

# Lower Duwamish Waterway Slip 4

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## Technical Memorandum: Status of Slip 4 Source Control

Prepared for



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# Table of Contents

	<u>Page</u>
<b>1.0 Introduction.....</b>	<b>1</b>
<b>2.0 Sediment Trap Sampling.....</b>	<b>1</b>
2.1 T1 – Downstream of North and Central Lateral Storm Drain Lines .....	1
2.2 T2/T2A – South Lateral Storm Drain Line.....	2
2.3 T3/T3A – Central Lateral #1 Storm Drain Line .....	2
2.4 T4/T4A – Central Lateral #2 Storm Drain Line .....	2
2.5 T5/T5A – North Lateral Storm Drain Line.....	3
2.6 T6 – I-5 Storm Drain (I-5 and Residential Drainage).....	3
2.7 Summary .....	3
<b>3.0 North Boeing Field.....</b>	<b>4</b>
3.1 Source Tracing in Storm Drain Lines .....	4
3.1.1 North Storm Drain Line .....	5
3.1.2 Cleanout of OWS-640.....	6
3.2 Removal of Joint Sealant Material.....	7
3.3 Other Source Control Activities.....	7
<b>4.0 Georgetown Steam Plant (GTSP).....</b>	<b>8</b>
4.1 Interim Remedial Action.....	8
4.2 Site Characterization.....	8
4.3 Other Source Control Activities.....	9
<b>5.0 King County International Airport.....</b>	<b>10</b>
5.1 Source Tracing in Storm Drain Lines .....	10
5.2 Testing of Joint Sealant Material .....	10
5.3 Cleanout of Catch Basins and Structures.....	11
<b>6.0 Georgetown Flume.....</b>	<b>11</b>
<b>7.0 Crowley Marine/Alaska Logistics .....</b>	<b>11</b>
<b>8.0 First South Properties/Emerald Services.....</b>	<b>12</b>
<b>9.0 Boeing Plant 2.....</b>	<b>13</b>
<b>10.0 Other Upland Properties.....</b>	<b>13</b>
<b>11.0 Other Source Control Activities .....</b>	<b>15</b>
<b>12.0 References.....</b>	<b>17</b>

## Figures

- Figure 1. Sediment Trap Locations
- Figure 2. NBF Storm Drain Cleanout (2006)
- Figure 3. Storm Drain Sample Locations, Northern End of NBF

## Tables

- Table ES-2-Rev1. Slip 4 Source Control Action Priorities
- Table 1. PCBs in Slip 4 Sediment Traps (August 2005 through January 2007)
- Table 2. Metals in Slip 4 Sediment Traps (August 2005 through January 2007)
- Table 3. Phthalates in Slip 4 Sediment Traps (August 2005 through January 2007)
- Table 4. Phthalates in Slip 4 Sediment Traps (August 2005 through January 2007), Comparison to Regulatory Levels
- Table 5. HPAH in Slip 4 Sediment Traps (August 2005 through January 2007)
- Table 6. HPAH in Slip 4 Sediment Traps (August 2005 through January 2007), Comparison to Regulatory Levels
- Table 7. LPAH in Slip 4 Sediment Traps (August 2005 through January 2007)
- Table 8. LPAH in Slip 4 Sediment Traps (August 2005 through January 2007), Comparison to Regulatory Levels
- Table 9. Other SVOCs in Slip 4 Sediment Traps (August 2005 through January 2007)

## 1.0 Introduction

This document summarizes the Slip 4 source control actions that have been conducted since preparation of the *Lower Duwamish Waterway Source Control Action Plan for the Slip 4 Early Action Area* (SCAP; July 2006), and provides a summary of the current status of source control for the Slip 4 Early Action Area. Table ES-2 of the SCAP, which identified source control actions, priorities, and responsibilities, has been updated and is attached to this Technical Memorandum. Additional background information and maps are located in the SCAP (Ecology 2006a).

Potential sources of sediment recontamination that were identified in the SCAP include piped outfalls, properties adjacent to Slip 4, and upland properties. These potential sources and recent source control activities are described below.

## 2.0 Sediment Trap Sampling

The potential for sediment recontamination associated with piped outfalls has been evaluated by the installation of sediment traps at stations selected to isolate individual storm drains and subbasins within the larger Slip 4 drainage basin. Traps are installed for a 4- to 6-month period to passively collect samples of suspended sediment present in the stormwater runoff. Sediment traps have been installed by Seattle Public Utilities (SPU) at the following 10 stations in the publicly-owned storm drains that discharge to Slip 4 (Figure 1):

- **T1:** Downstream end of the north and central lateral storm drain lines, upstream of the King County lift station (KC Airport SD#3/PS44 EOF)
- **T2 and T2A:** Downstream and upstream, respectively, of the Boeing-leased property along the south lateral (KC Airport SD#3/PS44 EOF)
- **T3 and T3A:** Downstream and upstream, respectively, of the Boeing-leased property along central lateral #1 (KC Airport SD#3/PS44 /EOF)
- **T4 and T4A:** Downstream and upstream, respectively, of the Boeing-leased property along central lateral #2 (KC Airport SD#3/PS44 EOF)
- **T5 and T5A:** Downstream and upstream, respectively, of the Boeing-leased property along the north lateral (KC Airport SD#3/PS44 EOF)
- **T6:** Intersection of S. Hardy Street and Airport Way S. (I-5 Storm Drain)

Four rounds of sediment trap sampling have been completed; samples were collected in August 2005, March 2006, October 2006, and January 2007. Results for analytes detected in at least one sample are shown in Tables 1 through 9 and are summarized below.

### 2.1 T1 – Downstream of North and Central Lateral Storm Drain Lines

Total PCBs at this location, which is downstream of the north and central lateral drain lines, have increased during each round of sediment trap sampling, from 10 mg/kg in August 2005 to 260

mg/kg in January 2007. This indicates that an ongoing upstream source of PCBs is still present in the Slip 4 drainage basin. PCBs are predominantly detected as Aroclor 1254.

Mercury and zinc have been detected at this location at levels above the Sediment Quality Standard (SQS); the highest concentrations (8.3 mg/kg mercury, 1,140 mg/kg zinc) were found during the most recent sampling round for which metals data were available (October 2006).

Bis(2-ethylhexyl)phthalate (BEHP) was detected above its SQS value in 2005, however a more recent sample showed a lower concentration. No other chemicals were detected at concentrations above sediment regulatory levels.

## **2.2 T2/T2A – South Lateral Storm Drain Line**

PCB concentrations in both upstream and downstream sediment traps in the south lateral drain line have consistently been relatively low. The most recent data (January 2007) shows PCB concentrations below 1 mg/kg DW, within the range of typical urban levels of PCBs.

In the most recent upstream sediment trap sample for which data are available (October 2006), phthalates (primarily BEHP), polynuclear aromatic hydrocarbons (PAHs), phenol, 4-methylphenol, and dibenzofuran were detected above the SQS.

The downstream sample collected during the October 2006 sampling round contained mercury and zinc above the SQS. This sample was not analyzed for phthalates, PAHs, or other semivolatile organics. An earlier (March 2006) downstream sample contained phthalates and PAHs at significantly higher dry weight (DW) concentrations than the October 2006 upstream sample, however no total organic carbon (TOC) data were available for the downstream sample and therefore an organic carbon (OC) normalized concentration could not be calculated for comparison to the SQS. It is likely that phthalates and PAHs in the downstream sediment sample also exceeded the SQS.

## **2.3 T3/T3A – Central Lateral #1 Storm Drain Line**

The most recent sediment trap samples in this storm drain line (both upstream and downstream) indicate PCB concentrations below 1 mg/kg DW, within the range of typical urban levels of PCBs.

In the most recent upstream sediment trap sample for which data are available (October 2006), lead and zinc were detected at concentrations above the SQS. The downstream sample contained zinc at a slightly higher concentration (660 mg/kg in the downstream sample versus 418 mg/kg in the upstream sample), but lead was significantly lower. In addition, the most recent downstream sample (March 2006) contained phthalates (BEHP and di-n-octyl phthalate) above the SQS, indicating a potential source of phthalates at NBF along this storm drain line.

## **2.4 T4/T4A – Central Lateral #2 Storm Drain Line**

Total PCBs in the upstream sediment trap have consistently been below 1 mg/kg DW, The PCB concentrations in the downstream sediment trap have ranged from 0.9 to 2.8 mg/kg DW, with the

most recent sample (January 2007) containing 1.7 mg/kg DW. These concentrations are within the range of typical urban levels of PCBs.

Zinc was present above the SQS in both the upstream and downstream October 2006 sediment trap samples (1,220 mg/kg DW and 2,460 mg/kg DW, respectively). In addition, the downstream sample exceeded the SQS for mercury. Phthalates (BEHP, di-n-octyl phthalate) have exceeded the SQS in both upstream and downstream samples.

## 2.5 T5/T5A – North Lateral Storm Drain Line

Total PCBs in the upstream sediment trap have consistently been below 1 mg/kg DW. PCB concentrations in the downstream sediment trap have ranged from 24 to 800 mg/kg DW, with the most recent sample (January 2007) containing 200 mg/kg DW. This indicates that an ongoing source of PCBs to the north lateral storm drain line is present, which has resulted in storm drain sediment PCB concentrations that are more than two orders of magnitude higher than the SQS.

The most recent upstream sediment trap sample (March or October 2006, depending on the analyte) contained copper, zinc and phthalates above the SQS. Downstream samples contained copper, mercury, zinc, and phthalates above the SQS. While the downstream zinc concentration was considerably higher than the upstream concentration (1,370 mg/kg DW versus 597 mg/kg DW), the concentrations of phthalates were similar in the upstream and downstream samples. This indicates that a potential source of phthalates is present at KCIA upstream of sediment trap T5A, while a potential source of mercury and zinc is present within the NBF area.

## 2.6 T6 – I-5 Storm Drain (I-5 and Residential Drainage)

PCB concentrations in the I-5 storm drain sediment trap are low (less than 0.1 mg/kg DW in the January 2007 sample). Zinc has consistently been detected at concentrations above the SQS. Phthalates and benzyl alcohol were also detected above the SQS in the only sample for which data were available for these analytes (August 2005). SPU will continue monitoring of sediment trap data in this drainage.

## 2.7 Summary

In summary, significant exceedances of sediment regulatory levels for PCBs continue to be detected in sediment trap T5 (north lateral drain line) and T1 (near the King County lift station and downstream of T5). It appears that PCB-contaminated sediment from the north drain line is being transported downstream to the King County lift station, and it is possible that contaminated sediments are continuing to enter Slip 4 through the KC SD#3/PS44 EOF outfall. *This is considered an ongoing source of sediment recontamination and should be addressed prior to Slip 4 sediment cleanup.*

At this time, it is unclear whether the elevated concentrations of PCBs in the north drain line are due to transport of contaminated soils or materials through inflow/infiltration, an unidentified new source, or the result of source control efforts in the drainage basin. The sediment traps may have collected residual sediment that was mobilized during cleaning of the storm lines in 2006. If this is the case, subsequent sediment trap sampling would be expected to show lower

concentrations of PCBs. If sediment trap concentrations remain high, an ongoing source is likely. However, even if PCB concentrations in the north drain line decrease, the level of uncertainty regarding the potential for Slip 4 sediment recontamination associated with PCB contamination in the storm drain system remains high.

Low to moderate exceedances of SQS values in sediment trap samples downstream of KCIA and upstream of NBF have been detected for copper (T5A), lead (T3A), zinc (T3A, T4A, T5A), phthalates (T2A, T4A, T5A) and PAHs (T2A). Moderate exceedances of SQS values have been detected in sediment trap samples downstream of NBF for copper (T5), mercury (T1, T2, T4, T5), zinc (T1, T2, T3, T4, T5), phthalates (T2, T3, T4, T5), and PAHs (T2). In addition, sediment trap samples from the I-5 storm drain (T6) have indicated low to moderate exceedances of the SQS for zinc, phthalates, and benzyl alcohol. These exceedances are not believed to pose an immediate threat of Slip 4 sediment recontamination.

Sediment traps have been reinstalled and sampling will continue during 2007.

## 3.0 North Boeing Field

### 3.1 Source Tracing in Storm Drain Lines

PCBs continue to be detected in the storm drain lines in the northern portion of NBF despite repeated efforts to clean out lines and structures. During the past six months, Boeing has made considerable efforts to identify and eliminate potential sources of PCBs in this area.

In July 2006, samples of storm drain solid material were collected from catch basins, manholes, and oil/water separators throughout NBF that historically have detected over 10 mg/kg PCBs (Bach 2006h). Concentrations generally ranged between 1 and 10 mg/kg in most structures sampled. Higher concentrations of PCBs were detected in the following structures (Bach 2006i): OWS-186, which is located near the corner of the GTSP (1,200 mg/kg); MH-193, which drains to OWS-186 (191 mg/kg); MH-179 (47 mg/kg); CB-372 (32.8 mg/kg) and CB-370 (28 mg/kg), in the central area of NBF; CB-225 (27.9 mg/kg); and CB-193, CB-194, CB-416, MH-226, MH-249, and OWS-226A (all between 10 and 20 mg/kg). In addition, a sample collected from CB-113 on July 7 contained 31.7 mg/kg PCBs; a re-sample collected on July 25 did not detect PCBs.

In August and October 2006, Boeing cleaned out over 1,700 feet of the north drain line as well as catch basins in various locations at NBF, including the following (Figure 2):

- South Drain Line: OWS-640
- Central Lateral #1: CB-415, CB-416, CB-418, CB-419, CB-420, CB-370
- Central Lateral #2: MH-249, CB-372, MH-226, MH-227
- North Drain Line: the north storm drain line from CB-173 to the King County lift station was cleaned out, including CB-113, CB-173, CB-174, CB-193, CB-194, CB-364A, MH-108, MH-130, MH-179, MH-179A, MH-187, MH-193, OWS-153, and OWS-186.

This clean-out included at least 20 feet of any side drain lines that connected to manholes along the north storm drain line (Bach 2006e), as well as drain lines associated with OWS-186 (Bach 2006f). On December 8, storm drain solids were collected from 15 catch basins that had been cleaned, and PCBs were again detected, as described below.

### 3.1.1 North Storm Drain Line

Boeing installed filters on two catch basins along the GSTP fence line area (CB-182 and CB-185) (Figure 3). Solids that had accumulated on the filter material were analyzed for PCBs on March 21, 2006. The samples contained 14 mg/kg and 5.5 mg/kg total PCBs, respectively (Aroclor 1254) (Bach 2006a). Sediment in catch basin CB-173 (the catch basin receiving drainage from CB-182 and CB-185) was re-sampled at the same time; PCBs were detected at 110 mg/kg (Aroclor 1254) (Bach 2006a).

On April 26, Boeing sampled the storm drain lines leading to CB-173 (Bach 2006b). Samples were collected from the base of CB-182 and CB-185 (the catch basins with filters); PCBs were detected at 6.1 and 11 mg/kg, respectively. A solids sample was also collected from a 6-inch concrete pipe entering CB-179; this pipe enters CB-179 from the north (parallel to the GTSP/NBF fence line) and contained 34 mg/kg PCBs. Another sample was collected at CB-173 in the pipe leading from CB-174 (29 mg/kg PCBs). An accumulation of dark fine sand had collected in this pipe. Groundwater appeared to be infiltrating to this line from an unsealed pipe connection (Bach 2006b). A sample was also collected from CB-175 (3.2 mg/kg), another influent sources to CB-173.

Boeing subsequently installed a temporary sandbag dam on the 15-inch line at CB-173 that receives drainage from MH-179, MH-179A, and the GTSP fence line catch basins (CB-182 and CB-185). The dam allowed accumulation of enough solid material to collect a sample prior to cleanout of the storm drain lines. This solids sample, collected on May 30, contained 122 mg/kg total PCBs (Aroclor 1254 and 1248) (Bach 2006c).

On May 31, immediately after completion of the interim remedial action at GTSP, Boeing cleaned the storm drain lines and catch basins flowing into CB-173 (Bach 2006c). In addition, they plugged two 6-inch storm drain lines entering MH-179 and MH-179A from the north that appeared to be abandoned. By June 22, approximately ½-inch of solids had accumulated in CB-173; another sample was collected, which contained 29 mg/kg PCBs (Bach 2006d). Boeing postulated that groundwater infiltration from the unsealed pipe connection between CB-174 and CB-173 may be transporting PCBs to CB-173 (Bach 2006d). To further evaluate this system, Boeing plugged and bypassed this line. They planned to install a sump pump in CB-174, and re-route the drainage directly from CB-174 to CB-173. CB-173 would then be cleaned again and re-sampled.

In July 2006, storm drain samples were collected as described above; in August 2006, the north storm drain line was cleaned out from CB-173 to the King County lift station, including drain lines associated with OWS-186. OWS-186 appeared to be quite old; it is a steel underground tank formerly known as UBF-55. The outflow from this unit is blocked, and stormwater apparently fills the separator and then backflows out of the inflow pipe (Bach 2006g). The line between CB-174 and CB-173 (with the unsealed pipe connected) remained temporarily plugged;

Boeing plans to repair this section of the storm drain in the near future. The remaining 500 feet of north drain line near the King County lift station was cleaned in early October 2006.

OWS-186 was plugged with inflatable pipe plugs on October 11 (Bach 2006k). In early November, Boeing personnel observed an increase in water level in OWS-186, even though the inflow and outflow lines to this separator had been plugged. The source of water is suspected to be groundwater infiltrating from the unpaved GTSP site. On November 2, a Boeing field engineer pumped water out of OWS-186 to avoid a potential overflow; a slight sheen was observed on the surface of the water in the separator (Bach 2006l). A grab sample collected from the water at the top of the separator (including the surface sheen) was analyzed for PCBs and contained 47 ug/L (Aroclor 1242). Due to heavy rain, it was necessary to continue pumping water out of this structure. Boeing ultimately removed the downstream plug, thus allowing the OWS to drain (Bach 2006l). On November 8, Boeing identified another line that leads to OWS-186 (Bach 2006m); on November 14, the inflow tube was cut off, allowing the installation of a temporary plug from the inside of this unit. The separator was completely pumped out at that time (Bach 2006o).

Boeing is planning to install new drain lines around the separator in 2007 (Bach 2006l); the unit will then be sealed, filled, and abandoned. On November 17, soil samples were collected to characterize this area prior to construction of the new drain lines (Bach 2006n). A work plan dated November 14 indicates that six borings were to be installed to a depth of 6 feet below ground surface (bgs) along the alignment of the planned storm drain line; samples were to be collected at three depth intervals (1-2 feet, 3-4 feet, and 5-6 feet bgs). All soil samples were to be analyzed for PCBs. One sample was to be analyzed for TPH and VOCs, and three samples were to be analyzed for toxicity characteristic leaching procedure (TCLP) metals. Preliminary sampling results indicate PCBs in the 200 mg/kg range in the 1-2 foot and 5-6 foot depth intervals (Cargill 2006).

Also on November 17, sediment samples were collected from two catch basins that drain to OWS-186 from the airfield side of the blast fence. CB-1 sediments contained 0.57 mg/kg PCBs; CB-188 sediments contained 0.39 mg/kg PCBs (Bach 2006p).

Another set of catch basin sediment samples were collected on December 8, 2006 (Bach 2006r). Preliminary results indicate that PCB concentrations in these samples ranged from 1.2 to 107 mg/kg. The highest concentrations (107 mg/kg) were found in CB-363 (located at the downstream end of the north drain line, near the northeast corner of Building 3-380). PCBs were also high in MH-187 (64 mg/kg), which is downstream of OWS-186, and CB-194 (28 mg/kg). CB-173 was also re-sampled and contained 43.2 mg/kg PCBs.

### **3.1.2 Cleanout of OWS-640**

OWS-640 was cleaned out in August 2006 (Bach 2006e). The clean-out took about one week to complete. The separator holds approximately 20,000 gallons of water and has multiple sets of coalescing plates that needed to be pressure washed. Solids removed from this unit were combined with those from other catch basins and the north storm drain line which were cleaned at the same time, therefore no samples specific to OWS-640 were collected.

### 3.2 Removal of Joint Sealant Material

In a survey of concrete joint caulk conducted in 2001, Boeing identified 57,900 linear feet of primary caulk, or residual caulking material from prior removals, that contained PCBs. In a report summarizing joint caulk removal for 2005, Boeing estimated that the total project involved the removal of approximately 89,000 linear feet of joint material. Boeing has been removing caulk containing PCBs from the North Field area that drains to Slip 4 under EPA oversight since 2002 (Boeing 2005, Bach 2005). Caulk that was removed had concentrations of PCBs up to 79,000 mg/kg.

The last of the joint sealant material with PCB concentrations above 50 mg/kg was removed by Boeing in 2006 (Personal communication, Carl Bach to Dan Cargill, July 13, 2006 Slip 4 Source Control Meeting). However, recent testing at Boeing Everett after replacement of PCB-containing joint sealant material found that the new material had been contaminated with PCBs. As a result, Boeing has collected samples at NBF of the joint sealant material that had been installed to replace the original PCB-containing caulk. Based on preliminary data, Boeing found that the new joint sealant material has been contaminated with PCBs at concentrations ranging from <1 mg/kg to 370 mg/kg (Bach 2007a). It is not clear whether the new sealant is being contaminated as a result of the incomplete removal of old sealant. Boeing is continuing its investigation of this issue.

While it is unclear whether PCBs in the new joint sealant material may be contributing to the storm drain concentrations, *it is not anticipated to pose an immediate threat of sediment recontamination and therefore may be addressed concurrently with Slip 4 sediment cleanup actions.*

### 3.3 Other Source Control Activities

SAIC (for Ecology) prepared a *Summary of Existing Information and Data Gaps* report for North Boeing Field and the Georgetown Steam Plant, using available information through early September 2006 (SAIC 2006i). This report summarizes historical information about potential contaminant sources at these two facilities and adjacent properties including KCIA. Documented historic releases do not explain the recurring detection of PCBs in the storm drain system at NBF.

Potential sources that may pose a risk of sediment recontamination were identified in the report. These include residual PCBs in soil and groundwater in the UBF-55/UBF-27 area, and the recurring presence of high levels of PCBs in storm drain structures in various locations at NBF. Potential sources that pose a lower risk of sediment recontamination include: residual PCBs in soil and possibly groundwater in the vicinity of Building 3-333; residual joint material at NBF with PCB concentrations up to 50 mg/kg; and unidentified historic releases of PCBs in the northern portion of NBF.

## 4.0 Georgetown Steam Plant (GTSP)

### 4.1 Interim Remedial Action

An interim remedial action was conducted by Integral Consultants, Inc. for SCL in May 2006 to control erosion and offsite migration of contaminated soil near the former low-lying area (Integral 2006a). The action involved excavation and replacement of contaminated soil behind the retaining wall and other measures to reduce potential ongoing erosion, as listed below:

- Removal of approximately 47 cubic yards of PCB-contaminated soil immediately behind the retaining wall located along the southwest boundary of the GTSP property, for a distance of approximately 125 feet;
- Offsite disposal of excavated soil at an approved TSCA landfill;
- Lining and backfilling of the excavation with clean imported fill material to prevent further loss of soil through the retaining wall joints;
- Installation of silt fencing along the south and southwest property boundary to filter stormwater that may be discharging from the site via overland flow, during larger storm events.

During the remedial action, it was noted that voids located in joints between the concrete panels that make up the retaining wall could not be enclosed by the interim remedial design. On August 24, 2006, Integral applied concrete grout to cover and seal the native soil in the voids at the base of the retaining wall joints (Integral 2006b), and thereby to reduce the potential for erosion of PCB-contaminated soil.

During the construction phase of the interim remedial action (May 2006), subsurface soil samples were collected and analyzed for PCBs. These data will be used to characterize the soil conditions at the base of the excavation for later consideration in developing a site-wide investigation plan. A total of 33 soil samples were collected at approximately 5-foot horizontal intervals at the bottom of the excavation (1 to 3.4 feet bgs). Samples from 19 locations were analyzed for PCBs; concentrations ranged from 0.077 to 3,800 mg/kg (almost exclusively Aroclor 1254) (Integral 2006a). This area was lined to prevent offsite transport of PCBs, and therefore *does not pose an immediate threat of sediment recontamination*.

### 4.2 Site Characterization

During July 27 to August 2, 2006 five soil borings were advanced at locations near the eastern, southern, and western property boundaries (Integral 2006d). Borehole depths ranged from 13.5 feet to 15 feet below ground surface (bgs). Soil samples were collected at approximately 2-foot intervals from each borehole; samples were analyzed for PCBs, semivolatile organic compounds (SVOCs), cadmium, chromium, hexavalent chromium ( $\text{Cr}^{+6}$ ), mercury, Skydrol components (a hydraulic oil), and TOC and total solids (if sufficient sample volumes were available). In addition, headspace screening was performed for each interval; selected samples were analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons as gasoline (TPH-G),

and diesel- and oil-range hydrocarbons (TPH-Dx). Thirty nine samples were collected; 29 were submitted for analysis and 10 were archived.

Soil sampling results were compared to MTCA Method A or B soil cleanup levels and to EPA soil screening levels for migration to groundwater (EPA Region 9 Preliminary Remediation Goals [PRGs]). Screening levels were exceeded for PCBs (2 locations), carcinogenic polynuclear aromatic hydrocarbons (cPAHs; 2 locations), and tributyl phosphate (1 location). PCBs were detected at concentrations from < 0.03 to 3.8 mg/kg; the screening level of 1.0 mg/kg was exceeded near the southern drainage ditch (0 to 3 feet bgs) and low-lying area (4 to 6 feet bgs).

Other exceedances of screening levels were found as follows:

- Boring GTSP-1 (northeast side of the Power House) – cPAHs
- Boring GTSP-2 (former fire training pit) -- tributyl phosphate
- Boring GTSP-3 (southern drainage ditch) -- cadmium, total chromium, cPAHs
- Boring GTSP-4 (along the western fenceline) – cPAHs
- Boring GTSP-5 (former low-lying area) -- total chromium, TPH-G

Groundwater monitoring wells were installed in each of the five boreholes to evaluate potential groundwater contamination at the GTSP. Groundwater will be monitored quarterly for 12 months. The first round of groundwater samples was collected on August 1-2, 2006. Samples were analyzed for PCBs, SVOCs, TPH-G, TPH-Dx, VOCs, total and dissolved metals (cadmium, chromium, mercury), dissolved Cr<sup>+6</sup>, Skydrol, and TOC (Integral 2006d).

PCBs (Aroclor 1242) were detected only in well GTSP-5 (former low-lying area), at a concentration of 0.24 ug/L (which exceeds the MTCA Method B groundwater cleanup level of 0.044 ug/L). In addition, trichloroethylene (TCE) exceeded the screening level in well GTSP-1 (near the Power House); 12 analytes, including cPAHs, were not detected however detection limits exceeded the screening levels.

The second round of groundwater sampling was conducted in November 2006. Results show PCBs in GTSP-5 (former low-lying area) at 0.19 ug/L, slightly lower than in August. TCE in GTSP-1 was comparable to the first quarter result (Goldberg 2007b). No other analytes were detected. The third round of sampling is scheduled for late February 2007 (Goldberg 2007a).

### 4.3 Other Source Control Activities

SAIC (for Ecology) prepared a *Summary of Existing Information and Data Gaps* report for North Boeing Field and the Georgetown Steam Plant, using available information through early September 2006 (SAIC 2006i). This report summarizes historical information about potential contaminant sources at these two facilities and adjacent properties including KCIA.

Potential sources that may pose a risk of sediment recontamination were identified in the report. These include residual PCBs in soil and groundwater in the vicinity of the former low-lying area at GTSP. Additional site characterization is planned.

## 5.0 King County International Airport

As discussed above, elevated concentrations of PAHs, phthalates, and metals (zinc, mercury) have been detected in sediment trap samples downstream of KCIA and upstream of the Boeing-leased area. While additional actions to reduce the concentrations of these contaminants in the storm drain system should be conducted, *they are not expected to pose a significant threat of Slip 4 sediment recontamination.*

### 5.1 Source Tracing in Storm Drain Lines

Eight stormwater vaults (oil/water separators) which drain to Slip 4, located in the northern and central portions of KCIA, were sampled on June 6 to 8, 2006. These vaults are configured to allow stormwater to flow through them under low-flow conditions, but allow high-flow bypass to occur via upgradient manhole overflow weirs. Samples were analyzed for PCBs, metals, SVOCs, TPH, TOC, and total solids (KCDNRP 2006).

PCB concentrations ranged from < 0.04 to 2.1 mg/kg. Only Vault 1680 exceeded 1 mg/kg; this structure drains to Central Lateral #1, where January 2007 sediment trap data (sample T3A) indicated 0.18 mg/kg PCBs. BEHP concentrations ranged from 29.4 to 232 mg/kg; concentrations were generally higher toward the central portion of KCIA (Vaults 1680 to 1757) and lower at the northern portion of KCIA. Other detected chemicals included high molecular weight polycyclic aromatic hydrocarbons (HPAHs) which ranged from 37.4 to 629 mg/kg; copper at 240 to 1,550 mg/kg; lead from 190 to 744 mg/kg; zinc from 574 to 1,880 mg/kg; diesel-range TPH from non-detect to 16,000 mg/kg; motor oil-range TPH from 3,500 to 81,000 mg/kg; and coprostanol (a sterol used as a biomarker to indicate the presence of fecal contamination) from 25.7 to 34 mg/kg in two vaults at the north end of KCIA (KCDNRP 2006).

Sampling results were compared to Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL) for marine sediment to evaluate potential impacts to Slip 4 sediments. SQS values were exceeded in all eight vaults for at least three chemicals. The concentration of PCBs in Vault 1680 exceeded the SQS value. In addition, SQS exceedances were present for copper, lead, zinc, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, total HPAH, BEHP, and butylbenzylphthalate. PAHs were highest in Vaults 1756 and 1757 in the central area of KCIA (total HPAH of 10.5 and 7.6 mg/kg OC, respectively); the highest BEHP concentrations were also detected in these two vaults (1.1 to 2.8 mg/kg OC) (KCDNRP 2006).

KCIA is continuing to track potential sources of metals, phthalates, and PAHs.

### 5.2 Testing of Joint Sealant Material

KCIA collected a caulk sample from the Alpha-2 intersection. This is the only exposed caulk at the KCIA site that is within the Slip 4 drainage basin. All caulk in this area was identical in appearance and was therefore assumed to be from the same application with the same materials.

PCBs were not detected in this sample with a detection limit of 0.78 mg/kg (Renaud 2006). *Joint sealant material at KCIA does not appear to pose a threat of Slip 4 sediment recontamination.*

### 5.3 Cleanout of Catch Basins and Structures

KCIA reportedly has cleaned out all catch basins in the Slip 4 drainage basin and four of the nine oil/water separators (Renaud 2007). The remaining five oil/water separators will be cleaned out by May 2007.

## 6.0 Georgetown Flume

SPU investigated and smoke tested connections to the flume in August 2006 (Schmoyer 2007a). They located a line near the head of the flume (where the flume leaves the GTSP and enters KCIA) on Boeing-leased property. Boeing planned to track the pipe and confirm that it was plugged. SPU will verify that the line is plugged when the flume is replaced in summer of 2007.

An 8-inch line was located that connected to an active warehouse near Myrtle Street; this line drains a paved area. Several drain lines from the Aero Motel were identified; these also drain paved areas.

Two new connections were found to MH-100 (located at the downstream end of the Georgetown flume, prior to draining under East Marginal Way) (Schmoyer 2007a). One, an 18-inch wood stave pipe, was determined to be plugged with silt. Flow was observed in the other, a 24-inch concrete line. This line appears to connect to a single catch basin in a loading dock of the Boeing 7-21-1 building. Boeing will replumb the catch basin to another drain line. SPU will plug the line when the flume is replaced in the summer of 2007. *The Georgetown flume is not considered to pose an immediate threat of sediment recontamination.*

Final characterization and preliminary design for remediating and filling the flume is expected to be completed in January 2007. All PCB-contaminated material above 1 mg/kg will be removed and the flume will be filled with clean soil to match the surrounding grade by Fall 2007. A new piped storm water conveyance will likely be installed in the clean fill (Goldberg 2007).

## 7.0 Crowley Marine/Alaska Logistics

To support design of the Slip 4 sediment removal action, a pre-design investigation was conducted in June 2006 by Integral Consulting, Inc. for the City of Seattle. As part of this investigation, six seep samples were collected from five locations along the eastern bank of Slip 4. Two of these samples were along the banks of the Crowley property (SP-01 and SP-04). PCBs were detected at 0.1 ug/L (Aroclor 1254) and 0.02 ug/L (Aroclor 1248), respectively (Integral 2006c). (Note: the State marine chronic water quality standard for PCBs is 0.03 ug/L.)

Potential sediment recontamination from historic operations at this property is associated with PAHs in soil and groundwater in the southern portion of the property (Parcel D). This area has been dredged and therefore sediment samples may not reflect ongoing contaminant inputs from

this property. SAIC (for Ecology) prepared a Technical Memorandum in October 2006 to assess the potential for Slip 4 sediment recontamination via groundwater discharge from the Crowley and First South Properties (SAIC 2006a). The report concluded that the main potential for sediment recontamination is associated with PAHs in the southern portion of the Crowley property (Parcel D). PAHs in this area are widespread, occur at high concentrations relative to screening levels, and are present in both soil and groundwater. In addition, the downgradient extent of groundwater having significant exceedances of screening levels is poorly defined. SAIC recommends that a series of groundwater monitoring wells be installed along the Parcel D shoreline and sampled for chemicals of concern to allow better assessment of the recontamination potential.

Given that there is a seep with high PAHs along the Duwamish River side of the Crowley property and high sediment PAHs in that area, additional investigation of the potential for sediment recontamination in Slip 4 is warranted. *Further investigations are planned and may be conducted concurrently with Slip 4 cleanup.*

Assessment of the recontamination potential from current operations is continuing; planned activities include the collection and analysis of stormwater runoff and in-line solids. No evidence of an ongoing source of contaminants of concern from current operations has been identified. However, because this site discharges directly to Slip 4, further assessment is warranted.

## 8.0 First South Properties/Emerald Services

SAIC (for Ecology) prepared a Technical Memorandum to assess the potential for Slip 4 sediment recontamination via groundwater discharge from the Crowley and First South Properties (SAIC 2006a). The report concluded that the potential for sediment recontamination associated with groundwater at the First South Properties site is low.

To support Slip 4 sediment removal action design, a pre-design investigation was conducted in June 2006 by Integral Consulting, Inc. for the City of Seattle. As part of this investigation, six seep samples were collected from five locations along the eastern bank of Slip 4 and were analyzed for PCBs. Three of these samples were along the banks of the Emerald Services site (SP-02, SP-03, and SP-05). PCBs were not detected (Integral 2006c).

A composite bank soil sample was collected from locations near the drainage swale and the southern boundary of the First South Properties site during the pre-design investigation (Integral 2006c). All detected analytes were below the SQS. PCBs were detected at 0.092 mg/kg (5.4 mg/kg OC). In addition, arsenic (14 mg/kg), cadmium (0.5 mg/kg), chromium (22.8 mg/kg), copper (62.3 mg/kg), lead (64 mg/kg), mercury (0.07 mg/kg), zinc (101 mg/kg), PAHs, diesel-range hydrocarbons (640 mg/kg), and motor oil (75 mg/kg) were detected.

The drainage swale area was excavated to a depth of 3 feet in September 2006. Approximately 5,000 pounds of soil was removed. Three samples were collected after the soil removal. Although the samples were not analyzed for phthalates, PCBs were not detected (Smith 2006b). The area was paved in October 2006.

SPU collected sediment samples from catch basins at this site, and did some follow-up testing of materials (Personal communication, Beth Schmoyer to Dan Cargill, November 30, 2006 Slip 4 Source Control Meeting). Sampling results were not available, however contaminants were reportedly not detected.

Emerald Services is currently constructing an office building on the property. In conjunction with the construction, the storm drainage system has been replaced; activities included installation of a new oil/water separator, excavation and paving of the former drainage swale; and abandonment of two previously identified discharge points (Goldberg 2006). All discharge now exits a single outfall.

*This property does not pose a significant threat of sediment recontamination, and no additional source control actions have been identified.*

## 9.0 Boeing Plant 2

Ecology inspection of the Building 2-122 area and sampling of onsite storm drain solids is planned. Onsite storm drains will be cleaned as necessary. *Because this property is directly adjacent to Slip 4, further assessment is required and may be conducted concurrently with Slip 4 cleanup.*

## 10.0 Other Upland Properties

A review of available information on contaminants of concern and pathways to Slip 4 has been conducted by SAIC for seven upland properties. Findings are described below. Due to the types of contaminants at these sites, the distance from Slip 4, and the absence of transport mechanisms and pathways for significant quantities of contaminants to reach Slip 4 sediments, *no significant potential for Slip 4 sediment recontamination was identified.*

***American Avionics*** (SAIC 2006b): A voluntary cleanup of petroleum hydrocarbon contaminated soil was conducted at this site between 1997 and 2000 in conjunction with the construction of an office building at this site. After remediation, residual hydrocarbon contamination above MTCA Method A cleanup levels remained in several locations. None of the soil or groundwater samples collected during this cleanup action were analyzed for PCBs, PAHs, or phthalates. Stormwater from American Avionics drains to KCIA stormwater vault 1680. Sediment in this vault was sampled in June 2006; the sample exceeded the SQS for zinc, PAHs, BEHP, butylbenzylphthalate, and PCBs, as well as the MTCA Method A cleanup levels for diesel and motor oil. While other facilities also drain to vault 1680, it is possible that residual soil or groundwater contamination at the American Avionics site is a source of contaminants to the storm drain system. The absence of data on groundwater concentrations of PAHs is considered a data gap. Sediment trap data for central lateral #1 downstream of this vault (T3A) does not indicate the presence of these contaminants above the SQS. This site is therefore not considered a potential source of Slip 4 sediment recontamination.

**ARCO #5218** (SAIC 2006c): Soil and groundwater at the facility have been analyzed for BTEX, gasoline-range hydrocarbons, total metals, and selected VOCs. Benzene was detected above the MTCA Method A cleanup level in one soil sample; however, VOCs are not expected to partition into or accumulate in sediments. Based on the types of activities conducted at the site and the results of soil and groundwater sampling, no chemicals of concern for sediment recontamination were identified. This site is therefore not a potential source of Slip 4 sediment recontamination.

**Aviation Fuel Storage/Schultz Distributing** (SAIC 2006d): There is no information on environmental sampling or remediation at this site, however based on available information, past fuel storage activities do not appear to have resulted in significant releases to the environment. Very little information was available on current activities at the site; recent King County/Seattle Public Utilities source control and KCIA inspections indicate that this facility is not in compliance with stormwater, industrial waste, and/or hazardous waste handling requirements. SPU is planning to dye test the storm drain lines in late February or early March 2007 to confirm site drainage and follow up on pollution prevention issues (Schmoyer 2007b). Ecology's Tanks unit has inspected the facility, and corrective measures are being required. No evidence of releases was observed. King County, Ecology, and Seattle will coordinate to ensure the facility's compliance with applicable requirements. This site is therefore not considered a potential source of Slip 4 sediment recontamination.

**King County Airport Maintenance Shop** (SAIC 2006e): Past site inspections have identified practices that could have resulted in releases of contaminants to storm drains, including poor housekeeping, accidental and intentional spillage, improper storage of PCB-containing transformers, and leaking underground storage tanks. Many of these potential sources (transformers, USTs) and contaminated soil have been removed. More recently, a December 2004 source control inspection identified several corrective actions, and catch basin sediments downstream of this facility indicated the presence of copper, zinc, PAHs, and BEHP at concentrations that could contribute to Slip 4 sediment recontamination. Data gaps include: information from follow-up inspections, if they have been conducted; confirmation that outlet traps were installed on catch basins CB-45 and CB-46; confirmation that no ongoing sources of contaminants are present at the site; and verification that groundwater is not a source of contaminants. While follow-up is appropriate at this site, it is not considered a significant potential source of Slip 4 sediment recontamination.

**Marine Vacuum Service** (SAIC 2006f): Documented releases of contaminants of concern for sediment recontamination have occurred at this site. While some remediation has occurred, it is likely that contaminants of concern, primarily PAHs, remain in soil. No information on groundwater contamination at the site was identified. Storm drainage at the facility is reportedly discharged to the sanitary sewer under a wastewater discharge permit. If this is correct, and given the facility's distance from Slip 4 (approximately 4,000 feet), Slip 4 sediment recontamination associated with the Marine Vacuum Service facility is considered unlikely. Data gaps include information on groundwater concentrations of contaminants, current facility practices, and confirmation that stormwater from this site does not flow to Slip 4.

**North Coast Chemical Company** (SAIC 2006g): Concentrations of HVOCs and petroleum hydrocarbons have been confirmed in soil and groundwater throughout the site. Groundwater

monitoring results indicate that low concentrations of TCE, DCE isomers, and vinyl chloride may have leached into drainage ditch surface waters along the southern edge of the site. Several contaminants are present in soil and/or groundwater at the site at concentrations exceeding screening levels: 1,2-dichlorobenzene and 1,4-dichlorobenzene in both soil and groundwater; and lead and cadmium in groundwater. The monitoring well closest to the stormwater drainage ditch has generally been free of contaminants of concern, however, and the site is currently undergoing remediation. While no samples at this site have been analyzed for PCBs, information on historic and current site use does not indicate a potential for PCB contamination. This site is therefore not considered a potential source of Slip 4 sediment recontamination. An inspection of the operations of the current site tenant, Ultrablock, Inc., was conducted in 2004 and several recommendations to reduce the potential for contamination of stormwater were made. The compliance status of Ultrablock is considered a data gap.

***Rainier Ice & Cold Storage*** (SAIC 2006h): Based on past and current activities at the site, no chemicals of concern for sediment recontamination were identified. In addition, storm drainage from this site does not appear to flow towards Slip 4.

Two other facilities were identified in the SCAP as not in compliance with applicable requirements. King County Surplus Storage was inspected by SPU in February 2005, and corrective actions related to material storage and tracking were identified. A joint inspection by SPU and Ecology was conducted in October 2005; all deficiencies had been corrected and no further action was required (Schmoyer 2007b). NE T Hangars was incorrectly identified in the SCAP as not in compliance; records indicate that no discrepancies or further actions were identified during a joint SPU/King County inspection (Schmoyer 2007b).

## 11.0 Other Source Control Activities

The City of Seattle is planning to purchase the portion of Crowley property that is affected by the proposed Slip 4 sediment removal action (Integral 2006c). HWA Geosciences, Inc. (HWA) performed a Phase I and Phase II Environmental Site Assessment for Seattle City Light at the Slip 4 upland area to characterize upland soil and groundwater conditions within the City purchase area (HWA 2006a,b). HWA collected subsurface soil samples at the soil-groundwater interface (typically at 12 to 16 feet bgs) from seven borings near the head of Slip 4. A total of 10 soil samples and five groundwater samples were analyzed for chemical constituents. One of 10 soil samples analyzed contained petroleum hydrocarbon concentrations exceeding MTCA cleanup levels. Six soil samples contained total cPAHs exceeding the MTCA Method A cleanup levels. Two soil samples contained PCB concentrations exceeding MTCA cleanup levels. One soil sample contained arsenic at the cleanup level. Two groundwater samples contained lube-oil-range hydrocarbons above applicable cleanup levels. *Additional investigations are continuing.*

The following source control actions are currently in progress or are planned for 2007:

- North Boeing Field:
  - Characterize extent of PCBs in new joint sealant (planned)
  - Continue source tracing in north drain line (in progress)

- Review results of Ecology and King County/Hazardous Waste inspections of NBF (in progress)
- Revise Stormwater Management Plan and conduct additional inspections as necessary (planned)
- GTSP:
  - Conduct site-wide site characterization (in progress)
  - Assess need for additional soil removal (planned)
- KCIA:
  - Complete source tracing (in progress)
  - Cleanout of catch basins, lines, and oil/water separators (in progress)
  - Conduct follow-up inspections at Schultz Distributing, Inc. until compliance is achieved.
- I-5/Residential Drainage:
  - Clean out catch basins and lines (planned)
- Georgetown Flume
  - Close connections to flume, remove sediments, and remediate (in progress)
- Crowley Marine:
  - Collect stormwater runoff and inline solids to assess recontamination potential of current operations (planned)
  - Clean catch basins and drain lines (planned)
  - Conduct groundwater investigation (planned)
- Boeing Plant 2
  - Assess existing groundwater data in the area (planned)
  - Inspect Building 2-122 area and sample onsite storm drain solids (planned)
  - Clean onsite storm drain system as necessary (planned)
- Other Actions:
  - Reinspections at Schultz Distributing and other upland properties as needed to ensure compliance (planned)
  - Review municipal and industrial NPDES permits for contaminants found in sediments (planned)
  - Continue monitoring of sediment trap data (planned)

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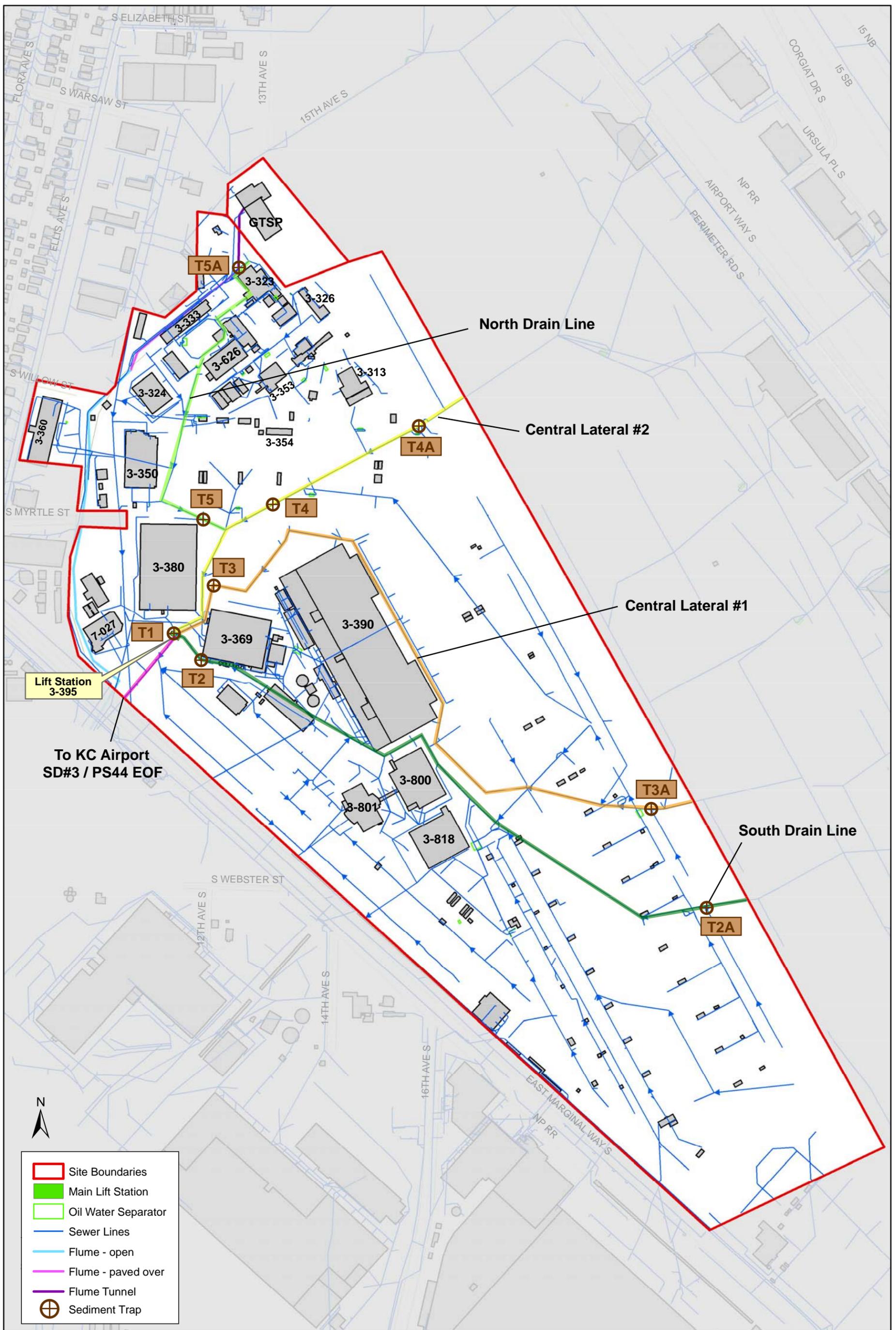
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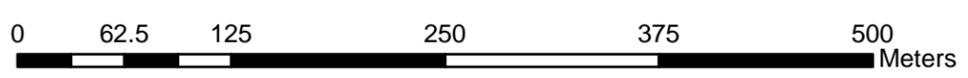
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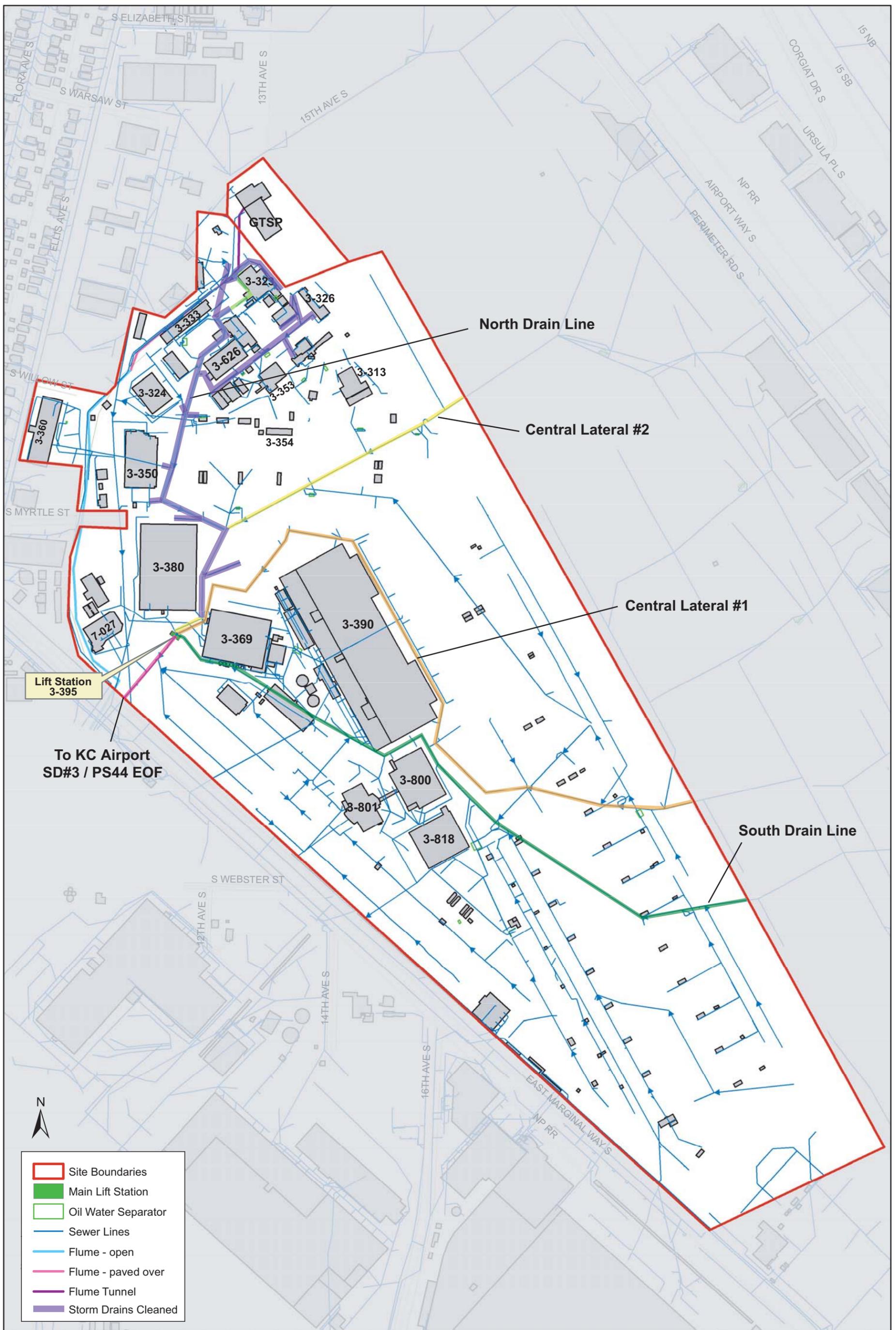
## Figures



- ▭ Site Boundaries
- ▭ Main Lift Station
- Oil Water Separator
- Sewer Lines
- Flume - open
- Flume - paved over
- Flume Tunnel
- ⊕ Sediment Trap



**Figure 1. Sediment Trap Locations**



- ▬ Site Boundaries
- ▬ Main Lift Station
- Oil Water Separator
- ▬ Sewer Lines
- ▬ Flume - open
- ▬ Flume - paved over
- ▬ Flume Tunnel
- ▬ Storm Drains Cleaned

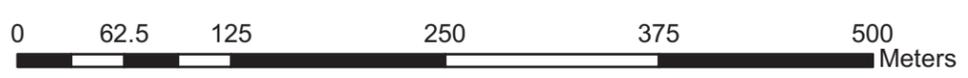


Figure 2. NBF Storm Drain Cleanout (2006)

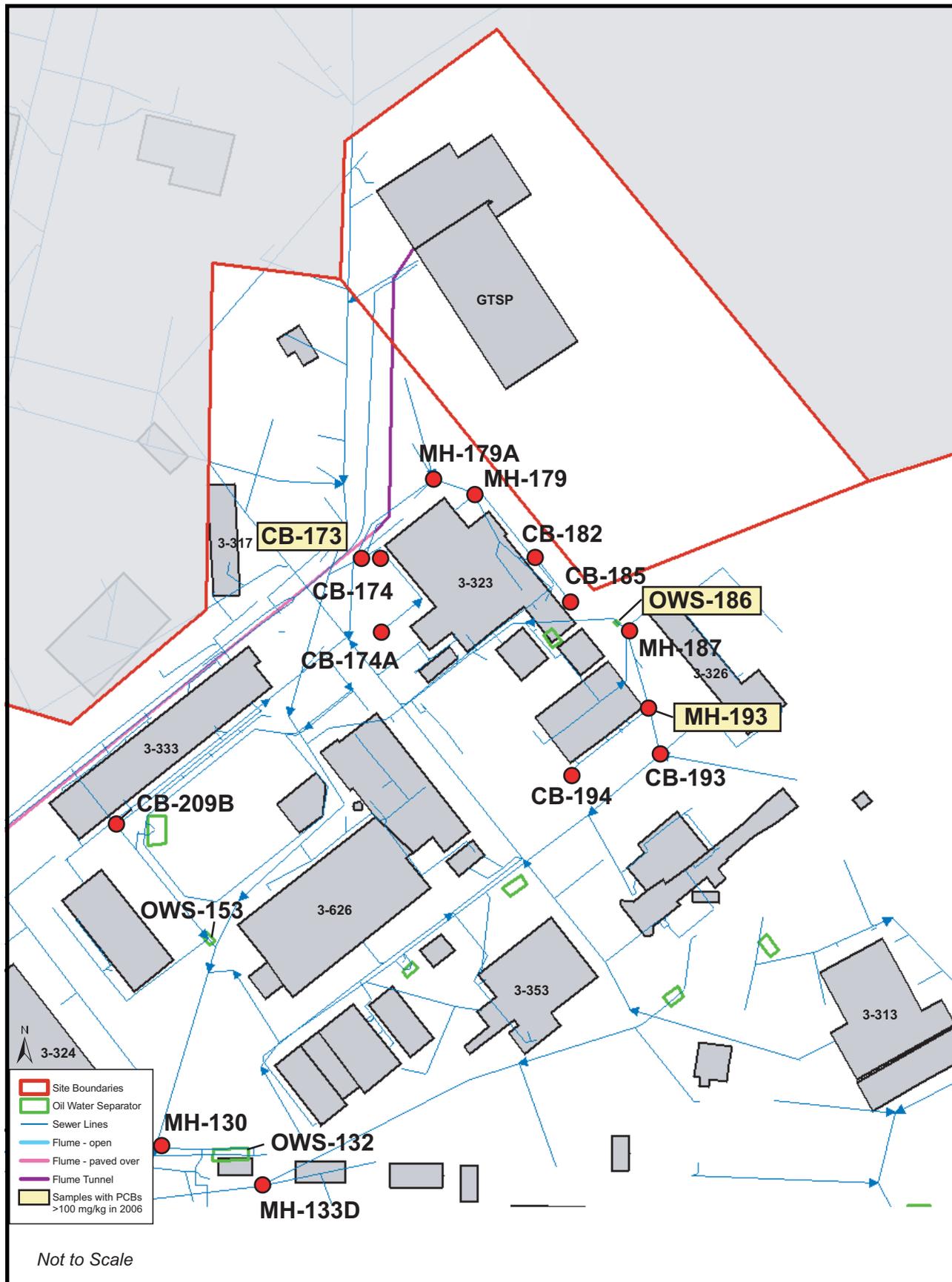


Figure 3. Storm Drain Sample Locations, Northern End of NBF

## **Tables**

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

**High Priority Source Control Actions<sup>1</sup>:**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[H1] NBF:</b> Remove PCB joint sealant.	Boeing	Bach, Power	Complete	NA	Characterize extent of PCBs in new joint sealant.	2007	None
<b>[H2] NBF/KCIA/I-5:</b> Distribute 2005/2006 in-line sediment trap data for winter wet season.	SPU	Schmoyer, Bach	Complete	NA	Continue monitoring of sediment trap data.	Ongoing	None
<b>[H3] GTSP:</b> Remove PCB contaminated soils; implement erosion or other source control as needed.	SCL	Goldberg	Complete	NA	Conduct site-wide site characterization.	2007	None
<b>[H4] NBF:</b> Complete source evaluation at north drain line and complete clean-out.	Boeing	Bach, Power	Complete	NA	Continue source tracing	2007	Identify source of PCBs in north drain line and/or eliminate transport of PCBs to Slip 4
<b>[H5] NBF/KCIA/I-5:</b> Conduct comprehensive analyses of sediment trap and catch basin data	Ecology	Cargill	Complete	NA	None	NA	None
<b>[H6] NBF:</b> Clean oil/water separator 640.	Boeing	Bach, Power	Complete	NA	None	NA	None
<b>[H7] I-5/Residential Drainage:</b> Complete source tracing.	SPU	Schmoyer	Complete	NA	Continue monitoring of sediment trap data.	Ongoing	None
<b>[H8] KCIA:</b> Sample seven oil/water separators.	KCIA	Renaud, Tiffany	Complete	NA	Continue source tracing at KCIA (see H9)	Ongoing	None
<b>[H9] KCIA:</b> Complete source tracing	KCIA	Renaud, Tiffany	In Progress	2007	None	Ongoing	None
<b>[H10] NBF:</b> Clean out catch basins.	Boeing	Bach, Power	Complete	NA	Continue source tracing in north drain line (see H4)	Ongoing	See H4
<b>[H11] NBF/KCIA/I-5:</b> Reinstall sediment traps.	SPU, Boeing	Schmoyer, Bach, Power	Complete	NA	Continue monitoring of sediment traps.	Ongoing	None

<sup>1</sup> High Priority: PCBs present or suspected, with potential for release to Slip 4

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[H12] KCIA:</b> Test for PCB joint sealant (~1acre); remove as necessary.	KCIA	Renaud	Complete	NA	None	NA	None
<b>[H13] KCIA:</b> Clean out catch basins and lines (if required).	KCIA	Renaud	In Progress	May 2007	None	NA	None
<b>[H14] I-5/Residential Drainage:</b> Clean out catch basins and lines (pending results of sediment trap analysis round 3, due 9/2006).	Ecology, SPU, WSDOT	Cargill, Schmoyer	Planned	Summer 2007	NA	NA	None
<b>[H15] Georgetown Flume:</b> Investigate connection toward North Boeing Field as a possible source of PCBs.	SPU, Boeing	Schmoyer, Bach, Power	Complete	NA	NA	NA	None
<b>[H16] Georgetown Flume:</b> Close connections to flume, remove contaminated sediments.	SCL, SPU	Goldberg, Schmoyer	In Progress	October 2007	NA	NA	None

**Medium Priority Source Control Actions<sup>2</sup>:**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[M1] Crowley Marine/Alaska Logistics:</b> Conduct physical site inspection confirming outfalls and what they drain(ed).	Ecology, SPU	Cargill, Schmoyer	Complete	NA	NA	NA	None

<sup>2</sup> Medium Priority: No PCBs present or suspected, but potential for release of other contaminants to Slip 4

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[M2] Crowley Marine/Alaska Logistics:</b> Collect stormwater runoff and in-line solids to assess recontamination potential of current operations.	Ecology, SPU	Cargill, Schmoyer	Planned	Spring 2007	NA	NA	None
<b>[M3] Crowley Marine/Alaska Logistics:</b> Clean catch basins and drain lines.	Crowley	None	Planned	Summer 2007	NA	NA	None
<b>[M4] First South Properties/Emerald Services:</b> Collect stormwater runoff and in-line solids to assess sediment recontamination potential from any ongoing operations.	Ecology, SPU	Cargill, Stegman, Schmoyer	Complete	NA	None	NA	None
<b>[M5] First South Properties/Emerald Services:</b> Investigate two 4- to 6-inch outfalls located on the bank of First South Properties. Determine if the outfalls are still functioning and their drainage areas.	Ecology, SPU	Cargill, Schmoyer	Complete	NA	None	NA	None
<b>[M6] First South Properties/Emerald Services:</b> Clean catch basins and drain lines.	Emerald Services	Smith	Complete	NA	None	NA	None
<b>[M7] First South Properties/Emerald Services:</b> Reassess drainage swale for erosion and recontamination potential for phthalates.	Ecology	Cargill	Complete	NA	None	NA	None

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[M8] KCIA:</b> Reinspect KC Surplus Storage, NE T-Hangars, and Schultz Distributing, Inc. as necessary to achieve compliance with BMPs.	SPU, Ecology	Schmoyer, Cargill	Complete	NA	See L7	NA	None
<b>[M9] NBF:</b> Review results of Ecology's TCP, Waste and Water programs, and King County/Hazardous Waste inspections of NBF (Nov-Dec 2005)	Ecology, EPA	Cargill, Flint	In Progress	Spring 2007	NA	NA	None
<b>[M10] NBF:</b> Revise Stormwater Management Plan; conduct additional inspections of the NBF facility as necessary.	Ecology Boeing	Stegman, Power	Planned	Summer 2007	NA	NA	None
<b>[M11] GTSP:</b> Conduct additional site characterization to assess need for additional soil removal.	SCL	Goldberg	Planned	2007	NA	NA	None
<b>[M12] Boeing Plant 2:</b> Inspect Bldg. 2-122 area, sample onsite storm drain solids.	Ecology	Cargill, Stegman	Planned	Spring 2007	NA	NA	None
<b>[M13] Boeing Plant 2:</b> Clean onsite storm drain system as necessary.	Boeing	Power	Planned	2007	NA	NA	None

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

**Low Priority Source Control Actions<sup>3</sup>:**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Action	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[L1] Crowley Marine/Alaska Logistics:</b> Compile and evaluate historic groundwater quality data; complete historic use investigation to identify data gaps for recontamination potential (soil and groundwater).	Ecology, SAIC	Cargill	Complete	NA	See L2	NA	None
<b>[L2] Crowley Marine/Alaska Logistics:</b> Determine means to fill data gaps.	Ecology	Cargill	Complete	NA	See L3	See L3	None
<b>[L3] Crowley Marine/Alaska Logistics:</b> Conduct sampling if necessary and evaluate data.	Ecology	Cargill	Planned	Fall 2007	Ecology will conduct groundwater investigation to fill data gaps.	Fall 2007	None
<b>[L4] First South Properties/Emerald Services:</b> Compile and evaluate historic groundwater quality data; complete historic use investigation to identify data gaps for recontamination potential (soil and groundwater).	Ecology/SAIC	Cargill	Complete	NA	None	NA	None
<b>[L5] First South Properties/Emerald Services:</b> Determine means to fill data gaps.	Ecology	Cargill	No Action Required	NA	None	NA	None
<b>[L6] First South Properties/Emerald Services:</b> Conduct sampling if necessary and evaluate data.	Ecology	Cargill	No Action Required	NA	None	NA	None

<sup>3</sup> Low Priority: Release of contaminants possible but unlikely, based on location, current/past operations, or results of investigations

**Table ES-2-Rev1. Slip 4 Source Control Action Priorities**

Source Control Action Item	Responsible Party	Contact	Status	Estimated Completion Date	Follow-On Actions	Follow-On Action Estimated Completion Date	Actions Needed Before Slip 4 Remediation
<b>[L7] KCIA:</b> Conduct follow-up inspections at Shultz Distributing, Inc. until compliance achieved. Evaluate potential contaminants of concern and pathways.	SPU, Ecology	Schmoyer, Cargill	In Progress	Summer 2007	Re-inspections as necessary to ensure compliance.	2007	None
<b>[L8] Boeing Plant 2:</b> Assess existing groundwater data in the area.	Ecology, EPA	Cargill, Flint	Planned	2007	NA	NA	None
<b>[L9] Other Upland Properties:</b> Review data for contaminants of concern or pathways to Slip 4 for North Coast Chemical Company, Marine Vacuum Service, Inc. American Avionics/KC Airport, Arco Station #5218, KC Airport Maintenance, Aviation Fuel Storage/Schultz Distributing, and Rainier Ice & Cold Storage.	Ecology, SAIC	Cargill	Complete	NA	Reinspections as needed to ensure compliance.	2007	None
<b>[L10] Review NPDES permits:</b> Review permits for COCs found in sediments. This will include both municipal and industrial permits. Permittees affected for Slip 4 include Boeing (NBF), Boeing Plant 2, Emerald Services, Alaska Logistics, KCIA, WSDOT, and SPU.	Ecology, EPA	Cargill, Flint	Planned	2007	NA	NA	None

**Table 1: PCBs in Slip 4 Sediment Traps (August 2005 through January 2007)**  
(Detected analytes only)

Sample Location	Sampling Round	Date Collected	Concentration (mg/kg DW)				TOC (%)	Total PCBs (mg/kg OC)
			Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCBs		
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	0.029 U	10	1.2 U	10	4.29	233
	2	3/15/2006	41	55	11	107	7.86	1360
	3	10/11/2006	110 U	110	21 U	110	NA	NA
	4	1/8/2007	100 Y	260	51 Y	260	NA	NA
T2A: south lateral: upstream	1	8/11/2005	0.048 U	0.067	0.11	0.18	NA	NA
	2	3/15/2006	0.084 Y	0.19	0.19	0.38	NA	NA
	3	10/6/2006 <sup>a</sup>	0.020 U	0.02 U	0.02 U	0.020 U	1.15	1.7
	4	1/9/2007	0.049 Y	0.15	0.13	0.28	NA	NA
T2: south lateral: downstream	1	8/11/2005	0.021 U	0.50 P	0.34	0.84 P	NA	NA
	2	3/15/2006	0.21 U	0.89	0.57	1.5	NA	NA
	3	10/11/2006	0.30 U	0.76	0.47	1.2	NA	NA
	4	1/8/2007	0.067 U	0.18	0.14	0.32	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	0.034 U	0.038 JP	0.034 U	0.038	NA	NA
	2	3/16/2006	0.020 U	0.55	0.18	0.73	11.8	6.2
	3	10/6/2006	NA	NA	NA	NA	NA	NA
	4	1/9/2007	0.032 U	0.10	0.087	0.19	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	0.020 U	1.4	0.38 U	1.4	NA	NA
	2	3/15/2006	0.27 U	1.3	0.51	1.8	5.80	31
	3	10/11/2006	0.16 U	0.48	0.15	0.63	NA	NA
	4	1/8/2007	0.12 Y	0.43	0.14	0.57	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	0.0098 U	0.29 P	0.16	0.45 P	5.35	8.4
	2	3/15/2006	0.0099 U	0.039	0.075	0.11	NA	NA
	3	10/11/2006	0.081 U	0.083	0.16	0.24	NA	NA
	4	1/8/2007	0.0098 U	0.041	0.062	0.10	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	0.0098 U	1.9 P	0.85	2.8 P	NA	NA
	2	3/15/2006	0.10 U	0.75	0.34	1.1	5.41	20
	3	10/11/2006	0.14 U	0.58	0.36	0.94	NA	NA
	4	1/8/2007	0.48 U	1.0	0.67	1.7	NA	NA
T5A: north lateral: upstream	1	8/11/2005	0.0096 U	0.072	0.034	0.11	NA	NA
	2	3/15/2006	0.10 U	0.32	0.33	0.65	7.62	8.5
	3	10/11/2006	0.10 U	0.43	0.17	0.60	7.68	7.8
	4	1/8/2007	0.070 U	0.086	0.07 U	0.086	NA	NA
T5: north lateral: downstream	1	8/11/2005	0.049 U	24	2.4 U	24	NA	NA
	2	3/15/2006	48	54	12	114	7.59	1500
	3	10/11/2006	660 U	800	130 U	800	11.00	7270
	4	1/8/2007	130 Y	200	66 U	200	NA	NA
T6: I-5 storm drain line	1	8/11/2005	1.8 U	1.8 U	7.8	7.8	3.17	246
	2	3/16/2006	0.039 Y	0.10	0.15	0.25	4.02	6.2
	3	10/6/2006	0.039 U	0.11	0.21	0.32	4.74	6.8
	4	1/9/2007	0.032 U	0.048	0.038	0.086	NA	NA
Regulatory Levels (mg/kg OC):								
SQS							12	
CSL							65	

NA - Not available or not analyzed

DW - Dry Weight

a - Low percent recoveries for surrogates

OC - Organic Carbon Normalized

U - Analyte not detected at reported concentration.

Y - Analyte not detected at or above reported concentration; reporting limit is raised due to chromatographic interference.

J - Estimated concentration.

P - Analyte detected on both chromatographic columns but quantified values differ by >=40% RPD with no obvious chromatographic interference.

Detected concentration above SQS

Detected concentration above SQS and CSL

**Table 2: Metals in Slip 4 Sediment Traps (August 2005 through January 2007)**  
(Detected analytes only)

Sample Location	Sampling Round	Date Collected	Concentration (mg/kg DW)				
			Arsenic	Copper	Lead	Mercury	Zinc
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	11	83.6	140	1.1	368
	2	3/15/2006	10	110	97 J	0.93 J	435
	3	10/11/2006	30	325	216	8.3	1140
	4	1/8/2007	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	7.0 U	33.9	41	0.060 U	137
	4	1/9/2007	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA
	3	10/11/2006	50 U	276	300	0.60	1560
	4	1/8/2007	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/16/2006	12	142	740	0.16	276
	3	10/6/2006	20 U	282	1070	0.20 U	418
	4	1/9/2007	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	30	99	120	0.30	448
	3	10/11/2006	100 U	106	100	0.70 U	660
	4	1/8/2007	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	16	94	144	0.19	460
	2	3/15/2006	13	75	116	0.10	337
	3	10/11/2006	20	262	414	0.30	1220
	4	1/8/2007	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	20	134	190	0.40	733
	3	10/11/2006	70	271	330	0.60	2460
	4	1/8/2007	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	14	113	962	0.86	220
	2	3/15/2006	20	541	233	0.27	597
	3	10/6/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	21	148	109	1.1	553
	2	3/15/2006	20 U	297	184	2.0	717
	3	10/11/2006	40 U	640	310	2.9	1370
	4	1/8/2007	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	11	85	110	0.10	422
	2	3/16/2006	9.0	93	91	0.070	697
	3	10/6/2006	10 U	156	137	0.20	801
	4	1/9/2007	NA	NA	NA	NA	NA
Regulatory Levels (mg/kg DW):							
SQS			57	390	450	0.41	410
CSL			93	390	530	0.59	960

NA - Not available or not analyzed

DW - Dry Weight

a - Low percent recoveries for surrogates

U - Analyte not detected at reported concentration.

J - Estimated concentration.

	Detected concentration above SQS
	Detected concentration above SQS and CSL
	Not detected, however detection limit exceeds SQS

**Table 3: Phthalates in Slip 4 Sediment Traps (August 2005 through January 2007)  
(Detected analytes only)**

Sample Location	Sampling Round	Date Collected	Concentration (mg/kg DW)			
			Di-n-butyl phthalate	Butylbenzyl phthalate	Bis(2-ethylhexyl) phthalate	Di-n-octyl phthalate
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	<b>0.13</b>	<b>0.12</b>	<b>2.4</b>	<b>0.44</b>
	2	3/15/2006	<b>0.36</b>	0.34 U	<b>2.6</b>	<b>1.0</b>
	3	10/11/2006	0.24 U	<b>1.2</b>	<b>10</b>	<b>1.5</b>
	4	1/8/2007	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	<b>0.25 B</b>	<b>0.50</b>	<b>4.1</b>	<b>0.19</b>
	4	1/9/2007	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA
	2	3/15/2006	1.3 U	<b>1.6</b>	<b>34</b>	<b>9.8</b>
	3	10/11/2006	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA
	2	3/16/2006	0.66 U	<b>0.54 J</b>	<b>3.8</b>	0.66 U
	3	10/6/2006	<b>0.11</b>	<b>0.062</b>	<b>0.67</b>	<b>0.044</b>
	4	1/9/2007	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA
	2	3/15/2006	0.53 U	0.53 U	<b>4.8</b>	<b>23</b>
	3	10/11/2006	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	<b>0.35</b>	0.16 U	<b>2.6</b>	<b>4.3</b>
	2	3/15/2006	0.60 U	0.60 U	<b>2.6</b>	<b>9.6</b>
	3	10/11/2006	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	<b>0.26</b>	0.21 U	<b>6.0</b>	<b>3.7</b>
	2	3/15/2006	0.55 U	0.55 U	<b>7.4</b>	<b>6.9</b>
	3	10/11/2006	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	<b>0.15</b>	0.11 U	<b>1.8</b>	<b>0.22</b>
	2	3/15/2006	0.68 U	0.68 U	<b>10</b>	<b>2.5</b>
	3	10/6/2006	<b>0.73</b>	<b>0.58</b>	<b>10</b>	<b>4.8</b>
	4	1/8/2007	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	0.13 U	<b>0.14</b>	<b>2.7</b>	<b>1.2</b>
	2	3/15/2006	1.2 U	1.2 U	<b>8.3</b>	<b>5.5</b>
	3	10/11/2006	<b>0.36</b>	<b>0.44</b>	<b>19</b>	<b>7.2</b>
	4	1/8/2007	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	<b>0.46</b>	<b>0.42</b>	<b>6.0</b>	<b>0.43</b>
	2	3/16/2006	NA	NA	NA	NA
	3	10/6/2006	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA

NA - Not available or not analyzed

DW - Dry Weight

a - Low percent recoveries for surrogates

U - Analyte not detected at reported concentration.

J - Estimated concentration.

B - Analyte detected in an associated method blank at a concentration greater than reporting limit

**Table 4: Phthalates in Slip 4 Sediment Traps (August 2005 through January 2007)  
Comparison to Regulatory Levels  
(Detected analytes only)**

Sample Location	Sampling Round	Date Collected	TOC (%)	Concentration (mg/kg OC)			
				Di-n-butyl phthalate	Butylbenzyl phthalate	BIS(2-ethylhexyl) phthalate	Di-n-octyl phthalate
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	4.29	3.0	2.8	56	10
	2	3/15/2006	7.86	4.6	4.3 U	33	13
	3	10/11/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	1.15	22 B	43	360	17
	4	1/9/2007	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA
	3	10/11/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/16/2006	11.8	5.6 U	4.6 J	32	5.6 U
	3	10/6/2006	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	5.80	9.1 U	9.1 U	83	400
	3	10/11/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	5.35	6.5	3.0 U	49	80
	2	3/15/2006	NA	NA	NA	NA	NA
	3	10/11/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	5.41	10 U	10 U	140	130
	3	10/11/2006	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	7.62	8.9 U	8.9 U	130	33
	3	10/6/2006	7.68	9.5	7.6	130	63
	4	1/8/2007	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA
	2	3/15/2006	7.59	16 U	16 U	110	72
	3	10/11/2006	11.00	3.3	4.0	170	65
	4	1/8/2007	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	3.17	15	13	190	14
	2	3/16/2006	4.02	NA	NA	NA	NA
	3	10/6/2006	4.74	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA
Regulatory Levels (mg/kg OC):							
SQS			NA	220	4.9	47	58
CSL			NA	1700	64	78	4500

NA - Not available or not analyzed

OC - Organic Carbon Normalized

a - Low percent recoveries for surrogates

U - Analyte not detected at reported concentration.

J - Estimated concentration.

B - Analyte detected in an associated method blank at a concentration greater than reporting limit

Detected concentration above SQS

Detected concentration above SQS and CSL

Not detected, however detection limit exceeds SQS

**Table 5: HPAH in Slip 4 Sediment Traps (August 2005 through January 2007)**  
(Detected analytes only)

Sample Location	Sampling Round	Date Collected	Concentration (mg/kg DW)									
			Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	4.1	3.0	1.4	1.9	2.4	1.3	1.7	0.81	0.26	0.72
	2	3/15/2006	7.0	3.40	2.0	2.7	2.0	2.3	2.0	0.93	0.34 U	0.89
	3	10/11/2006	7.7	4.7	1.6	4.3	3.2	4.1	2.8	2.0	0.70	2.0
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	12	7.0	2.6	5.5	6.9	4.9	4.2	2.0	0.78	1.8
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	45	23	11	23	26	17	15	9.2	2.1	9.0
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/16/2006	12	8.4	3.6	6.8	7.4	5.1	4.6	2.5	0.60	2.2 J
	3	10/6/2006	3.7	2.6	1.1	2.1	2.1	1.2	1.5	0.58	0.25	0.51
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	4.8	2.7	1.2	2.6	2.6	1.7	1.5	0.93	0.53 U	0.95
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	3.1	2.1	0.86	1.7	2.1	1.3	1.4	0.78	0.16 U	0.71
	2	3/15/2006	4.2	2.4	1.0	2.5	2.5	1.9	1.6	0.96	0.6 U	0.90
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	8.9	6.8	3.0	4.1	4.6	2.6	3.4	1.9	0.73	1.6
	2	3/15/2006	6.1	3.5	1.6	3.1	2.8	2.2	2.0	1.0	0.55 U	0.99
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	2.4	1.7	0.84	1.2	1.6	0.80	1.1	0.52	0.11 U	0.45
	2	3/15/2006	13	6.0	3.2	6.3	7.4	4.3	4.5	2.2	0.68 U	2.1
	3	10/6/2006	6.9	5.2	2.0	4.4	4.2	3.5	3.0	2.0	0.64	2.0
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	2.9	2.0	0.94	1.4	1.7	0.97	1.2	0.68	0.13 U	0.60
	2	3/15/2006	9.7	5.1	2.5	4.3	4.5	2.9	3.0	1.6	1.2 U	1.5
	3	10/11/2006	6.5	4.1	1.3	3.7	3.1	3.0	2.3	1.4	0.48	1.5
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	0.88	0.63	0.27	0.37	0.38	0.22	0.25	0.084	0.079 U	0.079 U
	2	3/16/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not available or not analyzed

DW - Dry Weight

U - Analyte not detected at reported concentration.

**Table 6: HPAH in Slip 4 Sediment Traps (August 2005 through January 2007)  
Comparison to Regulatory Levels  
(Detected analytes only)**

Sample Location	Sampling Round	Date Collected	TOC (%)	Concentration (mg/kg OC)										Total HPAH
				Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	4.29	96	70	33	44	56	30	40	19	6.1	17	410
	2	3/15/2006	7.86	89	43	25	34	25	29	25	12	4.3 U	11	295
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	1.15	1043	609	226	478	600	426	365	174	68	157	4146
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/16/2006	11.8	102	71	31	58	63	43	39	21	5.1	19	451
	3	10/6/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	5.80	83	47	21	45	45	29	26	16	9 U	16	327
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	5.35	58	39	16	32	39	24	26	15	3 U	13	263
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	5.41	113	65	30	57	52	41	37	18	10 U	18	430
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	7.62	171	79	42	83	97	56	59	29	9 U	28	643
	3	10/6/2006	7.68	90	68	26	57	55	46	39	26	8	26	441
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	7.59	128	67	33	57	59	38	40	21	16 U	20	462
	3	10/11/2006	11.00	59	37	12	34	28	27	21	13	4.4	14	249
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	3.17	28	20	8.5	12	12	6.9	7.9	2.6	2.5 U	2.5 U	97
	2	3/16/2006	4.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006	4.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Regulatory Levels (mg/kg OC):														
SQS			NA	160	1000	110	110	230 <sup>a</sup>	230 <sup>a</sup>	99	34	12	31	960
CSL			NA	1200	1400	270	460	450 <sup>a</sup>	450 <sup>a</sup>	210	88	33	78	5300

a - Criterion applies to the sum of benzo(b)fluoranthene and benzo(k)fluoranthene

NA - Not available or not analyzed

U - Analyte not detected at reported concentration.

Detected concentration above SQS

Detected concentration above SQS and CSL

Not detected, however detection limit exceeds SQS

OC - Organic Carbon Normalized

**Table 7: LPAH in Slip 4 Sediment Traps (August 2005 through January 2007)**  
(Detected analytes only)

Sample Location	Sampling Round	Date Collected	Concentration (mg/kg DW)						
			Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	0.10 U	<b>0.12</b>	0.10 U	<b>0.21</b>	<b>0.19</b>	<b>2.8</b>	<b>0.36</b>
	2	3/15/2006	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	<b>2.5</b>	<b>0.38</b>
	3	10/11/2006	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	<b>2.9</b>	<b>0.29</b>
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	0.18 U	<b>0.36</b>	0.18 U	<b>0.57</b>	<b>0.56</b>	<b>6.2</b>	<b>0.83</b>
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	<b>15</b>	<b>1.7</b>
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA
	2	3/16/2006	0.66 U	0.66 U	0.66 U	<b>0.37 J</b>	<b>0.42 J</b>	<b>6.0</b>	<b>0.69</b>
	3	10/6/2006	<b>0.037</b>	<b>0.042</b>	<b>0.034</b>	<b>0.083</b>	<b>0.10</b>	<b>1.8</b>	<b>0.23</b>
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	<b>1.8</b>	0.53 U
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	<b>1.7</b>	<b>0.18</b>
	2	3/15/2006	0.60 U	0.6 U	0.6 U	0.6 U	0.6 U	<b>1.6</b>	0.6 U
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	<b>0.67</b>	<b>4.0</b>	0.21 U	<b>1.3</b>	<b>1.0</b>	<b>8.6</b>	<b>1.5</b>
	2	3/15/2006	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	<b>2.8</b>	0.55 U
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	<b>1.3</b>	<b>0.15</b>
	2	3/15/2006	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U	<b>4.6</b>	0.68 U
	3	10/6/2006	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	<b>2.9</b>	0.38 U
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	<b>1.6</b>	<b>0.21</b>
	2	3/15/2006	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	<b>3.7</b>	1.2 U
	3	10/11/2006	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	<b>2.4</b>	0.26 U
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	0.079 U	<b>0.088</b>	0.079 U	0.079 U	0.079 U	<b>0.57</b>	<b>0.10</b>
	2	3/16/2006	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006	NA	NA	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA

NA - Not available or not analyzed

DW - Dry Weight

J - Estimated concentration.

U - Analyte not detected at reported concentration.

**Table 8: LPAH in Slip 4 Sediment Traps (August 2005 through January 2007)  
Comparison to Regulatory Levels  
(Detected analytes only)**

Sample Location	Sampling Round	Date Collected	TOC (%)	Concentration (mg/kg OC)							
				Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Total LPAH	
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	4.29	2.8	2.3 U	4.9	4.4	65	8.4	88	
	2	3/15/2006	7.86	4.3 U	4.3 U	4.3 U	4.3 U	32	4.8	37	
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	3	10/6/2006 <sup>a</sup>	1.15	31	16 U	50	49	539	72	741	
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/16/2006	11.8	5.6 U	5.6 U	3.1 J	3.6 J	51	5.8	63	
	3	10/6/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	5.80	9.1 U	9.1 U	9.1 U	9.1 U	31	9.1 U	31	
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T4A: central lateral #2: upstream	1	8/11/2005	5.35	3.0 U	3.0 U	3.0 U	3.0 U	32	3.4	35	
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T4: central lateral #2: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	5.41	10 U	10 U	10 U	10 U	52	10 U	52	
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T5A: north lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	7.62	8.9 U	8.9 U	8.9 U	8.9 U	60	8.9 U	60	
	3	10/6/2006	7.68	4.9 U	4.9 U	4.9 U	4.9 U	38	4.9 U	38	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T5: north lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA	
	2	3/15/2006	7.59	16 U	16 U	16 U	16 U	49	16 U	49	
	3	10/11/2006	11.0	2.4 U	2.4 U	2.4 U	2.4 U	22	2.4 U	22	
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA	
T6: I-5 storm drain line	1	8/11/2005	3.17	2.8	2.5 U	2.5 U	2.5 U	18	3.1	21	
	2	3/16/2006	4.02	NA	NA	NA	NA	NA	NA	NA	
	3	10/6/2006	4.74	NA	NA	NA	NA	NA	NA	NA	
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA	
Regulatory Levels (mg/kg OC):											
SQS				NA	38	66	16	23	100	220	370
CSL				NA	64	66	57	79	480	1200	780

NA - Not available or not analyzed

OC - Organic Carbon Normalized

J - Estimated concentration.

U - Analyte not detected at reported concentration.

Detected concentration above SQS

Detected concentration above SQS and CSL

**Table 9: Other SVOCs in Slip 4 Sediment Traps (August 2005 through January 2007)**  
(Detected analytes only)

Sample Location	Sampling Round	Date Collected	TOC (%)	Concentration (mg/kg DW)						
				Phenol	Benzyl alcohol	2-Methylphenol	4-Methylphenol	Dibenzofuran	Dibenzofuran (mg/kg OC)	Carbazole
T1: upstream of lift station, downstream of north lateral and central lateral #1	1	8/11/2005	4.29	0.10 U	0.10 U	0.10 U	0.10 U	0.15	3.5	0.39
	2	3/15/2006	7.86	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	4.3 U	0.48
	3	10/11/2006	NA	0.26	0.24 U	0.24 U	0.42	0.24 U	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T2A: south lateral: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006 <sup>a</sup>	1.15	0.67 B	0.18 U	0.18 U	0.82	0.49	43	1.3
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA
T2: south lateral: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	NA	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	NA	3.6
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T3A: central lateral #1: upstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/16/2006	11.8	0.66 U	0.66 U	0.66 U	3.0	0.66 U	5.6 U	1.4
	3	10/6/2006	NA	0.040 B	0.020 U	0.020 U	0.010 J	0.076	NA	0.34
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA
T3: central lateral #1: downstream	1	8/11/2005	NA	NA	NA	NA	NA	NA	NA	NA
	2	3/15/2006	5.80	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	9.1 U	0.53 U
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T4A: central lateral #2: upstream	1	8/11/2005	5.35	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	3.0 U	0.37
	2	3/15/2006	NA	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	NA	0.60 U
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T4: central lateral #2: downstream	1	8/11/2005	NA	0.22	0.21 U	0.24	0.21 U	0.74	NA	1.0
	2	3/15/2006	5.41	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	10 U	0.57
	3	10/11/2006	NA	NA	NA	NA	NA	NA	NA	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T5A: north lateral: upstream	1	8/11/2005	NA	0.11 U	0.11 U	0.11 U	0.41	0.11 U	NA	0.26
	2	3/15/2006	7.62	0.68 U	0.68 U	0.68 U	0.83	0.68 U	8.9 U	1.4
	3	10/6/2006	7.68	0.38 U	0.38 U	0.38 U	0.53	0.38 U	4.9 U	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T5: north lateral: downstream	1	8/11/2005	NA	0.13 U	0.13 U	0.13 U	0.36	0.13 U	NA	0.31
	2	3/15/2006	7.59	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	16 U	1.2 U
	3	10/11/2006	11.0	0.30	0.26 U	0.26 U	0.59	0.26 U	2.4 U	NA
	4	1/8/2007	NA	NA	NA	NA	NA	NA	NA	NA
T6: I-5 storm drain line	1	8/11/2005	3.17	0.079 U	0.13	0.079 U	0.17	0.079 U	2.5 U	0.081
	2	3/16/2006	4.02	NA	NA	NA	NA	NA	NA	NA
	3	10/6/2006	4.74	NA	NA	NA	NA	NA	NA	NA
	4	1/9/2007	NA	NA	NA	NA	NA	NA	NA	NA
Regulatory Levels (mg/kg DW):										
SQS			NA	0.42	0.057	0.063	0.67	NA	15 <sup>a</sup>	NA
CSL			NA	1.2	0.073	0.063	0.67	NA	58 <sup>a</sup>	NA

NA - Not available or not analyzed

a - mg/kg OC (Regulatory levels are organic-carbon normalized)

J - Estimated concentration.

U - Analyte not detected at reported concentration.

B - Analyte detected in an associated method blank at a concentration greater than reporting limit

Detected concentration above SQS

Detected concentration above SQS and CSL

Not detected, however detection limit exceeds SQS

DW - Dry Weight

OC - Organic Carbon Normalized