1 RCB39 RCB41 CB21 RCB11 RCB5 CB12 CB9 CB32 RCB29 RCB12 CB31 RCB2 CB25 CB32 RCB19 RCB17 RCB40 CB3 RCB33 RCB35 RCB13 CB2 CB20 RCB34 RCB1 RCB36 RCB21 RCB16 CB24 CB23 RCB3 CB16 RCB20 CB22 RCB4 CB11 CB19 CB18 CB8 RCB15 RCB31 CB46 CB45 CB44 CB37

E DENNY WY · BROADWAY E · E JOHN ST · 19TH AV · E MADISON ST · 15TH AV · TAYLOR AV · DEXTER AV N · E PIKE ST · BOREN AV · 11TH AV · E UNION ST · 23RD AV · M L KING JR WY · E CHERRY ST · 9TH AV · 12TH AV · E JEFFERSON ST · CHERRY ST · YESLER WY · 14TH AV S · S JACKSON ST · 20TH AV S · 23RD AV S · ALASKAN WY S · S DEARBORN ST · 7TH AV S · S ROYAL BROUGHAM WY · RAINIER AV S · S JUDKINS ST · S ATLANTIC ST · 12TH AV S · S MASSACHUSETTS ST · S HOLGATE ST · 17TH AV S · S COLLEGE ST · 1ST AV S · 4TH AV S · 6TH AV S · AIRPORT WY S · S LANDER ST · 31ST AV S · S MC CLELLAN ST · S FOREST ST · S HANFORD ST · S SPOKANE ST · HUNTER BV S · BEACON AV S · S INDUSTRIAL WY · S GENESEE ST · 50TH AV S · LAKE WASHINGTON BV S · S COLUMBIAN WY · S ALASKA ST · S HUDSON ST · 15TH AV S · S DAWSON ST · W MARGINAL WY SW · M L KING JR WY S · S ORCAS ST · S MICHIGAN ST · S GRAHAM ST · CORSON AV S · ELLIS AV S · 2ND AV SW · HIGHLAND PARK

5 · 90

Lower Duwamish Waterway

Figure 11
Diagonal Ave S CSO/SD Cleaning Project



Lower Duwamish Waterway

Figure 12

Areas draining to Slip 4

Legend

- Storm drain
- Sanitary sewer
- Combined sewer
- King County interceptor

Drainage basin boundaries

- Direct discharge
- Georgetown flume
- I-5 SD
- Slip 4 SD (King County Airport drain)
- Slip 4 CSO/SD

- King County CSO
- City CSO/SD
- City/County CSO/SD
- County storm drain
- City storm drain
- Private storm drain
- Unknown piped outfall
- WSDOT storm drain
- Port storm drain
- Seep
- Channel/ditch

400 0 400 800 Feet

S BENNETT ST
S LUCILE ST
16TH AVE S
17TH AVE S
18TH AVE S
S ORCAS ST
S JUNEAU ST
19TH AVE S
20TH AVE S
22ND AVE S
S JUNEAU ST
S GRAHAM ST
BEACON AVE S
STANLEY AVE S
S HARDY ST
6TH AVE S
7TH AVE S
S RIVER ST
S ELIZABETH ST.
13TH AVE S
15TH AVE S
15TH AVE S
23RD AVE S
24TH AVE S
S WARSAW ST
S HOLLY ST
CORSON AVE S
CARLETON AVE S
FLORA AVE S
ELLIS AVE S
S WARSAW ST
PERIMETER RD S
SWIFT AVE S
EAST MARGINAL WAY S
S WILLOW ST
S WILLOW ST
S WILLOW ST
S MYRTLE ST
S MYRT
S ORCHARD ST
AIRPORT WAY S
S GARDEN ST
S OTHELLO ST
8TH AVE S
Slip 4
S WEBSTER ST
14TH AVE S
16TH AVE S
Duwamish Waterway

Lower Duwamish Waterway

Figure 13

Businesses inspected in Slip 4
June - December 2004

Legend

- Storm drain
- Sanitary sewer
- Combined sewer
- King County interceptor

- Screening visit
- Onsite inspection
- Follow-up inspection

Drainage basin boundaries

- Direct discharge
- Georgetown flume
- I-5 SD
- Slip 4 SD (King County Airport drain)
- Slip 4 CSO/SD

400 0 400 800 Feet

Produced by the City of Seattle

S BENNETT ST
S LUCILE ST
16TH AVE S
17TH AVE S
18TH AVE S
S ORCAS ST
19TH AVE S
20TH AVE S
22ND AVE S
S JUNEAU ST
STANLEY AVE S
S HARDY ST
6TH AVE S
S RIVER ST
CORSON AVE S
S WARSAW ST
CARLETON AVE S
FLORA AVE S
ELLIS AVE S
13TH AVE S
15TH AVE S
S ELIZABETH ST
PERIMETER RD S
23RD AVE S
24TH AVE S
BEACON AVE S
S WARSA
SWIFT AVE S
EAST MARGINAL WAY S
S WILLOW ST
S MYRTLE ST
S ORCHARD ST
S GARDEN ST
S OTHELLO ST
8TH AVE S
Slip 4
S WEBSTER ST
14TH AVE S
16TH AVE S
AIRPORT WAY S
Duwamish Waterway

Lower Duwamish Waterway

Figure 14

Proposed Sediment Trap Locations in Slip 4 Storm Drains

Legend

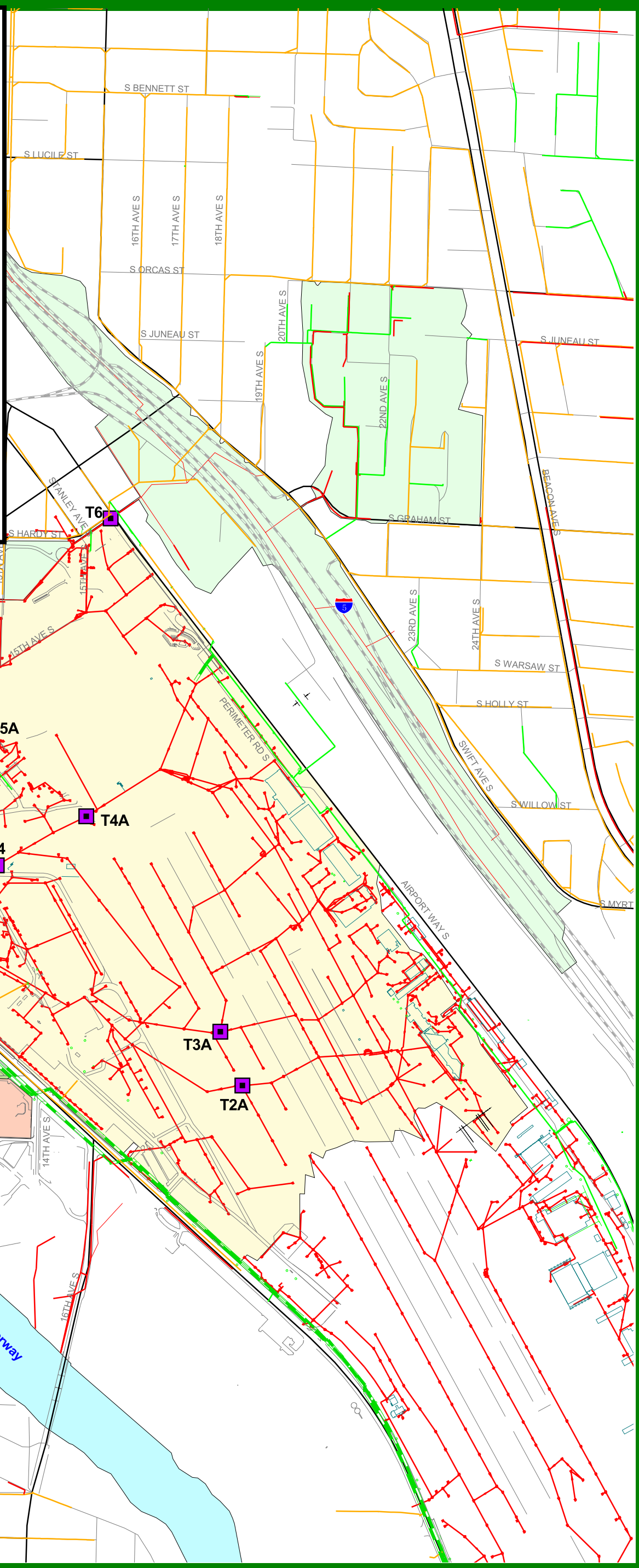
- Storm drain
- Sanitary sewer
- Combined sewer
- King County interceptor
- Sediment trap

Drainage basin boundaries

- Direct discharge
- Georgetown flume
- I-5 SD
- Slip 4 SD (King County Airport drain)
- Slip 4 CSO/SD

400 0 400 800 Feet

Produced by the City of Seattle



Lower Duwamish Waterway

Figure 15

Businesses inspected in Slip 5 and Slip 6 (June - December 2004)

Legend

- Screening visit
- Onsite inspection
- Follow-up inspection
- **Storm drain**
- **Sanitary sewer**
- **Combined sewer**
- **King County interceptor**

Drainage basin boundaries

- King County Airport storm drain (Slip 5)
- King County Airport storm drain (Slip 6)
- Waterfront discharges

400 0 400 800 Feet

Produced by the City of Seattle

Duwamish Waterway

Former Slip 5

Slip 6

AIRPORT WAY S

DIAGONAL AVE S

EAST MARGINAL WAY S

16TH AV S BR

S WILLOW ST

S FRONTENAC ST

S MYRTLE ST

S OTHELLO ST

S WEBSTER ST

S PORTLAND ST

S 96TH ST

S 98TH ST

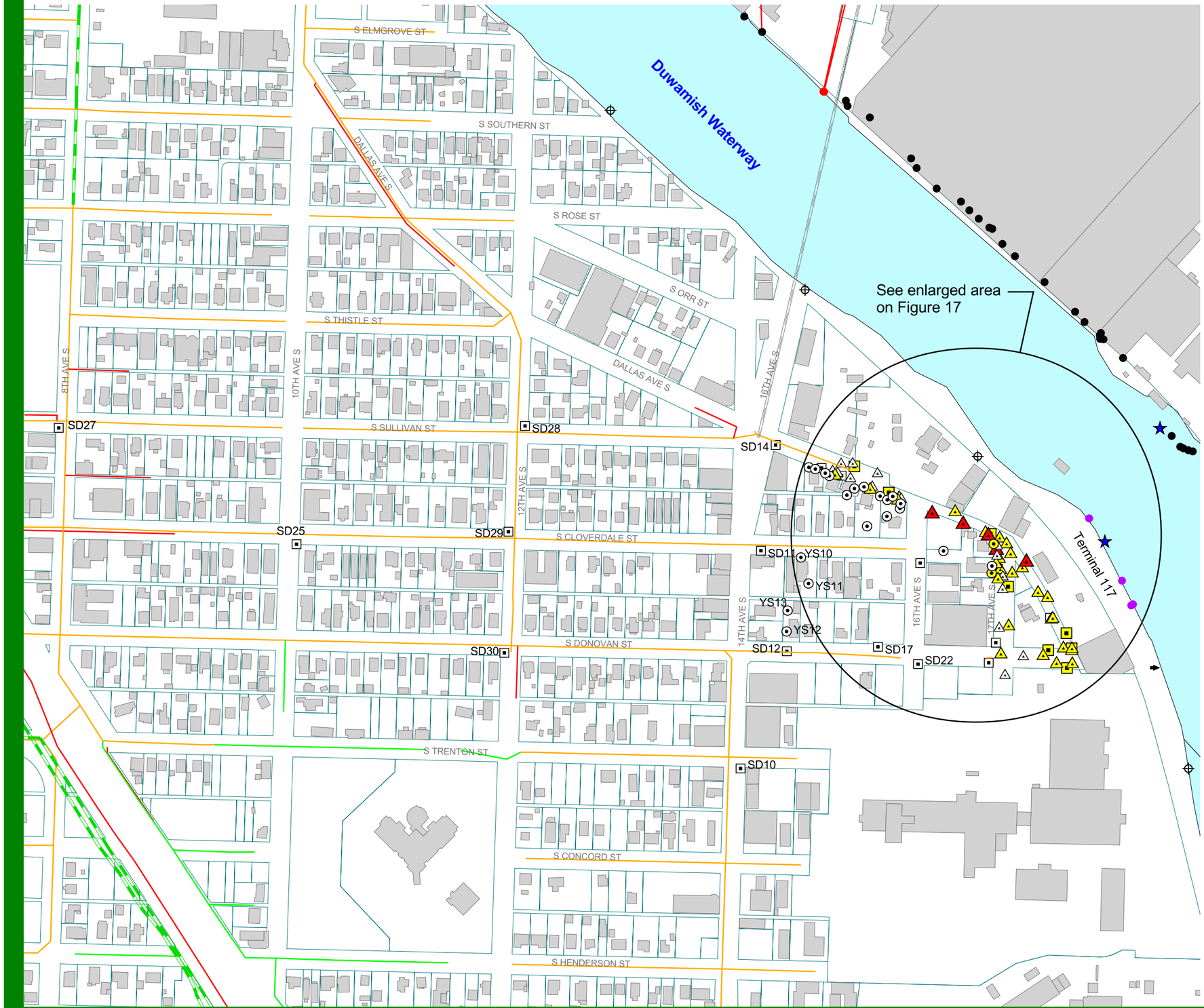
S NORFOLK ST

S 103RD ST

Lower Duwamish Waterway

Figure 16

Sediment Sample Locations in Vicinity of T117 Early Action Site



Legend

PCBs in Right-of-Way Soil

Below Cleanup Level | Above Cleanup Level | Greater than 50 ppm

PCBs in Roadway Dirt

Below Cleanup Level | Above Cleanup Level

PCBs in Yard Soil

Below Cleanup Level | Above Cleanup Level | Greater than 50 ppm

Property boundary

Building

Utilities

- Storm drain
- Sanitary sewer
- Combined sewer
- King County interceptor

Outfalls

- City storm drain
- Private storm drain
- Unknown piped outfall
- Port storm drain
- Seep
- Channel/ditch

PCBs = Polychlorinated Biphenyl

State Cleanup Level = 1 ppm PCBs

N W E S

50 0 50100 Feet

Produced by the City of Seattle

Lower Duwamish Waterway

Figure 17

Dallas Ave S and Vicinity
Street and Yard Sample Locations

Legend

PCBs in Right-of-Way Soil

Below Cleanup Level | Above Cleanup Level | Greater than 50 ppm

PCBs in Roadway Dirt

Below Cleanup Level | Above Cleanup Level

PCBs in Yard Soil

Below Cleanup Level | Above Cleanup Level | Greater than 50 ppm

Property boundary

Building

PCBs = Polychlorinated Biphenyl

State Cleanup Level = 1 ppm PCBs

N W E S

20 0 20 40 60 80 100 Feet

Produced by the City of Seattle

Duwamish Waterway

16TH AVE S

DALLAS AVE S

S CLOVERDALE ST

S DONOVAN ST

16TH AVE S

17TH AVE S

Terminal 117

8510 8500 8519 8523 8525 8514 8520 8529 1410 1420 1424 1440

8600 1415 1417 1421 1425 1429 1445

8616 1412 1418 1426 1430

8700 1437

8602 8609 8617 8620

8601 8700 8661

SD14 SD21 SD20 SD19 SD15 SD16 SD11 SD12 SD17 SD22 SD18 SD6 SD5 SD4 SD3 SD2 SD1 SD7 SD8 SD9

YS1 YS2 YS16 YS15 YS3 YS5 YS4 YS6 YS22 YS20 YS21 YS8 YS9 YS7 YS10 YS11 YS13 YS12 YS14 YS17 YS19 YS18

TP27 TP39 TP30 TP31 TP49 TP32 TP36 TP33 TP48 TP29 TP35 TP47 TP37 TP41 TP42 TP28 TP40 TP1 TP2 TP43 TP46 TP44 TP3 TP21 TP45 TP26 TP4 TP19 TP6 TP5 TP20 TP16 TP7 TP25 TP23 TP8 TP18 TP22 TP9 TP24 TP10 TP15 TP14 TP13 TP12 TP11 TP17