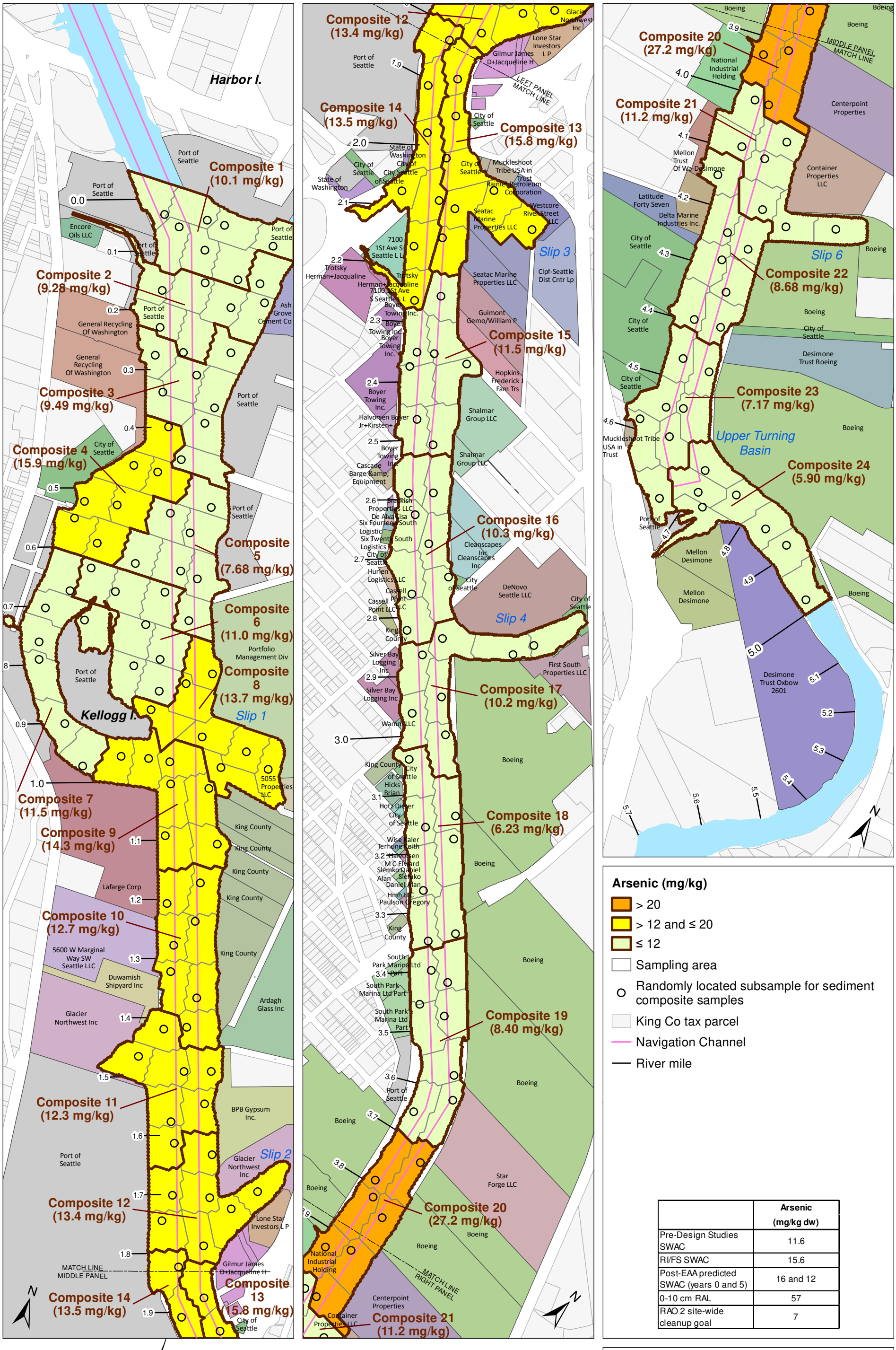
Arsenic results for 2018 surface sediment (0-10 cm) composite areas

DRAFT



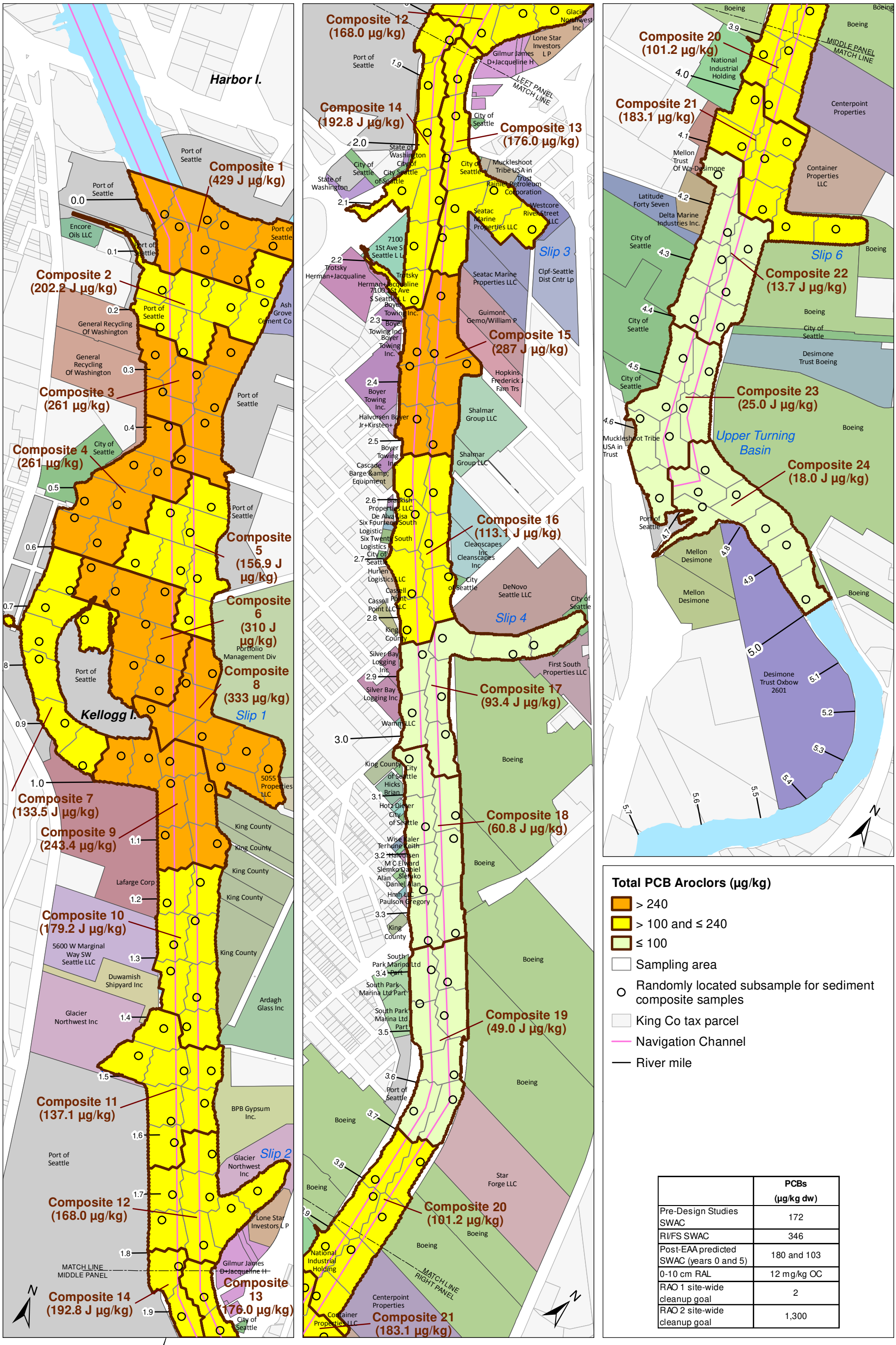
	Arsenic (mg/kg dw)
Pre-Design Studies SWAC	11.6
RI/FS SWAC	15.6
Post-EAA predicted SWAC (years 0 and 5)	16 and 12
0-10 cm RAL	57
RAO 2 site-wide cleanup goal	7

Windward environmental LLC

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

Prepared by craigh, 9/21/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 05 Data Reports\Surface Sediment\6849 Surface sediment compositing data - Arsenic.mxd


Harbor I.
Kellogg I.
Slip 1
Slip 2
Slip 3
Slip 4
Slip 6
Upper Turning Basin
Composite 1 (429 J µg/kg)
Composite 2 (202.2 J µg/kg)
Composite 3 (261 µg/kg)
Composite 4 (261 µg/kg)
Composite 5 (156.9 J µg/kg)
Composite 6 (310 J µg/kg)
Composite 7 (133.5 J µg/kg)
Composite 8 (333 µg/kg)
Composite 9 (243.4 µg/kg)
Composite 10 (179.2 J µg/kg)
Composite 11 (137.1 µg/kg)
Composite 12 (168.0 µg/kg)
Composite 13 (176.0 µg/kg)
Composite 14 (192.8 J µg/kg)
Composite 15 (287 J µg/kg)
Composite 16 (113.1 J µg/kg)
Composite 17 (93.4 J µg/kg)
Composite 18 (60.8 J µg/kg)
Composite 19 (49.0 J µg/kg)
Composite 20 (101.2 µg/kg)
Composite 21 (183.1 µg/kg)
Composite 22 (13.7 J µg/kg)
Composite 23 (25.0 J µg/kg)
Composite 24 (18.0 J µg/kg)
MIDDLE PANEL MATCH LINE
LEFT PANEL MATCH LINE
MATCH LINE RIGHT PANEL
MATCH LINE MIDDLE PANEL
Port of Seattle
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Wamm LLC
Hotz Dieter
Wise Raler Terhune Keith
Halvorsen M C Elward
Slemko Daniel Slemko Alan
Daniell Alan
Hmh LLC
Paulson Gregory
South Park Marina Ltd Part
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De Alva Lisa
Six Fourteen South Logistic
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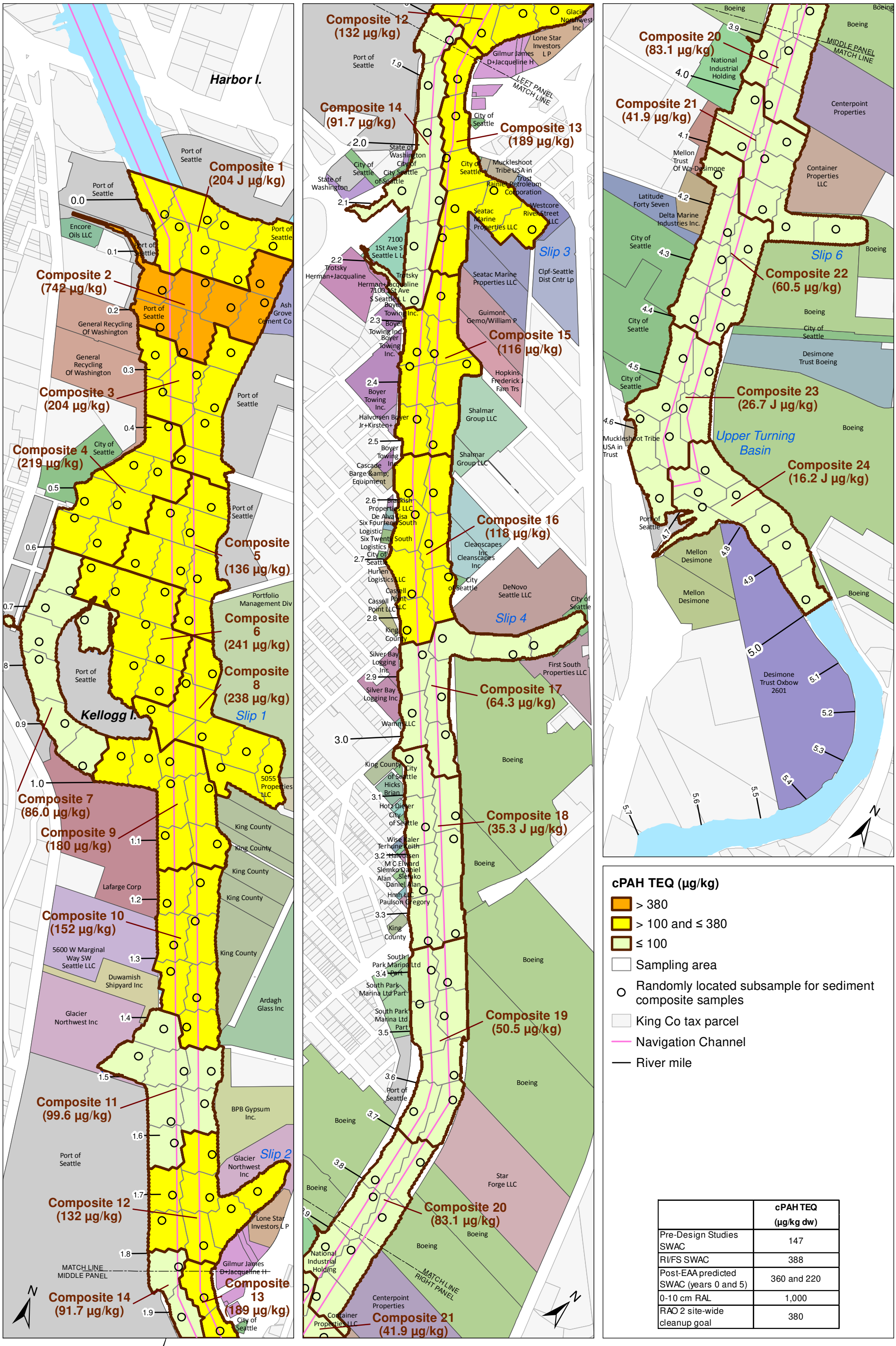
Latitude Forty Seven
Delta Marine Industries Inc.
Desimone Trust Boeing
Mellon Desimone
Desimone Trust Oxbow 2601
Star Forge LLC
Total PCB Aroclors (µg/kg)
> 240
> 100 and ≤ 240
≤ 100
Sampling area
Randomly located subsample for sediment composite samples
King Co tax parcel
Navigation Channel
River mile
PCBs (µg/kg dw)
Pre-Design Studies SWAC 172
RI/FS SWAC 346
Post-EAA predicted SWAC (years 0 and 5) 180 and 103
0-10 cm RAL 12 mg/kg OC
RAO 1 site-wide cleanup goal 2
RAO 2 site-wide cleanup goal 1,300
0 0.1 0.2 Miles
0 0.2 0.4 Kilometers
Scale is the same for each inset map
Total PCB Aroclors results for 2018 surface sediment (0-10 cm) composite areas
DRAFT
Windward environmental LLC
Lower Duwamish Waterway Group
Port of Seattle / City of Seattle / King County / The Boeing Company
Prepared by craigh, 9/27/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 05 Data Reports\Surface Sediment\6849 Surface sediment compositing data - tPCB Aroclors.mxd



	cPAH TEQ (µg/kg dw)
Pre-Design Studies SWAC	147
RI/FS SWAC	388
Post-EAA predicted SWAC (years 0 and 5)	360 and 220
0-10 cm RAL	1,000
RAO 2 site-wide cleanup goal	380

cPAH TEQs for 2018 surface sediment (0-10 cm) composite areas

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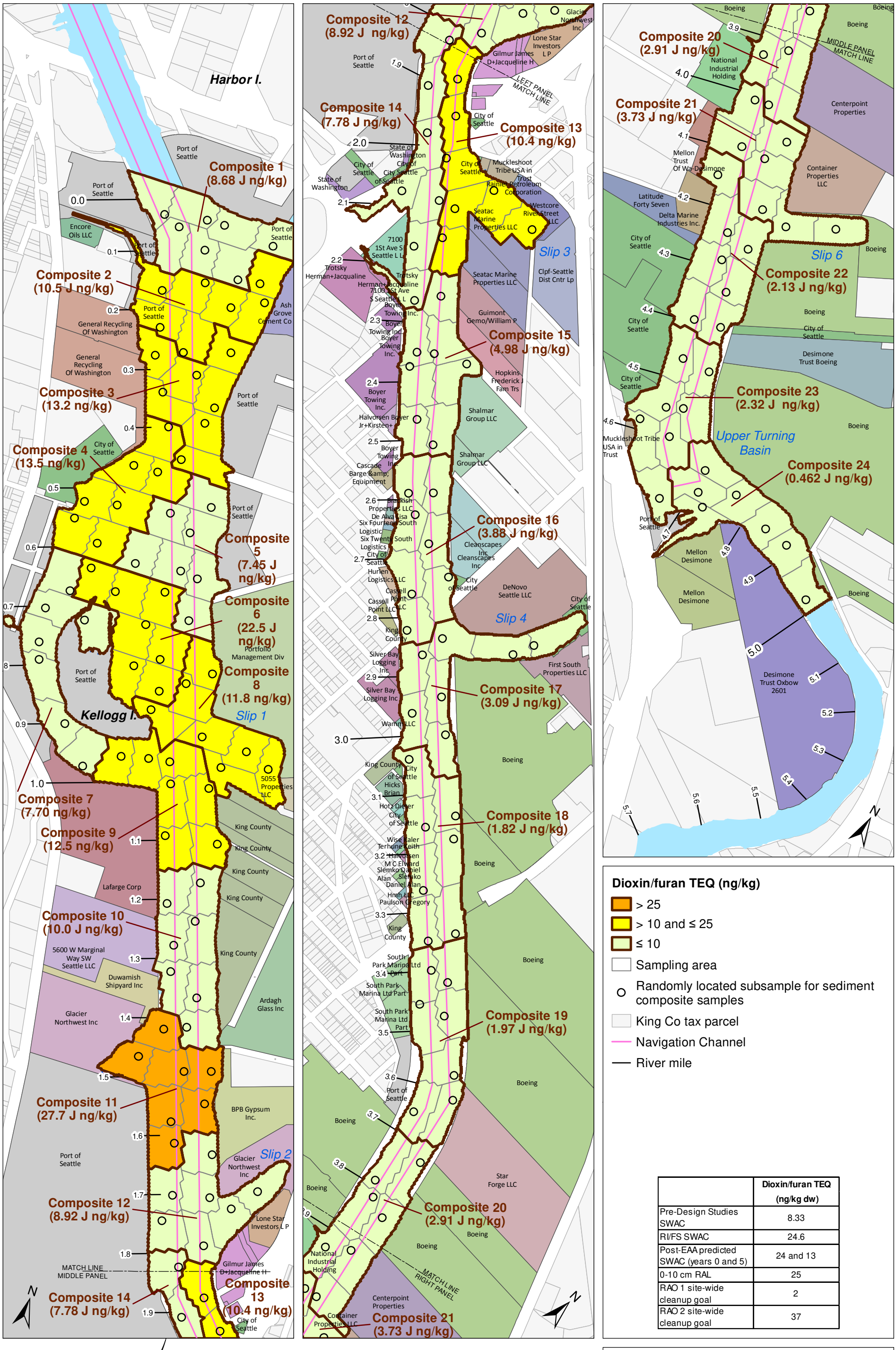

	Dioxin/furan TEQ (ng/kg dw)
Pre-Design Studies SWAC	8.33
RI/FS SWAC	24.6
Post-EAA predicted SWAC (years 0 and 5)	24 and 13
0-10 cm RAL	25
RAO 1 site-wide cleanup goal	2
RAO 2 site-wide cleanup goal	37

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Dioxin/furan TEQs for 2018 surface sediment (0-10 cm) composite areas

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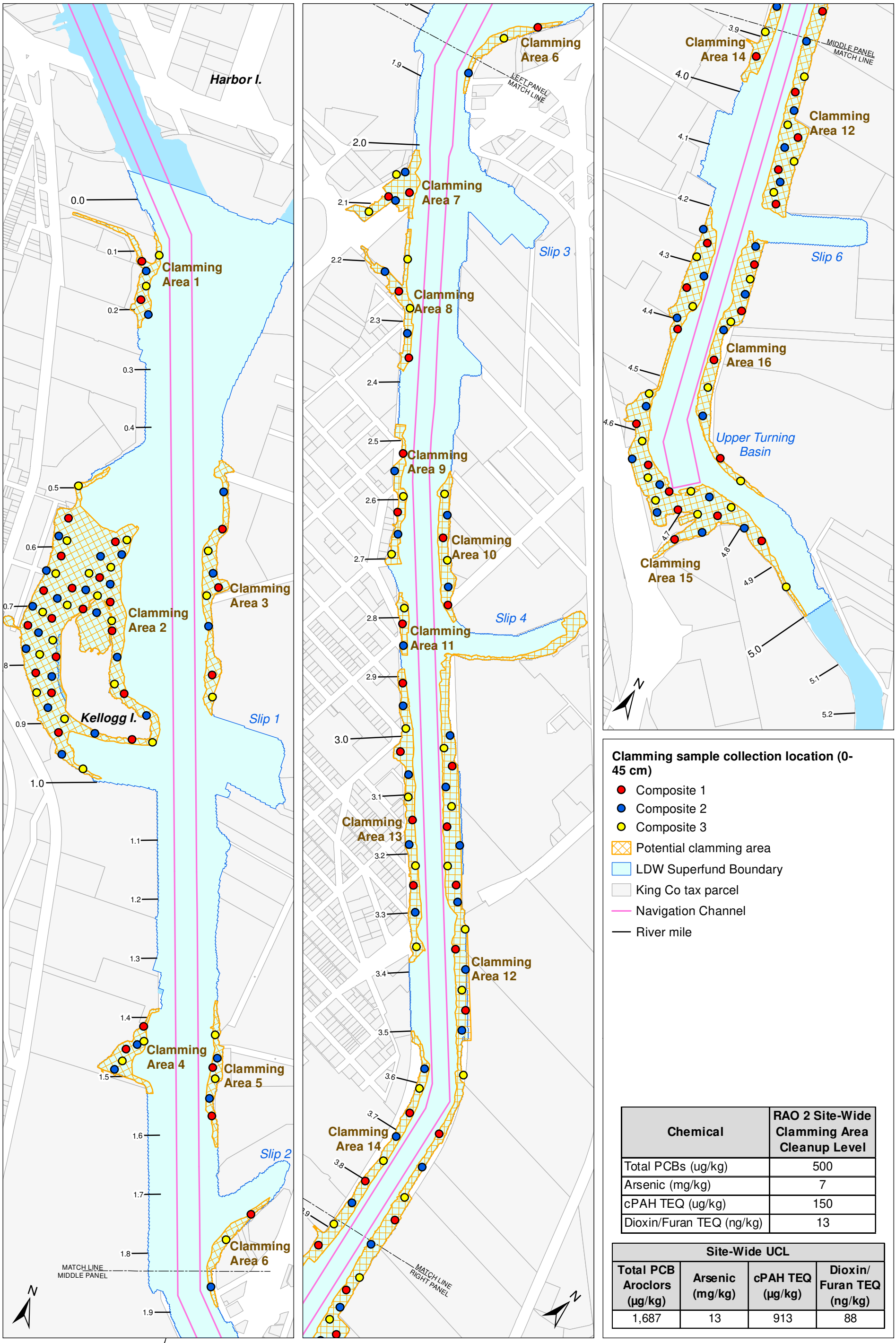

Clamming sample collection location (0-45 cm)

- Composite 1
- Composite 2
- Composite 3
- Potential clamming area
- LDW Superfund Boundary
- King Co tax parcel
- Navigation Channel
- River mile

Chemical	RAO 2 Site-Wide Clamming Area Cleanup Level
Total PCBs (ug/kg)	500
Arsenic (mg/kg)	7
cPAH TEQ (ug/kg)	150
Dioxin/Furan TEQ (ng/kg)	13

Site-Wide UCL			
Total PCB Aroclors (µg/kg)	Arsenic (mg/kg)	cPAH TEQ (µg/kg)	Dioxin/ Furan TEQ (ng/kg)
1,687	13	913	88

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0 0.1 0.2 Miles

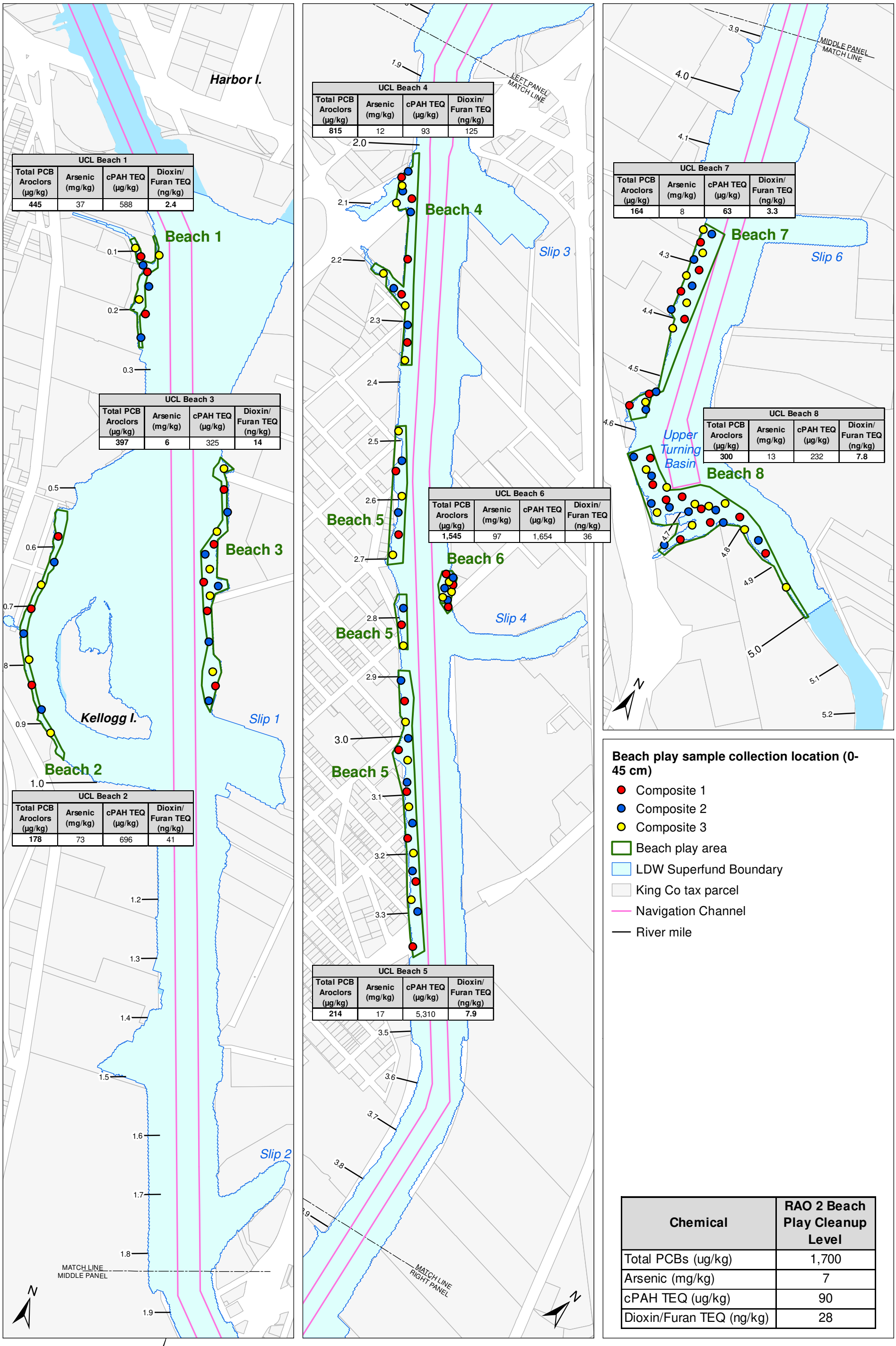
0 0.2 0.4 Kilometers

Scale is the same for each inset map

Comparison of potential clamming area site-wide UCLs with RAO 2 cleanup levels

DRAFT

Prepared by craigh, 9/27/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 06 Data Evaluation Report\KC-POS 20180919\6517 Intertidal locations - clamming.mxd



Beach play sample collection location (0-45 cm)

- Composite 1
- Composite 2
- Composite 3
- Beach play area
- LDW Superfund Boundary
- King Co tax parcel
- Navigation Channel
- River mile

Chemical	RAO 2 Beach Play Cleanup Level
Total PCBs (ug/kg)	1,700
Arsenic (mg/kg)	7
cPAH TEQ (ug/kg)	90
Dioxin/Furan TEQ (ng/kg)	28

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0 0.1 0.2 Miles

0 0.2 0.4 Kilometers

Scale is the same for each inset map

Comparison of 2018 UCLs for each beach with RAO 2 beach play cleanup levels

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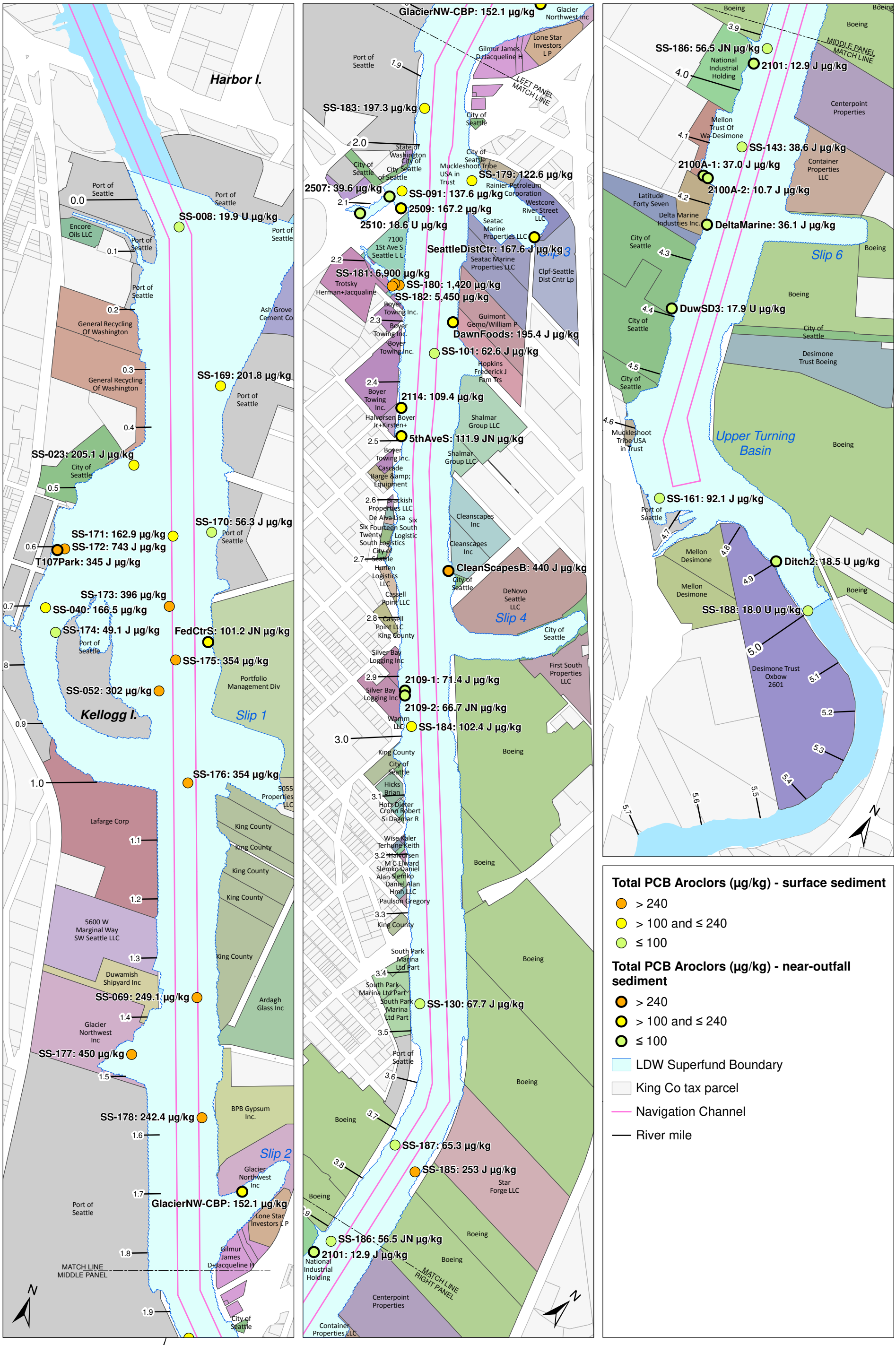
Prepared by craigh, 9/27/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 06 Data Evaluation Report\KC-POS 20180919\6517 Intertidal locations - beach play.mxd


Harbor I.
Kellogg I.
Slip 1
Slip 2
Slip 3
Slip 4
Slip 6
Upper Turning Basin
SS-008: 19.9 U µg/kg
SS-169: 201.8 µg/kg
SS-023: 205.1 J µg/kg
SS-170: 56.3 J µg/kg
SS-171: 162.9 µg/kg
SS-172: 743 J µg/kg
T107Park: 345 J µg/kg
SS-173: 396 µg/kg
SS-040: 166.5 µg/kg
SS-174: 49.1 J µg/kg
FedCtrS: 101.2 JN µg/kg
SS-175: 354 µg/kg
SS-052: 302 µg/kg
SS-176: 354 µg/kg
SS-069: 249.1 µg/kg
SS-177: 450 µg/kg
SS-178: 242.4 µg/kg
GlacierNW-CBP: 152.1 µg/kg
SS-183: 197.3 µg/kg
2507: 39.6 µg/kg
SS-091: 137.6 µg/kg
2509: 167.2 µg/kg
2510: 18.6 U µg/kg
SS-179: 122.6 µg/kg
SeattleDistCtr: 167.6 J µg/kg
SS-181: 6,900 µg/kg
SS-180: 1,420 µg/kg
SS-182: 5,450 µg/kg
DawnFoods: 195.4 J µg/kg
SS-101: 62.6 J µg/kg
2114: 109.4 µg/kg
5thAveS: 111.9 JN µg/kg
CleanScapesB: 440 J µg/kg
2109-1: 71.4 J µg/kg
2109-2: 66.7 JN µg/kg
SS-184: 102.4 J µg/kg
SS-130: 67.7 J µg/kg
SS-187: 65.3 µg/kg
SS-185: 253 J µg/kg
SS-186: 56.5 JN µg/kg
2101: 12.9 J µg/kg
SS-143: 38.6 J µg/kg
2100A-1: 37.0 J µg/kg
2100A-2: 10.7 J µg/kg
DeltaMarine: 36.1 J µg/kg
DuwSD3: 17.9 U µg/kg
SS-161: 92.1 J µg/kg
Ditch2: 18.5 U µg/kg
SS-188: 18.0 U µg/kg
MIDDLE PANEL MATCH LINE
LEFT PANEL MATCH LINE
MATCH LINE MIDDLE PANEL
MATCH LINE RIGHT PANEL
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Boeing
City of Seattle
King County
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Lone Star Investors L P
Gilmur James D+Jacqueline H
National Industrial Holding
Centerpoint Properties
Container Properties LLC
Star Forge LLC
Total PCB Aroclors (µg/kg) - surface sediment
> 240
> 100 and ≤ 240
≤ 100
Total PCB Aroclors (µg/kg) - near-outfall sediment
> 240
> 100 and ≤ 240
≤ 100
LDW Superfund Boundary
King Co tax parcel
Navigation Channel
River mile
0 0.1 0.2 Miles
0 0.2 0.4 Kilometers
Scale is the same for each inset map
Total PCB Aroclors results for 2018 surface sediment (0-10 cm) individual locations
DRAFT
Windward environmental LLC
Lower Duwamish Waterway Group
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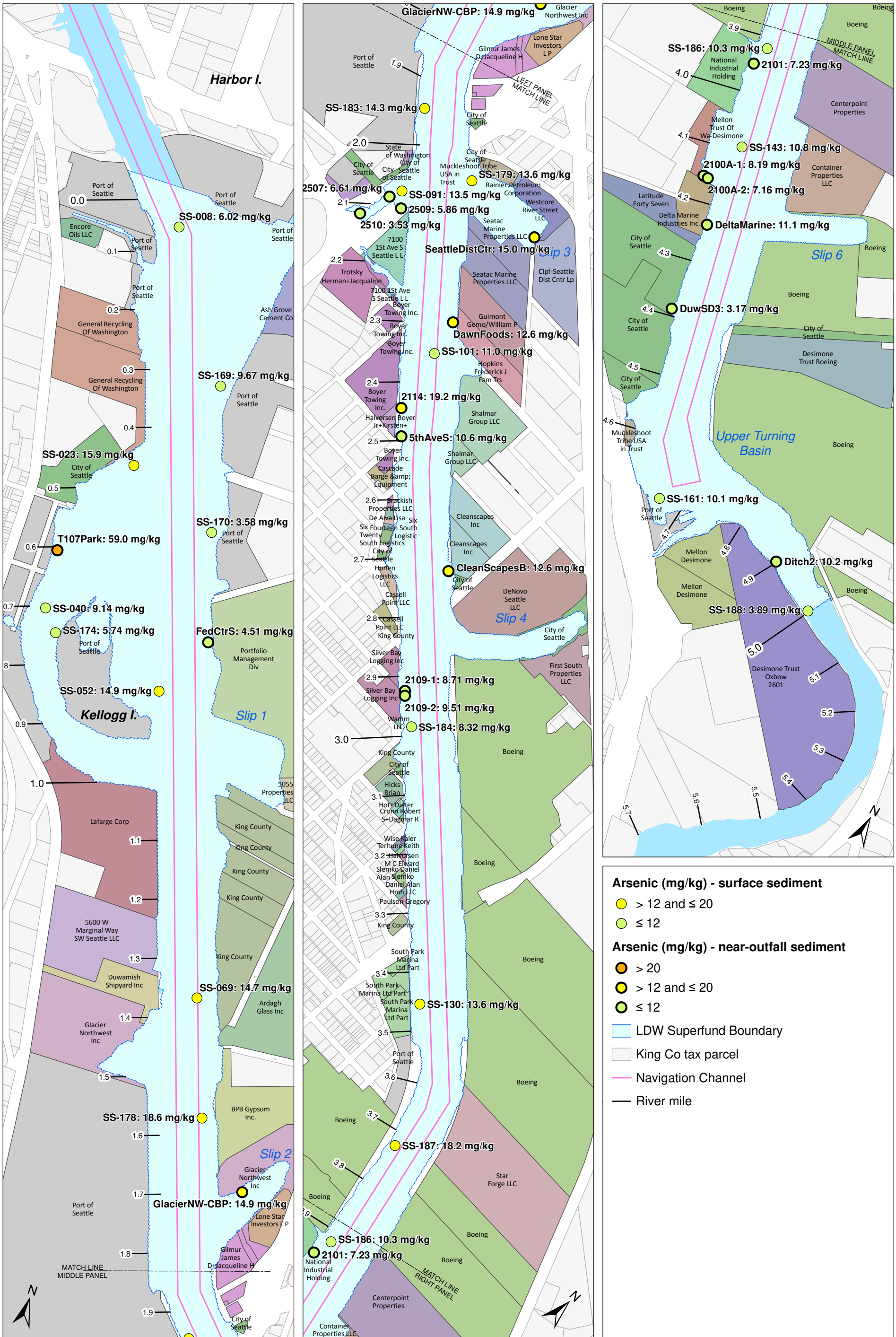
Prepared by craigh, 9/21/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 05 Data Reports\Surface Sediment\6849 Surface sediment individual data - tPCB Aroclors.mxd



Arsenic (mg/kg) - surface sediment

- > 12 and ≤ 20
- ≤ 12

Arsenic (mg/kg) - near-outfall sediment

- > 20
- > 12 and ≤ 20
- ≤ 12

LDW Superfund Boundary

King Co tax parcel

Navigation Channel

River mile

0 0.1 0.2 Miles

0 0.2 0.4 Kilometers

Scale is the same for each inset map

Arsenic results for 2018 surface sediment (0-10 cm) individual locations

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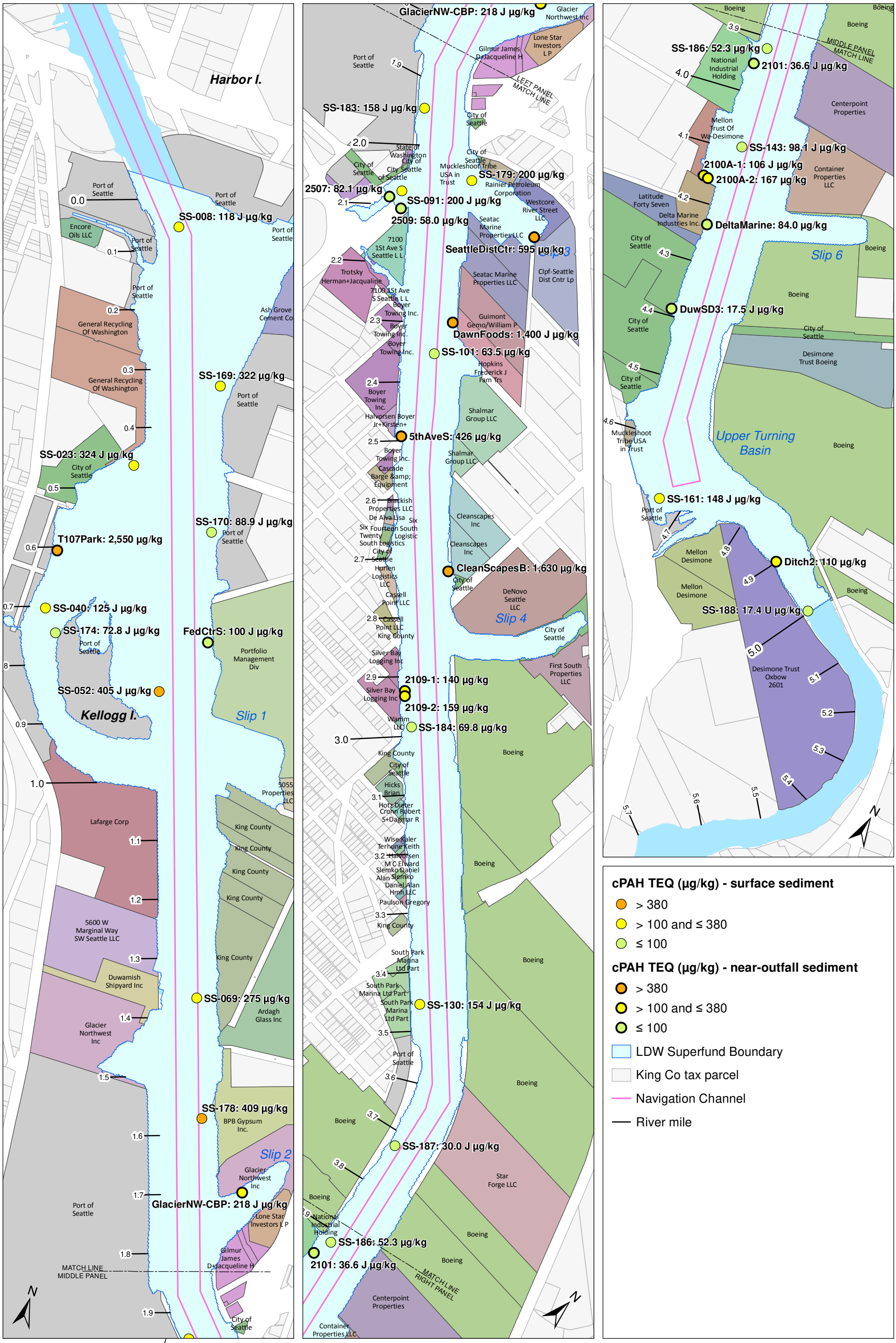
Harbor I.
SS-008: 118 J µg/kg
SS-169: 322 µg/kg
SS-023: 324 J µg/kg
SS-170: 88.9 J µg/kg
T107Park: 2,550 µg/kg
SS-040: 125 J µg/kg
SS-174: 72.8 J µg/kg
FedCtrS: 100 J µg/kg
SS-052: 405 J µg/kg
Kellogg I.
Slip 1
SS-069: 275 µg/kg
SS-178: 409 µg/kg
Slip 2
GlacierNW-CBP: 218 J µg/kg
SS-183: 158 J µg/kg
2507: 82.1 µg/kg
SS-091: 200 J µg/kg
2509: 58.0 µg/kg
SS-179: 200 µg/kg
SeattleDistCtr: 595 µg/kg
Slip 3
DawnFoods: 1,400 J µg/kg
SS-101: 63.5 µg/kg
5thAveS: 426 µg/kg
CleanScapesB: 1,630 µg/kg
Slip 4
2109-1: 140 µg/kg
2109-2: 159 µg/kg
SS-184: 69.8 µg/kg
SS-130: 154 J µg/kg
SS-187: 30.0 J µg/kg
SS-186: 52.3 µg/kg
2101: 36.6 J µg/kg
SS-143: 98.1 J µg/kg
2100A-1: 106 J µg/kg
2100A-2: 167 µg/kg
DeltaMarine: 84.0 µg/kg
Slip 6
DuwSD3: 17.5 J µg/kg
Upper Turning Basin
SS-161: 148 J µg/kg
Ditch2: 110 µg/kg
SS-188: 17.4 U µg/kg
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Cronn Robert S+Dagmar R
Wise Kaler Terhune Keith
Halvorsen M C Elward
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Paulson Gregory
South Park Marina Ltd Part
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King County
Muckleshoot Tribe USA in Trust
State of Washington
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0.0
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0.5
0.6
0.7
0.8
0.9
1.0
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1.5
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1.7
1.8
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1.9
2.0
2.1
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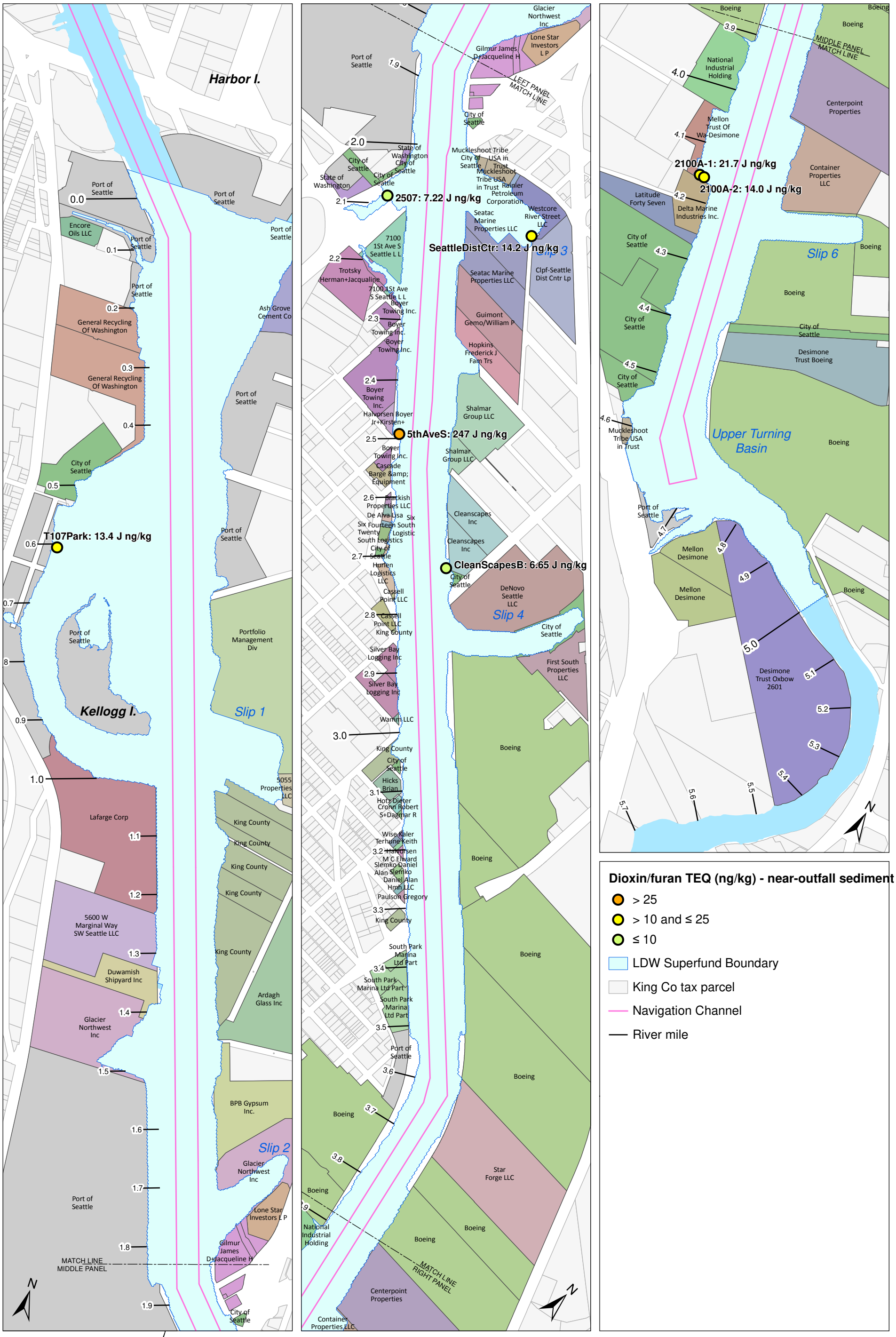
5.0
5.1
5.2
5.3
5.4
5.5
5.6
5.7
N
cPAH TEQ (µg/kg) - surface sediment
> 380
> 100 and ≤ 380
≤ 100
cPAH TEQ (µg/kg) - near-outfall sediment
> 380
> 100 and ≤ 380
≤ 100
LDW Superfund Boundary
King Co tax parcel
Navigation Channel
River mile
0 0.1 0.2 Miles
0 0.2 0.4 Kilometers
Scale is the same for each inset map
cPAH TEQs for 2018 surface sediment (0-10 cm) individual locations
DRAFT
Windward environmental LLC
Lower Duwamish Waterway Group
Port of Seattle / City of Seattle / King County / The Boeing Company
Prepared by craigh, 9/27/2018. W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 05 Data Reports\Surface Sediment\6849 Surface sediment individual data - cPAHs.mxd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Kellogg I.
Slip 1
Slip 2
Slip 3
Slip 4
Slip 6
Upper Turning Basin
T107Park: 13.4 J ng/kg
2507: 7.22 J ng/kg
SeattleDistCtr: 14.2 J ng/kg
5thAveS: 247 J ng/kg
CleanScapesB: 6.65 J ng/kg
2100A-1: 21.7 J ng/kg
2100A-2: 14.0 J ng/kg
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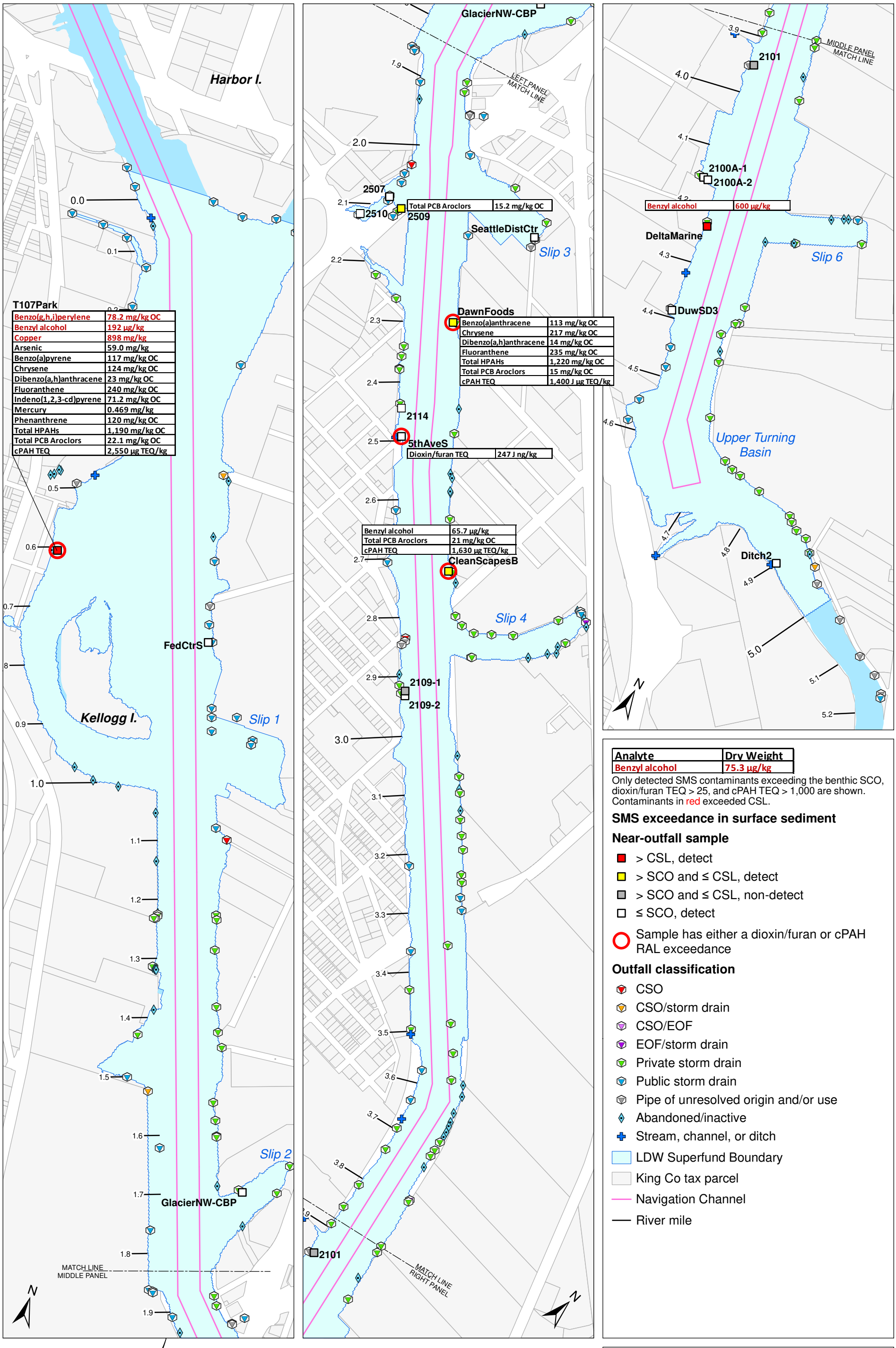
Mellon Trust Of Wa-Desimone
Mellon Desimone
Desimone Trust Boeing
Desimone Trust Oxbow 2601
First South Properties LLC
Dioxin/furan TEQ (ng/kg) - near-outfall sediment
> 25
> 10 and ≤ 25
≤ 10
LDW Superfund Boundary
King Co tax parcel
Navigation Channel
River mile
0 0.1 0.2 Miles
0 0.2 0.4 Kilometers
Scale is the same for each inset map
Dioxin/furan TEQs for 2018 surface sediment (0-10 cm) individual locations
DRAFT
Windward environmental LLC
Lower Duwamish Waterway Group
Port of Seattle / City of Seattle / King County / The Boeing Company
Prepared by craigh, 9/21/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 05 Data Reports\Surface Sediment\6849 Surface sediment individual data - DF.mxd



Analyte	Dry Weight
Benzyl alcohol	75.3 µg/kg

Only detected SMS contaminants exceeding the benthic SCO, dioxin/furan TEQ > 25, and cPAH TEQ > 1,000 are shown. Contaminants in red exceeded CSL.

SMS exceedance in surface sediment

Near-outfall sample

- > CSL, detect
- > SCO and ≤ CSL, detect
- > SCO and ≤ CSL, non-detect
- ≤ SCO, detect
- Sample has either a dioxin/furan or cPAH RAL exceedance

Outfall classification

- CSO
- CSO/storm drain
- CSO/EOF
- EOF/storm drain
- Private storm drain
- Public storm drain
- Pipe of unresolved origin and/or use
- Abandoned/inactive
- Stream, channel, or ditch
- LDW Superfund Boundary
- King Co tax parcel
- Navigation Channel
- River mile

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0 0.1 0.2 Miles

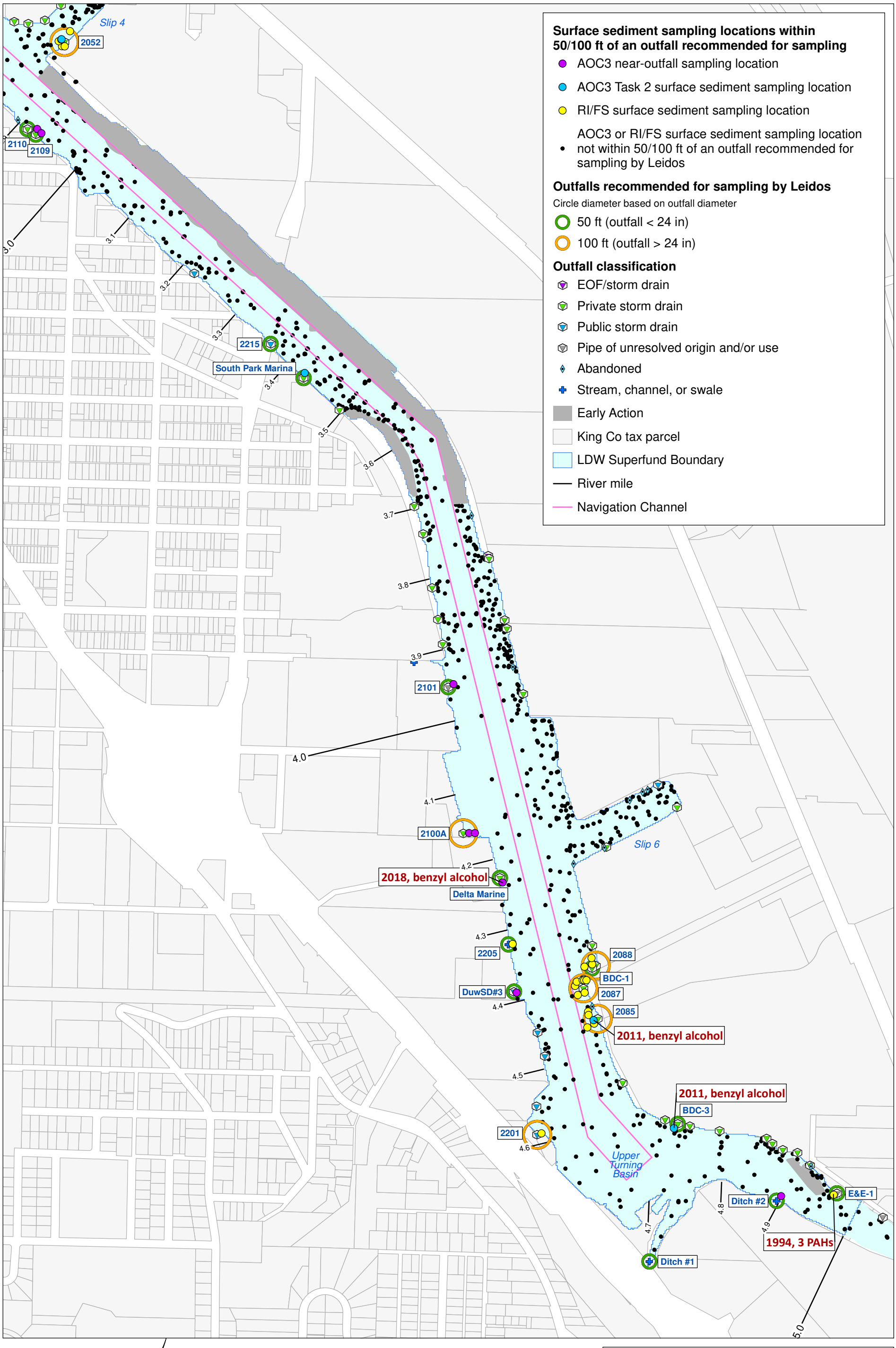
0 0.2 0.4 Kilometers

Scale is the same for each inset map

2018 results for near-outfall surface sediment (0-10 cm) locations relative to benthic SCOs and dioxin/furan and cPAH RALs

DRAFT

Prepared by craigh, 9/21/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 06 Data Evaluation Report\KC-POS 20180919\6868 Outfall locations - SMS exc.mxd



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Lower Duwamish Waterway Group

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N

0 200 400 Yards

0 200 400 Meters

Comparison of sediment concentrations (all data) near Leidos-recommended outfalls to benthic SCOs and cPAH (1,000 µg/kg) and dioxin/furan (25 ng/kg) RALs, RM 3.0 to RM 5.0

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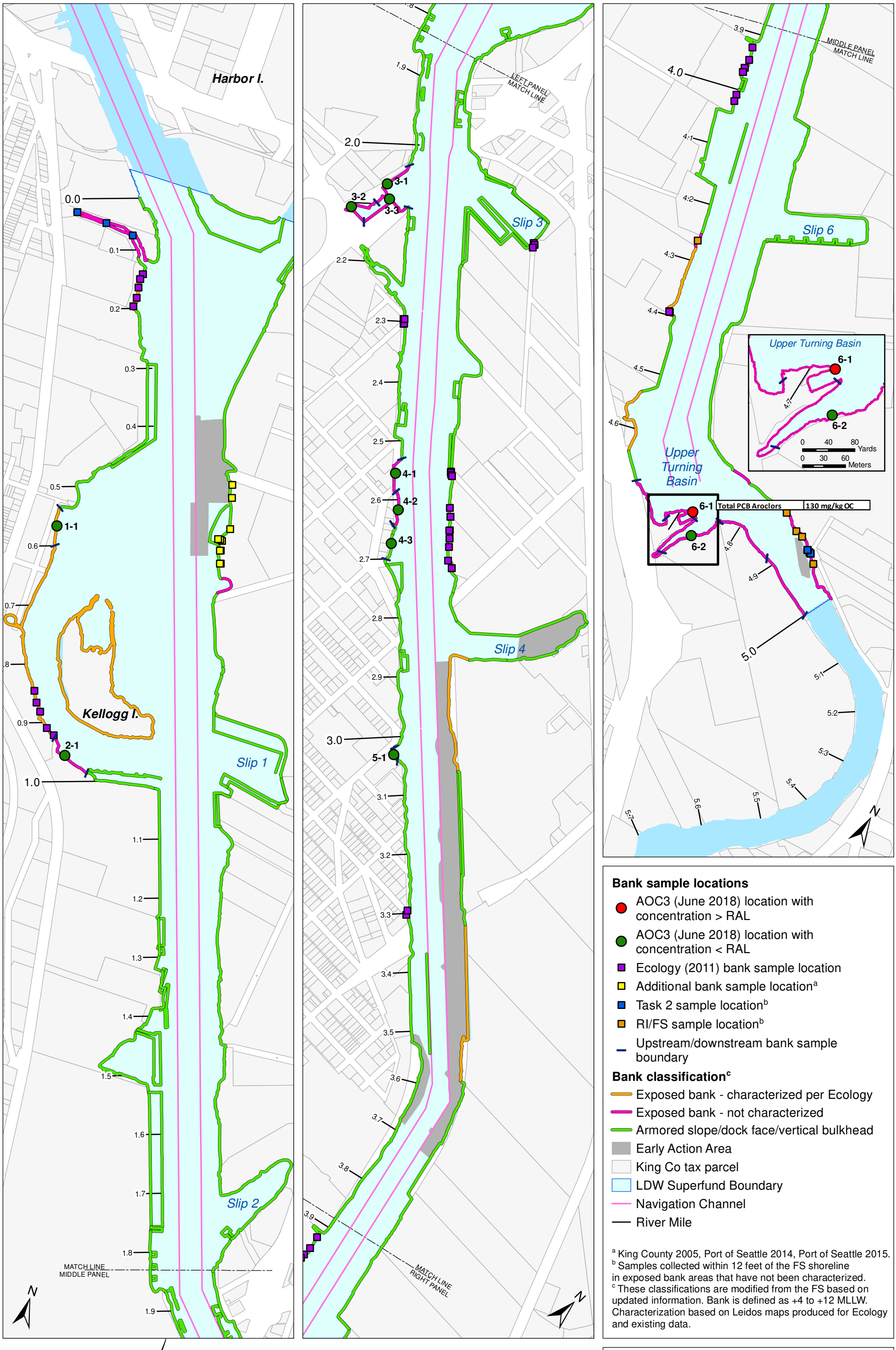
Prepared by craigh, 9/21/2018; W:\Projects\Duwamish AOC3\GIS\Maps and Analyses\Task 06 Data Evaluation Report\KC-POS 20180919\6868 Outfall locations - upper third.mxd



Bank sample locations

- AOC3 (June 2018) location with concentration > RAL
- AOC3 (June 2018) location with concentration < RAL
- Ecology (2011) bank sample location
- Additional bank sample location[a]
- Task 2 sample location[b]
- RI/FS sample location[b]
- Upstream/downstream bank sample boundary

Bank classification[c]

- Exposed bank - characterized per Ecology
- Exposed bank - not characterized
- Armored slope/dock face/vertical bulkhead
- Early Action Area
- King Co tax parcel
- LDW Superfund Boundary
- Navigation Channel
- River Mile

[a] King County 2005, Port of Seattle 2014, Port of Seattle 2015.
[b] Samples collected within 12 feet of the FS shoreline in exposed bank areas that have not been characterized.
[c] These classifications are modified from the FS based on updated information. Bank is defined as +4 to +12 MLLW. Characterization based on Leidos maps produced for Ecology and existing data.

0 0.1 0.2 Miles

0 0.2 0.4 Kilometers

Scale is the same for each inset map

Comparison of 2018 bank data with lowest sediment RALS

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Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

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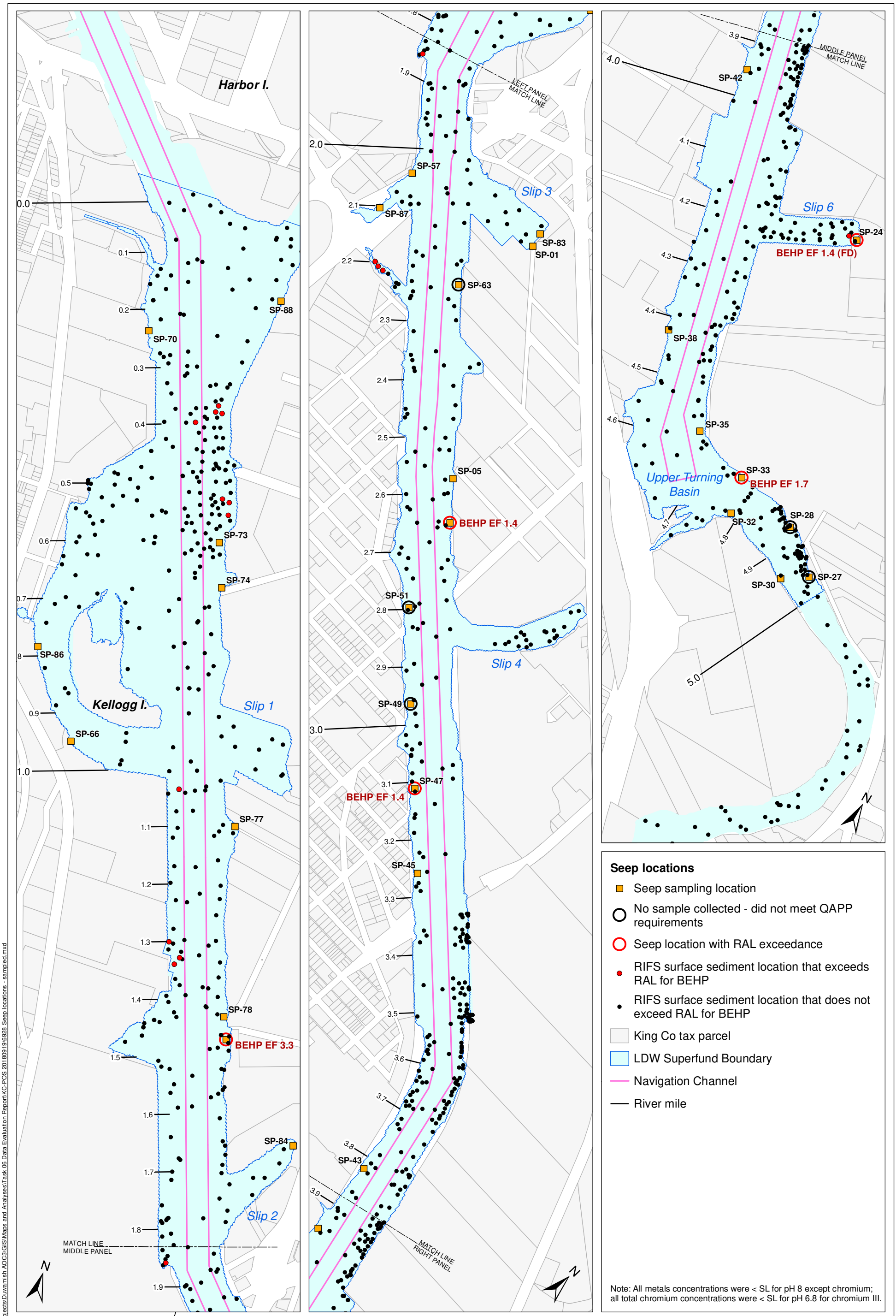

Seep locations

- Seep sampling location
- No sample collected - did not meet QAPP requirements
- Seep location with RAL exceedance
- RIFS surface sediment location that exceeds RAL for BEHP
- RIFS surface sediment location that does not exceed RAL for BEHP
- King Co tax parcel
- LDW Superfund Boundary
- Navigation Channel
- River mile

Note: All metals concentrations were < SL for pH 8 except chromium; all total chromium concentrations were < SL for pH 6.8 for chromium III.

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0 0.1 0.2 Miles

0 0.2 0.4 Kilometers

Scale is the same for each inset map

Comparison of detected 2018 seep data to screening levels protective of sediment RALs in Ecology 2016 (Table A.8)

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