

Appendix C:
Summary of Source Tracing Results by Outfall

TABLE OF CONTENTS

| | | |
|--------|--|--------|
| 1. | InTRoduction | - 1 - |
| 2. | UPPER REACH | - 1 - |
| 2.1. | 16 th Ave S SD (east)..... | - 1 - |
| 2.2. | KCIA SD#1 | - 3 - |
| 2.3. | Norfolk CSO/PS17 EOF/SD | - 4 - |
| 2.4. | I-5 SD at S Ryan St..... | - 11 - |
| 2.5. | 16 th Ave S SD (west)..... | - 12 - |
| 2.6. | 17 th Ave S SD | - 12 - |
| 2.7. | S 96 th St SD..... | 15 |
| 2.8. | DUWAMISH SUBSTATION OUTFALLS | 16 |
| 2.9. | W Marginal PI S SD | 18 |
| 3. | MIDDLE REACH | 19 |
| 3.1. | Head of Slip 2 SD..... | 19 |
| 3.2. | 1 st Ave S SD (east) | 20 |
| 3.3. | S River St SD..... | 21 |
| 3.4. | S Brighton St SD | 24 |
| 3.5. | S Myrtle St SD | 26 |
| 3.6. | S Garden St SD | 28 |
| 3.7. | I-5 SD at Slip 4..... | 29 |
| 3.8. | Georgetown SD..... | 33 |
| 3.9. | SW Kenny St SD/T115 CSO | 34 |
| 3.10. | Highland Park Wy SW SD | 37 |
| 3.11. | 1 st Ave S SD (west) | 39 |
| 3.12. | 2 nd Ave S SD | 42 |
| 3.13. | 7 th Ave S SD..... | 45 |
| 4. | LOWER REACH | 49 |
| 4.1. | S Nevada St SD..... | 49 |
| 4.2. | Diagonal Ave S CSO/SD..... | 50 |
| 4.2.1. | S Snoqualmie St Sub-basin | 54 |
| 4.2.2. | S Dakota St Sub-basin | 56 |
| 4.2.3. | City Light South Yard | 57 |
| 4.2.4. | Post-Cleanup Samples Offshore of the Diagonal Ave S CSO/SD outfall | 59 |
| 4.2.5. | Next Five Years | 62 |
| 4.3. | SW Dakota St SD | 63 |
| 4.4. | SW Idaho St SD | 65 |
| 4.5. | South Operations Center SD..... | 68 |
| 5. | REFERENCES..... | 68 |

TABLES

| | | |
|-------------|---|--------|
| Table C-1 : | Summary of chemicals exceeding SMS screening levels in the 16th Ave S (east) drainage system before cleaning..... | - 1 - |
| Table C-2: | Results for an inline grab sample collected from the 16th Ave S SD (east) after cleaning. | - 2 - |
| Table C-3: | Storm drain solids sample results for KCIA SD#1. | - 4 - |
| Table C-4: | Summary of chemicals exceeding the SMS screening levels in the City-owned MS4 within the S Norfolk CSO/PS17 EOF/SD drainage system before 2018 cleaning. | - 6 - |
| Table C-5: | Storm drain solids results for samples collected in S Norfolk CSO/PS 17 EOF/SD in 2019. | - 7 - |
| Table C-6: | Results for storm drain solids results collected in the S Norfolk St CSO/EOF PS17/SD after 2018 cleaning. | - 8 - |
| Table C-7: | Norfolk CSO/EOF/SD stormwater monitoring data (2010 - 2012). | - 9 - |
| Table C-8: | Chemicals exceeding SCO offshore of Norfolk CSO/PS17 EOF/SD following early action area cleanup. | - 10 - |
| Table C-9: | Storm drain solids sample results from I5 SD at S Ryan St..... | - 11 - |
| Table C-10: | Solids sampling results for 17th Ave S SD. | 14 |
| Table C-11: | Summary of chemicals exceeding SMS screening levels in the City-owned portion of the S 96th St SD before cleaning..... | 15 |
| Table C-12: | Storm drain solids sampling results, Duwamish Substation storm drains. | 16 |
| Table C-13: | Storm drain solids results for a sample collected from the W Marginal PI S SD..... | 18 |
| Table C-14: | Storm drain solids sample results for Head of Slip 2 SD. | 19 |
| Table C-15: | Summary of chemicals exceeding SMS screening levels in 1 st Ave S SD (east). | 20 |
| Table C-16: | Summary of chemicals exceeding SMS screening levels in S Myrtle St SD before cleaning. | 21 |
| Table C-17: | Summary of chemicals exceeding SMS screening levels in the S Myrtle St SD after cleaning..... | 22 |
| Table C-18: | Metals, HPAH, and PCBs in the S River St SD after cleaning compared to other storm drains in the LDW..... | 23 |
| Table C-19: | Summary of chemicals exceeding SMS screening levels in S Brighton St SD after cleaning..... | 25 |
| Table C-20: | Summary of chemicals exceeding SMS screening levels in S Myrtle St SD after cleaning (2010-2019)..... | 27 |
| Table C-21: | Summary of chemicals exceeding SMS screening levels in the S Garden St SD before cleaning.. | 28 |
| Table C-22: | Summary of chemicals exceeding the SMS screening levels in the I-5 SD at Slip 4 drainage system (2004-2014). | 30 |
| Table C-23: | Summary of chemicals exceeding the SMS screening levels in the I-5 SD at Slip 4 drainage system (2015-2019). | 30 |
| Table C-24: | Post-cleanup sediment monitoring data in Slip 4. | 31 |
| Table C-25: | Storm drain solids results for Georgetown SD (2014-2019). | 33 |
| Table C-26: | Summary of chemicals exceeding SMS screening levels in samples collected from the SW Kenny St SD/T115 drainage system before cleaning..... | 35 |
| Table C-27: | Results for storm drain solids samples collected in SW Kenny St SD/T115 CSO after cleaning.... | 35 |
| Table C-28: | Summary of chemicals exceeding SMS screening levels in samples collected from the Highland Park Wy SW SD system before cleaning (2008-2014). | 37 |
| Table C-29: | Summary of chemicals exceeding SMS screening levels in Highland Park Wy SW SD after cleaning. | 38 |
| Table C-30: | Summary of chemicals exceeding SMS screening levels in 1st Ave S SD (west) before cleaning (2002 -2017). | 40 |
| Table C-31: | Summary of chemicals exceeding SMS screening levels in samples collected from the 1 st Ave S SD, west storm drain system after cleaning..... | 41 |

| | | |
|--------------|---|----|
| Table C-32: | Summary of chemicals exceeding SMS screening levels in samples collected from the 2 nd Ave S SD storm drain system (2007-2013)..... | 42 |
| Table C-33: | Storm drain solids results for samples collected from the 2 nd Ave S SD (2014-2019). | 44 |
| Table C-34: | Summary of chemicals exceeding SMS screening levels in samples collected from the 7 th Ave S SD storm drain system before cleaning. | 45 |
| Table C-35: | Summary of chemicals exceeding SMS screening levels in samples collected from the 7 th Ave S SD storm drain system after cleaning. | 46 |
| Table C-36: | Chemicals exceeding SMS in surface sediment samples collected within 200 feet of the 7th Ave S SD..... | 48 |
| Table C-37: | Summary of chemicals exceeding SMS screening levels in S Nevada St SD..... | 49 |
| Table C-38: | Summary of chemicals exceeding SMS screening levels in the Diagonal Ave S CSO/SD drainage system during the previous reporting period (2003 – 2014). | 51 |
| Table C-39 : | Summary of chemicals exceeding SMS screening levels in the Diagonal Ave S CSO/SD during current reporting period (2014-2019)..... | 51 |
| Table C-40: | PCBs in water samples collected from S Snoqualmie St sub-basin. | 56 |
| Table C-41: | Mercury and PCBs in samples collected from the Dakota sub-basin in the Diagonal Ave S CSO/SD. | 57 |
| Table C-42: | Storm drain solids sample results for the Seattle City Light South Service Center (2015-2019).. | 58 |
| Table C-43: | Chemicals exceeding SCO offshore of Diagonal Ave CSO/SD following early action area cleanup. | 60 |
| Table C-44: | Summary of chemicals exceeding SMS screening levels in samples collected from the SW Dakota St drainage system before cleaning. | 64 |
| Table C-45: | Results for storm drain solids samples collected from SW Dakota St SD after cleaning (2014-2019)..... | 65 |
| Table C-46: | Summary of chemicals exceeding SMS screening levels in samples collected from the SW Idaho St SD system before cleaning. | 66 |
| Table C-47: | Summary of chemicals exceeding SMS screening levels in samples collected from the SW Idaho St SD system after cleaning. | 67 |

FIGURES

| | | |
|--------------|---|----|
| Figure 1: | S Brighton CSO before sealing. | 24 |
| Figure 2: | S Brighton CSO after sealing. | 24 |
| Figure C-3: | HPAH and PCBs in 7th-ST1 sediment trap before and after line cleaning. | 47 |
| Figure C-4: | Lead and mercury in ST1 trap samples (2003-2019)..... | 54 |
| Figure C-5: | PCBs, HPAH, and BEHP in ST1 trap samples (2004 - 2019). | 54 |
| Figure C-6: | Mercury and lead in MH18 (2003-2019)..... | 55 |
| Figure C-7: | PCBs and BEHP in MH18..... | 56 |
| Figure C-8: | BEHP in samples collected offshore of the Diagonal Ave S CSO/SD outfall post cleanup. | 61 |
| Figure C-9: | Butyl benzyl phthalate in samples collected offshore of the Diagonal Ave S CSO/SD after cleanup. | 61 |
| Figure C-10: | PCBs in samples collected offshore of the Diagonal Ave S CSO/SD outfall after cleanup. | 62 |
| Figure C-11: | Total organic carbon in samples collected offshore of the Diagonal Ave S CSO/SD after cleanup. | 62 |

1. INTRODUCTION

Information about individual City-owned outfalls and outfalls that receive stormwater and/or wastewater from City storm drains are described in the following sections. Sample numbers and descriptions are based on data collected through June 2019. In drainage systems where line cleaning has occurred, only samples collected after cleaning are included in the data summaries.¹ Map numbers (e.g., Map 4) refer to maps provided in the map attachment to this Source Control Implementation Plan.

2. UPPER REACH

2.1. 16th Ave S SD (east)

The 16th Ave S SD (east) serves a 3.2-acre basin west of E Marginal Wy S. This system mostly collects roadway runoff from short sections of 16th Ave S and E Marginal Wy S plus runoff from a portion of an industrial parcel located at the southwest corner of 16th Ave S and E Marginal Wy S within the City of Seattle (Map 4). This outfall also serves several catch basins on the east side of the 16th Ave S right-of-way within the City of Tukwila. Boeing disconnected the drainage from its property at 7755 E Marginal Wy S located on the east side of 16th Ave S as part of cleanup work conducted at Plant 2. This area no longer contributes runoff to the 16th Ave S SD (east).

In 2014, King County installed a stormwater wet vault as part of the South Park bridge construction. The approximately 34,000-gallon wet vault treats runoff from the lower 1,000 feet of the South Park bridge approach on 16th Ave S prior to discharging to the LDW via a new 24-inch outfall. The upper 550 feet between the pedestrian tunnel and E Marginal Wy S (city-owned part of the system) continues to discharge untreated to the LDW via the existing outfall.

SPU cleaned the city-owned portion of the 16th Ave S SD (east) drainage system in 2013. Prior to cleaning, SPU collected six storm drain solids samples from this system (one right-of-way catch basin and five inline grab samples). Results are summarized in Table C-1. Benzyl alcohol, benzoic acid, and 2-methylphenol exceeded the 2LAET screening levels in 2 to 3 of the 5 inline grab samples collected from this system. One inline sample (7.7 mg/kg at MH201) exceeded the CSL screening level for mercury and two inline samples (1,020 and 1,640 mg/kg, at MH201 and MH202, respectively) exceeded the CSL screening level for zinc.

After cleaning, in 2019, SPU collected an inline grab from a MH201 near the downstream end of the City-owned system. Results are presented in Table C-2. Benzyl alcohol (2,690 ug/kg dw), benzoic acid (1,120 ug/kg dw), and zinc (1,340 mg/kg) remained elevated after cleaning. Mercury (0.358 mg/kg) was below the SCO after cleaning but was still high compared to other storm drains in the LDW. PCBs (463 ug/kg dw) in the 2019 sample were higher than the samples collected in 2008 prior to cleaning (241 ug/kg dw) and were more than two times higher than the median concentration observed in other storm drains in the LDW (96 ug/kg dw). LPAH, HPAH, and cPAH in MH201 were also more than two times higher than the median concentration observed in other storm drains in the LDW, but this is not surprising given the heavy traffic that crosses the South Park Bridge.

¹ Samples flagged as “post cleaning” and “never been cleaned” are included. Samples flagged as “ODS” (outside the drainage system, such as soil, dirt, caulk, and paint), “non-MS4”, and “pre-cleaning” are not included in the data analysis.

Table C-1: Summary of chemicals exceeding SMS screening levels in the 16th Ave S (east) drainage system before cleaning.

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|---|-------|--------|--------|--------|---|--|
| Arsenic | 57 | 93 | 6 | 3 | 10 | 6.4 | 6.5 | 0 | 0 |
| Copper | 390 | 390 | 6 | 76 | 158 | 127 | 129 | 0 | 0 |
| Lead | 450 | 530 | 6 | 64 | 281 | 167 | 156 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 6 | 0.05 | 7.7 | 1.37 | 0.12 | 17 | 17 |
| Zinc | 410 | 960 | 6 | 219 | 1,640 | 736 | 587 | 67 | 33 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 6 | 1,100 | 3,900 | 1,980 | 1,650 | 33 | 33 |
| LPAH | 5,200 | 5,200 | 6 | 190 | 640 | 390 | 385 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 6 | 1,540 | 6,650 | 3,930 | 3,910 | 0 | 0 |
| cPAH | 1,000 ^b | 1,000 ^b | 6 | 167 | 819 | 514 | 522 | 0 | 0 |
| PCBs | 130 | 1,000 | 6 | 136 | 300 | 229 | 231 | 100 | 0 |
| BEHP | 1,300 | 1,900 | 6 | 1,500 | 44,000 | 12,100 | 6,050 | 100 | 67 |
| Butylbenzyl phthalate | 63 | 900 | 6 | 150 | 2,600 | 757 | 425 | 100 | 17 |
| Dimethyl phthalate | 71 | 160 | 6 | 29 | 130 | 74 | 68 | 50 | 0 |
| Benzoic acid | 650 | 650 | 6 | <580 | 13,000 | 2,800 | <1,700 | 33 | 33 |
| Benzyl alcohol | 57 | 73 | 6 | <58 | 31,000 | 5,600 | 300 | 50 | 50 |
| 2-methyl phenol | 63 | 63 | 6 | <58 | 5,700 | 1,100 | <170 | 33 | 33 |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/mg for cPAH.

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level

Samples collected November 2008 through April 2009.

Table C-2: Results for an inline grab sample collected from the 16th Ave S SD (east) after cleaning.

| | SCO LAET | CSL 2LAET | MH201 ^c 06/06/19 |
|-----------------------|--------------------|--------------------|--------------------------------|
| Arsenic | 57 | 93 | 13.8 U |
| Copper | 390 | 390 | 234 |
| Lead | 450 | 530 | 144 |
| Mercury | 0.41 | 0.59 | 0.358 |
| Zinc | 410 | 960 | 1,340 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 12,100 J |
| LPAH | 5,200 | 5,200 | 1,430 J |
| HPAH | 12,000 | 17,000 | 8,582 J |
| cPAH ^d | 1,000 ^b | 1,000 ^b | 840 J |
| PCBs | 130 | 1,000 | 463 |
| BEHP | 1,300 | 1,900 | 29,300 J |
| Butylbenzyl phthalate | 63 | 900 | 100 UJ |

| | SCO LAET | CSL 2LAET | MH201 ^c 06/06/19 |
|--------------------|-------------|--------------|--------------------------------|
| Dimethyl phthalate | 71 | 160 | 125 J |

| | |
|--|-------------------|
| | Exceeds SCO/LAET |
| | Exceeds CSL/2LAET |

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

- MTCA Method A soil cleanup for unrestricted use
- Sediment remedial action level
- Near end-of-pipe inline grab.

Nine surface sediment samples were collected within 200 feet of the 16th Ave S SD outfall (AECOM 2012) prior to 2015 when The Boeing Company completed an Early Action Cleanup at Plant 2. Chemicals that exceeded SCO included:

- Zinc: 420 J mg/kg at one sample located 180 feet upstream of the outfall
- PCBs: multiple samples. The sample closest to the outfall (40 feet offshore) contained 1,450 ug/kg dw PCBs, but concentrations were higher (2,400 – 17,300 ug/kg dw) at stations further away (180 feet) from the outfall
- Total HPAH and several individual HPAHs at one station located 200 feet upstream of the outfall.

PCBs exceeded SMS in eight of the samples, but the highest concentrations were found in samples collected upstream of the 16th Ave S outfall and PCB concentrations in the storm drain samples (136 – 300 ug/kg dw) were generally lower than the concentrations found in nearby sediment (220 – 17,300 ug/kg dw, 4,900 ug/kg dw mean).

After the Plant 2 cleanup, samples were collected in 2015 and 2016 from three locations within 200 feet of the outfall (PCM006, PCM016, and PCM026, Windward 2018). None of the samples exceeded the SCO for any chemicals.²

Based on this information, SPU does not consider the 16th Ave S SD to be a significant source to the waterway. However, given that the concentrations of several chemicals of concern for the waterway were higher than in other City storm drains discharging to the LDW, additional work is warranted. Over the next 5 years, SPU intends to conduct the following activities in the 16th Ave S SD (east) basin:

- Establish a long-term monitoring station near the downstream end of the City-owned portion of this system to monitor the quality of storm drain solids discharged to the LDW.
- Inspect business at corner of E Marginal Wy S and 16th Ave S and if possible, collect sample from private onsite catch basin.
- Clean entire system after completing source tracing.

2.2. KCIA SD#1


The KCIA SD#1 serves a total area of about 192 acres (Map 5). Approximately 114 acres in the City MS4 system (residential areas along Military Rd S) discharges to the KCIA SD#1 outfall via a ditch/culvert system that runs parallel to the railroad. This system crosses under the railroad and ties into the KCIA SD#1 system on the east side of Airport Wy S.

² PCM006 is 130 feet upstream, PCM016 is 170 feet upstream, and PCM026 is 110 feet downstream of the outfall.

To date, SPU has collected three storm drain solids samples from the City MS4 that discharges to the KCIA SD#1 drainage system (two right-of-way catch basin samples in 2007³ and one inline grab sample in 2018). Results are provided in Table C-3. No chemicals exceeded the SMS screening levels in RCB118 and only phthalates exceeded the CSL/LAET screening level in RCB116. MH47 was collected from a maintenance hole located on Military Rd S just upstream of the ditch/culvert system. All chemicals except butyl benzyl phthalate (670 ug/kg dw) were below the SCO/LAET screening levels.

Table C-3: Storm drain solids sample results for KCIA SD#1.

| | SCO LAET | CSL 2LAET | RCB116 11/16/07 | RCB118 11/16/07 | MH47 10/12/18 |
|------------------------|---------------------|----------------------|----------------------------|----------------------------|--------------------------|
| Arsenic | 57 | 93 | 8 U | 7 U | 8.27 |
| Copper | 390 | 390 | 44.2 | 53.2 | 42.9 |
| Lead | 450 | 530 | 36 | 20 | 87.9 |
| Mercury | 0.41 | 0.59 | 0.06 U | 0.05 U | 0.0581 |
| Zinc | 410 | 960 | 161 | 73 | 169 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 1,500 | 620 | 309 |
| LPAH | 5,200 | 5,200 | 100 | 66 | 682 J |
| HPAH | 12,000 | 17,000 | 496 | 169 | 4,267 |
| cPAH ^d | 1,000 ^b | 1,000 ^b | 67 | 51 | 540 |
| PCBs | 130 | 1,000 | 20 U | 20 U | 33 |
| BEHP | 1,300 | 1,900 | 2,700 | 660 | 603 |
| Butyl benzyl phthalate | 63 | 900 | 640 | 60 U | 670 |
| Dimethyl phthalate | 71 | 160 | 60 U | 60 U | 19.6 U |

 Exceeds SCO/LAET

 Exceeds CSL/2LAET

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

a. MTCA Method A soil cleanup for unrestricted use

b. Sediment remedial action level

More than 20 surface sediment samples have been collected within 200 feet of the KCIA SD#1 outfall. There were no SMS exceedances at two stations located within 30 feet of the outfall (LDW-SS127 and 23-intsed-2). At the next closest station to the outfall (LDW-SS2080-A at 40 feet offshore) only dimethyl phthalate and benzyl alcohol exceeded the SMS, although both exceeded the CSL. Multiple SVOCs exceeded the SCO at stations 90 to 200 feet from the outfall and many of these chemicals also exceeded the CSL.

It does not appear that solids from the City MS4 system are affecting sediment quality offshore of KCIA SD#1. Over the next 5 years, SPU plans to continue collecting near end-of-pipe samples from the City MS4 system and will evaluate whether a sediment trap should be installed to capture a representative sample of solids entering KCIA SD#1.

2.3. Norfolk CSO/PS17 EOF/SD

The Norfolk CSO/PS17 EOF/SD drainage system serves an area of about 649 acres. Land use in the basin is approximately 29.4 percent industrial, 18.5 percent residential, 15.9 percent open/vacant/parks, 3.5 percent

³ RCB116 and RCB118 were collected from catch basins in the residential area east of I5.

commercial, and 32.7 percent right-of-way. Approximately 431 acres are located within the City of Seattle (Map 6). The remaining 218 acres are within the City of Tukwila's jurisdiction. The I-5 corridor (11,000 LF) takes up a significant portion of the right-of-way within this basin.

SPU jetted and cleaned the lines south of S Norfolk St in 2005 in preparation for the Sound Transit Light Rail project, which when completed in 2010, upgraded the drainage system along Martin Luther King, Jr Wy S. There are now 30- to 42-inch storm drains on both sides of the roadway, which improves drainage along this corridor. Unfortunately, Sound Transit mistakenly connected some sanitary side sewers to the storm drain system, while re-connecting pipes along the corridor. SPU inspectors continue to find and correct illicit connections that resulted from this work.

In 2011 SPU constructed a 5-acre foot stormwater wet pond just west of I-5 that treats runoff from the 226-acre MLK sub-basin. Runoff from this portion of the drainage basin now passes through a 1,000-foot long heavily vegetated drainage swale, the new wet pond, and a natural wetland before discharging to the LDW. SPU cleaned all the pipes in this sub-basin in 2018.

The CSO and emergency overflow (EOF) connections to the Norfolk outfall are no longer very active. In 2005, King County installed a 14-foot diameter, 3,100 –foot-long tunnel to store, treat, and disinfect CSOs. The facility provides storage and treatment of potential CSO during peak, storm events. The diversion of wastewater into the tunnel prevents the discharge of CSO to surface waters during all but the most severe storms. CSOs that are discharged, receive primary treatment by settling, screening, disinfection, and dechlorination (King County 2006). Since 2005, the Norfolk CSO has discharged treated flows 0 to 3 times per year with overflow volumes ranging from <1 to 19.8 million gallons per year (King County 2006 – 2018).

SPU records show that the emergency overflow on pump station #17 in the Norfolk system has discharged twice in the past 10 years. The first occurred during a large December 11-12, 2010 storm event during which the pump station discharged approximately 1.3 million gallons over a nearly 7-hr period. This is considered a worst-case estimate, because there was no evidence that the duckbill valve opened to allow flow from the sanitary sewer to discharge to the storm drain. SPU crews did not observe any evidence of sewage in the ditch downstream of the duckbill valve (e.g., toilet paper, rags). The second overflow occurred on February 19, 2017. Total volume discharged during this event was estimated at 47,075 gallons.

The 25-acre parcel located at 3301 S Norfolk St is being re-developed. Redevelopment is expected to bring significant changes to the onsite drainage system, which will affect the City's Norfolk CSO/EOF/SD system at NST2 and the I-5 SD at S Ryan St system. The Seattle Department of Construction and Inspections is currently reviewing the developer's building permit application. SPU will review project plans when they become available and make necessary adjustments to monitoring locations when the site is developed.

Between the 2005 and 2018 cleanings, SPU collected 122 storm drain solids samples from the City-owned lines within the Norfolk CSO/EOF/SD drainage system (38 sediment trap, 31 onsite catch basins, 12 right-of-way catch basin, and 41 inline grab samples). Results are summarized in Table C-4.

Chemical concentrations in samples collected from the Norfolk CSO/EOF/SD drainage system were comparable to other City storm drains in the LDW (see box plots in Appendix B). However, elevated levels of HPAH have repeatedly been found in the MLK Jr Wy S sub-basin. SPU continues to track sources of HPAHs in this area. To date, SPU has found and eliminated several illicit connections (e.g., vehicle/equipment wash pads). During the 2018 cleaning, SPU's contractor observed and removed deposits of asphalt from the 30-inch pipe on MLK Jr Wy S north of S Norfolk St.

Table C-4: Summary of chemicals exceeding the SMS screening levels in the City-owned MS4 within the S Norfolk CSO/PS17 EOF/SD drainage system before 2018 cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|---------|--------|--------|---|--|
| Arsenic | 57 | 93 | 111 | <5.4 | 48 | 13 | 11 | 0 | 0 |
| Copper | 390 | 390 | 109 | 17.2 | 3,590 | 160 | 102 | 4 | 4 |
| Lead | 450 | 530 | 109 | 10 | 407 | 83 | 64 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 109 | <0.02 | 0.33 | 0.09 | 0.08 | 0 | 0 |
| Zinc | 410 | 960 | 109 | 74 | 2,850 | 650 | 540 | 58 | 22 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 103 | <64 | 24,000 | 3,700 | 2,860 | 60 | 60 |
| LPAH | 5,200 | 5,200 | 106 | <18 | 79,127 | 2,500 | 565 | 5 | 5 |
| HPAH | 12,000 | 17,000 | 106 | 19.2 | 585,400 | 16,000 | 3,328 | 10 | 8 |
| cPAH | 1,000 ^c | 1,000 ^c | 106 | <30 | 83,540 | 2,200 | 423 | 24 | 24 |
| PCBs | 130 | 1,000 | 114 | <17 | 2,100 | 150 | 86 | 35 | 1 |
| BEHP | 1,300 | 1,900 | 106 | <22 | 74,000 | 8,100 | 5,500 | 69 | 60 |
| Butyl benzyl phthalate | 63 | 900 | 106 | <18 | 4,600 | 330 | 235 | 69 | 7 |
| Dimethyl phthalate | 71 | 160 | 106 | <18 | 1,950 | 140 | 120 | 44 | 22 |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds.

Samples collected October 2005 through April 2018.

- Includes all samples collected in the MS4 that have not been affected by the 2005 cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint) Does not include samples collected before the 2005 cleaning
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Since the 2018 cleaning, SPU has collected 5 inline grabs or traps and 1 onsite CB sample in the MLK sub-basin. Results are displayed in Table C-5. Sampling locations are shown on Map 59. PAH concentrations in all samples were below the 2LAET screening level. Peak LPAH (1,030 ug/kg dw) and HPAH (8,074 ug/kg dw) concentrations were also significantly lower than samples collected prior to cleaning (79,127 and 585,400 ug/kd dw, respectively).

Zinc and phthalates continue to exceed SMS screening levels, but except for PCBs at NST-4 (866 J ug/kg dw), concentrations of these and other chemicals are comparable to levels found in other storm drains in the LDW. SPU has collected trap samples at NST-4 since 2008. Prior to 2019, PCB concentrations were all below 200 ug/kg dw. The higher level in 2019 (866 J ug/kg dw) is unusual and may reflect new source(s) in this sub-basin. NST4 drains the southern end of the King County Airport, portions of Airport Wy S, the railroad right-of-way, and a few private parcels located north of S Norfolk St on the east side of I-5. SPU collected storm drain solids samples from one right-of-way catch basin on Airport Wy S (RCB130 in 2008) and one private onsite catch basin at a trucking facility (CB233 in 2015). PCBs in both samples were low (22 and 11 J ug/kg dw, respectively). SPU inspected the trucking business in 2019 and found no violations. The lot area is swept each month and the onsite drainage system was well maintained.

Table C-5: Storm drain solids results for samples collected in the MLK Jr Wy S sub-basin after cleaning.

| | SCO LAET | CSL 2LAET | CB334 05/03/19 | NST1 ^a 04/17/19 | NST1 ^b 04/17/19 | NST3 ^a 04/16/19 | NST4 ^a 04/16/19 | NST5 ^a 04/16/19 |
|--------------------------|--------------------|--------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Arsenic | 57 | 93 | 17.4 | 11.2 | 6.75 U | 10.2 U | 95.4 U | -- |
| Copper | 390 | 390 | 123 | 110 | 40 | 94.7 | 111 | -- |
| Lead | 450 | 530 | 58.3 | 76.4 | 27.6 | 72.7 | 407 | -- |
| Mercury | 0.41 | 0.59 | 0.0426 | 0.117 | 0.0573 | 0.142 | 0.494 UJ | -- |
| Zinc | 410 | 960 | 1,010 | 713 | 207 | 463 | 435 | -- |
| TPH-oil | 2,000 ^c | 2,000 ^c | 2,790 | 3,980 J | 1,090 | 1,680 J | 1,000 J | -- |
| LPAH | 5,200 | 5,200 | 1,032 J | 1,020 J | 414 | 1,025 | 791 | -- |
| HPAH | 12,000 | 17,000 | 5,969 J | 8,074 J | 3,271 | 6,017 J | 3,873 | -- |
| cPAH ^d | 1,000 ^d | 1,000 ^d | 684 J | 963 J | 407 | 573 J | 683 J | -- |
| PCBs | 130 | 1,000 | 66 | 162 J | 111 J | 20 U | 866 J | 492 |
| BEHP | 1,300 | 1,900 | 7,280 | 9,950 J | 3,070 | 15,700 J | 2,060 J | -- |
| Butylbenzyl phthalate | 63 | 900 | 205 J | 156 J | 50.9 J | 427 J | 791 UJ | -- |
| Dimethyl phthalate | 71 | 160 | 296 U | 100 UJ | 59.8 U | 99.8 UJ | 791 UJ | -- |



Exceeds SCO/LAET

Exceeds CSL/2LAET

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

BEHP = bis(2-ethylhexyl)phthalate

New samples collected after the lines were cleaned in 2018.

- a. Sediment trap sample
- b. Inline grab at sediment trap location
- c. Sediment remedial action level
- d. Sediment remedial action level.

For the past 2 years, SPU has not been able to retrieve the sediment trap at station NST-2 due to high water levels in the maintenance hole. This trap will be relocated and re-established following redevelopment at the 3301 S Norfolk St property.

All samples collected in the S Norfolk CSO/EOF PS17/SD system that have not been affected by either the 2005- or 2018-line cleaning operations are summarized in **Error! Not a valid bookmark self-reference..** Median concentrations for all chemicals are similar to the levels observed at other storm drains in the LDW.

Table C-6: Results for storm drain solids results collected in the S Norfolk St CSO/EOF PS17/SD after 2018 cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|---------|--------|--------|---|--|
| Arsenic | 57 | 93 | 56 | <5.4 | 48 | 13 | 10 | 0 | 0 |
| Copper | 390 | 390 | 55 | 17.2 | 3,590 | 200 | 106 | 7 | 7 |
| Lead | 450 | 530 | 55 | 15 | 407 | 90 | 63 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 55 | <0.03 | 0.33 | 0.09 | 0.09 | 0 | 0 |
| Zinc | 410 | 960 | 55 | 74 | 2,220 | 610 | 579 | 51 | 27 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 49 | <64 | 24,000 | 4,300 | 3,200 | 51 | 51 |
| LPAH | 5,200 | 5,200 | 52 | <20 | 79,127 | 4,400 | 568 | 10 | 10 |
| HPAH | 12,000 | 17,000 | 52 | 21 | 585,400 | 27,000 | 3,168 | 12 | 12 |
| cPAH | 1,000 ^c | 1,000 ^c | 52 | <34 | 83,540 | 3,600 | 396 | 17 | 17 |
| PCBs | 130 | 1,000 | 59 | <18 | 2,100 | 140 | 73 | 14 | 1 |
| BEHP | 1,300 | 1,900 | 53 | <22 | 74,000 | 9,600 | 6,500 | 60 | 53 |
| Butyl benzyl phthalate | 63 | 900 | 53 | <20 | 4,600 | 330 | 180 | 70 | 4 |
| Dimethyl phthalate | 71 | 160 | 53 | <19 | 1,950 | 140 | 65 | 40 | 17 |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds.

Samples collected October 2005 through April 2019

- Includes all samples collected in the MS4 that have not been affected by the 2005 and 2018 cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Near end-of-pipe samples collected at NST-1 and NST-4 were below the CSL/2LAET screening level for metals and PCBs (See Appendix B). Occasional exceedances (≤ 10 percent of the 21 samples) have occurred for LPAH, HPAH, and cPAH. Like other outfalls in the LDW, phthalates more often exceed the 2LAET screening levels (29-43 percent).

As reported in SCIP 1, from 2010-2012, SPU collected 33 stormwater samples at the downstream end of the 164-acre MLK sub-basin as part of its NPDES stormwater monitoring requirements. The MLK sub-basin was selected to characterize stormwater quality from industrial land use. Land use in the is 37 percent industrial, 32 percent residential, 13 percent commercial and 18 percent open space. Sample results are summarized in Table C-7.

Table C-7: Norfolk CSO/PS17 EOF/SD stormwater monitoring data (2010 - 2012).

| | No. of samples | # Detects | Min | Max | Median | Mean |
|----------------------------|----------------|-----------|-------|-------|--------|-------|
| Total suspended solids | 33 | 33 | 16 | 455 | 63 | 87 |
| Copper, total | 33 | 33 | 10.2 | 64.3 | 18 | 23 |
| Copper, dissolved | 33 | 33 | 2 | 19.2 | 5 | 5.7 |
| Lead, total | 33 | 33 | 2 | 43 | 8 | 10 |
| Lead, dissolved | 33 | 15 | 0.2 | 3 | 0.5 | 0.5 |
| Mercury, total | 33 | 5 | 0.01 | 0.047 | 0.01 | 0.01 |
| Mercury, dissolved | 33 | 0 | -- | -- | -- | -- |
| Zinc, total | 33 | 33 | 71 | 420 | 131 | 155 |
| Zinc, dissolved | 33 | 33 | 12 | 125 | 46 | 47 |
| TPH-diesel | 32 | 32 | 0.15 | 2.4 | 0.77 | 0.8 |
| TPH-oil | 32 | 32 | 0.34 | 3.3 | 1.6 | 1.7 |
| Acenaphthene | 33 | 0 | -- | -- | -- | -- |
| Acenaphthylene | 33 | 0 | -- | -- | -- | -- |
| Anthracene | 33 | 0 | -- | -- | -- | -- |
| Fluorene | | | -- | -- | -- | -- |
| Naphthalene | 33 | 5 | 0.05 | 2.1 | 0.05 | 0.1 |
| Phenanthrene | 33 | 13 | 0.04 | 0.33 | 0.05 | 0.1 |
| Benzo(a)anthracene | 33 | 2 | 0.04 | 0.3 | -- | 0.1 |
| Benzo(a)pyrene | 33 | 5 | 0.05 | 0.36 | 0.05 | 0.1 |
| Benzo(g,h,i)perylene | 33 | 9 | 0.035 | 0.36 | 0.05 | 0.1 |
| Benzofluoranthenes, total | 33 | 8 | 0.05 | 0.72 | 0.095 | 0.1 |
| Chrysene | 33 | 11 | 0.04 | 0.44 | 0.05 | 0.1 |
| Dibenzo(a,h)anthracene | 33 | 0 | -- | -- | -- | -- |
| Fluoranthene | 33 | 17 | 0.05 | 0.6 | 0.06 | 0.1 |
| Indeno(1,2,3-cd)pyrene | 33 | 3 | 0.04 | 0.28 | 0.05 | 0.1 |
| Pyrene | 33 | 21 | 0.05 | 0.74 | 0.11 | 0.2 |
| Bis(2-ethylhexyl)phthalate | 33 | 20 | 0.5 | 2.2 | 1.6 | 2.2 |
| Butyl benzyl phthalate | 33 | 0 | -- | -- | -- | -- |
| Diethyl phthalate | 33 | 3 | 0.5 | 8.9 | 0.5 | 0.8 |
| Dimethyl phthalate | 33 | 0 | -- | -- | -- | -- |
| Di-n-butylphthalate | 33 | 0 | -- | -- | -- | -- |
| Di-n-octylphthalate | 33 | 0 | -- | -- | -- | -- |
| PCBs | 6 | 4 | <0.01 | 0.022 | 0.008 | 0.010 |

Reference: SPU 2012

Units: Total suspended solids (mg/L). All other parameters (ug/L)

King County dredged and capped contaminated sediment offshore of the Norfolk outfall in February-March 1999 and monitored sediment offshore of the Norfolk for the following five years (King County 2005). Chemicals exceeding SCO during the five-year post-cleanup monitoring program are listed in Table C-8. In September 2003, Boeing conducted additional cleanup in the area offshore of the outfall from Boeing property, due to elevated levels of PCBs found at NK503 during the 2000 sampling event and subsequent sampling conducted by Ecology in 2002. PCB concentrations offshore of the Boeing storm drain outfall were greater than six times the CSL (King County 2005). PCBs consistently exceeded the SCO and/or LAET in samples collected offshore of the Boeing storm drain outfall.

In addition, sporadic exceedances of PCBs occurred in the channel offshore of the Norfolk outfall (NFK501 in 2004) and the combined channel down gradient of both outfalls (NFK502 in 2001). The 2004 NFK501 sample was collected less than a year after Boeing dredged the adjacent area offshore of the Boeing storm drain outfall. The NFK502 exceedance was never repeated in any of the subsequent samples at this location.

Sporadic exceedances of SCO for butyl benzyl phthalate and PCBs have occurred offshore of the Norfolk CSO/PS 17 EOF/SD outfall since the 1999 cleanup, but there was no consistent upward trend (King County 2005). Butyl benzyl phthalate exceeded the SCO at both stations located downstream of the outfall in the 0-2 cm samples collected in April 2001. All other samples were below the SCO for BBP.

Based on these results, King County (2005) concluded that:

There have been periodic exceedances of SMS criteria on the Norfolk sediment cap. These exceedances, however, have been sporadic in nature and do not appear to show a consistent upward trend. Surface recontamination of the sediment cap from discharges of the Norfolk CSO, to levels approaching SCO chemical criteria, does not appear to have occurred over the five-year monitoring period. There appear to be some residual PCB concentrations at the site that are greater than the SCO criterion of the LAET.

Table C-8: Chemicals exceeding SCO offshore of Norfolk CSO/PS17 EOF/SD following early action area cleanup.

| Sample Station | NFK501 ^a | NFK502 ^b | NFK503 ^c |
|----------------------------|-------------------------------------|--|---------------------|
| Distance from outfall (ft) | 50 | 100 | 90 |
| Direction | Opposite | Opposite | Downstream |
| 1999 baseline | None | None | PCBs |
| 2001 | Butyl benzyl phthalate ^e | Butyl benzyl phthalate ^e , PCBs | PCBs |
| 2002 | None | BEHP | PCBs |
| 2003 | None | None | PCBs ^d |
| 2004 | PCBs | None | PCBs |

Results for samples collected at depths of 0-10 cm.

Reference: King County (1999, 2001, 2002, 2003, 2004).

- Outlet channel opposite Norfolk CSO/PS17 EOF/SD outfall
- Combined channel downstream of Norfolk and Boeing outfalls
- Outlet channel opposite Boeing storm drain
- PCB results could not be OC normalized because of high TOC in sample. Dry weight concentration exceeded the LAET for PCBs.
- Sample collected at 0-2 cm depth exceeded the SCO for butyl benzyl phthalate. All butyl benzyl phthalate results for samples collected in 2002 and 2003 were qualified as non-detect due to problems with laboratory contamination.

Over the next 5 years, SPU intends to conduct the following activities in the S Norfolk St CSO/EOF PS17/SD:

- Continue inspecting businesses
- Remove material from the sediment trap at the downstream end of the MLK Wy Jr sub-basin and re-establish flow channel, clean oil/water separator, 64-inch pipe (EQNUM 614010) west of MLK Wy Jr S and 36-inch pipe (EQNUM 614009) pipe on MLK Jr Wy S that were not completed during the 2018 line cleaning work in this basin. Schedule annual preventative maintenance cleaning for the sediment trap and oil/water separator.

- Work with King County Airport to investigate potential sources of PCBs in the NST-4 sub-basin where elevated levels of PCBs (866 J ug/kg dw) were observed in the 2019 trap sample.
- Relocate trap NST-2, if necessary, after property at 3301 S Norfolk St is redeveloped. SPU will notify Ecology if this trap is moved.
- Continue source tracing to determine whether PAH sources have been sufficiently controlled.

2.4. I-5 SD at S Ryan St

The I-5 SD at S Ryan St, constructed by WSDOT in 1964, serves an area of about 529 acres, a portion of which (122 acres) is in Tukwila (Map 7). In 1994, WSDOT constructed a dry pond/swale system to treat runoff from I-5. Low flows from I-5 were routed to the treatment system, which discharges to the Norfolk CSO/EOF/SD drainage system, while high flows were diverted around the treatment system to the S Ryan St outfall. In 2011, SPU constructed a wet pond/wetland system immediately south of the WSDOT dry pond. The wet pond replaced the existing swale, but effluent from the WSDOT dry pond continues to discharge to the Norfolk drainage system. Other modifications to this system include:



- In 1992, SPU constructed a diversion structure on the S Norfolk CSO/PS17 EOF/SD drainage system at NST-2 to allow high flows from the City's approximately 224-acre ML King Jr Wy S sub-basin to bypass to the I-5 SD at S Ryan St during large storm events.
- In 1995, SPU constructed a 200-foot long biofiltration swale on the north side of the S Boeing Access Rd (along the I-5 cloverleaf). The swale treats runoff from an 18-inch SD on S Ryan St in Tukwila.

Because of the high flow bypass at NST-2, many of the storm drain solids samples collected from the Norfolk CSO/EOF/SD would be representative of stormwater discharging from the I-5 SD at S Ryan St. In addition, during the previous reporting period SPU collected two inline (MH215 near the downstream end just east of E Marginal Wy S and MH116 on the 60-inch pipe just west of I-5) and two right-of-way catch basin samples (RCB122 and RCB123) from this system. As shown in Table C-9, phthalates and TPH-oil are the only parameters that exceeded the SMS screening levels and except for lead, median concentrations were similar to the concentrations observed in other storm drains in the LDW.

SPU attempted to collect samples from near the downstream end of this drainage system at E Marginal Wy S during the current reporting period but was unable to find enough material to sample.

Table C-9: Storm drain solids sample results from I5 SD at S Ryan St.

| | SCO LAET | CSL 2LAET | RCB122 01/04/08 | RCB123 01/04/08 | MH215 ^c 05/13/09 | MH116 11/02/11 |
|------------------------|--------------------|--------------------|--------------------|--------------------|--------------------------------|-------------------|
| Arsenic | 57 | 93 | 10 U | 6 U | 10 J | 10 U |
| Copper | 390 | 390 | 52.6 | 54.9 | 87.6 J | 44.4 J |
| Lead | 450 | 530 | 40 | 21 | 357 J | 330 J |
| Mercury | 0.41 | 0.59 | 0.04 U | 0.05 U | 0.07 J | 0.03 U |
| Zinc | 410 | 960 | 93 | 233 | 315 J | 201 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 570 | 740 | 7,800 | 240 |
| LPAH | 5,200 | 5,200 | 72 | 90 | 184 J | 58 U |
| HPAH | 12,000 | 17,000 | 230 | 885 | 2,249 J | 133 J |
| cPAH | 1,000 ^b | 1,000 ^b | 51 | 136 | 202 | 52 |
| PCBs | 130 | 1,000 | 20 U | 19 U | 232 | 18 U |
| BEHP | 1,300 | 1,900 | 300 | 480 | 5,600 B | 350 B |
| Butyl benzyl phthalate | 63 | 900 | 60 U | 790 | 380 | 58 U |
| Dimethyl phthalate | 71 | 160 | 60 U | 59 U | 61 U | 58 U |

| | |
|---|-------------------|
|  | Exceeds SCO/LAET |
|  | Exceeds CSL/2LAET |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

- a. Sediment remedial action level
- b. Sediment remedial action level
- c. Near end-of-pipe inline grab.

Except for TPH-oil, chemical concentrations in the single near end-of-pipe inline sample (MH215) collected in 2009, were all below the CSL/2LAET/MTCA Method A screening level.

Eleven surface sediment samples (EIT048, OR-05, OR-06, OS-04, OS-05, OS-06, DR-04, EST104, EST098, DRB-116, and LDW-SSRWSD-A) have been collected within 6 – 200 feet of the I-5 SD at S Ryan St outfall (AECOM 2012, SAIC 2011). One SCO exceedance for total PCBs was observed at OS-06 (770 ug/kg dw), located about 40 feet upstream of the outfall. No other SMS exceedances have been reported at these stations.

Over the next 5 years, SPU intends to continue operating and maintaining the two sediment traps, NST-2, located at the overflow structure on the Norfolk drainage that discharges to the I-5 SD at S Ryan St and NST3, located at the upstream end of the biofiltration swale adjacent to the I-5 cloverleaf. As described above, trap NST-2 may need to be relocated to accommodate likely changes in drainage due to proposed development on the property at 3301 S Norfolk St. SPU will notify Ecology if the NST-2 needs to be re-located.

2.5. 16th Ave S SD (west)

The 16th Ave S SD (west) serves about 4 acres of roadway on the west side of the South Park Bridge, including the bridge approach plus portions of Dallas Ave S, S Sullivan St, and 14th Ave S within the Seattle city limits (Map 8). Approximately 1.3 acres are located within the City of Seattle, the remainder is in unincorporated King County. King County installed a bioretention treatment system along the east side of the bridge when it was rebuilt in 2011-2014. It treats runoff from all but a small portion of this drainage system (roof drains and roadway along the east side of the bioretention system, which are in unincorporated King County).

SPU has not sampled the 16th Ave S SD (west). Nine sediment samples have been collected within 90-190 feet offshore of the outfall. No exceedance of SCO was observed in any sample.

Over the next 5 years, SPU will sample select catch basins located within the city along Dallas Ave S and 14th Ave S.

2.6. 17th Ave S SD

The 17th Ave S SD was constructed in 2016 when the City completed the Adjacent Streets and Drainage Improvement Project for the T117 Early Action Area cleanup to remove PCB-contaminated soil found in the right-of-way (Integral 2017). It serves about 2.9 acres of roadway (Dallas Ave S between 14th Ave S and 17th Ave S, 16th Ave S/17th Ave S between Dallas Ave S and S Donovan St, as well as property adjacent to the roadway (see Map 9). Runoff is collected and treated in a system composed of eight infiltrating bioretention cells and four Filterra™ tree box units. Treated runoff from the Filterra™ units and high flows that bypass the Filterra™ and bioretention cells are discharged to the waterway via an 18-inch outfall. The bioretention cells are constructed with two layers of media, 18 inches of soil-mulch mixture to support plant growth underlain by 24 inches of a mixture of sand, zeolite, and granular activated carbon (GAC). The media in the Filterra™ tree box units is also amended with 10 percent GAC (Integral et al., 2014).

Since the outfall was put into operation in 2016, SPU has collected six samples from 1) pre-settling cells on the bioretention system, 2) dirt adjacent to pedestrian path where stormwater ponded⁴, and 3) a near end-of-pipe sediment trap. Results are presented in Table C-10. Concentrations of most chemicals were similar to what has been found in other storm drains in the LDW. However, as shown in Table C-11, phthalate concentrations increased between 2017 and 2018 in the samples collected from RCB76 on 17th Ave S

Although the median PCB concentration was similar to what has been observed in other storm drains in the LDW, concentrations in RCB85 and 17th-ST1 (456 and 685 ug/kg dw) were higher than expected given that PCB-contaminated soil was removed as part of the Superfund cleanup conducted in 2015-2016.

SPU also collected stormwater samples from the underdrains in one of the bioretention cells and one FilterraTM unit in 2018-2019 (SPU 2018). Underdrain sampling was required by EPA and Ecology to allow SPU to evaluate when the filtration media needs to be replaced. Bioretention Cell B was constructed with a portion of the cell equipped with a liner and underdrain for this purpose. Five samples were collected from each unit during storm events in 2018-2019. PCBs were not detected at 0.01 ug/L in any of the underdrain samples.

The first post-cleanup sediment samples were collected in the waterway offshore of T117 in March 2019 (Cabanillas 2019). Samples, collected as part of the long-term monitoring and maintenance plan (Integral and AECOM 2018), were analyzed for PAHs, PCBs, dioxins/furans, and arsenic. One sample was collected within 200 feet of the 17th Ave S SD outfall; PERIM-5-LTM was collected about 100 feet downstream of the outfall. It exceeded the project-designated removal action level for arsenic (15.9 mg/kg dw versus 12 mg/kg dw) but did not exceed the SCO (57 mg/kg dw). Arsenic concentrations in the four storm drains solids samples tested in the 17th Ave S SD (<19.3 – 29.8 mg/kg) were all below the SCO, but above the removal action level. Cabanillas (2019) also reported exceedances of the removal action level for arsenic at two other sampling stations located 250-750 feet offshore of the 17th Ave S SD outfall.

Over the next 5 years, SPU intends to conduct the following activities in the 17th Ave S SD:

- Check the sediment trap each year and retrieve samples when there is sufficient material for analysis.
- Collect solids samples from various locations to track PCBs in the basin
- Implement the underdrain monitoring program as described in the project sampling and analysis plan (SPU 2018). The next round of sampling is scheduled to occur in 2021.

⁴ SPU had contractor regrade area to prevent future ponding along pathway.

Table C-10: Solids sampling results for 17th Ave S SD.

| Chemical | SCO LAET | CSL 2LAET | RCB75 ^a 01/08/17 | RCB76 ^b 01/09/17 | RCB76 ^b 12/18/18 | RCB85 ^c 12/18/18 | ODS51 ^d 01/09/17 | 17 th -ST1 ^e 05/08/19 |
|------------------------|--------------------|--------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--|
| Arsenic | 57 | 93 | 21 | 29.8 | 12.3 | 19.3 U | 21.2 | -- |
| Copper | 390 | 390 | 87.6 | 114 | 93.8 | 146 | 62.3 | -- |
| Lead | 450 | 530 | 29.4 | 46.7 | 28.5 | 61.3 | 21 | -- |
| Mercury | 0.41 | 0.59 | 0.09382 | 0.06326 | 0.0471 U | 0.0878 J | 0.06059 | -- |
| Zinc | 410 | 960 | 455 | 1,090 | 500 | 601 | 176 | -- |
| TPH-oil | 2,000 ^f | 2,000 ^f | 2,030 | 1,620 | 3,180 | 3,570 | 628 | -- |
| LPAH | 5,200 | 5,200 | 383 J | 236 J | 257 J | 431 J | 107 J | -- |
| HPAH | 12,000 | 17,000 | 3,048 | 2,781 J | 5,945 | 4,354 | 775 J | -- |
| cPAH | 1,000 ^f | 1,000 ^f | 349 | 312 J | 867 | 525 | 92 J | -- |
| PCBs (total Aroclors) | 130 | 1,000 | 74.3 | 85.1 | 63.3 | 456 | 24.4 | 685 |
| BEHP | 1,300 | 1,900 | 14,500 | 9,610 | 89,000 | 12,800 | 4,450 | -- |
| Butyl benzyl phthalate | 63 | 900 | 533 | 298 | 1,150 | 97.9 U | 113 | -- |
| Dimethyl phthalate | 71 | 160 | 49.3 U | 243 U | 1,230 | 88.9 U | 91.4 | -- |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls PAH = polycyclic aromatic hydrocarbons,

TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Exceeds SCO/LAET

Exceeds CSL/2LAET

- Presettling cell on Cell F located on 16th Ave S
- Presettling cell on Cell D located on 17th Ave S
- Presettling cell on Cell C located on 16th Ave S
- Dirt sample collected from southeast corner of pedestrian path at Dallas Ave S and S Donovan St
- Sediment trap at last maintenance hole before outfall. Trap installed in 2017. Retrieval attempted in 2018, but insufficient material for analysis. 2019 sample contained enough material for only PCBs analysis.
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level.

TableC-11: Phthalate concentrations in RCB76 in 17th Ave S SD basin.

| Phthalates (ug/kg dw) | RCB76 1/9/17 | RECB76 12/18/18 |
|----------------------------|-----------------|--------------------|
| Bis(2-ethylhexyl)phthalate | 9,610 | 89,000 |
| Butyl benzyl phthalate | 298 | 1,150 |
| Dimethyl phthalate | 243 U | 1,230 |

2.7. S 96th St SD

The S 96th St SD serves an area of 1,089 acres, mostly in unincorporated King County (Map 10). Approximately 99 acres within the City of Seattle drain to this outfall. SPU cleaned the City's MS4 system in this basin in 2016.⁵ Prior to cleaning, SPU collected 12 storm drain solids samples from the City portion of this system (9 right-of-way catch basin, 2 private onsite catch basin, and 1 inline grab sample). Results are summarized in Table C-12. Zinc, TPH-oil, and phthalates exceeded SMS screening levels, but concentrations were comparable to levels found in other storm drains in the LDW.

Table C-12: Summary of chemicals exceeding SMS screening levels in the City-owned portion of the S 96th St SD before cleaning.

| Chemical | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 9 | 4.9 | 30 | 15 | 11 | 0 | 0 |
| Chromium | 260 | 270 | 1 | 55 | 55 | 55 | 55 | 0 | 0 |
| Copper | 390 | 390 | 9 | 21 | 158 | 66 | 58 | 0 | 0 |
| Lead | 450 | 530 | 9 | 19 | 120 | 41 | 27 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 9 | <0.02 | 0.1 | 0.04 | 0.04 | 0 | 0 |
| Zinc | 410 | 960 | 9 | 82 | 1,740 | 620 | 291 | 44 | 22 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 9 | <120 | 18,000 | 2,400 | 510 | 11 | 11 |
| LPAH | 5,200 | 5,200 | 9 | 18 | 3,180 | 610 | 92 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 9 | 78 | 4,910 | 1,900 | 1,177 | 0 | 0 |
| cPAH | 1,000 ^b | 1,000 ^b | 9 | 17 | 555 | 210 | 124 | 0 | 0 |
| PCBs | 130 | 1,000 | 12 | <17 | 130 | 41 | 20 U | 0 | 0 |
| BEHP | 1,300 | 1,900 | 9 | 200 | 19,000 | 3,100 | 1,300 | 44 | 33 |
| Butyl benzyl phthalate | 63 | 900 | 9 | <19 | 5,900 | 1,300 | 490 | 67 | 33 |
| Dimethyl phthalate | 71 | 160 | 9 | <19 | 155 | 426 | 39 | 11 | 0 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected March 2008 through May 2013.

⁵ Over the past 5 years, SPU has focused on cleaning drains on the west side of the waterway because SPU had access to a site on the west side of the waterway where dewatering and solids handling could be performed, which minimized transportation requirements.

- a. MTCA Method A soil cleanup level for unrestricted use.
- b. Sediment remedial action level.

SPU attempted to collect an inline sample from near the downstream end of the City system after cleaning. An inline grab was collected in 2018 (MH41), but this maintenance hole does not capture all of the runoff from the City portion of the basin. Only chromium (795 mg/kg) exceeded the CSL/2LAET screening levels. Zinc (795 mg/kg), and butyl benzyl phthalate (320 ug/kg dw) exceeded the SCO/LAET screening levels. SPU tried again to sample a downstream location in 2019, but there was not enough material in the downstream maintenance holes.

There are several potential sources of chromium in the area, a hard chrome plater; a painting and blasting facility, and an electroplater. The electroplater is on Ecology's list of known and suspected contaminated sites due to metals contamination found in onsite soil and groundwater. Runoff from the painting/blasting facility discharges to the City system upstream of MH41. SPU inspected this facility in 2015 and found an internal floor drain in the wheelabrator room connected to the drainage system and also noted that more frequent yard sweeping was needed. This site installed a stormwater treatment system in 2009-2011, to remove metals. Further investigation is needed to determine whether this site is the source of chromium found in MH41.

Two sediment samples were collected offshore of the S 96th St SD outfall (LDW18-2100A-1 and LDW18-2100A-2). as part of the pre-design, near outfall sampling effort (Windward 2018). No chemicals exceeded sediment criteria. It does not appear that this outfall and particularly the MS4 portion of the basin has affected sediment quality in the waterway.

Over the next 5 years, SPU intends to conduct the following activities in the S 96th St SD basin:

- Continue to inspect the businesses in the area served by the City MS4 with the intent of re-inspecting all businesses at least once during the 5-year period.
- Evaluate whether a sediment trap can be installed in this system to facilitate collection of storm drain solids for long term monitoring.

2.8. DUWAMISH SUBSTATION OUTFALLS

Seattle City Light's approximately 8.4-acre Duwamish Substation facility located at the southern end of LDW study area is served by four small drainage systems, three discharge to outfalls owned by City Light (Duwamish Substation SDs #1, #2, and #3) and one discharges to the W Marginal PI S SD owned by the City of Tukwila (Map 11). Ecology (Leidos 2015a) collected solids samples from three of the drainage systems on December 16, 2014 (Map 62). Results for the outfalls owned by City Light are presented in Table C-13. See following section for W Marginal PI S SD results. Samples were analyzed for priority pollutant metals, semi-volatile organic chemicals, PCBs (Aroclor and congener), and dioxins/furans. In addition, one sample from outfall #2 (CB-H1) was analyzed for volatile organic chemicals, but only acetone (11 ug/kg dw), a common laboratory contaminant, was detected.

Table C-13: Storm drain solids sampling results, Duwamish Substation storm drains.

| Chemical | SCO LAET | CSL 2LAET | CB-H1 ^a Duw Sub SD #2 | CB-I3 ^b Duw Sub SD #3 |
|----------|-------------|--------------|-------------------------------------|-------------------------------------|
| Arsenic | 57 | 93 | 10 | 4.9 |
| Cadmium | 5.1 | 6.7 | 1.1 | 0.51 |
| Chromium | 260 | 270 | 60 | 21 |
| Copper | 390 | 390 | 120 | 82 |
| Lead | 450 | 530 | 150 | 48 |

| Chemical | SCO LAET | CSL 2LAET | CB-H1 ^a Duw Sub SD #2 | CB-I3 ^b Duw Sub SD #3 |
|------------------------|--------------------|--------------------|-------------------------------------|-------------------------------------|
| Mercury | 0.41 | 0.59 | 0.05 | 0.019 J |
| Silver | 6.1 | 6.1 | 1.4 | 0.63 |
| Zinc | 410 | 960 | 550 | 240 |
| LPAH | 5,200 | 5,200 | 39,000 J | 310 J |
| HPAH | 12,000 | 17,000 | 140,000 | 2,300 J |
| cPAH ^c | 1,000 ^b | 1,000 ^b | 18,000 | 300 J |
| PCBs (total Aroclors) | 130 | 1,000 | 62 J | 35 J |
| PCBs (total congeners) | 130 | 1,000 | 147 J | 47.2 J |
| Dioxins/furans | 25 ^d | -- | 53.6 J | 12.2 J |
| BEHP | 1,300 | 1,900 | 19,000 U | 11,000 U |
| Butylbenzyl phthalate | 63 | 900 | 6,500 U | 3,600 U |
| Dimethyl phthalate | 71 | 160 | 390 J | 260 J |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Exceeds SCO/LAET

Exceeds CSL/2LAET

Source: Leidos (2015a)

a. Inline catch basin

b. Inline catch basin

c. Non-detects included at 0.5 times the reporting limit.

d. Sediment remedial action level.

PAHs exceeded the 2LAET screening level in the sample collected from Duwamish Substation SD#2. Phthalates also appeared elevated in both drains, but due to matrix interferences, the analytical detection limits for phthalates were well above the 2LAET screening level. As a result, concentrations of bis(2-ethylhexyl)phthalate and butyl benzyl phthalate could not be quantified. PCBs in both drains were relatively low, although total congeners, but not total Aroclors, in SD#2 was slightly above the LAET.

After the 2014 Ecology inspection, Seattle City Light cleaned all the onsite trench drains, eliminated materials storage for all work projects other than substation projects⁶, and repaired all oil stop valves in the drainage system⁷.

Nineteen sediment samples have been collected within 200 feet of the three Duwamish Substation outfalls, but only benzyl alcohol exceeded the SCO and at only one station located 40 feet downstream of Outfall #2. Based on these data it appears that the substation outfalls are not a significant source of contaminants to waterway sediment.

Over the next 5 years, Seattle City Light intends to conduct the following activities at the Duwamish Substation:

- Clean all onsite catch basins (2020).
- Continue inspecting catch basins annually and cleaning when sump is 50 percent full of sediment.
- Collect storm drain solids samples from each of the four onsite drainage systems following cleaning.

⁶ Prior to 2014, the south end of the substation had been used to store materials for other City Light projects.

⁷ Oil stop valves close when floating product/oil is present in the catch basin.

2.9. W Marginal PI S SD

The W Marginal PI S SD receives runoff from about 4.9 acres on the Seattle City Light Duwamish Substation plus an unknown area along W Marginal Wy SW in the City of Tukwila⁸ (Map 11). Most runoff from the substation passes through an oil/water separator before discharging offsite.⁹ Results from a sample collected by Ecology on December 16, 2014 are presented in Table C-14. Sample locations are shown on Map 62. The sample was a composite of grabs from trench drains in three transformer banks (#77, 78, and 79).

Table C-14: Storm drain solids results for a sample collected from the W Marginal PI S SD.

| Chemical | SCO LAET | CSL 2LAET | TD-01 W Marginal PI S SD |
|------------------------|--------------------|--------------------|--------------------------------|
| Arsenic | 57 | 93 | 17 |
| Cadmium | 5.1 | 6.7 | 7.2 |
| Chromium | 260 | 270 | 100 |
| Copper | 390 | 390 | 320 |
| Lead | 450 | 530 | 500 |
| Mercury | 0.41 | 0.59 | 0.061 |
| Silver | 6.1 | 6.1 | 7.3 |
| Zinc | 410 | 960 | 4,200 |
| LPAH | 5,200 | 5,200 | 1,500 J |
| HPAH | 12,000 | 17,000 | 9,400 J |
| cPAH ^a | 1,000 ^b | 1,000 ^b | 1,300 J |
| PCBs (total Aroclors) | 130 | 1,000 | 77 J |
| PCBs (total congeners) | 130 | 1,000 | 84.4 J |
| Dioxins/furans | 25 ^b | -- | 45.5 J |
| BEHP | 1,300 | 1,900 | 7,200 J |
| Butyl benzyl phthalate | 63 | 900 | 1,300 J |
| Dimethyl phthalate | 71 | 160 | 1,600 U |

Exceeds SCO/LAET

Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Source: Leidos (2015a).

a. Non-detected values included at 0.5 times the reporting limit.

b. Sediment remedial action level.

Other than PAHs and PCBs, concentrations of chemicals in the sample collected from W Marginal PI S SD were higher than those observed in the other two storm drains sampled on the Duwamish Substation site (see previous Section [2.8]). Copper, lead, zinc, and cPAHs were also greater than two times the median of the median concentrations observed in other outfalls within the LDW (200 mg/kg, 160 mg/kg, 900 mg/kg, and 780 ug TEQ/kg).¹⁰

Six sediment samples have been collected offshore of the W Marginal PI S SD, the closest sample (LDW-SS141) is located approximately 60 feet upstream of the outfall. Benzyl alcohol is the only chemical that exceeded SCO in

⁸ Basin boundaries for areas within the City of Tukwila have not been developed.

⁹ Two catch basins that serve primarily the site service roads discharge directly to the storm drain on W Marginal Wy S.

¹⁰ PSU used a value of two times the median of the median concentrations measured in all outfalls to prioritize outfalls (see Appendix J).

the offshore sediment and only in four of six samples. Exceedances occurred in stations located 80 to 200 feet from the outfall. No exceedances occurred in the closest station (LDW-SS141). These results indicate that the W Marginal PI S SD is not impacting sediment quality in the waterway.

As described above for the Duwamish Substation storm drains, City Light will conduct the following activities in the W Marginal PI S SD basin:

- Clean all onsite catch basins and trench drains in 2020.
- Continue inspecting catch basins annually and cleaning when sump is 50 percent full of sediment.
- Collect storm drain solids samples from the onsite drainage system following cleaning.

3. MIDDLE REACH

3.1. Head of Slip 2 SD

The Head of Slip 2 SD serves an approximately 12-acre commercial area (Map 12). The area is occupied by three warehouses with loading docks and employee parking. The drainage system is privately owned, but collects runoff from seven City-owned catch basins on E Marginal Wy S and one on 1st Ave S.


SPU inspected four businesses in the basin between 2008 and 2015. A potential illicit connection was identified at one site. Otherwise, no serious source control issues were identified.

In 2018, SPU collected an inline grab from a maintenance hole near the downstream end of the system (MH38 on Map). None of the chemicals exceeded SMS screening levels. Results are provided in Table C-15.

Table C-15: Storm drain solids sample results for Head of Slip 2 SD.

| Chemical | SCO LAET | CSL 2LAET | MH38 05/25/18 |
|------------------------|--------------------|--------------------|------------------|
| Arsenic | 57 | 93 | 14.8 |
| Copper | 390 | 390 | 62.5 |
| Lead | 450 | 530 | 79.8 J |
| Mercury | 0.41 | 0.59 | 0.0282 |
| Zinc | 410 | 960 | 198 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 454 |
| LPAH | 5,200 | 5,200 | 208 |
| HPAH | 12,000 | 17,000 | 227 |
| cPAH | 1,000 ^b | 1,000 ^b | 85 |
| PCBs (total Aroclors) | 130 | 1,000 | 27.3 |
| BEHP | 1,300 | 1,900 | 458 |
| Butyl benzyl phthalate | 63 | 900 | 94.3 U |
| Dimethyl phthalate | 71 | 160 | 94.3 U |

 Exceeds SCO/LAET

 Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level.

Between 1997 and 2011, five sediment samples were collected from between 50 and 120 feet of the outfall. PCBs exceeded the SCO in one of the 50-foot samples and benzyl alcohol exceeded the SCO in the other. Benzyl alcohol was not detected (94.3 U ug/kg dw) and PCBs (27.3 ug/kg dw) were below the LAET screening level in the inline sample collected from this outfall. Therefore, it does not appear that the Head of Slip 2 SD is a significant source of contaminants to the waterway sediment.

Over the next five years, SPU will continue to inspect businesses in the basin and will collect an inline grab sample at MH38 every three years to evaluate the quality of storm drain solids discharged to the waterway.

3.2. 1st Ave S SD (east)

The 1st Ave S SD (east) serves a 15-acre basin under the 1st Ave S Bridge (Map 13). The drainage basin encompasses areas under the 1st Ave S Bridge, approaches to the bridge, and portions of E Marginal Wy S. Stormwater passes through a biofiltration swale before discharging to the waterway. Most of this drainage system was installed by the Washington State Department of Transportation (WSDOT) between 1999 and 2001, when the 1st Ave S Bridge and approaches were modified. SPU has collected three inline grab samples (MH264, MH265, and MH39) from the two main trunk lines connected to this outfall. Results are summarized in Table C-16. Sampling locations are shown on Map 64.

Table C-16: Summary of chemicals exceeding SMS screening levels in 1st Ave S SD (east).

| | SCO LAET | CSL 2LAET | MH264 06/06/13 | MH265 06/06/13 | MH39 05/25/18 |
|------------------------|--------------------|--------------------|-------------------|-------------------|------------------|
| Arsenic | 57 | 93 | 7 | 7 | 22.6 |
| Copper | 390 | 390 | 73.9 | 401 | 185 |
| Lead | 450 | 530 | 38 | 130 | 115 J |
| Mercury | 0.41 | 0.59 | 0.03 | 0.04 | 0.131 |
| Zinc | 410 | 960 | 526 | 550 | 1,020 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 910 | 1,200 | 3,100 |
| LPAH | 5,200 | 5,200 | 180 | 752 | 798 |
| HPAH | 12,000 | 17,000 | 1,938 | 3,147 | 5,434 |
| cPAH | 1,000 ^b | 1,000 ^b | 264 | 388 | 601 |
| PCBs | 130 | 1,000 | 54 | 109 | 328 |
| BEHP | 1,300 | 1,900 | 1,300 | 2,600 | 4,660 |
| Butyl benzyl phthalate | 63 | 900 | 350 | 570 | 256 |
| Dimethyl phthalate | 71 | 160 | <53 | 64 | <94.1 |

Exceeds SCO/LAET

Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Note: All three samples were used to characterize end-of-pipe storm drain solids in this system

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level.

Copper, zinc, TPH-oil, PCBs, and phthalates exceeded the SMS screening levels but only TPH-oil and bis(2-ethylhexyl)phthalate exceeded the source tracing screening levels (CSO/2LAET and MTCA Method A). Concentrations of zinc, TPH-oil, HPAH, cPAH, PCBs, and bis(2-ethylhexyl)phthalate in the 2018 sample (MH39) were higher than in the two earlier samples collected in 2013. Although the median concentration for all three

samples was less than two times the median of the median concentrations measured at other storm drains in the LDW, zinc and PCBs in MH39 were above that threshold.

There were no SCO exceedances in a sediment sample collected directly offshore of the biofiltration swale (LDW-SS2503-A; SAIC 2011). PCBs (460 ug/kg dw) exceeded the SCO in a sample collected about 100 feet downstream of the swale outlet (LDW-SS71; AECOM 2012), but this sample is located directly offshore of another outfall (Michigan CSO). Given the distance from the outfall, the small contributing area, and the absence of SCO exceedances in the sample closer to the outfall, it is unlikely that the 1st Ave S SD (east) is a significant contributor of PCBs at LDW-SS71.

Over the next 5 years, SPU intends to conduct the following activities in the 1st Ave S SD (east) basin:

- Jet and clean the City MS4 portion of the system
- Evaluate whether a sediment trap can be installed in this system to facilitate collection of storm drain solids for long term monitoring.

3.3. S River St SD

The S River St SD serves a 7.6-acre industrial area on the north side of Slip 3 (Map 14). The entire drainage system was jetted and cleaned in 2009 - 2010 because previous samples contained elevated levels of arsenic (19 – 110 mg/kg), copper (94.8 – 470 mg/kg), zinc (346 – 1,170 mg/kg), and motor oil (2,500 – 9,300 mg/kg). PCBs (54-450 J ug/kg dw) were similar to the concentrations observed in other storm drains in the LDW. Results are summarized in Table C-17. Sampling locations are shown on Map 65.

Table C-17: Summary of chemicals exceeding SMS screening levels in S River St SD before cleaning.

| Chemical | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|---|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 6 | 19 | 110 | 56 | 42 | 33 | 33 |
| Copper | 390 | 390 | 6 | 94.8 | 470 | 249 | 192 | 33 | 33 |
| Lead | 450 | 530 | 6 | 44 | 432 | 234 | 235 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 6 | 0.04 | 0.36 | 0.18 | 0.18 | 0 | 0 |
| Zinc | 410 | 960 | 6 | 346 | 1,170 | 714 | 671 | 83 | 33 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 6 | 2,500 | 9,300 | 4,500 | 3,750 | 100 | 100 |
| LPAH | 5,200 | 5,200 | 6 | 180 | 807 | 590 | 666 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 6 | 3,120 | 11,490 | 6,600 | 5,066 | 0 | 0 |
| cPAH | 1,000 ^b | 1,000 ^b | 6 | 353 | 1,508 | 840 | 650 | 33 | 33 |
| PCBs | 130 | 1,000 | 6 | 54 | 450 | 210 | 154 | 50 | 0 |
| BEHP | 1,300 | 1,900 | 6 | 1,600 | 7,400 | 4,200 | 3,950 | 100 | 83 |
| Butyl benzyl phthalate | 63 | 900 | 6 | <160 | 1,300 | 410 | 165 | 100 | 17 |
| Dimethyl phthalate | 71 | 160 | 6 | <120 | 160 | 100 | 140 | 83 | 0 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected March 2009 through May 2009.

- a. MTCA Method A soil cleanup level for unrestricted use.
- b. Sediment remedial action level.

SPU collected 18 storm drain solids samples in this system after the line was cleaned (6 inline, 9 right-of-way catch basin, and 3 private onsite catch basin grab). Results are summarized in Table C-18. Samples collected shortly after cleaning in 2011-2012 (inline grabs at MH211 and MH220 and right-of-way catch basin at RCB192) contained lower concentrations of arsenic, copper, and zinc concentrations than observed before cleaning, but HPAH concentrations increased, especially at MH211 (26,160 ug/kg dw).

PCBs were also elevated in one MH220 (870 J ug/kg dw), but MH220 was resampled in 2016 and PCBs (200 J ug/kg dw) had declined. As shown in Table C-19, the median and mean concentrations of HPAH and PCBs after cleaning are within the ranges found in other storm drains sampled in the LDW. Concentrations of other chemicals were also similar to concentrations observed in other storm drains in the LDW.

Table C-18: Summary of chemicals exceeding SMS screening levels in the S River SD after cleaning.

| Chemical | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|------------------------|--------------------|--------------------|----------------|-------|--------|-------|--------|--|---|
| Arsenic | 57 | 93 | 18 | <7 | 50 | 18 | 15.8 | 0 | 0 |
| Copper | 390 | 390 | 18 | 64.9 | 271 | 130 | 104 | 0 | 0 |
| Lead | 450 | 530 | 18 | 20 | 393 | 90 | 71.6 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 18 | <0.02 | 4.4 | 0.31 | 0.065 | 6 | 6 |
| Zinc | 410 | 960 | 18 | 273 | 2,020 | 620 | 434 | 61 | 17 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 18 | 1,400 | 6,800 | 4,500 | 3,000 | 95 | 95 |
| LPAH | 5,200 | 5,200 | 18 | <230 | 2,470 | 1,000 | 812 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 18 | 530 | 26,160 | 8,000 | 5,836 | 17 | 11 |
| cPAH | 1,000 ^c | 1,000 ^c | 18 | 201 | 2,363 | 860 | 703 | 22 | 22 |
| PCBs | 130 | 1,000 | 18 | 53 | 870 | 190 | 142 | 56 | 0 |
| BEHP | 1,300 | 1,900 | 18 | 2,100 | 8,200 | 4,600 | 4,005 | 100 | 100 |
| Butyl benzyl phthalate | 63 | 900 | 18 | <220 | 970 | 350 | 295 | 100 | 6 |
| Dimethyl phthalate | 71 | 160 | 18 | <62 | 590 | 160 | 200 | 83 | 33 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected May 2009 through June 2019.

- a. Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- b. MTCA Method A soil cleanup level for unrestricted use.
- c. Sediment remedial action level.

Table C-19: Metals, HPAH, and PCBs in the S River St SD after cleaning compared to other storm drains in the LDW.

| | Arsenic (mg/kg) | Copper (mg/kg) | Zinc (mg/kg) | HPAH (ug/kg dw) | PCBs (ug/kg dw) |
|------------------------------------|--------------------|-------------------|-----------------|--------------------|--------------------|
| S River St SD pre-cleaning | | | | | |
| Range | 19 - 110 | 94.8 - 470 | 346 – 1,170 | 3,120 – 11,490 | 54 – 470 |
| Median | 51 | 130 | 251 | 5,401 | 201 |
| Mean | 56 | 250 | 710 | 6,133 | 206 |
| S River St SD post-cleaning | | | | | |
| Range | <7 - 50 | 64.9 - 271 | 273 – 2,020 | 530 – 26,160 | 53 - 870 |
| Median | 15.8 | 104 | 434 | 5,836 | 142 |
| Mean | 16 | 130 | 620 | 8,000 | 190 |
| Other LDW storm drains | | | | | |
| Range | 4.9 - 20 | <19.2 – 10,900 | 44 – 4,100 | 10 – 585,400 | 8 – 45,900 |
| Median | 10 | 110 | 460 | 2,975 | 110 |
| Mean | 12 | 230 | 700 | 9,000 | 540 |

During this reporting period, between 2016 and 2019, SPU collected 13 catch basin and inline grab samples from the S River St SD¹¹. Except for three private onsite catch basin samples (CB270, CB288, and CB289), metals, and LPAH were all below the SMS screening levels. Mercury exceeded the CSL in CB288 (4.4 mg/kg)¹², zinc exceeded the CSL in in all 3 catch basins (1,140-2,020 mg/kg), and HPAH exceeded the 2LAET at CB270 (18,900 ug/kg dw).

SPU also collected three samples of dirt that had accumulated around a catch basin located on the same property as CB270 at 150 S River St.¹³ The mud samples (ODS58) were collected between February 2018 and May 2019 to assist in tracing HPAH. This site had been leased by a truck and trailer repair facility but is now occupied by a business that tests buses for King County Metro. The 2018 mud sample contained very high levels of HPAH (1,082,300 ug/kg dw) and LPAH (118,118 ug/kg dw). SPU worked with the owner of the property who pressure washed the yard area, cleaned the onsite drainage system (catch basins and pipes), and installed filter socks in the catch basins. Two samples collected in 2019 contained lower concentrations (42,599 – 131,550 ug/kg dw HPAH) and 3,609 – 17,715 ug/kg dw LPAH); however, concentrations continued to exceed the SMS screening levels.

The four near end-of-pipe samples collected between 2012 and 2019 also exceeded the 2LAET screening level for HPAH (2012 sample) and cPAH (2012 and 2019 samples), reflecting the source found at 150 S River St. Like other storm drains in the LDW, the near end-of-pipe samples also exceeded the 2LAET for BEHP (4 samples) and dimethyl phthalate (3 samples).

¹¹ These 13 samples are included in the summary of SMS exceedances provided in Table C-18.

¹² SPU has inspected this facility and found no mercury source. However, this private catch basin does collect runoff from the 2nd Ave S roadway which flows across the property. It is possible that mercury residue from fluorescent light tubes may be contributing to the contamination found in this catch basin.

¹³ Dirt samples were collected because there was not enough material in the nearby catch basin for analysis.

Six sediment samples have been collected within 200 feet of the outfall. Two of the three samples (SSRVSTD-A, -D) collected within 50 feet from the outfall exceeded the SCO for benzyl alcohol, but all other chemicals were below the SCO. PCBs (124 ug/kg dw) exceeded the SCO at station LDW-SS329 located approximately 150 feet offshore of the S River St SD outfall, but PCBs were not elevated at stations located 30 to 40 feet from the outfall. Based on these data, it does not appear that discharges from the S River St SD have had a significant impact on waterway sediment.

Over the next 5 years, SPU intends to conduct the following activities in the S River St SD basin:

- Resample the catch basins at 150 S River St to determine whether the source control actions implemented by the owner have sufficiently controlled the levels of HPAH in private onsite drainage system
- Continue collecting inline solids samples from a maintenance hole located near the downstream end of the system. SPU started collecting annual grab samples at MH211 in 2016 and will evaluate whether installing a sediment trap at this location would improve sample representativeness.
- Continue to inspect high priority businesses in the basin to ensure that they implement appropriate source control BMPs.

3.4. S Brighton St SD

The S Brighton St SD serves an 18.6-acre industrial basin located between Slip 3 and Slip 4 (Map 15). SPU plugged the overflow from the combined sewer that had been connected to this outfall in 2012 (Figure 1 and Figure 2).



Figure 1: S Brighton CSO before sealing.



Figure 2: S Brighton CSO after sealing.

The entire system (all City-owned lines and structures) was cleaned in 2009 - 2010 because previous samples contained elevated levels of arsenic (8 – 1,420 mg/kg), copper (86 -998 mg/kg), lead (84 – 977 mg/kg), mercury (0.06 – 3.41 mg/kg), zinc (247 – 4,000 mg/kg), motor oil (200 – 30,000 mg/kg), LPAH (<170 – 13,645 ug/kg dw), HPAH (1,483 – 110,200 ug/kg dw), and PCBs (28 – 3,460 ug/kg dw).

SPU re-sampled the system after cleaning in 2011-2012 and again in 2016-2018. Results are summarized in Table C-20. Since cleaning all 7 samples were below the SCO/LAET screening levels for arsenic, copper, lead, mercury, LPAH, and HPAH, although arsenic and mercury were 2 and 10 times higher, respectively in the most recent inline sample collected from MH223, near the downstream end of the system. Median concentrations were also comparable to levels observed in other storm drains in the LDW, which suggests that there are no unusual sources in the basin.

Table C-20: Summary of chemicals exceeding SMS screening levels in S Brighton St SD after cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 6 | 6 | 30 | 11 | 10 | 0 | 0 |
| Copper | 390 | 390 | 6 | 25.4 | 158 | 75 | 40.2 | 0 | 0 |
| Lead | 450 | 530 | 6 | 15 | 448 | 140 | 114 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 6 | <0.02 | 0.267 | 0.11 | 0.04 | 0 | 0 |
| Zinc | 410 | 960 | 6 | 143 | 970 | 470 | 204 | 50 | 17 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 6 | 92 | 6,200 | 1,800 | 140 | 33 | 33 |
| LPAH | 5,200 | 5,200 | 6 | <19.8 | 1,076 | 390 | 44 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 6 | 94 | 5,996 | 2,000 | 333 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 6 | 16 | 757 | 280 | 430 | 0 | 0 |
| PCBs | 130 | 1,000 | 7 | <18 | 562 | 200 | 39 | 57 | 0 |
| BEHP | 1,300 | 1,900 | 6 | 110 | 10,000 | 2,700 | 350 | 33 | 33 |
| Butyl benzyl phthalate | 63 | 900 | 6 | 48 | 410 | 210 | 84 | 83 | 0 |
| Dimethyl phthalate | 71 | 160 | 6 | <18 | 520 | 110 | <19 | 17 | 27 |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected August 2010 through May 2018.

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Metals other than zinc, PAHs, PCBs, butyl benzyl phthalate, and dimethyl phthalate in the two near end-of-pipe samples collected in 2012 and 2018 were below the CSL/2LAET screening levels (PCBs were above the LAET screening level in only the 2018 sample). Zinc and bis(2-ethylhexyl)phthalate exceeded the CSL2LAET screening level in the 2018 near end-of-pipe sample.

Seven sediment samples have been collected in the waterway within 200 feet of the outfall. SCO exceedances were observed at four stations. Fluoranthene exceeded the SCO at station DR112 which is located 140 feet downstream of the outfall, but not in any of the samples collected within 60 feet. In addition, fluoranthene did not exceed the LAET in any of the storm drain solids collected after the system was cleaned. The only other chemicals exceeding SCO in the waterway sediment were benzyl alcohol and hexachlorobenzene, neither of which were detected in any of the post-cleaning samples collected from this system. These data indicate that the S Brighton St SD has not had a significant effect on the waterway sediment.

Over the next 5 years, SPU intends to conduct the following activities in the S Brighton St SD basin:

- Regularly sample a maintenance hole (MH223) located near the end of the pipe in this system and evaluate whether installing a sediment trap at this location would improve sample representativeness.

- Re-sample CB163 and re-inspect the business at this location.
- Re-inspect Delta Marine and sample the onsite catch basins.

3.5. S Myrtle St SD

The S Myrtle St SD serves an 8.6-acre industrial basin located between Slip 3 and Slip 4 (Map 16). This entire system (City-owned storm drain lines and structures) was cleaned in 2009 – 2010 due to elevated levels of copper (291 – 2,110 mg/kg), lead (192 – 675 mg/kg), mercury (0.33 – 1.88 mg/kg), zinc (985 – 2,420 mg/kg), motor oil (2,900 – 10,000 mg/kg), and PCBs (840 – 3,700 ug/kg dw). This storm drain is heavily impacted by activities at an adjacent metal recycling facility located on the south side of S Myrtle St and its storage yard located on the north side of S Myrtle St. See the discussion of Seattle Iron and Metals Company (SIMC) in Appendix D for more details.

SPU resampled three right-of-way catch basins located near the metal shredding facility in 2010 - 2011 after cleaning and found continuing exceedances of CSL/2LAET screening levels for copper (860 – 3,280 mg/kg), lead (724 – 905 mg/kg), mercury (0.66 – 1.53 mg/kg), zinc (3,890 – 4,170 mg/kg), and PCBs (2,950 – 8,230 ug/kg dw) in the catch basin located near the driveway entrance. Motor oil (8,600 – 20,000 mg/kg) was also elevated. Metals and PCBs concentrations measured in this system were significantly higher than in other City storm drains in the LDW basin (see box plots in Appendix B). Two private onsite catch basins at businesses east of the metal shredding facility were also sampled in 2011. Copper (1,930 mg/kg), mercury (0.38 mg/kg), zinc (5,240 mg/kg), bis(2-ethylhexyl)phthalate (14,000 ug/kg dw), and PCBs (1,020 ug/kg dw) in the one located within 15 feet of S Myrtle St were higher than median concentrations found in other LDW samples

During the 2014-2019 reporting period, SPU collected a sample from one right-of-way catch basin near the metal shredding facility (RCB65 in 2015) and an inline grab from near the end of pipe (MH100 in 2018). Mercury (0.69 – 1.39 mg/kg), zinc (2,470 – 2,940 mg/kg), bis(2-ethylhexyl)phthalate (4,100 – 14,000 ug/kg dw), and PCBs (1,144 – 1,750 ug/kg dw) exceeded the CSL/2LAET screening levels in both samples.

In 2017, SPU also installed five different style sediment traps at MH100 as part of a pilot test funded by Ecology to develop a new trap design. Trap samples were collected in 2018 and 2019. Copper (444-692 mg/kg), lead (498 – 690 mg/kg), zinc (2,940-4,390 mg/kg), bis(2-ethylhexyl)phthalate (4,100 – 56,700 ug/kg dw), butyl benzyl phthalate (1,300-3,350 ug/kg dw), and PCBs (1,030 – 2,895 ug/kg dw) exceeded the CSL/2LAET screening levels in all samples.

Sample results for all samples collected since the system was cleaned (2010-2019) are summarized in Table C-21. Median concentrations of copper, lead, mercury, zinc, TPH-oil, PCBs, and phthalates were more than two times higher than the median of the median concentrations observed in other storm drains in the LDW. The seven near end-of-pipe samples show similar trends with copper, lead, mercury, zinc, PCBs, and phthalates above the CSL/2LAET in nearly all samples (see Appendix B).

Six sediment samples have been collected in the waterway within 200 feet of the outfall. Multiple chemicals exceeded SCO at the station located within 25 feet of the outfall (LDW-SS027A in 2011):

- Mercury (0.42 mg/kg)
- Zinc (552 J mg/kg)
- Bis(2-ethylhexyl)phthalate (37,000 ug/kg dw)
- Butyl benzyl phthalate (1,600 ug/kg dw)
- PCBs (890 ug/kg dw)
- Benzoic acid (1,200 ug/kg dw)
- Benzyl alcohol (320 ug/kg dw).

Only zinc and a few SVOCs (hexachlorobenzene, benzoic acid, and benzyl alcohol) exceeded SCO in the four samples collected within 80 -160 feet from the outfall. However, three of these four samples were collected within 25-60 feet of another outfall and could have also been affected by that outfall.

Table C-21: Summary of chemicals exceeding SMS screening levels in S Myrtle St SD after cleaning (2010-2019).

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|--------|--------|--------|---|--|
| Arsenic | 57 | 93 | 14 | 6.3 | 23.4 | 17 | 20 | 0 | 0 |
| Copper | 390 | 390 | 14 | 193 | 3,280 | 880 | 657 | 79 | 79 |
| Lead | 450 | 530 | 14 | 174 | 1,700 | 620 | 557 | 71 | 64 |
| Mercury | 0.41 | 0.59 | 11 | 0.24 | 2.56 | 1.2 | 1.04 | 73 | 73 |
| Zinc | 410 | 960 | 14 | 763 | 8,310 | 3,700 | 3,890 | 100 | 93 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 9 | 1,700 | 20,000 | 7,200 | 7,850 | 89 | 89 |
| LPAH | 5,200 | 5,200 | 11 | 220 | 3,040 | 1,700 | 1,454 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 11 | 2,737 | 11,840 | 6,700 | 6,246 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 11 | 189 | 1,469 | 780 | 788 | 36 | 36 |
| PCBs | 130 | 1,000 | 13 | 360 | 8,230 | 2,400 | 1,483 | 100 | 85 |
| BEHP | 1,300 | 1,900 | 11 | 4,100 | 84,000 | 31,000 | 21,500 | 100 | 100 |
| Butyl benzyl phthalate | 63 | 900 | 11 | 660 | 6,200 | 2,800 | 2,055 | 100 | 82 |
| Dimethyl phthalate | 71 | 160 | 11 | <57 | 1,610 | 760 | 650 | 91 | 82 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Samples collected May 2010 through May 2019

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Samples collected during this reporting period indicate that the S Myrtle St SD continues to be a source of metals, PCBs, and phthalates to the waterway and the primary source (i.e., SIMC metal recycling facility) is known. The recycling facility is permitted by both Ecology and the Puget Sound Clean Air Agency; however, contaminants continue to migrate offsite, affecting the right-of-way and the City MS4. Under a 2019 Consent Decree (U.S. District Court 2019), the recycling facility is required to implement a number of source control actions to reduce the amount of pollution released offsite (see Appendix D). SPU hopes that the Consent Decree will be successful in controlling the offsite release of contaminants from this site. In the meantime, actions that the City will take in the S Myrtle St SD basin over the next five years include the following:

- Continue to annually sample the sediment trap located near the downstream end of the system.¹⁴

¹⁴ SPU intends to leave the new style sediment trap for long term monitoring and remove all the others used in the recent pilot test.

- Continue to inspect the two Filterra™ stormwater treatment units that SIMC installed to the driveway on S Myrtle St to ensure that these units are maintained properly.
- Coordinate with Ecology inspectors on SIMC inspections and conduct joint inspections, as necessary.
- Continue to monitor sediment levels in the catch basins on S Myrtle St each quarter and clean when sediment depths reach 60 percent of the sump depth.
- SDOT will continue to sweep S Myrtle St on a bi-weekly basis as part of the City's ongoing Street Sweeping for Water Quality Program.
- After SIMC completes the source control actions required under the 2019 Consent Decree, SPU will jet and clean the S Myrtle St drainage system to remove residual contaminants.

3.6. S Garden St SD

The S Garden St SD serves a 12-acre industrial basin located between Slip 3 and Slip 4 (Map 17). A metal recycling facility, Seattle Iron and Metals Company (9.6 acres) takes up most of the drainage basin. Runoff from approximately 1 acre of the S Garden St right-of-way and 0.46 acres from a rental facility on 8th Ave S, also discharge to this outfall. Seattle vacated a portion of S Garden St to the metal recycling facility, Seattle Iron and Metals, Inc. (SIMC) in 1999 when they relocated to this location from their previous location on Harbor Island. Runoff from the Seattle Iron and Metals Company property is collected and treated in an onsite wastewater treatment system before discharging to the outfall. Roof runoff from many of the buildings on the property is treated in downspout media filters before discharging to the outfall.

The City-owned portion of this system was cleaned in 2009-2010 at the same time the other adjacent storm drains were cleaned. Only two samples were collected from this system prior to cleaning (RCB146 and CB149). RCB146 is a catch basin on S Garden St adjacent to the entrance to the metal recycling facility. CB 149 is an onsite catch basin on the property located at 7135 8th Ave S. This unpaved parcel drains to the S Garden St SD. As shown in Table C-22, elevated levels of copper (1,020 mg/kg), lead (670 mg/kg), mercury (1.08 mg/kg), and PCBs (2,560 ug/kg dw) were found in the right-of-way sample, which are comparable to the levels found in the adjacent S Myrtle St drainage system.

Because SIMC occupies most of the drainage basin and the outfall structure is located on SIMC property, which makes it difficult for SPU to maintain, SIMC agreed to take over ownership of the outfall in 2012. SIMC is now responsible for operating and maintaining the 586 feet of pipe in the vacated portion of S Garden St and in 2014, installed a Filterra™ stormwater treatment system on S Garden St as part of its expansion on 701 S Orchard St property. SIMC has agreed to operate and maintain this system. SPU negotiated this agreement because of concerns about potential impacts to this catch basin from trucks conveying auto shredding residuals along S Garden St between SIMC's metal recycling facility on 601 S Myrtle St and the facility on S Orchard St. SPU also added S Garden St to its street sweeping routes in 2014. It is currently swept every other week.

Table C-22: Summary of chemicals exceeding SMS screening levels in the S Garden St SD before cleaning.

| | SCO LAET | CSL 2LAET | CB149 05/27/09 | RCB146 09/12/08 |
|---------|--------------------|--------------------|-------------------|--------------------|
| Arsenic | 57 | 93 | 10 U | 10.7 |
| Copper | 390 | 390 | 67.8 | 1,020 |
| Lead | 450 | 530 | 52 | 670 |
| Mercury | 0.41 | 0.59 | 0.03 | 1.08 |
| Zinc | 410 | 960 | 84 | 130 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 760 | 760 |

| | SCO LAET | CSL 2LAET | CB149 05/27/09 | RCB146 09/12/08 |
|------------------------|--------------------|--------------------|-------------------|--------------------|
| LPAH | 5,200 | 5,200 | 58 | 1,140 |
| HPAH | 12,000 | 17,000 | 112 J | 8,152 J |
| cPAH | 1,000 ^b | 1,000 ^b | 88 | 788 |
| PCBs | 130 | 1,000 | 60 | 2,560 |
| BEHP | 1,300 | 1,900 | 360 U | 47,000 |
| Butyl benzyl phthalate | 63 | 900 | 58 U | 2,100 |
| Dimethyl phthalate | 71 | 160 | 35 J | 360 |

Exceeds SCO/LAET

Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level.

SPU did not collect any samples from the S Garden St SD during this reporting period.

Eleven sediment samples have been collected in the waterway within 200 feet of the outfall. SCO exceedances have occurred at eight of the locations. However, only acenaphthene, benzyl alcohol, and dibenzofuran exceeded SCO at the three stations closest to the outfall (LDW-SS2035-A, -D, and -U located 50-60 feet from the outfall). Other chemicals that exceeded SCO included hexachlorobenzene and PCBs, but these samples were all collected farther away from the outfall (90-180 feet), so it is not clear whether these contaminants are associated with discharges from the S Garden St SD.

SPU intends to conduct the following activities in this drainage basin in the future:

- Establish a routine monitoring station in the maintenance hole located near the west end of the City right-of-way on S Garden St. Inline solids samples will be collected each year using either an inline sediment trap or by collecting inline grabs if sufficient sediment accumulates in the system.
- Monitor track out of auto shredding residuals on S Garden St and require controls, as necessary
- Coordinate with Ecology inspectors on SIMC inspections and conduct joint inspections, as necessary.
- Continue to inspect the other active business in this drainage basin, which has a high priority ranking.
- Inspect the Filterra™ unit to make sure it is maintained appropriately.
- SDOT will continue to sweep S Garden St on a bi-weekly basis as part of the City’s ongoing Street Sweeping for Water Quality Program.
- After SIMC completes the source control actions required under the 2019 Consent Decree, SPU will jet and clean the S Garden St MS4 drainage system to remove residual contaminants

3.7. I-5 SD at Slip 4

The I-5 SD at Slip 4, constructed by WSDOT in 1965, serves a 150-acre basin. The upper 44 acres consists of a primarily residential neighborhood along the west slope of Beacon Hill. The 1.3 mile I-5 corridor covers about 60 acres and the remaining area is made up of industrial properties and railroad property along Airport Wy S,

and a few small parcels along Ellis Ave S (Seattle Fire Station #27, Air National Guard property, as well as a convenience store/gas station). The drainage system and basin boundaries are shown on Map 18.

During the previous reporting period, SPU collected 23 samples from the I-5 S SD at Slip 4 drainage system (3 private onsite catch basin grabs, 3 right-of-way catch basin grabs, 4 inline grabs, and 13 sediment trap samples). Results are summarized in Table C-23. Sampling locations are shown on Map 68.

Table C-23: Summary of chemicals exceeding the SMS screening levels in the I-5 SD at Slip 4 drainage system (2004-2014).

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----|-------|---------|-------|--------|---|--|
| Arsenic | 57 | 93 | 23 | 3 | 50 | 10 | 5 | 0 | 0 |
| Copper | 390 | 390 | 23 | 38 | 6,320 | 410 | 103 | 9 | 9 |
| Lead | 450 | 530 | 23 | 10 | 481 | 140 | 106 | 4 | 0 |
| Mercury | 0.41 | 0.59 | 23 | <0.04 | 0.34 | 0.08 | 0.04 | 0 | 0 |
| Zinc | 410 | 960 | 23 | 93 | 3,420 | 610 | 488 | 65 | 4 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 20 | 290 | 4,700 | 1,600 | 1,400 | 25 | 25 |
| LPAH | 5,200 | 5,200 | 23 | <38 | 21,160 | 1,700 | 830 | 4 | 4 |
| HPAH | 12,000 | 17,000 | 23 | 140 | 150,600 | 9,700 | 4,180 | 4 | 4 |
| cPAH | 1,000 ^b | 1,000 ^b | 23 | 35 | 21,440 | 1,300 | 505 | 4 | 4 |
| PCBs | 130 | 1,000 | 23 | <19 | 7,800 | 530 | 160 | 57 | 4 |
| BEHP | 1,300 | 1,900 | 23 | 180 | 16,000 | 5,000 | 5,550 | 74 | 74 |
| Butyl benzyl phthalate | 63 | 900 | 23 | <20 | 1,900 | 380 | 350 | 83 | 4 |
| Dimethyl phthalate | 71 | 160 | 23 | <20 | 215 | 90 | 98 | 57 | 9 |

N = number of samples. Note that some of the sediment traps could not be analyzed for all parameters because there was insufficient material in the trap.

BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

- a. MTCA Method A soil cleanup level for unrestricted use.
- b. Sediment remedial action level.

Samples collected December 2004 through April 2014.

During this reporting period, SPU collected an additional 7 samples in the I-5 SD at Slip 4, all from the station at SL4-T6. Results are summarized in Table C-24. Sample locations are shown on Map 68. Except for zinc, metals concentrations remained below the SCO screening levels. Phthalates continued to frequently exceed both the LAET and 2LAET screening levels, while PAH concentrations were lower than the previous reporting period with no exceedances of LAET screening levels observed. PCBs in sediment trap SL4-T6 exceeded the LAET screening level in 29 percent of samples, but none exceeded the 2LAET screening level.

Table C-24: Summary of chemicals exceeding the SMS screening levels in the I-5 SD at Slip 4 drainage system (2015-2019).

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|---|--------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 7 | 3.43 | 16.1 | 9.4 | 12 | 0 | 0 |
| Copper | 390 | 390 | 7 | 23.5 | 163 | 99 | 87.7 | 0 | 0 |
| Lead | 450 | 530 | 7 | 4.66 | 228 | 92 | 68 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 7 | 0.0224 | 0.07 | 0.05 | 0.04 | 0 | 0 |
| Zinc | 410 | 960 | 7 | 41 | 1,090 | 402 | 354 | 43 | 14 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 5 | 168 | 3,540 | 1,363 | 1,300 | 20 | 20 |
| LPAH | 5,200 | 5,200 | 7 | <82 | 1,522 | 705 | 604 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 7 | 174 | 8,260 | 3,700 | 3,433 | 0 | 0 |
| cPAH | 1,000 ^b | 1,000 ^b | 7 | 26 | 970 | 426 | 404 | 0 | 0 |
| PCBs | 130 | 1,000 | 7 | <19 | 281.8 | 111 | 100 | 29 | 0 |
| BEHP | 1,300 | 1,900 | 7 | 248 | 20,000 | 6,900 | 4,100 | 71 | 71 |
| Butyl benzyl phthalate | 63 | 900 | 7 | <19.2 | 22,300 | 3,400 | 340 | 71 | 14 |
| Dimethyl phthalate | 71 | 160 | 7 | <19.2 | 117 | 54 | 97 | 29 | 0 |

N = number of samples. Note that some of the sediment traps could not be analyzed for all parameters because there was insufficient material in the trap.

BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

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

b. Sediment remedial action level.

Samples collected May 2015 through April 2019.

Chemical concentrations in storm drain solids samples collected from the I-5 SD at Slip 4 were similar to the levels observed in other storm drains in the LDW. The 25 near end-of-pipe samples collected from this drain showed similar results with only one sample exceeding the 2LAET for zinc and PCBs and all samples exceeding the 2LAET for phthalates (see heat tables in Appendix B).

PCBs are the primary chemical of concern in the surface sediments in Slip 4. PCB concentrations in samples collected within 200 feet of the five outfalls located at the head of Slip 4 exceeded the CSL prior to cleanup. Other chemicals that have also been found above SMS in the nearshore samples from the head of Slip 4 include lead, mercury, zinc, HPAH and multiple HPAH components, phenanthrene, and phthalates (bis[2-ethylhexyl]phthalate and di-n-octyl phthalate, AECOM 2012 and Integral 2006).

In 2012, the City of Seattle completed an Early Action Area cleanup (Integral 2012). Seattle conducted post-construction sampling in 2012 (baseline), 2013, 2015, 2017, and 2019. Results for PCBs, HPAH, and bis(2-ethylhexyl)phthalate in samples collected within 200 ft of the I-5 SD at Slip 4 outfall are summarized in Table C-25.

Table C-25: Post-cleanup sediment monitoring data in Slip 4 compared to near end-of-pipe inline samples.

| Station ^a | WC-1 | WC-2 ^b | SC-2 | SC-3 | SL4-T6 ^c | MH23 ^d |
|----------------------------|---------|-------------------|---------|-------|---------------------|---------------------|
| Distance from outfall (ft) | 70 | 100 | 50 | 150 | 0 | 0 |
| PCBs | | | | | | |
| 2012 | 5.5 | 24 | 5.7 | 3.8 U | 160 | -- |
| 2013 | 89 | 81 | 18 | 6 | 199 | -- |
| 2015 | 290 J | 77 J | 14.1 | 2.8 J | 171 J | 540 ^e |
| 2017 | 212.2 | 106.8 | 33 J | 17.4 | 99.7 | 253 ^f |
| 2019 | 187.8 | 189.7 | 34.4 | 48.2 | 282 | 229 J |
| HPAH | | | | | | |
| 2012 | 52 J | 263 J | 179 J | 18 U | 4,480 | -- |
| 2013 | 2,300 | 1,540 | 346 J | 105 J | 6,150 | -- |
| 2015 | 5,180 J | 790 J | 324 J | 90 J | 8,260 J | 74,300 ^e |
| 2017 | 4,600 J | 2,128 J | 525 J | 549 J | 5,004 | 22,900 ^f |
| 2019 | 8,300 | 6,300 | 1,417 J | 3,130 | 5,580 J | 30,300 J |
| BEHP | | | | | | |
| 2012 | 68 U | 120 U | 100 U | 22 U | 5,900 | -- |
| 2013 | 1,800 | 370 | 120 | 48 U | 6,200 | -- |
| 2015 | 7,000 | 500 | 300 | 47 U | 20,000 | 18,000 ^e |
| 2017 | 7,390 | 2,330 | 887 | 557 | 4,420 | 7,040 ^f |
| 2019 | 5,850 | 3,590 | 1,070 | 1,250 | 15,500 J | 11,200 J |

Source: Windward (2020) Units: ug/kg dw

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons

BEHP = bis(2-

ethylhexyl)phthalate

Values shaded in gray exceed the SCO/LAET.

Values shaded in black exceed the CSL/2LAET

- WC samples were collected from the waterway cap and SC samples were collected from the slope cap.
- WC-2 is located in a channel that has developed downstream of the KCIA SD#3/ PS 45 EOF. WC-1 is located in the waterway approximately midway between WC-2 and SC-2. SC-3 is located on the opposite side of the slip (east slope) from the I-5 SD at Slip 4.
- Inline sediment trap that captures runoff from the bulk of the I-5 SD at Slip 4 drainage system.
- Inline grab near end-of-pipe sample location in the Georgetown SD (see following Section 3.8).
- Sample collected in 2014
- Sample collected in 2018.

PCBs, HPAH, and BEHP have increased at all 4 stations since the cleanup. Zinc (2015, 2017, and 2019 samples at WC-1), butyl benzyl phthalate (2013 -2019 samples at WC-1, 2019 sample at WC-2, and 2017 sample at SC-2), and fluoranthene (2019 sample at WC-1) were the only other chemicals that exceeded the SCO within 200 feet of the outfall. Data summarized in

Table C-25 indicate that the I-5 SD at Slip 4 and Georgetown SD are likely contributing to the increase in PCB, HPAH, and BEHP concentrations observed in waterway sediment since cleanup. However, two other outfalls also discharge to the head of Slip 4 (KCIA SD#3/PS 44 EOF, East Marginal PS), which also likely contribute contaminants to the slip.

Over the next five years, SPU will continue to deploy the sediment trap (SL4-T6) in this system and inspect businesses in the basin.

3.8. Georgetown SD

In 2009 ,SPU constructed the Georgetown SD to replace the old flume that served the Georgetown Steam Plant, when Seattle City Light (SCL) removed the flume and contaminated soil adjacent to the flume. The flume was a system of wood and concrete-lined channels constructed after the Duwamish Waterway was straightened in 1916. It was originally built to convey cooling water from the Georgetown Steam Plant to the Duwamish Waterway. Cooling water discharge was discontinued when the power plant ceased operation in the 1960s. However, the flume, which was owned and operated by Seattle City Light (SCL), continued to serve as a drainage channel conveying stormwater runoff from portions of the steam plant property, North Boeing Field, the Washington National Guard property on Ellis Ave S, as well as a short section of S Myrtle St and the adjacent parcels.

The Georgetown SD follows the same alignment as the old flume, but most of the area east of the flume on North Boeing Field has been disconnected from the storm drain. Areas currently draining to this system include the roof of the Georgetown Steam Plant, a short section of S Myrtle St and adjacent parcels, and areas immediately adjacent to the storm drain (catch basin in parking lot at Washington National Guard property and service drains from the motel at the downstream end of the system). The drainage basin and system are shown on Map 19. Total drainage area is approximately 4.5 acres. SPU also installed two biofiltration swales along the drainage corridor to treat runoff from S Myrtle St. The Georgetown SD has the capacity to convey runoff from all the Steam Plant property. However, at this time, only the roof is connected to the drainage system.

Four samples have been collected from the Georgetown SD system since 2014. Results are presented in Table C-26. Sampling locations are shown on Map 69. Except for zinc, metals were all below the SCO. However, HPAH, bis(2-ethylhexyl)phthalate, and butyl benzyl phthalate exceeded the 2LAET screening levels in all samples. cPAH also exceeded the RAL (1,000 ug TEQ/kg) and PCBs exceeded the LAET, but not the 2LAET screening level, in all samples.

Table C-26: Storm drain solids results for Georgetown SD (2014-2019).

| | SCO LAET | CSL 2LAET | MH23 ^c 06/20/14 | MH6 ^b 12/17/15 | MH23 ^c 06/12/18 | MH23 ^c 06/05/19 |
|---------|--------------------|--------------------|-------------------------------|------------------------------|-------------------------------|-------------------------------|
| Arsenic | 57 | 93 | 10 U | 8 | 7.94 U | 8.36 |
| Copper | 390 | 390 | 153 | 62.6 J | 86.8 | 130 |
| Lead | 450 | 530 | 143 | 57 | 65.7 | 102 |
| Mercury | 0.41 | 0.59 | 0.17 | 0.0182 J | 0.0845 | 0.164 |
| Zinc | 410 | 960 | 878 | 591 J | 432 | 579 |
| TPH-oil | 2,000 ^d | 2,000 ^d | 7,900 ^d | -- | 2,430 | 2,690 J |
| LPAH | 5,200 | 5,200 | 5,780 | 24,500 | 3,317 J | 2,829 J |
| HPAH | 12,000 | 17,000 | 74,300 | 146,000 | 22,913 | 30,343 |
| cPAH | 1,000 ^e | 1,000 ^e | 8,821 | 21,530 | 2,965 | 3,815 J |
| PCBs | 130 | 1,000 | 540 | 477 | 253 | 229 J |
| BEHP | 1,300 | 1,900 | 18,000 | 2,900 | 7,040 | 11,200 |

| | SCO LAET | CSL 2LAET | MH23 ^c 06/20/14 | MH6 ^b 12/17/15 | MH23 ^c 06/12/18 | MH23 ^c 06/05/19 |
|------------------------|-------------|--------------|-------------------------------|------------------------------|-------------------------------|-------------------------------|
| Butyl benzyl phthalate | 63 | 900 | 1,300 | 1,300 U | 599 | 990 J |
| Dimethyl phthalate | 71 | 160 | 620 U | 1,300 U | 111 | 305 J |

Exceeds SCO/LAET
Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: ug/kg dw for all but cPAH (ug TEQ/kg)

- Inline grab from maintenance hole located near the downstream end of the system
- Composite of 3 inline grabs collected from maintenance holes downstream of S Willow St, which receive runoff from only the Georgetown Steam Plant roof (Landau 2015).
- Sample analyzed with no cleanup. Other samples processed using silica gel and acid cleanup before analysis.
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level.

City Light plans to replace the steam plant roof in 2020. The old roofing material may have been a source of HPAH in this system.

As described in Section 3.7, chemicals exceeding the SCO/LAET in waterway sediment following the 2012 cleanup include 1) bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, PCBs, zinc, and fluoranthene at WC-1, which is located about 70 feet offshore and 2) PCBs, bis(2-ethylhexyl)phthalate, and butyl benzyl phthalate at WC-2, which is located about 100 feet offshore.

Over the next 5 years, SPU intends to conduct the following activities in the Georgetown SD basin:

- Install a sediment trap in MH23 near the downstream end of the system.
- SPU and SCL will jet and clean the Georgetown SD after roof replacement is completed.

3.9. SW Kenny St SD/T115 CSO

The SW Kenny St SD serves an area of about 154 acres, encompassing the commercial/industrial areas along W Marginal Wy SW, as well as undeveloped land located on the steep hillside west of W Marginal Wy SW (Map 20). A significant portion of the undeveloped land (53 acres) is owned by the Seattle Department of Parks and Recreation. Land use in the basin is approximately 5.8 percent residential, 10.1 percent commercial, 28.1 percent industrial, and 56 percent open/vacant/parks.

SPU jetted and cleaned the SW Kenny St SD/T115 CSO drainage system in 2017. Prior to cleaning, multiple samples exceeded the SCO screening levels for arsenic, lead, mercury, and zinc, but none exceeded the CSL screening levels. In addition, LPAH, HPAH, and cPAH exceeded both the LAET and 2LAET screening levels in 7, 13, and 20 percent of the samples, respectively. Other chemicals that exceeded the screening levels included PCBs, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and dimethyl phthalate. Chemicals that exceeded the screening levels in pre-cleaning samples are summarized in Table C-27.

Table C-27: Summary of chemicals exceeding SMS screening levels in samples collected from the SW Kenny St SD/T115 drainage system before cleaning.

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----|------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 15 | 4 | 70 | 28 | 20 | 13 | 0 |
| Copper | 390 | 390 | 15 | 36 | 193 | 121 | 129 | 0 | 0 |
| Lead | 450 | 530 | 15 | 11 | 470 | 201 | 82 | 20 | 0 |
| Mercury | 0.41 | 0.59 | 15 | 0.03 | 0.42 | 0.19 | 0.18 | 7 | 0 |
| Zinc | 410 | 960 | 15 | 78 | 879 | 528 | 566 | 73 | 0 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 15 | 370 | 4,700 | 1,970 | 1,700 | 47 | 47 |
| LPAH | 5,200 | 5,200 | 15 | 60 | 5,240 | 1,100 | 640 | 7 | 7 |
| HPAH | 12,000 | 17,000 | 15 | 60 | 36,520 | 7,890 | 5,410 | 13 | 13 |
| cPAH | 1,000 ^b | 1,000 ^b | 15 | 103 | 4,543 | 970 | 734 | 20 | 20 |
| PCBs | 130 | 1,000 | 15 | 9 | 710 | 189 | 155 | 53 | 0 |
| BEHP | 1,300 | 1,900 | 15 | 190 | 5,500 | 2,500 | 2,100 | 73 | 60 |
| Butyl benzyl phthalate | 63 | 900 | 15 | 38 | 1,100 | 254 | 150 | 80 | 7 |
| Dimethyl phthalate | 71 | 160 | 15 | 9 | 230 | 70 | 50 | 20 | 13 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds.

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

b. Sediment remedial action level.

Samples collected March 2006 through April 2013.

SPU collected two sediment trap samples at KN-ST1 after cleaning in 2018 and 2019 (Table C-28 and Map 70). Metals, LPAH, HPAH, and cPAH were below the SMS screening levels. Bis(2-ethylhexyl)phthalate exceeded the 2LAET screening level in both post cleaning samples, and TPH-oil exceeded the MTCA screening level in the 2019 sample. PCBs and butyl benzyl phthalate exceeded the LAET, but not the 2LAET in two and one (2019) of the samples, respectively.

Table C-28: Results for storm drain solids samples collected in SW Kenny St SD/T115 CSO after cleaning.

| | SCO LAET | CSL 2LAET | KN-ST1 04/19/18 | KN-ST1 04/23/19 |
|---------|--------------------|--------------------|--------------------|--------------------|
| Arsenic | 57 | 93 | 13.8 | 26.7 |
| Copper | 390 | 390 | 55.4 | 86.2 |
| Lead | 450 | 530 | 34.1 | 66.3 |
| Mercury | 0.41 | 0.59 | 0.123 | 0.222 |
| Zinc | 410 | 960 | 299 | 500 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 1,650 | 2,480 |
| LPAH | 5,200 | 5,200 | 511 | 465 J |
| HPAH | 12,000 | 17,000 | 2,649 | 4,296 J |

| | SCO LAET | CSL 2LAET | KN-ST1 04/19/18 | KN-ST1 04/23/19 |
|------------------------|--------------------|--------------------|--------------------|--------------------|
| cPAH | 1,000 ^b | 1,000 ^b | 362 | 455 |
| PCBs | 130 | 1,000 | 138 | 153 J |
| BEHP | 1,300 | 1,900 | 2,980 | 4,350 |
| Butyl benzyl phthalate | 63 | 900 | 99.4 U | 194 |
| Dimethyl phthalate | 71 | 160 | 99.4 U | 98.4 U |



Exceeds SCO/LAET

Exceeds CSL/2LAET

Note: KN-ST1 is a near end-of-pipe inline sediment trap

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

BEHP = bis(2-ethylhexyl)phthalate

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

b. Sediment remedial action level.

Concentrations in the storm drain solids are comparable to levels observed in other storm drains in the LDW. However, arsenic in the 2019 sample was greater than two times the median of the median concentrations measured in other storm drains. Arsenic was also elevated (43-70 mg/kg) in four of the 14 samples collected from this location prior to cleaning but has not exceeded SCO in any of the offshore sediment samples. It does not appear to be a concern for waterway sediment, but SPU will need to track the concentration of arsenic in this system to ensure that there are no ongoing sources of arsenic in this basin.

Metals, PAH, butyl benzyl phthalate, dimethyl phthalate, and PCBs were below the CSL/2LAET screening levels in both near end-of-pipe sediment trap samples collected since the line was cleaned. Bis(2-ethylhexyl)phthalate exceeded the 2LAET screening level in both samples. Chemicals that exceeded the SCO/LAET screening levels included zinc (2019), PCBs (2018 and 2019), and butyl benzyl phthalate (2019).

Eight waterway sediment samples have been collected within 200 feet of the SW Kenny St SD/T115 CSO outfall. SCO exceedances occurred at 6 of the 8 sites, but hexachlorobenzene, benzyl alcohol, and butyl benzyl phthalate were the only chemicals that exceeded SCO. No chemicals exceeded both the CSL/2LAET in the storm drain solids and the SCO in the waterway sediment. Butyl benzyl phthalate is the only chemical where there was a SCO/LAET exceedance in the storm drain solids and a SCO exceedance in the waterway sediment (at DR126 located approximately 110 feet away from the outfall).

As explained earlier, phthalates are commonly found in urban storm drain sediments. These chemicals are used in a variety of consumer products and are difficult, if not impossible to control using conventional source control methods. Other actions like lobbying industry to reduce the amount of these chemicals used in consumer products, educating the community about these issues, and searching for alternative products may help to address these problems, but are outside the scope of what local jurisdictions can accomplish.

Over the next 5 years, SPU intends to conduct the following activities in the SW Kenny St SD/T115 CSO basin:

- Continue operating and maintaining the sediment trap (KN-ST1) located at the downstream end of this drainage system to characterize conditions in this drainage system
- Continue to inspect businesses operating in the basin.

3.10. Highland Park Wy SW SD

The Highland Park Wy SW SD serves an area of about 296 acres¹⁵ (Map 21). The drainage basin is predominately residential (49 percent) with commercial/industrial areas (19.2 percent) located along W Marginal Wy SW. Open space/vacant/parks makes up the remainder of the basin (31.8 percent). An approximately 94-acre portion of the 1st Ave S SD basin overlaps with the Highland Park Wy SW basin where depending on rainfall, runoff can discharge to either outfall. The area of overlap covers the commercial/industrial area between Detroit Ave SW and W Marginal Wy SW. Recently, most of the runoff has been flowing south to the 1st Ave S SD due to heavy sediment accumulation in the 36-inch pipe east of W Marginal Wy SW on the Highland Park Wy SW system (Map 21).

SPU jetted and cleaned the Highland Park Wy SW drainage system in 2015. Prior to cleaning, concentrations of arsenic, lead, mercury, LPAH, and HPAH were below the SCO/LAET and CSL/2LAET screening levels in all samples. Zinc exceeded SCO only at trap stations HP-ST4 and HP-ST6, but none exceeded the CSL screening level. HP-ST6 is located on the 36-inch line downstream of W Marginal Wy SW. This line conveys runoff from the primarily industrial areas along W Marginal Wy SW, including the area of overlap with the 1st Ave S SD, west basin. HP-ST4 is located on the storm drain serving the mainly residential area on the ridge west of Detroit Ave SW.

PCBs exceeded the LAET screening level in 40 percent of the samples (8 samples); however, none of the samples exceeded the 2LAET screening level. Seven of the eight samples that exceeded the LAET screening level for PCBs (152 – 700 ug/kg dw) were collected at HP-ST6. Concentrations were within the range observed in other storm drain samples collected in the LDW (see box plots in Appendix B). Chemicals that exceeded the screening levels in before cleaning are summarized in Table C-29.

Table C-29: Summary of chemicals exceeding SMS screening levels in samples collected from the Highland Park Wy SW SD system before cleaning (2008-2014).

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----|------|-------|-------|--------|---|--|
| Arsenic | 57 | 93 | 20 | 3.5 | 30 | 16 | 11.5 | 0 | 0 |
| Copper | 390 | 390 | 20 | 28 | 1,400 | 156 | 103 | 5 | 5 |
| Lead | 450 | 530 | 20 | 19 | 200 | 95 | 94 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 20 | 0.02 | 0.36 | 0.15 | 0.10 | 0 | 0 |
| Zinc | 410 | 960 | 20 | 69 | 932 | 490 | 445 | 50 | 0 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 20 | 62 | 4,800 | 1,400 | 960 | 20 | 20 |
| LPAH | 5,200 | 5,200 | 20 | 27 | 965 | 275 | 175 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 20 | 188 | 7,310 | 1,980 | 1,750 | 0 | 0 |
| cPAH | 1,000 ^b | 1,000 ^b | 20 | 28 | 833 | 240 | 174 | 0 | 0 |
| PCBs | 130 | 1,000 | 20 | 10 | 700 | 154 | 77 | 40 | 0 |
| BEHP | 1,300 | 1,900 | 20 | 68 | 9,900 | 3,400 | 3,100 | 80 | 65 |
| Butylbenzyl phthalate | 63 | 900 | 20 | 19 | 780 | 300 | 180 | 80 | 0 |
| Dimethyl phthalate | 71 | 160 | 20 | 10 | 320 | 71 | 56 | 40 | 5 |

¹⁵ Does not include the 94-acre overlap with the 1st Ave S SD (west) drainage basin.

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level

Samples collected September 2008 through May 2014.

SPU collected 15 storm drain solids samples in the Highland Park Wy SW SD after it was cleaned (8 sediment trap, 4 inline grabs, 2 private onsite catch basin, and one right-of-way catch basin samples). Results are summarized in Table C-30. Sample locations are shown on Map 71.

Table C-30: Summary of chemicals exceeding SMS screening levels in Highland Park Wy SW SD after cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 15 | <6 | 55 | 21 | 16 | 0 | 0 |
| Copper | 390 | 390 | 15 | 19.5 | 302 | 116 | 113 | 0 | 0 |
| Lead | 450 | 530 | 15 | 11 | 263 | 114 | 129 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 15 | <0.03 | 0.27 | 0.14 | 0.17 | 0 | 0 |
| Zinc | 410 | 960 | 15 | 85 | 1,150 | 570 | 660 | 67 | 13 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 15 | 290 | 5,480 | 2,500 | 1,545 | 77 | 77 |
| LPAH | 5,200 | 5,200 | 15 | <54 | 1,125 | 520 | 607 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 15 | 192 | 7,096 | 2,600 | 2,813 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 15 | <86 | 718 | 270 | 264 | 0 | 0 |
| PCBs | 130 | 1,000 | 18 | <19.9 | 2,451 | 340 | 209 | 67 | 6 |
| BEHP | 1,300 | 1,900 | 15 | 340 | 11,200 | 4,900 | 4,120 | 87 | 87 |
| Butyl benzyl phthalate | 63 | 900 | 15 | <94 | 9,520 | 830 | 235 | 80 | 7 |
| Dimethyl phthalate | 71 | 160 | 15 | <60 | 241.5 | 98 | 82 | 60 | 13 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected May 2015 through April 2019

a. Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)

b. MTCA Method A soil cleanup level for unrestricted use

c. Sediment remedial action level

Except for mercury, metals concentrations in storm drain solids samples collected after cleaning were similar to levels observed in other storm drains in the LDW. The median mercury concentration (0.17 mg/kg) was slightly greater than two times the median of the median concentrations measured in other storm drains (0.15 ug/kg). Most of the higher mercury concations were measured at HP-ST6, which serves a parking lot, two currently undeveloped parcels, two commercial parcels, and a small area on the southwest portion of Terminal 115 (roof drains and catch basins in loading dock at the Northland Services warehouse). Mercury did not exceed the SCO

in any offshore waterway sediment samples and did not exceed the SCO screening level in any of the storm drain solids samples collected from this drainage system.

Zinc exceeded the CSL screening level in 13 percent of the storm drain solids samples, which is more than occurred prior to cleaning, but concentrations were similar to other storm drains in the LDW. Zinc also exceeded the CSL screening level in one of the 11 near end-of-pipe samples but did not exceed the SCO in any of the offshore sediment samples collected within 200 feet of the outfall.

Only one of 15 storm drain solids samples exceeded the CSL/2LAET for PCBs, a private onsite catch basin (2,451 ug/kg dw at CB304) on a loading dock at a metal fabrication facility. The facility jetted and cleaned the onsite drainage system in 2017. PCBs were not above the 2LAET screening level in any of the near end-of-pipe samples collected from the Highland Park Wy SW SD and only two of the eight waterway samples collected within 200 feet of the Highland Park Wy SW SD outfall exceeded the SCO for PCBs (137 J ug/kg dw at R3 and 172 ug/kg dw at R4). R3 and R4 are 40 and 100 feet downgradient of the outfall, respectively. R4 is located immediately adjacent to the southern-most pier at T115. Sample T115-01-SS-090428, which is located 10 feet away from the outfall did not exceed SCO for any chemicals.

Phthalates continued to exceed the CSL/2LAET screening levels (7-87 percent of the samples) after cleaning but concentrations were similar to the levels observed in other storm drains in the LDW. Phthalates (bis[2-ethylhexyl], butyl benzyl, and dimethyl) also exceeded SCO at samples collected within 40 to 100 feet of the outfall.

Over the next 5 years, SPU intends to conduct the following activities in the Highland Park Wy SW SD basin:

- Continue operating and maintaining the existing sediment traps (HP-ST4 and HP-ST6) installed in the Highland Park Wy SW SD system to characterize conditions in this drainage system.
- Resample onsite catch basins at the metal fabrication facility.
- Continue to inspect businesses operating in the basin.
- Continue to monitor mercury at HP-ST6. If concentrations exceed the CSL, SPU will investigate potential sources this sub-basin.

3.11. 1st Ave S SD (west)

The 1st Ave SW system serves an area of about 606 acres (Map 22). Land use in the basin is approximately 32.6 percent industrial, 31.6 percent open/vacant/parks, 28.2 percent residential, and 7.6 percent commercial. The SR 509 (8,500 LF) and SR99 (3,800 LF) corridors take up a significant portion of the right-of-way within this basin. As explained above, an approximately 94-acre portion of the 1st Ave S SD, west basin overlaps with the Highland Park Wy SW drainage basin. All runoff from the basin passes through a saltwater wetland prior to discharge to the waterway.

Major improvements were made to the 1st Ave S Bridge and approaches in 1995. SPU constructed a 2.5-acre wet pond near the downstream end of this system as part of the 1st Ave S bridge project to treat runoff from SR99 and SR509. Low flows are treated in the pond and high flows are diverted to the wetland located on WSDOT right-of-way between SR509 and 2nd Ave SW. A series of biofiltration swales were also constructed as part of the drainage system to convey and treat some of the runoff entering the wetland. The wetland discharges to the LDW via a wetland channel located under the 1st Ave S bridge.

SPU jetted and cleaned portions of the 1st Ave S SD (west) drainage system in 2017¹⁶. Prior to cleaning PCBs (1,050 – 1,950 J ug/kg dw) frequently exceeded the 2LAET in the 1st-ST7 sediment trap located on Olson PI SW

¹⁶ Ditches and culverts located adjacent to the wetland could not be cleaned because sediment accumulation in the wetland has partially clogged many of the pipes entering it. Cleaning of these drainage structures would need to be coordinated with removal of sediment from the wetland, which is not owned by SPU.

west of Myers Way S (Map 72). The drainage system at this location serves a mostly residential area west of Myers Wy S, including a public storage facility on Olson PI SW. Other chemicals that exceeded the CSL/2LAET screening levels prior to cleaning included HPAH (10 percent), cPAH (24 percent), and phthalates (10-38 percent). Sample results are summarized in Table C-31.

Table C-31: Summary of chemicals exceeding SMS screening levels in 1st Ave S SD (west) before cleaning (2002 -2017).

| | SCO LAET | CSL 2LAET | N | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 29 | <5 | 20 | 7.6 | 8 | 0 | 0 |
| Copper | 390 | 390 | 29 | 29.6 | 467 | 81 | 40.2 | 3 | 3 |
| Lead | 450 | 530 | 29 | 5 | 261 | 79 | 12 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 29 | <0.02 | 1.294 | 0.12 | 0.06 | 3 | 3 |
| Zinc | 410 | 960 | 29 | 102 | 2,940 | 430 | 215 | 34 | 3 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 29 | 160 | 17,100 | 2,500 | 950 | 31 | 31 |
| LPAH | 5,200 | 5,200 | 29 | 39 | 3,460 | 740 | 324 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 29 | 295 | 24,500 | 5,900 | 2,864 | 17 | 10 |
| cPAH | 1,000 ^b | 1,000 ^b | 29 | 59 | 3,033 | 730 | 367 | 24 | 24 |
| PCBs | 130 | 1,000 | 29 | <16 | 1,950 | 380 | 20 | 31 | 21 |
| BEHP | 1,300 | 1,900 | 29 | 160 | 28,600 | 3,600 | 790 | 41 | 38 |
| Butyl benzyl phthalate | 63 | 900 | 29 | <20 | 650 | 120 | 99 | 45 | 0 |
| Dimethyl phthalate | 71 | 160 | 29 | <20 | 4,200 | 210 | 96 | 34 | 10 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

a. MTCA Method A soil cleanup level for unrestricted use

b. Sediment remedial action level

Samples collected September 2008 through May 2017. Does not include samples collected prior to cleaning that were not affected by SPU's cleaning (e.g., private onsite catch basins).

SPU has collected 46 samples in the 1st Ave S SD (west) since the lines were cleaned in 2017 and from locations where pipes/structures have never been cleaned. Results are summarized in Table C-32. Except for zinc, metals concentrations remained low. Arsenic, copper, and lead did not exceed the SMS screening levels in any samples. Mercury exceeded the screening levels in only 3 samples (two trap samples at 1st-ST5 collected in 2008 and 2010 and the 2019 trap sample at 1st-ST2). ST5 is located on Occidental Ave S just north of S Kenyon St and serves an industrial area between W Marginal Wy S and SR509 and between S Kenyon St and S Sullivan St. Businesses include SPU's South Transfer Station (STS), the former STS, the South Park Landfill property, and a small business park on S Kenyon St. ST2 is located on the 18-inch drain entering the southwest corner of the wet pond S Holden St which collects runoff primarily from SR509.

Zinc concentrations were comparable to the concentrations observed at other storm drains in the LDW. Although zinc also exceeded the CSL in seven of the 32 near end-of-pipe samples collected from the 1st Ave S SD (west), it did not exceed the SCO in any of the 10 sediment samples collected within 20-170 feet of

the outfall. These data suggest that the outfall is not having a significant effect on zinc concentrations in waterway sediment.

Other chemicals that exceeded the SMS screening levels include PCBs and phthalates. One inline grab sample (MH218) collected in 2010 exceeded the 2LAET for PCBs (1,760 ug/kg dw). MH218 is on S Kenyon St downstream of the industrial area described above. SPU did not clean this approximately 540-foot section of pipe on S Kenyon St between Occidental Ave S and 2nd Ave S because it is continuously backwatered from the WSDOT wetland system and SPU simply ran out of time in 2017 to complete this work. SPU intends to clean this section of the 1st Ave S SD (west) system in 2020. Work will be coordinated with demolition of the onsite drainage system at the former South Transfer Station site¹⁷.

Table C-32: Summary of chemicals exceeding SMS screening levels in samples collected from the 1st Ave S SD, west storm drain system after cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----------------|-------|--------|--------|--------|---|--|
| Arsenic | 57 | 93 | 45 | <5.7 | 30 | 9.8 | 6.4 | 0 | 0 |
| Copper | 390 | 390 | 45 | 18.6 | 305 | 94 | 109 | 0 | 0 |
| Lead | 450 | 530 | 45 | 5.38 | 301 | 93 | 81 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 45 | <0.02 | 0.6 | 0.15 | 0.12 | 7 | 2 |
| Zinc | 410 | 960 | 45 | 108 | 3,770 | 740 | 579 | 62 | 24 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 44 | 280 | 18,500 | 4,300 | 3,300 | 62 | 62 |
| LPAH | 5,200 | 5,200 | 43 | <26 | 3,220 | 780 | 405 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 43 | 98 | 15,306 | 4,400 | 3,149 | 7 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 43 | 19 | 1,928 | 520 | 360 | 9 | 9 |
| PCBs | 130 | 1,000 | 45 | <17.6 | 1,760 | 170 | 93 | 30 | 2 |
| BEHP | 1,300 | 1,900 | 44 | 19 | 44,000 | 11,000 | 8,500 | 80 | 77 |
| Butylbenzyl phthalate | 63 | 900 | 44 | 11 | 6,500 | 560 | 230 | 73 | 14 |
| Dimethyl phthalate | 71 | 160 | 44 | <20 | 36,000 | 960 | 72 | 50 | 23 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Samples collected September 2008 through May 2019.

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level
 - Includes samples collected prior to 2017 in areas that were not cleaned (e.g., private onsite catch basins or culverts/pipes that were not cleaned in 2017)

¹⁷ The entire onsite drainage system will be removed sometime in 2021 to prepare the site for construction of a new SPU recycling facility. Construction of the new facility is currently scheduled to start in 2022.

Ten sediment samples have been collected in the waterway within 200 feet of the 1st Ave S SD (west) outfall. PCBs (137.6 – 300 ug/kg dw) exceeded the SCO at four locations and butyl benzyl phthalate (82 ug/kg dw) exceeded the SCO at one location. A large mudflat/delta has formed offshore of the channel that discharges from the wetland. No SMS exceedances were observed at the three stations closest to the end of the wetland channel. Exceedances occurred at the stations located closest to the main channel. Given that PCBs in the waterway sediment were higher than most of the near end-of-pipe storm drain solids samples (<17 – 550 ug/kg dw with a median of 74 ug/kg dw and an average concentration of 115 ug/kg dw), it does not appear that the 1st Ave S SD (west) is a significant source of PCBs to the waterway at this location.

Over the next 5 years, SPU intends to conduct the following activities in the 1st Ave S SD (west) drainage basin:

- Continue operating the existing sediment traps (1st-ST1, 1st-ST2, 1st-ST3, and 1st-ST7)
- Jet and clean the 30-inch storm drain on S Kenyon St between Occidental Ave S and 2nd Ave S. Coordinate cleaning with the demolition of the onsite drainage system at the former South Transfer Station site.
- Continue inspecting businesses.

3.12. 2nd Ave S SD

The 2nd Ave S SD serves a 38-acre industrial drainage basin located on the south side of the Trotsky inlet (Map 23). The 30-inch outfall was constructed in 1964 by Northwest Cooperage, Inc, a barrel recycling facility. Prior to 1964, runoff from this basin discharged to the LDW via an open ditch. Over the years, other businesses located on the west side of 2nd Ave S connected their onsite storm drains to this outfall. The City MS4 located east of 2nd Ave S connects to this private system at various points along 2nd Ave S. The area served by the City MS4 encompasses about 18.4 acres.

Northwest Cooperage discharged stormwater and wastewater to this drainage system until about 1965 when they connected onsite drains to the combined sewer. Plat maps of this area show a wastewater lagoon on Northwest Cooperage property connected to this drainage system. This property continues to be occupied by a barrel recycling facility; however most onsite runoff and wastewater are now discharged to the combined sewer under a permit with King County Industrial Waste. Only roof downspouts on buildings located at the northwest corner of the site continue to discharge to the waterway.

SPU jetted and cleaned the City-owned portions of the 2nd Ave S SD along S Fontanelle St and S Webster St in 2010. However, the privately owned pipes and ditches west of 2nd Ave S were not cleaned.

During the previous reporting period, SPU collected 18 samples (2 private onsite catch basins, 14 right-of-way catch basins, and 2 inline grabs) from City-owned storm drains in the 2nd Ave S drainage system. Metals concentrations were comparable to concentrations observed in other storm drains in the LDW. Copper, lead, and mercury exceeded the CSL screening levels in two samples collected at a small recycling facility located at 7620 2nd Ave S (CB116), which stored fluorescent lamps containing mercury and lamp ballasts containing PCBs in an uncovered outside location. The property was sold in 2013 and the recycling business was closed. The new owner jetted and cleaned the onsite drainage system and remodeled the building. The site is now occupied by a machine shop and a theatre company that fabricates stage props. All work is done inside.

Results for samples collected from 2007 through 2013 are summarized in Table C-33. Median concentrations of all chemicals were on the lower end of the concentrations reported at other drains in the LDW (see box plots in Appendix B and Appendix J).

Except for a sample collected from a catch basin at the recycling facility (902 ug/kg dw at CB116), PCB concentrations were relatively low (26 – 304 ug/kg dw). Only seven of the other 17 samples exceeded the LAET screening level (151 – 304 ug/kg dw) and none exceeded the 2LAET screening level

Table C-33: Summary of chemicals exceeding SMS screening levels in samples collected from the 2nd Ave S SD storm drain system (2007-2013).

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 18 | <6 | 50 | 13 | 9.5 | 0 | 0 |
| Copper | 390 | 390 | 18 | 80 | 2,110 | 280 | 142 | 11 | 11 |
| Lead | 450 | 530 | 18 | 25 | 1,540 | 220 | 82 | 11 | 11 |
| Mercury | 0.41 | 0.59 | 18 | <0.04 | 48 | 3.3 | 0.09 | 11 | 11 |
| Zinc | 410 | 960 | 18 | 111 | 2,950 | 720 | 448 | 56 | 17 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 18 | 590 | 16,000 | 4,600 | 3,400 | 78 | 78 |
| LPAH | 5,200 | 5,200 | 18 | <60 | 2,030 | 520 | 226 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 18 | <190 | 9,090 | 2,400 | 1,672 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 18 | <114 | 1,049 | 320 | 214 | 6 | 6 |
| PCBs | 130 | 1,000 | 18 | 26 | 902 | 170 | 118 | 44 | 0 |
| BEHP | 1,300 | 1,900 | 18 | 980 | 39,000 | 8,200 | 4,050 | 94 | 78 |
| Butyl benzyl phthalate | 63 | 900 | 18 | <95 | 11,000 | 900 | 250 | 94 | 11 |
| Dimethyl phthalate | 71 | 160 | 18 | <19 | 840 | 160 | 135 | 56 | 22 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Samples collected May 2007 through June 2013.

During the 2014-2019 reporting period, SPU collected five storm drain solids samples in the 2nd Ave S SD basin. Results are provided in Table C-34. Sampling locations are shown on Map 73. Two samples were associated with a small truck repair service that has struggled to maintain appropriate BMPs (CB263 from an onsite catch basin and CB108 from a right-of-way catch basin adjacent to the site). SPU has inspected this business twice in the past 5 years and the owner has been cooperative in making the necessary improvements. The other samples (CB116, CB280, and CB282) were collected at the former recycling facility described above. Mercury (2.109 – 4.34 mg/kg) was significantly lower than in samples collected prior to site cleanup (10.5-48 mg/kg) but continued to exceed the CSL screening level. PCBs (349 J - 560 J ug/kg dw) were also lower than the last sample collected in 2010 (902 ug/kg dw). Phthalates, particularly bis(2-ethylhexyl)phthalate continued to exceed SMS screening levels.

Table C-34: Storm drain solids results for samples collected from the 2nd Ave S SD (2014-2019).

| | SCO LAET | CSL 2LAET | CB108 05/14/15 | CB116 08/25/17 | CB263 05/14/15 | CB280 08/25/17 | CB282 08/25/17 |
|--------------------------|--------------------|--------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| Arsenic | 57 | 93 | 7 U | 21.8 | 6.7 J | 29.2 | 25.1 |
| Copper | 390 | 390 | 218 | 375 | 158 | 426 | 822 |
| Lead | 450 | 530 | 35 | 348 | 33 | 321 | 386 |
| Mercury | 0.41 | 0.59 | 0.03 U | 2.109 | 0.1 | 4.34 | 2.199 |
| Zinc | 410 | 960 | 216 | 1,630 | 302 | 862 | 966 |
| TPH-oil | 2,000 ^a | 2,000 ^a | 6,500 | 2,500 ^b | 6,600 | 5,270 | 3,610 |
| LPAH | 5,200 | 5,200 | 110 | 933 J | 3,942 J | 1,577 J | 2,077 J |
| HPAH | 12,000 | 17,000 | 761 J | 3,020 J | 7,748 J | 3,327 | 3,834 J |
| cPAH | 1,000 ^b | 1,000 ^b | 92 J | 378 J | 732 J | 429 | 452 J |
| PCBs | 130 | 1,000 | 97 | 560 J | 16 J | 470 J | 349 J |
| BEHP | 1,300 | 1,900 | 4,400 | 8,390 | 6,600 | 14,700 | 12,300 |
| Butylbenzyl phthalate | 63 | 900 | 59 U | 674 | 580 | 193 | 776 |
| Dimethyl phthalate | 71 | 160 | 59 U | 274 J | 110 U | 109 | 296 U |

Exceeds SCO/LAET

Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

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

b. Sample prepared using silica acid cleanup prior to analysis.

c. Sediment remedial action level.

Two near end-of-pipe inline solids samples were collected at MH241 in the 2nd Ave S SD in 2011 and 2012. Zinc and bis(2-ethylhexyl)phthalate were the only chemicals that exceeded the CSL/2LAET screening level; PCBs and butyl benzyl phthalate exceeded the LAET screening levels in both samples.

Over 20 surface sediment samples have been collected in the waterway within 200 feet of the 2nd Ave S outfall. The most recent samples were collected in 2014 by Industrial Container Services (Windward 2018). Many of these and previous samples exceeded the SCO for multiple chemicals including metals (chromium, copper, mercury, lead and zinc), PCBs, PAHs, and other semi-volatile organic chemicals (e.g., pentachlorophenol, phenol, 2,4-dimethylphenol, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, and 1,4-dichlorobenzene). The concentrations of chemicals in waterway sediment were generally higher than the concentrations found in the samples collected from the City's storm drain indicating that the City MS4 is not a major source of the contamination found in waterway sediment.

Over the next 5 years, SPU intends to conduct the following activities in the 2nd Ave S SD drainage basin:

- Continue to monitor locations within the City MS4. However, given that a large portion of this drainage system is privately owned, additional sampling outside the City MS4 is needed to characterize contaminant contributions from this drainage system.
- Start collecting annual grab samples at MH241 and evaluate whether installing a sediment trap at this location would improve sample representativeness.

3.13. 7th Ave S SD

The 7th Ave S SD serves an area of about 238 acres (Map 24). Land use in the basin is a mix of industrial (34.2 percent), residential (18.7 percent), open/vacant/park (16.7 percent), commercial (2.9 percent), and right-of-way (27.6 percent). The basin can be generally divided into three sub-basins. The upper basin above SR509 covers about 37.4 acres and is occupied by the City's Fire Training Facility, a church, an apartment building, and several undeveloped parcels. The middle basin (126.3 acres) contains a combination of commercial and residential properties. The lower basin (66.1 acres) is very industrialized with numerous small and medium-sized light to heavy industrial businesses.

The 54-inch and 72-inch mainlines that convey stormwater to the waterway were constructed in 1988-1992. King County constructed the 72-inch line on 7th Ave S as part of the Renton Effluent Transfer System that conveys wastewater from the treatment plant in Renton to Elliott Bay. SPU constructed the 54-inch line on 5th Ave S. Maintenance holes on the 54-inch line are equipped with weirs to trap sediment. The 7th Ave S system is equipped with a tide gate, because the lower approximately 3,000 feet of this system is tidally influenced. SPU installed a new inline check valve in 2017 after the external duck bill-style check valve failed for the second time.

SPU jetted and cleaned the 7th Ave S SD drainage system in 2013. Prior to cleaning, SPU conducted extensive sampling in this drainage system. A total of 58 samples (1 private onsite catch basin, 13 right-of-way catch basins, 24 inline grabs, and 12 sediment traps) were collected through 2013 (Table C-35). As shown in the box plots in Appendix B, chemical concentrations in most samples from 7th Ave S SD were comparable to the levels found in other storm drains sampled in the LDW.

Table C-35: Summary of chemicals exceeding SMS screening levels in samples collected from the 7th Ave S SD storm drain system before cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|-------|-----------|--------|--------|---|--|
| Arsenic | 57 | 93 | 56 | <6 | 55 | 17 | 19 | 0 | 0 |
| Copper | 390 | 390 | 56 | 8.9 | 2,880 | 200 | 138.5 | 7 | 7 |
| Lead | 450 | 530 | 56 | 3 | 3,690 | 190 | 116 | 7 | 5 |
| Mercury | 0.41 | 0.59 | 56 | <0.02 | 1.08 | 0.16 | 0.18 | 5 | 2 |
| Zinc | 410 | 960 | 56 | 50 | 4,140 | 660 | 561 | 68 | 9 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 54 | <12 | 46,000 | 3,400 | 2,350 | 54 | 54 |
| LPAH | 5,200 | 5,200 | 55 | <18 | 80,840 | 2,600 | 340 | 4 | 4 |
| HPAH | 12,000 | 17,000 | 55 | <19 | 193,000 | 9,600 | 3,468 | 11 | 4 |
| cPAH | 1,000 ^c | 1,000 ^c | 55 | <32 | 25,840 | 1,100 | 417 | 16 | 16 |
| PCBs | 130 | 1,000 | 56 | <17 | 3,190 | 300 | 137 | 52 | 5 |
| BEHP | 1,300 | 1,900 | 55 | <19 | 1,400,000 | 30,000 | 2,700 | 69 | 58 |
| Butyl benzyl phthalate | 63 | 900 | 55 | <18 | 3,400 | 320 | 230 | 84 | 5 |
| Dimethyl phthalate | 71 | 160 | 55 | <18 | 650 | 100 | 130 | 51 | 22 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

Samples collected April 2005 through April 2013.

None of the samples exceeded the screening level for arsenic and only a few samples (4-6 percent) exceeded the SCO screening levels for copper, lead, and mercury. Other chemicals that exceeded the CSL/2LAET screening levels included LPAH and HPAH (4 percent of samples), PCBs (5 percent of samples), and phthalates (5-60 percent of samples). SPU identified and controlled a source of metals and HPAH and another source of PCBs during the previous reporting period (SPU 2015).

SPU cleaned the 7th Ave S drainage system in 2013. Since cleaning, SPU has collected 36 storm drain solids samples from the system. Results are summarized in Table C-36. Sampling locations are shown on Map 74. Chemical concentrations were similar to levels measured in other storm drains in the LDW. Arsenic concentrations remained below the SMS screening levels. Concentrations of lead, mercury, HPAH, and LPAH have declined since cleaning. Except for HPAH, none of the post-cleaning samples exceeded the SCO/LAET screening levels. HPAH concentrations exceeded the LAET in one right-of-way catch sample collected on S Riverside Dr at S Holden St (16,170 ug/kg dw in RCB64). S Riverside Dr is a heavily used industrial street, but samples collected from three nearby right-of-way catch basins (4,710 – 8,570 ug/kg dw HPAH) were all well below the LAET.

Table C-36: Summary of chemicals exceeding SMS screening levels in samples collected from the 7th Ave S SD storm drain system after cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|--------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 36 | 2.985 | 30 | 14 | 10 | 0 | 0 |
| Copper | 390 | 390 | 36 | 9.18 | 635 | 110 | 100.8 | 3 | 3 |
| Lead | 450 | 530 | 36 | <6 | 225 | 59 | 45.35 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 36 | <0.022 | 0.26 | 0.09 | 0.06 | 0 | 0 |
| Zinc | 410 | 960 | 36 | 52.1 | 1,670 | 415 | 319 | 42 | 6 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 35 | 16 | 9,900 | 2,500 | 2,080 | 49 | 49 |
| LPAH | 5,200 | 5,200 | 35 | <19 | 3,700 | 460 | 270 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 35 | <38 | 16,170 | 2,900 | 1,696 | 3 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 35 | <19.2 | 1,828 | 340 | 236 | 9 | 9 |
| PCBs | 130 | 1,000 | 40 | <9.3 | 1,454 | 220 | 117 | 48 | 3 |
| BEHP | 1,300 | 1,900 | 36 | <46 | 30,000 | 4,900 | 3,630 | 61 | 58 |
| Butyl benzyl phthalate | 63 | 900 | 36 | <19 | 980 | 180 | 110 | 58 | 3 |

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|------------------------------------|-------------|--------------|----------------|-----|-----|------|--------|---|--|
| Dimethyl phthalate ^c | 71 | 160 | 36 | <18 | 290 | 76 | 98 | 33 | 11 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected November 2010 through April 2019

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level

Butyl benzyl phthalate and dimethyl phthalate concentrations also declined after cleaning; however, samples continued to exceed both the LAET (33 and 58 percent, respectively) and the 2LAET (3 and 11 percent, respectively).

Zinc, bis(2-ethylhexyl)phthalate, and PCB concentrations remained about the same after cleaning. Zinc (1,670 mg/kg in the 2016 trap sample at 7th-ST1 and 1,460 mg/kg at RCB61) and PCBs (1,454 ug/kg dw in onsite catch basin CB154), exceeded the 2LAET screening levels in only two and one samples, respectively, after cleaning but 40-50 percent of the post-cleaning samples exceeded the LAET. Bis(2-ethylhexyl)phthalate continued to exceed the 2LAET screening level in about 60 percent of the samples.

As shown in Figure C-3, although HPAH and PCBs in the near end-of-pipe sediment trap samples (7th-ST1) were initially much lower after cleaning, both have shown a steady increase in the years following cleaning and are approaching the pre-cleaning levels.

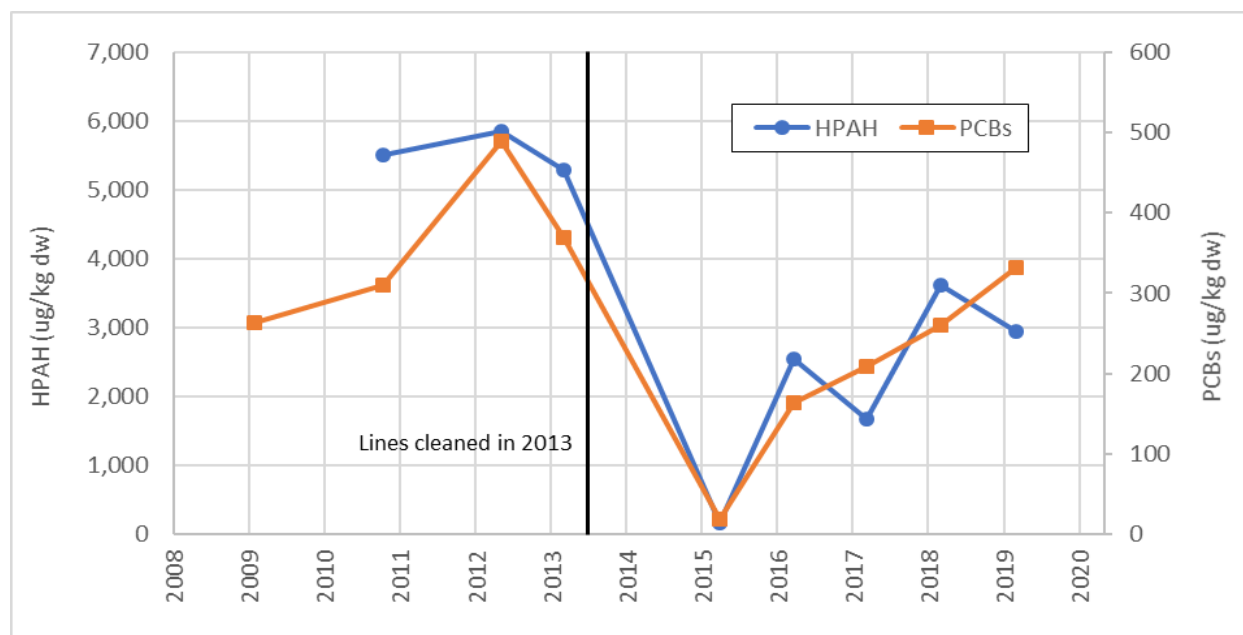


Figure C-3: HPAH and PCBs in 7th-ST1 sediment trap before and after line cleaning.

Surface sediment samples have been collected at six stations located within 70-185 feet of the 7th Ave S SD. SCO exceedances were reported at five of the sites. Results are summarized in Table C-37. BBP and BEHP exceeded the SCO at the two closest stations within 50-70 feet of the outfall, but PAHs were elevated at the farther stations (95-185 feet offshore of the outfall).

Fluoranthene is the only PAH that exceeded the SCO in the stations within 100 feet of the outfall, but only at the 70-foot and not at the 50-foot station. Fluoranthene exceeded the LAET in only 2 of the 22 near end-of-pipe samples collected in the 7th Ave S SD since 2005 and none exceeded the 2LAET. In addition, only 6 of the nearly 100 samples collected from this drain exceeded the 2LAET for fluoranthene. This information suggests that the 7th Ave S SD is not the source of fluoranthene in waterway sediment.

PCBs exceeded the SCO in the 50- (196 ug/kg dw) and 95-foot samples (860 ug/kg dw), but not in the 70-foot sample. Only one of the 22 near end-of-pipe samples (2,400 at 7th-ST-091008) collected since 2005 and none of the samples collected since the system was cleaned in 2013 exceeded the 2LAET screening level for PCBs. However, 16 of the 22 near end-of-pipe samples (164 – 710 ug/kg dw PCBs) exceeded the LAET screening level.

With the exception of BEHP, of the nearly 100 samples collected in the 7th Ave S SD since 2005, only the following 9 locations exceeded the 2LAET or RAL for one or more of the chemicals found above the SCO in the offshore sediment samples:

- RCB139: PCBs, butyl benzyl phthalate
- RCB198: PCBs, cPAH
- RCB227: cPAH, butyl benzyl phthalate
- RCB291: PAH, cPAH, butyl benzyl phthalate
- RCB350: PAH
- CB154: PCBs
- CB262: Butyl benzyl phthalate
- 7th-ST1: PCBs, cPAH¹⁸
- MH22: cPAH

Table C-37: Chemicals exceeding SMS in surface sediment samples collected within 200 feet of the 7th Ave S SD.

| Station | Distance from outfall | Direction from outfall | Chemicals ≥SCO and ≤CSL | Chemicals >CSL |
|-----------|-----------------------|------------------------|---|---|
| SS2112-A | 50 | Opposite | BBP, BEHP, hexachlorobenzene, PCBs | Mercury, benzyl alcohol |
| LDW-SS335 | 70 | Opposite | BBP, fluoranthene | BEHP |
| LDW-SS530 | 95 | Downstream | 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzofuran, fluoranthene, fluorene, phenanthrene, total benzofluoranthenes, HPAH, LPAH, PCBs | Acenaphthene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, |

¹⁸ PCBs exceeded 2LAET in 1 of 12 inline grab samples collected at 7th- ST1. cPAHs exceeded the 2LAET in 2 of 12 inline grab samples collected at 7th- ST1.

| Station | Distance from outfall | Direction from outfall | Chemicals ≥SCO and ≤CSL | Chemicals >CSL |
|----------|-----------------------|------------------------|--|--|
| TRI-095T | 156 | Upstream | Benzyl alcohol | 2,4-dimethylphenol |
| LDW-SS95 | 185 | Upstream | Anthracene, benzo(a)anthracene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, HPAH | Acenaphthene, dibenzofuran, fluorene, phenanthrene, LPAH |

Although zinc was above the SCO screening level in 15 of 36 storm drain solids samples including 4 of the 10 near end-of-pipe samples, it was below the SCO in all six surface sediment samples collected offshore of the outfall.

Over the next 5 years, SPU intends to conduct the following activities in the 7th Ave S SD drainage basin:

- Continue operating and maintaining the three sediment traps
- Continue source tracing as needed
- Continue inspecting businesses.

4. LOWER REACH



4.1. S Nevada St SD

The Nevada St SD serves an area of approximately 26 acres, most of which is occupied by a large warehouse and associated parking on the Port of Seattle's Terminal 106 (Map 25). The west end of S Nevada St was vacated to the Port in 1970. Catch basins located on the east end of S Nevada St may collect runoff from a short section of E Marginal Wy S, but most of the runoff at this outfall is from S Nevada St, as well as roof and parking areas on adjacent Port property. Source tracing has been difficult due to the lack of accumulation of storm drain solids this system. Five samples have been collected from this drainage system since it was last cleaned in 2015. Results are summarized in Table C-38. Sample locations are shown on Map 75. Results for metals were like the previous sample collected prior to cleaning with arsenic, copper, lead, mercury concentrations below the SCO screening level. Zinc exceeded the SCO screening level in all samples and the CSL screening level in 2 samples. However, elevated levels of LPAH (6,187 – 95,700 ug/kg dw) and HPAH (24,300 – 425,900 ug/kg dw) were measured in three catch basin samples collected in 2019. All three catch basins are located across from the warehouse currently leased by Seattle Tunnel Partners (north side of S Nevada St) and B & G Machine, Inc. (south side of S Nevada St). Illegal dumping of concrete waste has also been observed on several occasions in this general area. SPU has taken measures to track the illegal dumping problem but has not yet determined the source.

Table C-38: Summary of chemicals exceeding SMS screening levels in S Nevada St SD.

| | SCO LAET | CSL 2LAET | RCB312 05/25/18 | RCB89 06/06/19 | MH56 06/06/19 | RCB86 06/19/19 | RCB88 06/19/19 |
|---------|-------------|--------------|--------------------|-------------------|------------------|-------------------|-------------------|
| Arsenic | 57 | 93 | 13.8 | 23 | 10.3 | 8.8 U | 11.4 |
| Copper | 390 | 390 | 110 | 160 | 104 | 101 | 221 |
| Lead | 450 | 530 | 116 J | 225 | 32.6 | -- | 67.9 |
| Mercury | 0.41 | 0.59 | 0.0605 | 0.348 | 0.29 | 0.0919 | 0.0716 |
| Zinc | 410 | 960 | 1,010 | 1,270 | 478 | 590 | 794 |

| | SCO LAET | CSL 2LAET | RCB312 05/25/18 | RCB89 06/06/19 | MH56 06/06/19 | RCB86 06/19/19 | RCB88 06/19/19 |
|--------------------------|--------------------|--------------------|--------------------|-------------------|------------------|-------------------|-------------------|
| TPH-oil | 2,000 ^a | 2,000 ^a | 3,740 | 5,600 | 1,130 | 3,320 | 7,090 |
| LPAH | 5,200 | 5,200 | 824 | 9,833 | 194.2 J | 95,672 | 6,187 J |
| HPAH | 12,000 | 17,000 | 4,033 | 47,054 J | 804 | 425,890 | 24,253 |
| cPAH | 1,000 ^b | 1,000 ^b | 378 | 4,700 J | 82 J | 42,000 | 2,700 |
| PCBs | 130 | 1,000 | 627 | 394 | 19.5 U | 502 J | 82.4 J |
| BEHP | 1,300 | 1,900 | 10,300 | 27,800 | 1,110 | 8,990 | 18,800 |
| Butylbenzyl phthalate | 63 | 900 | 733 | 2,200 | 19.9 U | 3.080 | 99.6 U |
| Dimethyl phthalate | 71 | 160 | 126 | 293 U | 19.9 U | 499 U | 99.6 U |

 Exceeds SCO/LAET
 Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

Samples collected May 2018 through June 2019.

a. Sediment remedial action level

b. Sediment remedial action level.

One waterway sediment sample has been collected approximately 60 feet offshore of the outfall. No chemicals exceeded the SCO in this sample. This outfall is not considered a significant source of chemicals of concern to the LDW. Over the next 5 years, SPU intends to conduct the following activities in the S Nevada St SD basin:

- Evaluate the potential to install a sediment trap near the downstream end of the system to improve long term monitoring
- Continue to investigate illegal discharges of concrete slurry in this system.
- Track sources of PAHs found in the 2019 samples
- Continue to inspect businesses.

4.2. Diagonal Ave S CSO/SD

The Diagonal Ave S CSO/SD drainage basin, which covers an area of about 2,666 acres, is the largest drainage basin in the City (Maps 26 and 27). Land use in the basin is a mixture of residential (23 percent), commercial (9 percent), industrial (19 percent), vacant/park (10 percent), and right-of-way (39 percent). The upper portion of the basin east of I-5 is mostly residential with commercial businesses clustered along the major transportation corridors (Rainier Ave S, Beacon Ave S, and S Jackson St). The lower portion of the basin west of I-5 is mostly industrial. The main trunkline west of I-5 is also tidally influenced. Given the size of the pipes (108 - 144 inches), these pipes are backwatered throughout most of the tidal cycle. The outfall at elevation approximately -5 ft NAVD88 (-2.5 ft MLLW) is exposed only during a minus tide.

SPU has conducted extensive source tracing in the Diagonal Ave S drainage basin, collecting nearly 400 samples over the past 17 years. Results for the previous reporting period (2003-2014) are summarized in Table C-39 and results for the current reporting period (2014-2019) are summarized in Table C-40. Sample locations for the current reporting period are shown on Maps 76 and 77. Overall, concentrations in the Diagonal Ave S CSO/SD drainage system are comparable to other storm drains in the LDW (see box plots in Appendix B).

Table C-39: Summary of chemicals exceeding SMS screening levels in the Diagonal Ave S CSO/SD drainage system during the previous reporting period (2003 – 2014).

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----------------|-------|-----------|--------|--------|---|---|
| Arsenic | 57 | 93 | 274 | <4.6 | 180 | 9 | 9.45 | 1 | 1 |
| Copper | 390 | 390 | 274 | 13.2 | 6,250 | 210 | 108.5 | 7 | 7 |
| Lead | 450 | 530 | 274 | <12 | 5,830 | 170 | 80 | 4 | 3 |
| Mercury | 0.41 | 0.59 | 274 | <0.02 | 11.5 | 0.21 | 0.08 | 6 | 4 |
| Zinc | 410 | 960 | 274 | 44 | 3,170 | 530 | 391.5 | 46 | 12 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 264 | 40 | 250,000 | 5,900 | 2,100 | 51 | 51 |
| LPAH | 5,200 | 5,200 | 271 | <19 | 44,860 | 1,500 | 498 | 7 | 7 |
| HPAH | 12,000 | 17,000 | 271 | <19 | 256,800 | 7,500 | 2,400 | 14 | 10 |
| cPAH | 1,000 ^c | 1,000 ^c | 271 | <8 | 42,980 | 1,022 | 342 | 23 | 23 |
| PCBs | 130 | 1,000 | 277 | <17 | 13,300 | 420 | 86 | 40 | 5 |
| BEHP | 1,300 | 1,900 | 266 | 51 | 1,400,000 | 18,000 | 4,950 | 74 | 67 |
| Butylbenzyl phthalate | 63 | 900 | 266 | <19 | 160,000 | 2,900 | 280 | 79 | 22 |
| Dimethyl phthalate | 71 | 160 | 266 | <18 | 1,800 | 170 | 120 | 47 | 27 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds.

Samples collected August 2003 through June 2014.

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level.

Table C-40 : Summary of chemicals exceeding SMS screening levels in the Diagonal Ave S CSO/SD during current reporting period (2014-2019).

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------|--------------------|--------------------|----------------|--------|---------------------|-------|--------|---|--|
| Arsenic | 57 | 93 | 118 | <5.4 | 452 | 17 | 10 | 3 | 3 |
| Copper | 390 | 390 | 118 | 31.6 | 10,900 | 340 | 135 | 8 | 8 |
| Lead | 450 | 530 | 118 | 11.3 | 40,500 ^c | 560 | 84.4 | 6 | 4 |
| Mercury | 0.41 | 0.59 | 118 | <0.021 | 4.72 | 0.22 | 0.1 | 11 | 7 |
| Zinc | 410 | 960 | 118 | 119 | 10,100 | 980 | 613 | 71 | 29 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 118 | 174 | 47,900 | 4,900 | 2,710 | 69 | 69 |

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----------------|-------|---------|--------|--------|---|--|
| LPAH | 5,200 | 5,200 | 116 | <14.8 | 40,680 | 2,100 | 704 | 8 | 8 |
| HPAH | 12,000 | 17,000 | 116 | 64 | 134,780 | 8,500 | 3,868 | 12 | 9 |
| cPAH | 1,000 ^c | 1,000 ^c | 116 | 15 | 13,416 | 930 | 392 | 17 | 17 |
| PCBs | 130 | 1,000 | 123 | <19.6 | 46,060 | 1,400 | 158 | 59 | 16 |
| BEHP | 1,300 | 1,900 | 117 | 236 | 170,000 | 16,000 | 7,475 | 85 | 82 |
| Butylbenzyl phthalate | 63 | 900 | 117 | <8 | 48,000 | 1,300 | 304 | 80 | 15 |
| Dimethyl phthalate | 71 | 160 | 117 | <6.4 | 3,460 | 180 | 120 | 58 | 19 |

N = number of samples BEHP = bis(2-ethylhexyl)phthalate PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds.

Samples collected July 2014 through June 2019.

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level.
- Inline grab sample collected in 2019 from discrete deposit beneath a lateral entering at ST2 from the adjacent property. Lead in the three sediment trap samples collected at this location were below the SCO.

Exceedances of SMS screening levels for arsenic, copper, lead, and mercury were infrequent (<10 percent) during both the previous and current reporting periods. Elevated levels of lead and mercury have occurred in a few inline samples in three main areas:

- Along S Snoqualmie St and S Dakota St (see following section for discussion)
- At the City Light South Yard (see following section for discussion)
- Multiple locations in the downstream mainlines. Elevated levels of lead (2,760 mg/kg) were found in an inline sample (MH260) east of I-5 on a drain line that serves a short section of Beacon Ave and SPU’s Beacon Reservoir site. SPU plans to conduct further source tracing in this area.

The only other location where lead and mercury have been found were in samples collected from private onsite catch basins at industrial or recycling sites:

- Battery store: Elevated lead at CB7 and CB83 (805 – 5,830 mg/kg) and elevated mercury at CB83 (2.05 mg/kg). SPU inspected this facility multiple times in 2003 – 2006 and found a number of problems related to spill control/containment, illicit discharges, storage of waste materials, and general housekeeping practices. The company implemented improvements as required by City inspectors. Other than catch basins needing cleaning, no problems were identified during the most recent inspection in 2016. This catch basin was re-sampled in 2016 and concentrations of mercury (0.007 mg/kg), lead (981 mg/kg), TPH-oil (4,100 mg/kg), and LPAH (293 J ug/kg dw) had declined. However, lead continues to exceed the CSL screening level. This site is not currently permitted by Ecology.
- Donation center. Mercury (11.5 J mg/kg) exceeded the CSL in an onsite catch basin sample collected in 2014.

The Diagonal Ave S CSO/SD drainage system, like other drainage systems in the LDW, experienced more frequent exceedances of the SCO/CSL screening levels for zinc (71 and 29 percent, respectively during the current reporting period) compared to other metals. However, none of the samples collected offshore of the outfall since 2004 Diagonal/Duwamish early action site cleanup exceeded the SCO for zinc (King County 2008, 2010, Windward 2018).

PAHs continued to exceed CSL/2LAET infrequently (<10 percent of the samples) in the Diagonal Ave S CSO/SD system during the current reporting period. Over half of the exceedances to date occurred in private onsite catch basins. Typical sites where PAHs have been a problem include fast food restaurants, repair shops, maintenance yards, parking lots, and light manufacturing facilities. One site, the King County Sheriff's storage facility, exhibited extremely high levels of LPAH (140,100 – 173,200 ug/kg dw) and HPAH (1,296,000 – 1,555,000 ug/kg dw) during the previous reporting period due to the historic use of coal tar sealant in the storage yard. Concentrations declined significantly after the sealant material was removed and replaced with an asphalt-based material. Samples collected in 2019 contained 514 – 4,519 ug/kg dw LPAH and 4,808, 34,310 ug/kg dw HPAHs.

LPAH and HPAH exceedances were observed in right-of-way catch basins (4 samples), inline grab samples (2 samples), and sediment trap samples (8 samples). Samples collected from sediment trap ST6 at Bush Pl and Rainier Ave S frequently exceeded the screening levels in 8 of 10 samples collected between 2003 and 2009. This drain line serves a mixed commercial and residential basin in Seattle's Central District. None of the three other samples collected in this sub-basin exceeded the screening levels. SPU attempted to trace sources in this basin in 2019, but efforts were hampered due to lack of sediment accumulation.

PCBs also exceeded the 2LAET screening level infrequently during the current reporting period (16 percent of the samples); however, LAET screening level exceedances were more frequent, occurring in 60 percent of the samples. Eleven of the 20 samples that exceeded the 2LAET screening level, were associated with known or suspected¹⁹ PCB sources (e.g., in building materials such as paint or caulk or were collected as part of source tracing efforts to identify PCB sources) and 14 of the 20 samples were from private onsite catch basins. The other three samples that exceeded the 2LAET screening level for PCBs were inline grab or sediment trap samples:

- MH29 (10/11/17): 1,413 ug/kg dw
- MH33 (11/07/17): 9,730 ug/kg dw
- ST 1 (04/23/19): 1,508 J ug/kg dw

MH29 and MH 23 were collected in the vicinity of an old sanitary sewer flush tank that was occasionally to clean out the sanitary sewer line. SPU jetted and cleaned this area in 2018. ST1 is the farthest downstream sample in the Diagonal Ave S CSO/SD system. No other samples collected at ST1. Only one of the 22 other samples collected at this location exceeded the 2LAET screening level for PCBs (13,300 ug/kg dw in a grab sample collected on April 1, 2010).

While exceedances of LAET/2LAET screening levels have occurred at various locations in the Diagonal Ave S CSO/SD basin, except for phthalates, concentrations at the most downstream sediment trap (ST1 at Diagonal Ave S west of E Marginal Wy S) were relatively low. As shown in Figure C-4, lead concentrations at ST1 have consistently been below the SCO screening level (450 mg/kg). Mercury is more variable, but except for two peaks in 2015 and 2019, concentrations were below the SCO screening level (0.41 mg/kg).

HPAH, PCBs, and BEHP are plotted in Figure C-5. Since 2006, HPAH at ST1 have been below the LAET and 2 LAET screening levels. Except for 2019, PCBs, ranging from 85 to 870 ug/kg dw (320 ug/kg dw average) were consistently below the 2LAET screening level. A spike of 1,508 ug/kg dw was observed in 2019. This may be

¹⁹ PCBs suspected based on detection dog alert and/or inspector observations of PCB-like odors.

associated with the PCB spill that the City found and cleaned up in 2019 (see Appendix D for details). Bis(2-ethylhexyl)phthalate exceeded the 2 LAET screening level in 90 percent of the trap samples collected at ST1. Phthalates are widespread in urban areas and will be difficult to control.

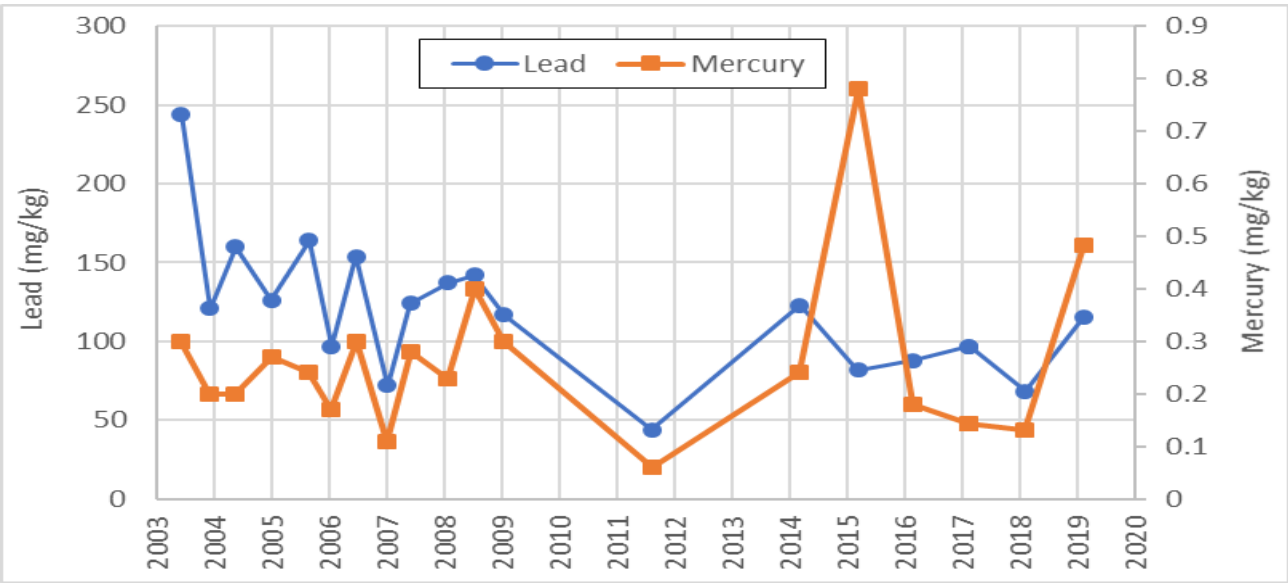


Figure C-4: Lead and mercury in ST1 trap samples (2003-2019).

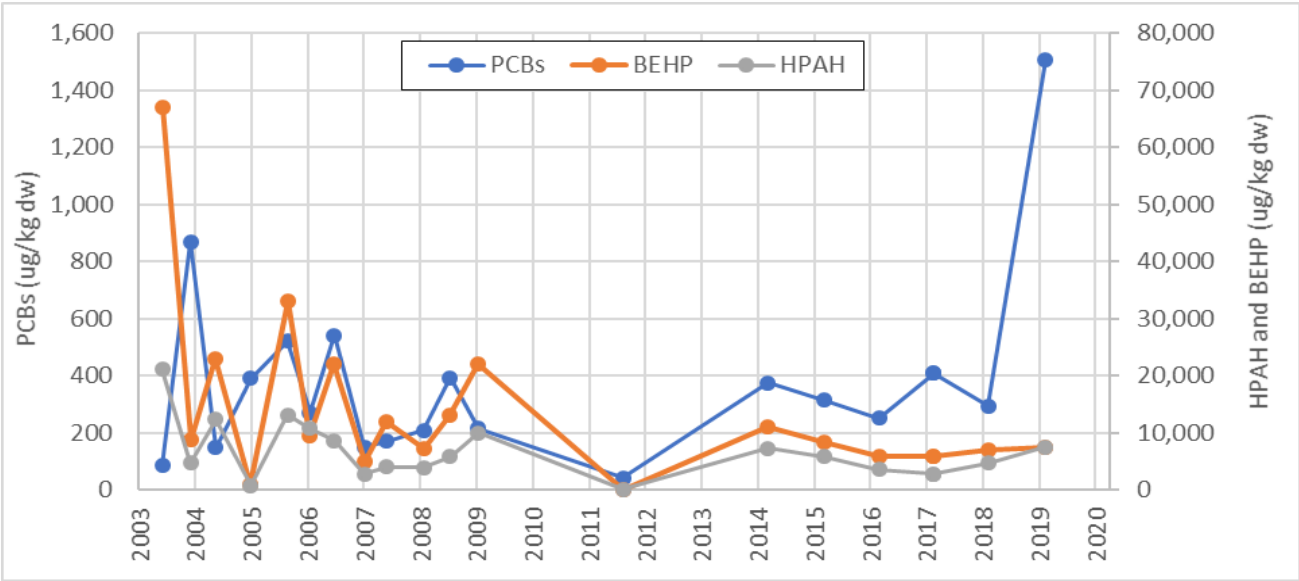
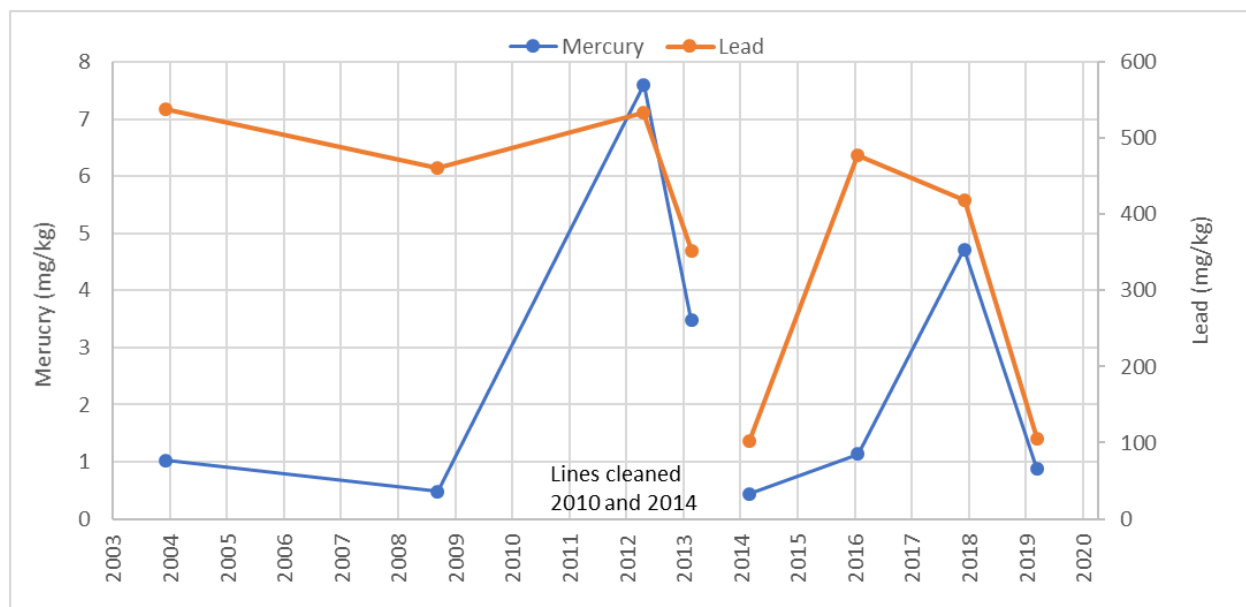


Figure C-5: PCBs, HPAH, and BEHP in ST1 trap samples (2004 - 2019).

4.2.1. S SNOQUALMIE ST SUB-BASIN

The S Snoqualmie St sub-basin is a 103-acre industrial area located between I-5 and the railroad corridor (Map 92). SPU continues to look for sources of mercury and PCBs in the vicinity of MH18 on S Snoqualmie St at 6th Ave S. As described in the previous SCIP, SPU jetted and cleaned the S Snoqualmie drainage lines in 2010 after source tracing failed to identify specific source(s) of the elevated levels of mercury found at MH18. Cleaning was performed to remove all historical contamination to facilitate source tracing for ongoing sources.

As shown in Figure C-6, mercury concentrations continued to exceed SCO screening level after cleaning. Given the industrial nature of this sub-basin, there are likely multiple sources of mercury.



*2014 partial cleaning of lines on 7th Ave S to MH18 by Western Waterproofing

Figure C-6: Mercury and lead in MH18 (2003-2019).

In addition, PCB concentrations increased after cleaning, indicating a potential new source of PCBs. PCBs increased at this location in 2013 and remained elevated in the 4 samples collected between 2014-2019. Results for PCBs and bis(2-ethylhexyl)phthalate are shown in Figure C-7. Both chemicals followed a similar pattern indicating that source(s) may be related. This maintenance hole is equipped with a 3-foot deep sump which serves to trap sediment. SPU has cleaned the MH twice since 2010 (2013 and 2019). During the previous reporting period, SPU completed an intensive inspection/sampling effort and identified two likely sources of PCBs (a masonry/waterproofing facility and an exterior paint source, see Appendix D for additional details). The masonry facility swept and later paved over areas where PCBs were suspected. The other site jetted and cleaned the onsite drainage system to remove paint residues. During this reporting period, SPU deployed the detection dog and installed two new sediment traps to aid in source tracing. The dog found several potential sources of PCBs in building materials (primarily caulk). Trap samples retrieved in 2019 found only low levels of PCBs in two of the three laterals connected to MH18 (265 and 284 ug/kg dw). The third was not sampled because a suitable location for trap installation was not identified.

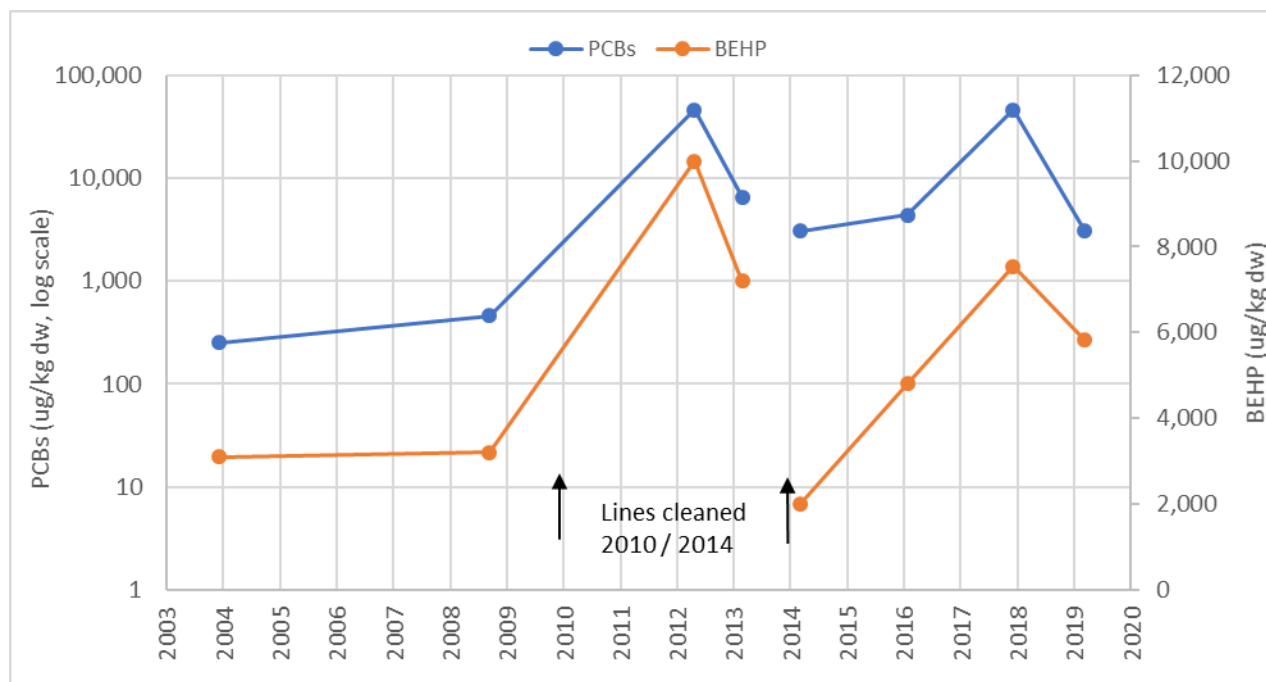


Figure C-7: PCBs and BEHP in MH18.

*2014 partial cleaning of lines on 7th Ave S to MH18 by Western Waterproofing

SAIC (2011) also collected 2 base flow and 3-4 stormwater samples at each of the 4 sampling locations in the S Snoqualmie St sub-basin (Map 92). Mercury was detected in only 3 of the 22 water samples. However, PCBs were detected at all 4 stations (Table C-41). The highest concentrations measured at Stations SQ1 and SQ2 were in base flow samples.

Table C-41: PCBs in water samples collected from S Snoqualmie St sub-basin.

| | SQ1 | SQ2 | SQ3 | SQ4 |
|-------------------|---------------|---------------|---------------|---------------|
| Baseflow | | | | |
| # of samples | 2 | 2 | 2 | 2 |
| # of detects | 1 | 2 | 2 | 0 |
| Range | 0.198 | 0.043 – 9.15 | 0.048 – 0.115 | -- |
| Stormwater | | | | |
| # of samples | 4 | 3 | 4 | 4 |
| # of detects | 2 | 2 | 4 | 3 |
| Range | 0.013 – 0.032 | 0.011 – 0.123 | 0.073 – 0.344 | 0.011 – 0.062 |

Units: ug/L

Reference: SAIC 2011.

PCBs were also detected in all three tidal water samples collected from the S Snoqualmie St sub-basins (0.014 – 0.025 ug/L).

4.2.2. S DAKOTA ST SUB-BASIN

The S Dakota St sub-basin includes a 145-acre residential area in the Beacon Hill neighborhood, approximately 63 acres in the I-5 corridor, and approximately 86 acres in the industrial area west of I-5 (Map 93). As shown in Table C-42, SPU found elevated levels of mercury and PCBs at a few locations in the basin over the past 15 years.

Mercury exceedances were found at a number of onsite catch basins, an inline grab from a maintenance hole on 6th Ave S in the lower industrial portion of this sub-basin (MH233), and an inline grab (MH252) in a maintenance hole on 15th Ave S in the upper, mostly residential basin. Elevated levels of PCBs were found in catch basins associated with buildings that had PCBs in the paint or caulk material.

Table C-42: Mercury and PCBs in samples collected from the Dakota sub-basin in the Diagonal Ave S CSO/SD.

| Station ID | Date | Sample type | Mercury | PCBs |
|--------------------|-----------|--------------------|--------------|----------|
| ST7 ^a | 2003-2019 | Sediment trap | <0.05 – 1.28 | 74 - 457 |
| MH233 | 05/27/09 | Inline grab | 1.34 J | 340 |
| CB336 | 04/22/19 | Onsite catch basin | 0.0482 | 1,430 |
| CB121 | 05/23/08 | Onsite catch basin | 1.411 | 8,300 |
| | 08/12/10 | Onsite catch basin | 0.66 | 3,700 |
| | 09/23/16 | Onsite catch basin | 0.86 | 7,630 |
| ODS27 ^b | 11/10/16 | Soil | -- | 5,950 |
| ODS54 ^c | 04/06/17 | Paint chip | -- | 100,000 |
| CB302 | 10/12/17 | Onsite catch basin | 0.0844 | 4,153 |
| CB300 | 10/12/17 | Onsite catch basin | 0.784 | 164.8 |
| MH252 | 08/01/12 | Inline grab | 0.69 | 29 |
| CB341 | 06/12/19 | Onsite catch basin | 0.433 | 130.5 J |
| SCO/LAET | | | 0.41 | 130 |
| CSL/2LAET | | | 0.59 | 1,000 |

| | |
|--|-------------------|
| | Exceeds SCO/LAET |
| | Exceeds CSL/2LAET |

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

BEHP = bis(2-ethylhexyl)phthalate

- One of 15 trap samples collected in 2006 exceeded the CSL. No other samples exceeded the SCO screening level for mercury.
- Dirt sample scraped from base of building adjacent to CB121.
- Paint chip sample collected from ground adjacent to CB302.

4.2.3. CITY LIGHT SOUTH YARD

The Seattle City Light South Yard is located on 4th Ave S south of S Spokane St. Most of the property drains to the combined sewer, but the western and southern portions of the property drain to the Diagonal Ave S CSO/SD drainage system. During the previous reporting period, SPU sampled catch basins on the combined sewer basin, which can overflow to the East Waterway during large storm events. During this reporting period, Ecology (Leidos 2015b) and SPU collected storm drain solids samples from areas of the South Yard that drain to the Diagonal Ave S CSO/SD drainage system. Results are provided in Table C-43.

Copper, lead, mercury, zinc, HPAH, PCBs, and phthalates exceeded the SMS screening levels at multiple locations. City Light performs the following routine maintenance at the South Service Center:

- Inspects onsite catch basins annually and cleans when the sump is 50 percent full.

- Inspects oil water separators each month and clean when ≥ 5 inches of sediment accumulate in the vault. OWS-D, located at the downstream end of the drain serving the western portion of the property, is cleaned annually or whenever the coalescing plates appear to be coated with sediment.
- Sweeps the entire yard area monthly and salvage areas twice a month

In addition, City Light has made the following improvements since 2015:

- Cleaned all catch basins in the salvage area where elevated levels of mercury were found.
- Installed incidental spill stations containing spill response equipment at 3 locations in areas draining to the Diagonal Ave S CSO/SD drainage system and one location served by the combined sewer system.
- Stored additional spill supplies and overpack drums at 2 locations in drainage and 2 locations in the combined sewer service area.
- Installed inserts in 14 catch basins in the vicinity of the salvage area loading dock and the PCB building. Inserts are reconditioned every year by power washing and are immersed in a salt brine solution to restore metal adsorption capacity.
- Installed new dumpsters with lids in the main yard area and in the area where pole butts are stored.
- Installed lids on storage bins for galvanized equipment, and bare copper and wire with damaged sheathing. Tarps are also available if needed for large quantities of damaged wire that cannot be stored in bins.
- Replaced coalescing plates and baffle in OWS-D.
- Jetted and cleaned approximately 150 feet of pipe between CB45 and CB49 on the drain line serving the western portion of the property.²⁰

Work scheduled in 2020 includes:

- Awarded contracts to install canopies over the staged projects/galvanized equipment storage area and the spent/salvage wire area.
- Plan to install two additional canopies over the salvage dock and oil house to cover salvage bins and transformers. Purchasing and permitting are currently underway.
- Plan to install an outdoor covered cantilevered storage rack at the warehouse area to allow covered storage of galvanized equipment and treated wood. Purchasing and permitting are currently underway.

Table C-43: Storm drain solids sample results for the Seattle City Light South Service Center (2015-2019).

| | SCO LAET | CSL 2LAET | CB24 ^a 12/11/14 | CB35 ^b 12/11/14 | OWS5 ^c 12/11/14 | CB343 ^d 06/12/19 | CB344 ^e 06/12/19 |
|----------|--------------------|--------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Arsenic | 57 | 93 | 10 | 14 | 14 | 14.8 | 14.1 |
| Chromium | 260 | 270 | 62 | 130 | 66 | -- | -- |
| Copper | 390 | 390 | 2,500 | 990 | 740 | 1,560 | 233 |
| Lead | 450 | 530 | 490 | 250 | 430 | 684 | 119 |
| Mercury | 0.41 | 0.59 | 0.18 | 0.20 | 1.1 | 1.55 | 0.13 |
| Zinc | 410 | 960 | 1,600 | 2,700 | 2,000 | 1,490 | 1,570 |
| TPH-oil | 2,000 ^f | 2,000 ^f | 8,900 J | 5,800 J | 15,000 J | 20,300 | 7,470 |
| LPAH | 5,200 | 5,200 | 3,500 J | 2,900 J | 6,100 J | 12,287 | 30,047 |
| HPAH | 12,000 | 17,000 | 20,000 J | 16,000 | 36,000 J | 62,755 J | 111,230 J |
| cPAH | 1,000 ^g | 1,000 ^g | 2,200 J | 2,000 | 4,000 J | 5,833 | 13,416 |

²⁰ Adjacent to decant station. Pipes where visible sediment had accumulated and were cleaned in 2019.

| | SCO LAET | CSL 2LAET | CB24 ^a 12/11/14 | CB35 ^b 12/11/14 | OWS5 ^c 12/11/14 | CB343 ^d 06/12/19 | CB344 ^e 06/12/19 |
|-----------------------|-------------|--------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Total PCB Aroclors | 130 | 1,000 | 570 J | 520 J | 3,500 | 3,378 | 747 J |
| Total PCB congeners | 130 | 1,000 | 1,320 J | 762 J | 7,500 J | -- | -- |
| BEHP | 1,300 | 1,900 | 64,000 | 87,000 | 120,000 | 74,900 | 85,400 |
| Butylbenzyl phthalate | 63 | 900 | 4,200 U | 6,000 | 6,100 J | 964 | 99.8 U |
| Dimethyl phthalate | 71 | 160 | 1,200 J | 180 J | 420 J | 276 | 99.8 U |



Exceeds SCO/LAET

Exceeds CSL/2LAET

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

- Catch basin adjacent to the salvage/scrap storage yard
- Catch basin adjacent to the PCB building.
- Oil water separator D at the downstream end of the storm drain serving the western portion of the property.
- Catch basin at loading dock for material salvage/scrap operations
- Catch basin along southern fence line in south storage yard.
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level.

4.2.4. POST-CLEANUP SAMPLES OFFSHORE OF THE DIAGONAL AVE S CSO/SD OUTFALL

Results from samples collected from 2006 - 2012 following completion of the 2005 Duwamish/Diagonal Early Action Area cleanup show that BEHP and butyl benzyl phthalate concentrations have increased and often exceeded the SCO at the station closest to the outfall (Station DUD_1A located 100 feet offshore of the outfall) (Anchor 2007, King County and Anchor 2008, King County 2010, 2015b). Bis(2-ethylhexyl)phthalate exceeded the SCO in six and butyl benzyl phthalate exceeded in five of the nine samples collected following cleanup. However, neither chemical exceeded the SCO in the most recent, 2012 sample. Dimethyl phthalate exceeded the SCO in only two samples but none after 2009.

Bis(2-ethylhexyl)phthalate and butyl benzyl phthalate also increased in the first few years following cleanup at Stations DUD_2A and DUD_3A, located 170 and 200 feet upstream of the outfall, respectively, but then declined and were below SCO after 2008 at DUD_2A and after 2006 at DUD_3A. Dimethyl phthalate did not exceed the SCO in any samples collected at DUD_2A and DUD_3A.

Time series charts for BEHP and butyl benzyl phthalate, presented in Figure C-8 and Figure C-9, show that phthalate concentrations appear to have reached equilibrium at about 500-1,000 ug/kg dw BEHP and 60-110 ug/kg dw butyl benzyl phthalate.

Time series charts for PCBs and total organic carbon are presented in Figure C-10 and Figure C-11. Peaks in PCBs appear to coincide with peaks in total organic carbon content of the samples. PCB concentrations declined to between 100 and 150 ug/kg dw after cleanup. However, concentrations at DUD_1A and DUD-2A increased to 132 and 202 ug/kg dw, respectively in 2011; DUD_1A exceeded the SCO, but DUD_2A did not. Concentrations at both locations declined in 2012 (both were below the SCO). King County (2015b) concluded that "PCB concentrations in Cap Areas A and B and the enhanced natural recovery area appear to be stable and within the

range of anthropogenic background.”²¹ PCB patterns at DUD_1A are similar to the trends observed in phthalates, which may be associated with fluctuating total organic carbon content of the samples (Figure C-11). Phthalates, PCBs and TOC at DUD_1A all exhibit a similar spike in 2011 followed by declining levels in 2012.

Table C-44: Chemicals exceeding SCO offshore of Diagonal Ave CSO/SD following cleanup.

| Sample Station | DUD_1A | DUD_2A | DUD_3A |
|----------------------------|--|-------------------------|-----------|
| Distance from outfall (ft) | 100 | 170 | 225 |
| Direction | Opposite | Upstream | Upstream |
| 2005 | BEHP ^b , DMP, benzyl alcohol ^b , PCBs ^a , fluoranthene | BEHP, BBP | BEHP, BBP |
| 2006 | BEHP ^b , BBP, PCBs, benzoic acid | BEHP, BBP | -- |
| 2007 | BEHP ^b , BBP | BEHP | -- |
| 2008 | BMP, DMP ^b , 1,4-dichlorobenzene | BEHP, PCBs ^a | BEHP |
| 2009 | BEHP | -- | -- |
| 2010 | BEHP ^b , BBP | Phenol ^b | Phenol |
| 2011 | Chrysene, fluoranthene ^b , phenanthrene ^b , pyrene ^b , LPAH ^b , HPAH ^b , BEHP ^b , BBP, PCBs, 2,4-dimethylphenol ^b | -- | -- |
| 2012 | BEHP ^b , BBP ^b | Phenol | Phenol |

Reference: Anchor (2007), King County and Anchor (2008, 2010), King County (2015b), Windward (2018).

BEHP = bis(2-ethylhexyl)phthalate, BBP = butyl benzyl phthalate, DMP = dimethyl phthalate

a. PCB results could not be OC normalized because of high TOC in sample. Dry weight concentration exceeded the LAET for PCBs.

b. Exceeded SCO and CSL.

²¹ Cap area A is immediately offshore of the Diagonal Ave S CSO/SD outfall. Cap area B is located immediately offshore of the former Diagonal Avenue treatment plan outfall, and the ENR is offshore of Cap area B. Anthropogenic background concentrations for PCBs (40-90 ug/kg dw) were evaluated in the LDW Feasibility Study (AECOM 2012).

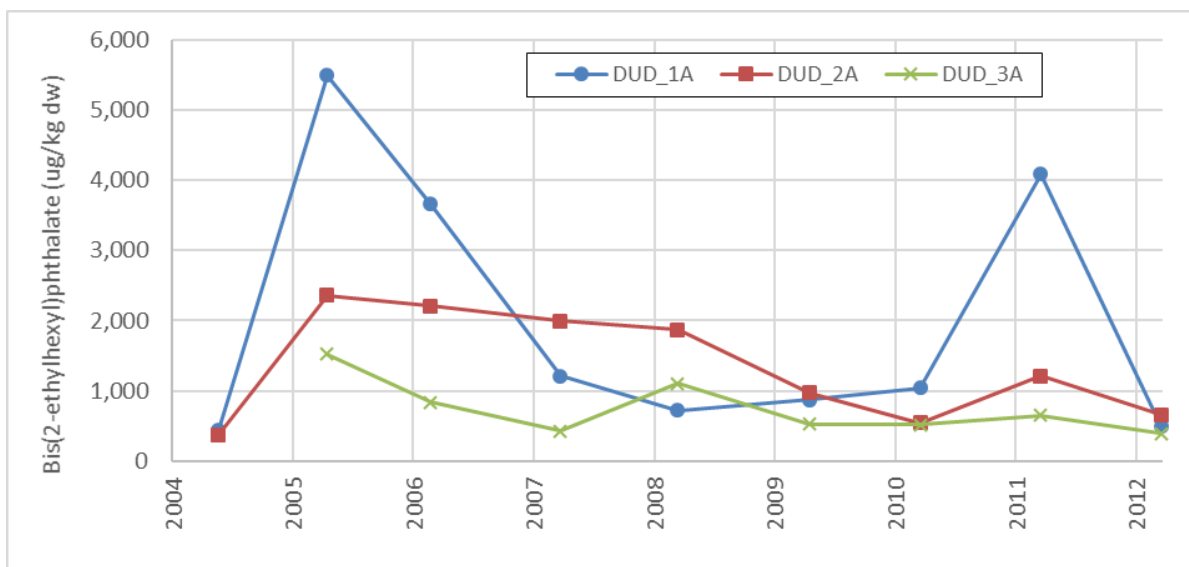


Figure C-8: BEHP in samples collected offshore of the Diagonal Ave S CSO/SD outfall post cleanup.

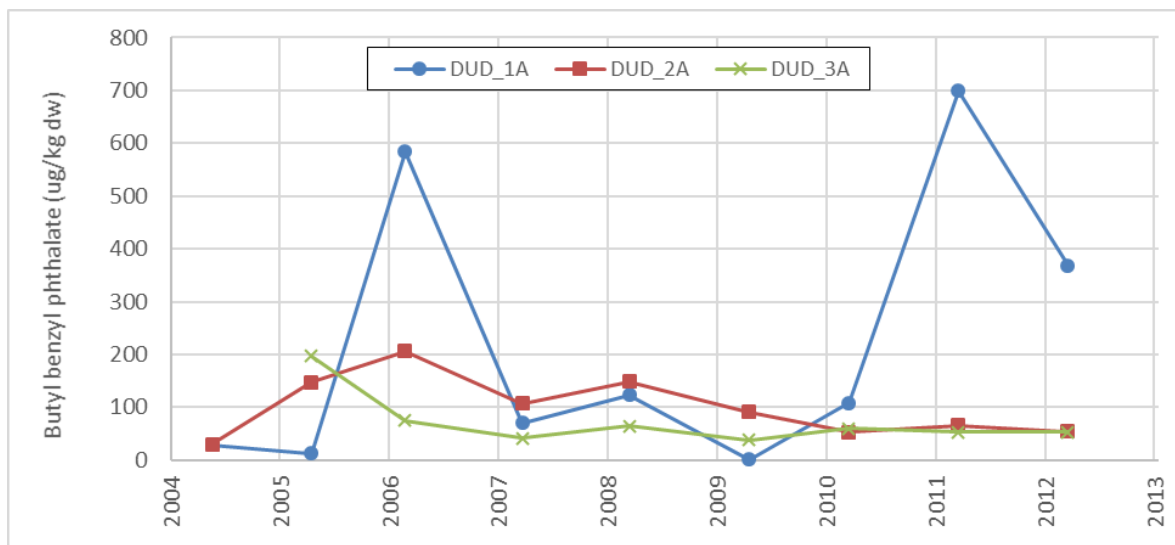


Figure C-9: Butyl benzyl phthalate in samples collected offshore of the Diagonal Ave S CSO/SD after cleanup.

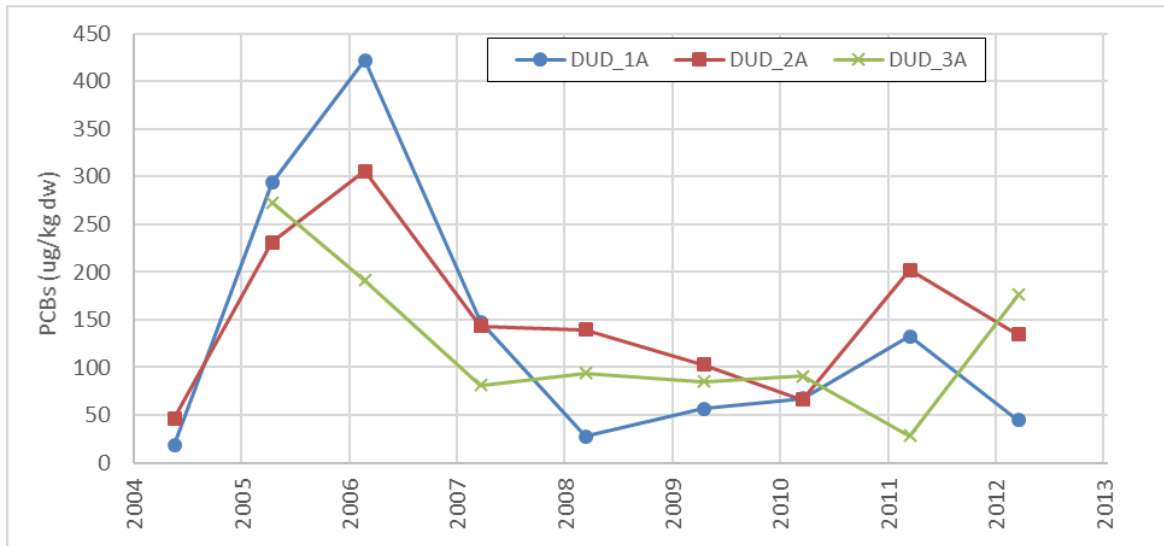


Figure C-10: PCBs in samples collected offshore of the Diagonal Ave S CSO/SD outfall after cleanup.

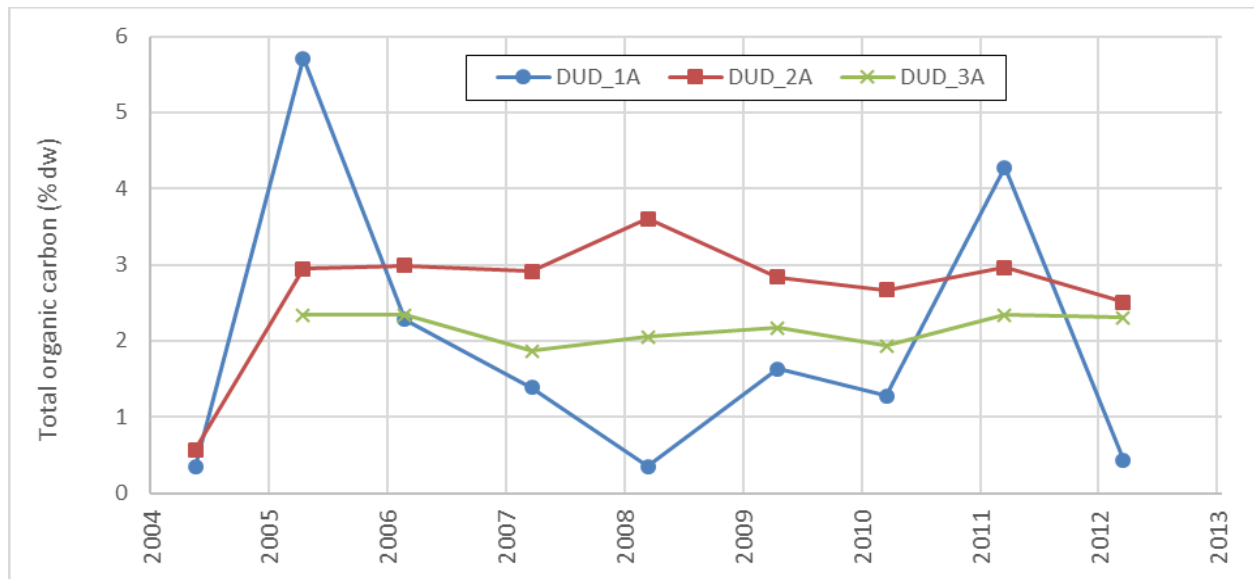


Figure C-11: Total organic carbon in samples collected offshore of the Diagonal Ave S CSO/SD after cleanup.

Results of the near end-of-pipe to waterway sediment comparisons are similar to the ST/BCM recontamination potential analysis from the FS. Both analyses predicted potential exceedances of the sediment RALs for BEHP, BBP, and PCBs. However, the storm drain solids to waterway sediment matches for PCBs are considered weak given that only 2 of 35 near end-of-pipe storm drains solids samples and 3 of 27 sediment samples collected offshore of the outfall after cleanup exceeded the respective criteria.

4.2.5. NEXT FIVE YEARS

Mercury, HPAH, and PCBs are the primary contaminants of concern in the Diagonal Ave S CSO/SD system, although these contaminants are found in different sub-basins within the overall drainage basin. Over the next five years, SPU intends to:

- Resample City mainline in Airport Wy S downstream of the Rainier Commons property at 3100 Airport Wy S and if necessary, require Rainier Commons to jet and clean onsite and affected MS4 to remove PCBs discharged from the site.
- Sample the 144-inch diameter trunkline downstream of Denver Ave S and the Denver Ave S sub-basin to monitor PCB levels following the cleanup of the spill that occurred in 2019.
- Monitor mercury and PCBs in the S Snoqualmie St sub-basin to assess whether source control actions have been effective.
- Conduct source tracing in the Bush Pl sub-basin to locate source(s) of HPAHs.
- Clean maintenance hole at ST2 (EQNUM 597066) where elevated lead levels were found in 2019 inline grab sample and inspect adjacent property.
- Conduct source tracing along Beacon Ave where elevated levels of lead were recently found in an inline sample.
- Work with businesses where elevated levels of mercury, LPAH, and HPAH have been found in private onsite catch basins to identify and control the source of these chemicals.
- Continue to monitor the two sediment traps installed in this system (ST1, ST2, ST09, and ST10).
- Continue inspecting businesses in the basin.

4.3. SW Dakota St SD

The SW Dakota St SD serves an area of about 47 acres²², encompassing commercial/industrial areas along W Marginal Wy SW, as well as developed/undeveloped residential parcels and large tracts owned by the Seattle Department of Parks and Recreation located on the hillside west of W Marginal Wy SW (Map 28). Land use in the basin is approximately 17.3 percent residential, 1.2 percent commercial, 44.7 percent industrial, 36.8 percent open/vacant/parks. The location of the SW Dakota St SD outfall was changed in 1994 when the Port constructed a wetland channel along the south side of their property at 3838 W Marginal Wy SW. The City's 30-inch diameter storm drain now discharges to the head of the channel approximately 800 feet from the waterway. When it was constructed in 1970, the SW Dakota St SD extended east along SW Dakota St and terminated at an existing ditch about 100 ft east from W Marginal Wy SW.

SPU jetted and cleaned the SW Dakota St SD system in 2016. Prior to cleaning, SPU collected eight storm drain solids samples from this system, five private onsite catch basin (CB41C, CB49, CB50, CB51, and CB52), two right-of-way catch basin (RCB43 and RCB185), and one inline (RCB200a) sample. Results are summarized in Table C-45.

Except for zinc, PCBs, and phthalates, contaminant levels were below SCO/LAET screening levels. Zinc (3,740 mg/kg) exceeded the CSL screening level in a private onsite catch basin (CB41C) located in the parking lot of a business park, which contains an aquarium manufacture/service business, radiator repair facility, and custom wheelchair distributor. BEHP (37,000 ug/kg dw) was also relatively high at this location. PCBs (133 – 610 ug/kg dw) were above the LAET screening level, but below the 2LAET screening level in all of the samples collected from this system. As shown in the box plots in Appendix B and in the storm drain to storm drain comparisons in Appendix J, chemical concentrations in the SW Dakota St SD were comparable to other storm drains sampled in the LDW.

²² Includes areas served by the City's SW Dakota St SD system, not the portion of Port property that drains to the wetland channel.

Table C-45: Summary of chemicals exceeding SMS screening levels in samples collected from the SW Dakota St drainage system before cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----------------|-------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 8 | <7 | 30 | 10 | 8 | 0 | 0 |
| Copper | 390 | 390 | 3 | 101 | 350 | 207 | 170 | 0 | 0 |
| Lead | 450 | 530 | 8 | 36 | 203 | 98 | 106 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 8 | <0.04 | 0.22 | 0.08 | 0.05 | 0 | 0 |
| Zinc | 410 | 960 | 3 | 202 | 3,740 | 1,460 | 424 | 67 | 33 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 5 | 330 | 2,000 | 1,120 | 1,100 | 0 | 0 |
| LPAH | 5,200 | 5,200 | 5 | 113 | 1,600 | 570 | 340 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 5 | <92 | 7,550 | 2,820 | 1,460 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 5 | <112 | 903 | 350 | 208 | 0 | 0 |
| PCBs | 130 | 1,000 | 5 | 133 | 610 | 288 | 223 | 100 | 0 |
| BEHP | 1,300 | 1,900 | 5 | 880 | 37,000 | 9,800 | 2,900 | 60 | 60 |
| Butylbenzyl phthalate | 63 | 900 | 5 | <56 | 19,000 | 4,500 | 1,300 | 80 | 60 |
| Dimethyl phthalate | 71 | 160 | 5 | <19 | 220 | 79 | 60 | 20 | 20 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use
- Sediment remedial action level

Samples collected February 2005 through April 2010.

During the current reporting period, two inline grabs were collected at the last maintenance hole on the drainage system (RCB200A). Results are provided in Table C-46. Sample locations are shown on Map 78. TPH-oil and bis(2-ethylhexyl)phthalate exceeded the respective MTCA and 2LAET screening levels. In addition, zinc, PCBs, butyl benzyl phthalate, and dimethyl phthalate exceeded the SCO/LAET screening levels. All other chemicals were below screening levels. However, chemical concentrations were comparable to other storm drains sampled in the LDW.

Table C-46: Results for storm drain solids samples collected from SW Dakota St SD after cleaning (2014-2019).

| | SCO LAET | CSL 2LAET | RCB200A ^a 06/12/18 | RCB200A ^a 06/06/19 |
|-----------------------|--------------------|--------------------|----------------------------------|----------------------------------|
| Arsenic | 57 | 93 | 16.5 U | 8.31 |
| Copper | 390 | 390 | 135 | 138 |
| Lead | 450 | 530 | 113 | 111 |
| Mercury | 0.41 | 0.59 | 0.174 | 0.262 |
| Zinc | 410 | 960 | 932 | 921 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 3,060 | 5,200 |
| LPAH | 5,200 | 5,200 | 548 J | 874 J |
| HPAH | 12,000 | 17,000 | 3,681 J | 7,147 J |
| cPAH | 1,000 ^c | 1,000 ^c | 457 J | 716 J |
| PCBs | 130 | 1,000 | 259.7 | 198.1 J |
| BEHP | 1,300 | 1,900 | 6,850 | 12,500 |
| Butylbenzyl phthalate | 63 | 900 | 295 U | 489 |
| Dimethyl phthalate | 71 | 160 | 295 U | 173 J |



Exceeds SCO/LAET

Exceeds CSL/2LAET

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH.

a. RCB200A is a near end-of-pipe inline grab sample

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

c. Sediment remedial action level.

One sample has been collected within 25 feet of the City's storm drain outfall (SS2149-A). Zinc (478 mg/kg), butyl benzyl phthalate (220 ug/kg dw), BEHP (1,700 ug/kg dw), and PCBs (146 ug/kg dw) exceeded the SCO and benzyl alcohol (100 ug/kg dw) exceeded the CSL.

Over the next five years, SPU intends to conduct the following activities in the SW Dakota St SD basin:

- Establish a long-term monitoring station near the downstream end of this system to monitor the quality of storm drain solids discharged to the LDW and assess whether installing one of the new sediment traps would provide a more representative sample of near end-of-pipe solids in this system.
- Continue inspecting businesses.

4.4. SW Idaho St SD

The SW Idaho St SD serves an area of about 423 acres (Map 29). The drainage basin is predominately residential (45.7 percent) with commercial/industrial areas (23.6 percent) located along W Marginal Wy SW. A significant portion of the basin is undeveloped (30.7 percent). The lower basin on the steep hillside west of W Marginal Wy SW is mostly undeveloped land owned by the Seattle Department of Parks and Recreation. Puget Creek enters the SW Idaho St drainage system just west of W Marginal Wy S at Puget Wy SW.

SPU jetted and cleaned the SW Idaho St SD in 2012-2013.²³ A total of 24 storm drain solids samples were collected from this system prior to cleaning (10 inline grab, 9 sediment trap, and 5 right-of-way catch basin samples). Results are summarized in Table C-47. Arsenic, copper, lead, and mercury were below the SCO screening level in all samples. Zinc exceeded the CSL screening level in one sample (1,540 in 2012) and the SCO screening level in 2 samples (794 and 836 mg/kg, respectively in 2010 and 2009) collected in sediment trap ID-ST1. ID-ST1 is located at the downstream end of the upper, primarily residential sub-basin. The two highest LPAH (4,190 – 8,310 ug/kg dw) and HPAH concentrations (88,600 – 108,800 ug/kg dw) were also observed at this station. In addition, two of the four inline samples (grabs and traps) at this location also exceeded the MTCA level A soil screening level for TPH-oil (2,700 – 7,700 mg/kg). SPU conducted extensive source tracing in the upper basin during the previous reporting period, but no specific sources were identified. The upper basin is almost entirely residential. The South Seattle Community College is the only non-residential site. SPU inspected the campus in 2011, 2014, and 2017 but did not find any relationship between onsite activities and the elevated levels of PAHs observed at station ID-ST1.

Table C-47: Summary of chemicals exceeding SMS screening levels in samples collected from the SW Idaho St SD system before cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|--------------------------|--------------------|--------------------|----------------|-------|---------|-------|--------|---|--|
| Arsenic | 57 | 93 | 24 | <5 | 20 | 8 | 9 | 0 | 0 |
| Copper | 390 | 390 | 24 | 16.7 | 194 | 59 | 33 | 0 | 0 |
| Lead | 450 | 530 | 24 | 7 | 113 | 49 | 34 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 24 | <0.02 | 0.28 | 0.09 | 0.06 | 0 | 0 |
| Zinc | 410 | 960 | 24 | 58 | 1,540 | 300 | 168 | 13 | 4 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 24 | 60 | 7,700 | 1,100 | 445 | 17 | 17 |
| LPAH | 5,200 | 5,200 | 24 | <18 | 8,310 | 660 | 68 | 4 | 4 |
| HPAH | 12,000 | 17,000 | 24 | <38 | 108,800 | 9,900 | 667 | 8 | 8 |
| cPAH | 1,000 ^c | 1,000 ^c | 24 | <17 | 14,600 | 1,200 | 94 | 8 | 8 |
| PCBs | 130 | 1,000 | 28 | 8 | 391 | 92 | 20 | 25 | 0 |
| BEHP | 1,300 | 1,900 | 24 | 40 | 20,000 | 2,300 | 570 | 29 | 21 |
| Butylbenzyl phthalate | 63 | 900 | 24 | <18 | 1,400 | 230 | 61 | 46 | 8 |
| Dimethyl phthalate | 71 | 160 | 24 | <18 | 255 | 47 | 58 | 13 | 8 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level

Samples collected September 2008 through April 2013.

²³ All but the lower approximately 3,600 feet of the system was cleaned in 2012. The remainder was cleaned in 2013.

SPU has collected 23 storm drain solids samples in the SW Idaho St SD since it was cleaned. Results are summarized in Table C-48. Sample locations are shown on Map 79. PAH concentrations have declined since the previous reporting period. However, cPAH exceeded the RAL screening level in 14 percent of the samples.

Table C-48: Summary of chemicals exceeding SMS screening levels in samples collected from the SW Idaho St SD system after cleaning.

| | SCO LAET | CSL 2LAET | N ^a | Min | Max | Mean | Median | Percent of samples >SCO LAET screening level | Percent of samples >CSL 2LAET screening level |
|---------------------------|--------------------|--------------------|----------------|--------|--------|-------|--------|---|--|
| Arsenic | 57 | 93 | 21 | <6 | 30 | 12 | 11 | 0 | 0 |
| Copper | 390 | 390 | 21 | 17.4 | 139 | 54 | 31.5 | 0 | 0 |
| Lead | 450 | 530 | 21 | 9.18 | 111 | 46 | 46 | 0 | 0 |
| Mercury | 0.41 | 0.59 | 21 | <0.024 | 0.23 | 0.10 | 0.08 | 0 | 0 |
| Zinc | 410 | 960 | 21 | 74 | 1,200 | 380 | 225 | 24 | 14 |
| TPH-oil | 2,000 ^b | 2,000 ^b | 20 | 53 | 5,700 | 910 | 340 | 15 | 15 |
| LPAH | 5,200 | 5,200 | 22 | <40 | 1,111 | 290 | 122 | 0 | 0 |
| HPAH | 12,000 | 17,000 | 22 | <58 | 10,190 | 2,500 | 888 | 0 | 0 |
| cPAH | 1,000 ^c | 1,000 ^c | 22 | <52 | 1,406 | 330 | 129 | 14 | 14 |
| PCBs | 130 | 1,000 | 23 | <18.3 | 402 | 130 | 40 | 35 | 0 |
| BEHP | 1,300 | 1,900 | 22 | 122 | 14,000 | 3,500 | 924 | 45 | 45 |
| Butyl benzyl phthalate | 63 | 900 | 22 | <19.9 | 4,030 | 510 | 52.3 | 45 | 14 |
| Dimethyl phthalate | 71 | 160 | 22 | <19.5 | 249 | 52 | 46.7 | 23 | 5 |

N = number of samples

BEHP = bis(2-ethylhexyl)phthalate

PCBs = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons, TPH = total petroleum hydrocarbons

Units: mg/kg for metals and TPH-oil, ug/kg dw for organic compounds, ug TEQ/kg for cPAH

Samples collected September 2009 through April 2019.

- Includes all samples collected in the MS4 that have not been affected by cleaning operations (i.e., data flagged as “never been cleaned” or “post cleaning”). Does not include ODS (outside the drainage system) samples, which include surface dirt, soil, or other materials (e.g., caulk, paint)
- MTCA Method A soil cleanup level for unrestricted use.
- Sediment remedial action level

Chemical concentrations in the SW Idaho St SD are similar to the levels observed in other storm drains in the LDW. In addition, metals, PAHs, and bis(2-ethylhexyl)phthalate were below both the CSL/2LAET and the SCO/LAET in all six of the near end-of-pipe samples. Butyl benzyl phthalate, dimethyl phthalate and PCBs were below the 2 LAET in all six samples, but exceeded the LAET in 3, 1, and 2, samples, respectively.

None of the surface sediment samples collected within 72-165 feet of the SW Idaho St SD outfall exceeded SCO levels (LDW-SS14, WIT299, DR036, DR067, and SS2147; AECOM 2012 and SAIC 2011). One sample collected about 180 feet upstream of the outfall (TRI-016) exceeded the SCO for benzyl alcohol, 2,4-dimethylphenol, and phenol. Benzyl alcohol has been detected in 16 of the 31 samples collected to date from the SW Idaho St SD. Concentrations ranged from 24-6,400 ug/kg with an average concentration of about 582 ug/kg dw.²⁴ 2,4-

²⁴ Non-detected values are included at half the detection limit.

Dimethylphenol has not been detected and phenol was only detected in 12 of the 31 samples collected from the SW Idaho St SD. Phenol concentrations have ranged from <18 to 820 ug/kg dw, with an average of 147 ug/kg dw. Given that the sampling stations closer to the outfall did not exceed the SCO, it is unlikely that the SW Idaho St SD is a significant contributor to the SCO exceedances at the 180-foot station.

Over the next 5 years, SPU intends to conduct the following activities in the SW Idaho St SD basin:

- Continue to operate and maintain the existing sediment traps in this system to assess whether additional source controls are needed
- Continue to inspect the community college, which is currently ranked a high priority²⁵.

4.5. South Operations Center SD

SPU purchased the former Grayline/Evergreen Bus Company site at 4500 W Marginal Wy SW in 2013 (Map 30). The 6-acre site was vacant until 2019 when SPU opened its South Operation Center, which houses Field Operations staff that cover the south end of Seattle (south of Denny Way), associated vehicles and heavy equipment (dump trucks, mowers, excavators, backhoes, vector trucks), and also contains storage bins for materials (e.g., sand, topsoil, gravel, and waste material from day-to-day operations).

Runoff from the site passes through a presettling vault and an oil/water separator before discharging to the waterway via a 30-inch outfall. SPU cleaned the vault and separator in 2018. No samples have been collected from the drainage system.²⁶

Five surface sediment samples were collected within 200 feet of the outfall in 1996, the closest sample (SD-16) was collected about 20 feet shortly upstream of the outfall. No SMS exceedances were reported at any of the locations.

Over the next five years, SPU intends to conduct the following activities in the South Operations Center SD basin:

- Collect an inline grab sample from the downstream-most maintenance hole in the system (EQNUM 1051294), or presettling vault, or oil/water separator, wherever there is enough material for chemical analysis.
- Inspect SPU operations.

5. REFERENCES

AECOM. 2012. Final Feasibility Study Lower Duwamish Waterway, Seattle, Washington. Prepared for Lower Duwamish Waterway Group (Port of Seattle / City of Seattle / King County / The Boeing Company by AECOM, Seattle, WA. Surface sediment data downloaded from: http://www.ldwg.org/rifs_docs9.htm.

Cabanillas, D. 2019. Personal Communication (Technical memorandum from to Jim Flynn, AECOM and Roy Kuroiwa, Port of Seattle regarding T117 early action area sediment sampling, January 8, 2019). AECOM, Seattle, WA.

Anchor. 2007. Duwamish/Diagonal sediment remediation project. 2005 monitoring report. Prepared for King County Department of Natural Resources and Parks by Anchor Environmental, LLC, Seattle, WA.

²⁵ High ranked businesses are inspected every two years.

²⁶ SPU attempted to sample storm drain solids in August 2018, but there was not enough material in the system

Integral, DCG, Inc., and Moffat & Nichol. 2014. Final Removal Action Design Report, Adjacent streets and stormwater, Lower Duwamish Waterway Superfund site, Terminal 117 Early Action Area. Prepared for City of Seattle By Integral Consulting, Seattle, WA, DCG, Inc., Lake Forest Park, WA and Moffat & Nichol, Seattle, WA.

Integral. 2017. Removal action construction and completion report. Phase 2: Adjacent streets and residential yards study area, Part 2: Adjacent streets and stormwater, Lower Duwamish Waterway Superfund site, Terminal 117 early action area. Prepared for City of Seattle by Integral Consulting, Inc., Seattle, WA.

Integral and AECOM. 2018. Final joint long-term monitoring and maintenance plan. Lower Duwamish Waterway Superfund site, Terminal 117 early action area. Prepared for the Port of Seattle and City of Seattle by Integral Consulting, Inc., Seattle, WA and AECOM Environment, Seattle, WA.

King County and Anchor. 2008. Duwamish/Diagonal sediment remediation project, 2006/2007 monitoring report. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources and Parks, Seattle, WA and Anchor Environmental, LLC, Seattle, WA.

King County. 1999. Norfolk CSO sediment remediation project, Five-year monitoring program, April 1999 monitoring report. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources, Seattle, WA.

King County. 2001. Norfolk CSO sediment remediation project, Five-year monitoring program, Annual monitoring report – year two, April 2001. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources, Seattle, WA.

King County. 2002. Norfolk CSO sediment remediation project, Five-year monitoring program, Annual monitoring report – year three, April 2002. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources, Seattle, WA.

King County. 2003. Norfolk CSO sediment remediation project, Five-year monitoring program, Annual monitoring report – year four, April 2003. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources, Seattle, WA.

King County. 2005. Norfolk CSO sediment remediation project, Five-year monitoring program, Annual monitoring report – year five, April 2004. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources, Seattle, WA.

King County. 2010. Duwamish/Diagonal sediment remediation project, 2008/2009 monitoring report. Panel Publication 42. Prepared for the Elliott Bay/Duwamish Restoration Program by King County Department of Natural Resources and Parks, Seattle, WA.

King County. 2015b. Duwamish/Diagonal Sediment Remediation Project, Final 2010 Monitoring Report, Panel Publication 43. Water and Land Resources Division, King County Department of Natural Resources and Parks, Seattle, WA.

Leidos. 2015a. NPDES inspection sampling support 2014/2015, Appendix T: Duwamish Substation. Prepared for Toxics Cleanup Program, Washington State Department of Ecology by Leidos, Bothell, WA.

Leidos. 2015b. NPDES inspection sampling support 2014/2015, Appendix S: South Service Station. Prepared for Toxics Cleanup Program, Washington State Department of Ecology by Leidos, Bothell, WA.

SAIC. 2011. Surface sediment sampling at outfalls in the Lower Duwamish Waterway Seattle, WA, Data Report. Prepared for Washington State Department of Ecology, Toxics Cleanup Program, Northwest Regional Office by Science Applications International Corporation, Bothell, WA.

SPU. 2012. City of Seattle 2012 Phase 1 Municipal Stormwater Permit, Stormwater Monitoring Report. Seattle Public Utilities, Seattle, WA. Available at:

<http://www.seattle.gov/Documents/Departments/SPU/Documents/2012AttachmentCAAnnualMonitoringReport.pdf>

SPU. 2018. T117 Adjacent streets and stormwater maintenance monitoring, Bioretention cell and Filterra™ Tree Box unit underdrain sampling, quality assurance project plan. Seattle Public Utilities, Seattle, WA.

U.S. District Court. 2019. Consent Decree. Puget SoundKeeper Alliance v. Seattle Iron & Metals, Corp. Case No. 12-01201RSM. Western District of Washington at Seattle.

Windward. 2018. Technical memorandum: compilation of existing data. Prepared for Lower Duwamish Waterway Group by Windward Environmental, Seattle, WA.

Windward. 2019. Final Lower Duwamish Waterway surface sediment data report. Prepared for Lower Duwamish Waterway Group by Windward Environmental, Seattle, WA.

Windward. 2020. Lower Duwamish Waterway Slip 4 early action area. Long-term monitoring data report for the Slip 4 early action area: Year 7 (2019). Prepared for the City of Seattle by Windward Environmental, LLC, Seattle, WA.