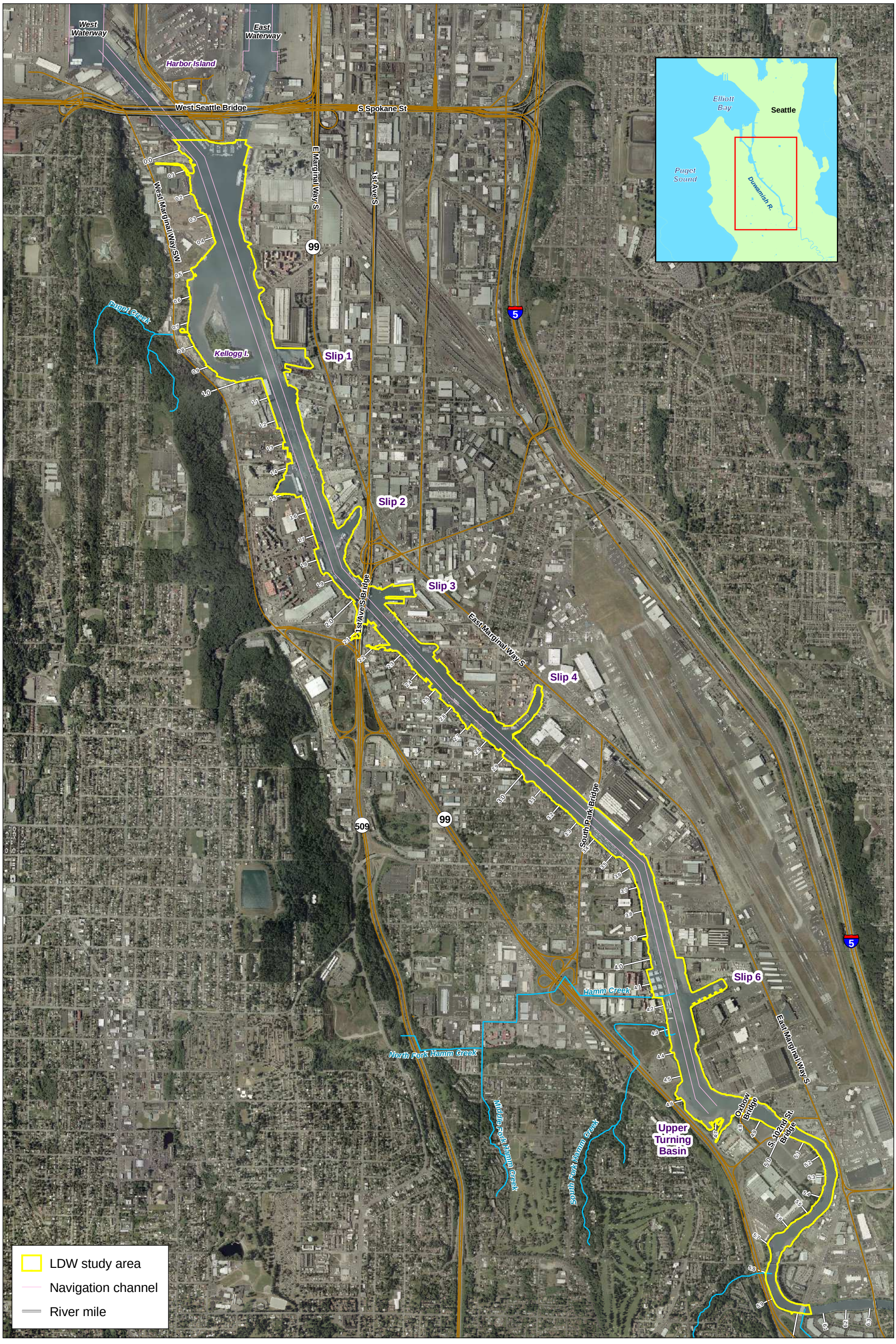
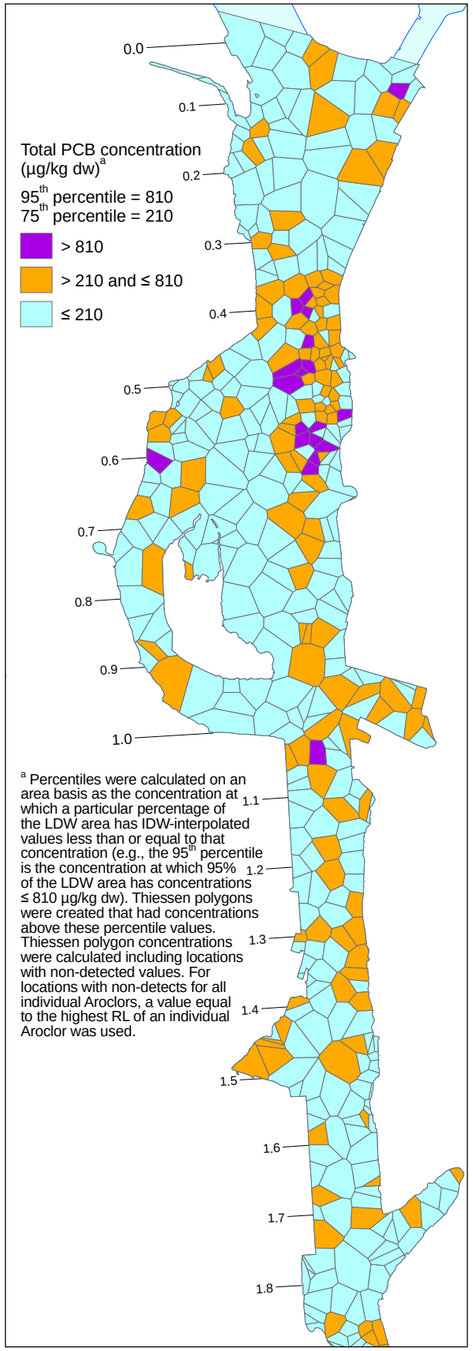


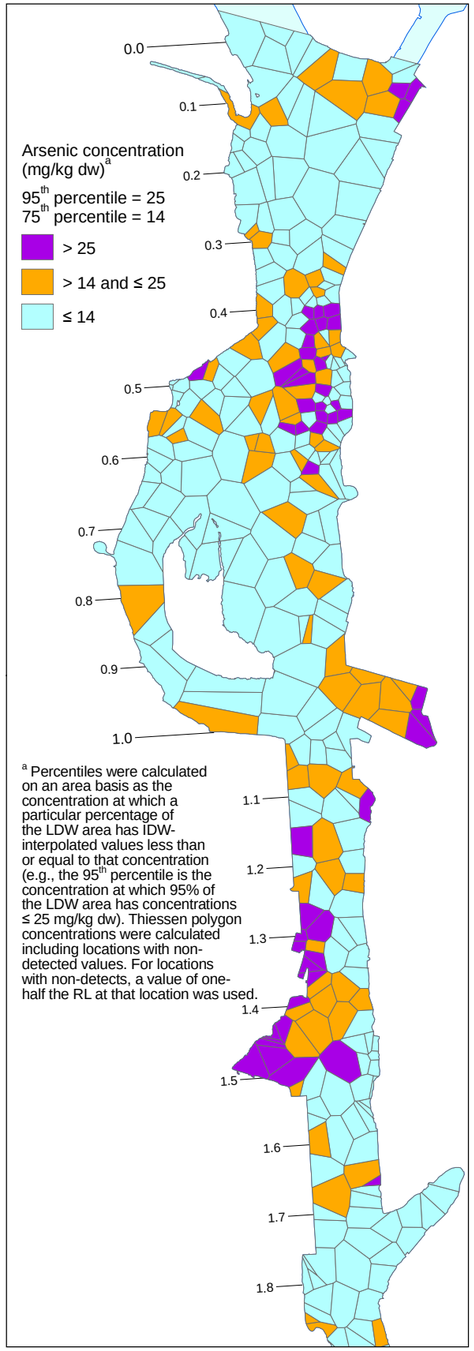
Wind Ward LLC environmental

Map ES-1. Lower Duwamish Waterway

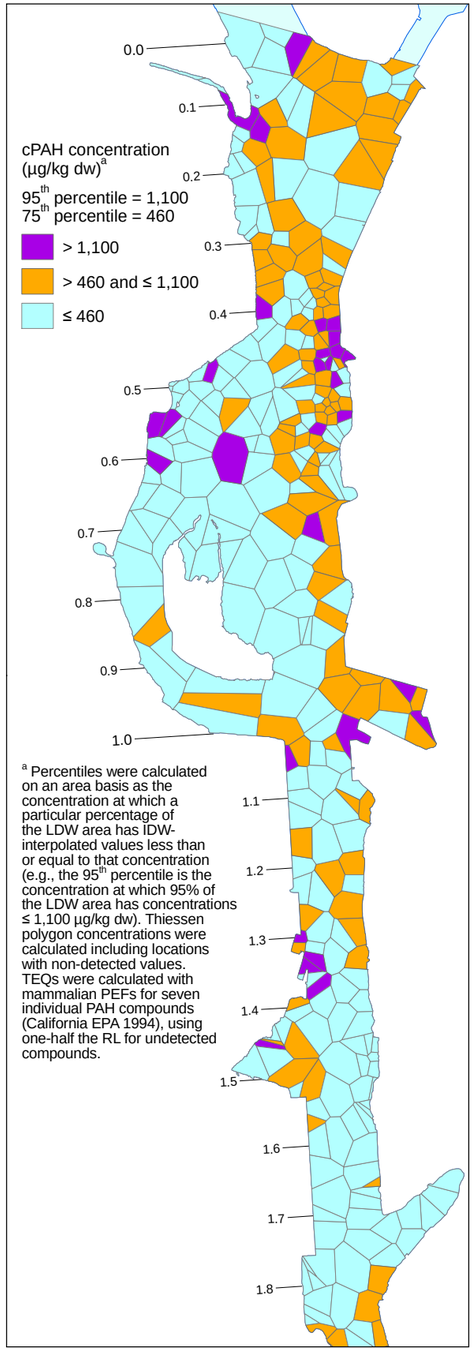
Prepared by CEH 06/28/2010; MAP #2387; W:\Projects\00-08-06 Duwamish R\data\gis\Phase2 RI\Intro - Env Setting



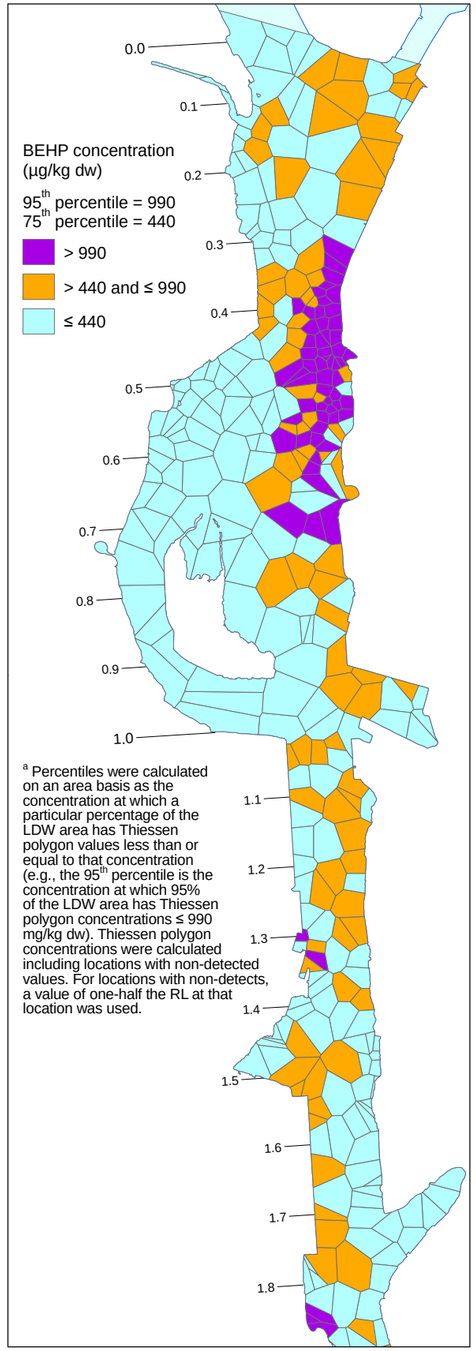
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 810 µg/kg dw). Thiessen polygons were created that had concentrations above these percentile values. Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects for all individual Aroclors, a value equal to the highest RL of an individual Aroclor was used.



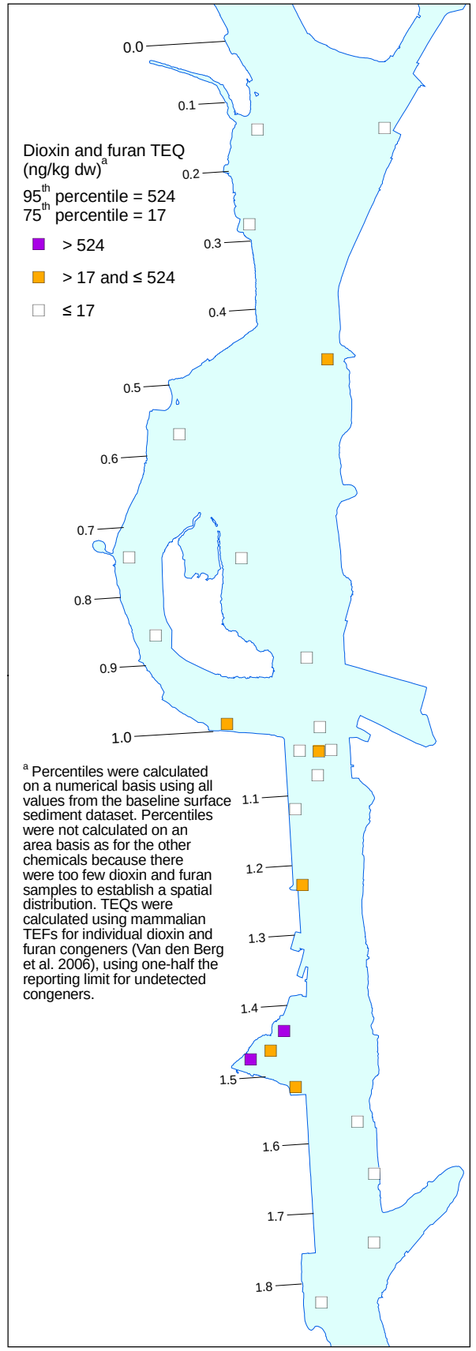
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 25 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 1,100 µg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. TEQs were calculated with mammalian PEFs for seven individual PAH compounds (California EPA 1994), using one-half the RL for undetected compounds.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has Thiessen polygon values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has Thiessen polygon concentrations ≤ 990 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on a numerical basis using all values from the baseline surface sediment dataset. Percentiles were not calculated on an area basis as for the other chemicals because there were too few dioxin and furan samples to establish a spatial distribution. TEQs were calculated using mammalian TEFs for individual dioxin and furan congeners (Van den Berg et al. 2006), using one-half the reporting limit for undetected congeners.

Wind Ward LLC environmental

0 1,000 2,000 Feet

0 250 500 Meters

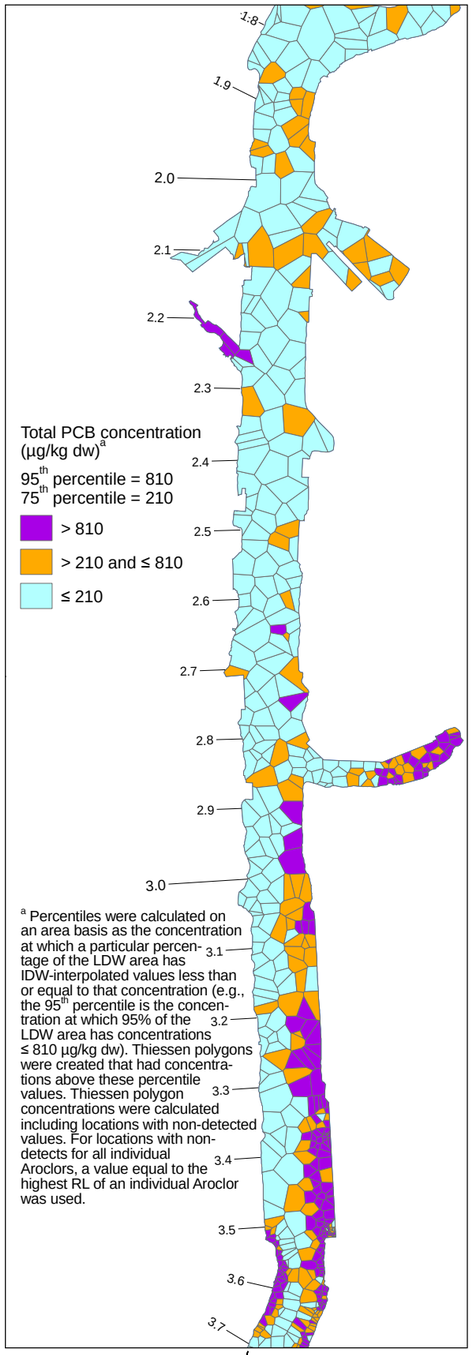
Scale is the same for each inset map

N

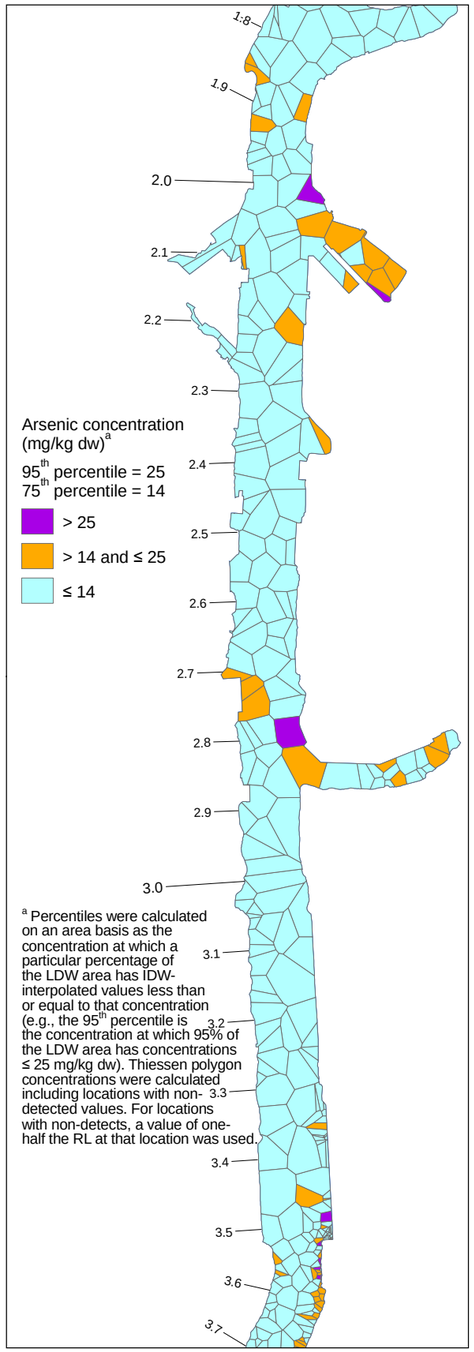
Map ES-2a. 95th and 75th Percentiles of risk driver chemicals, RM 0.0 to RM 1.8

For the Duwamish/Diagonal Early Action Area, surface sediment data in the baseline dataset represent samples collected before dredging, capping, or thin-layer placement in 2003 to 2005.

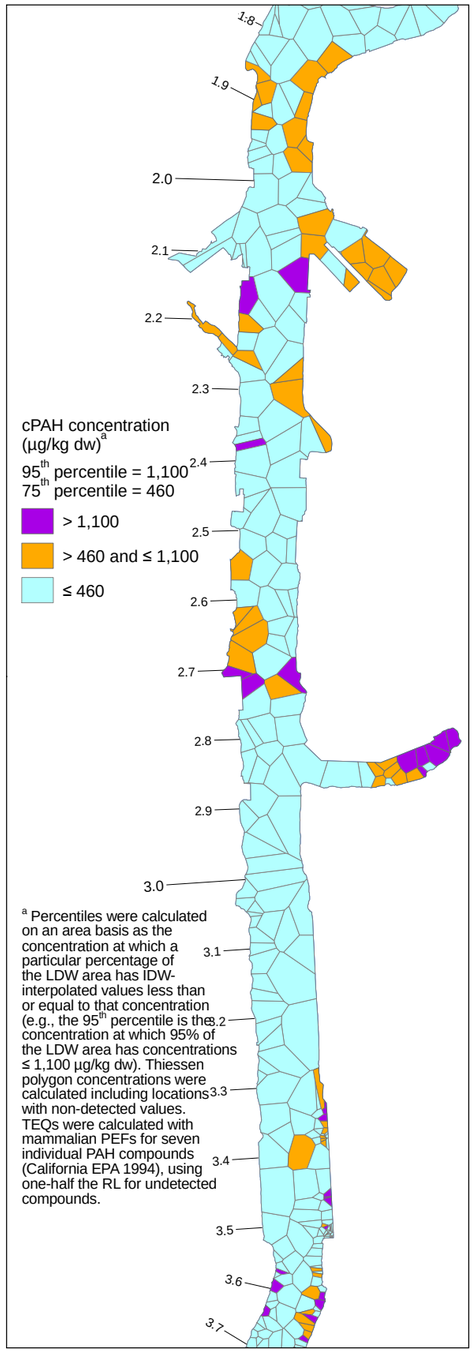
Produced by CEH, 06/28/2010, MAP 3056, W:\Projects\00-09-06_Duwamish_Rl\data\GIS\Phase2 RI\mxd - Env Setting



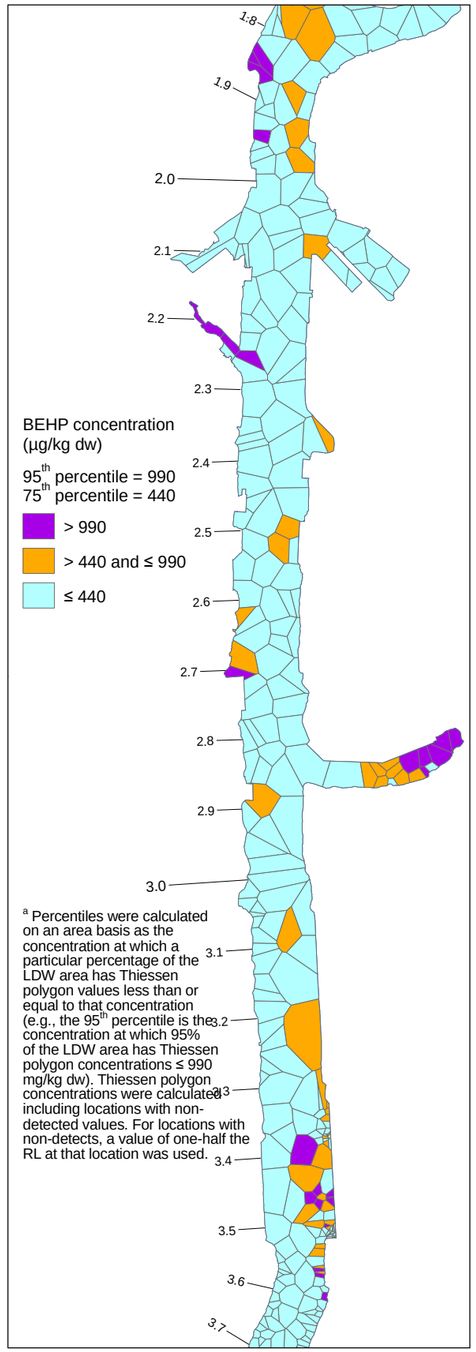
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 810 µg/kg dw). Thiessen polygons were created that had concentrations above these percentile values. Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects for all individual Aroclors, a value equal to the highest RL of an individual Aroclor was used.



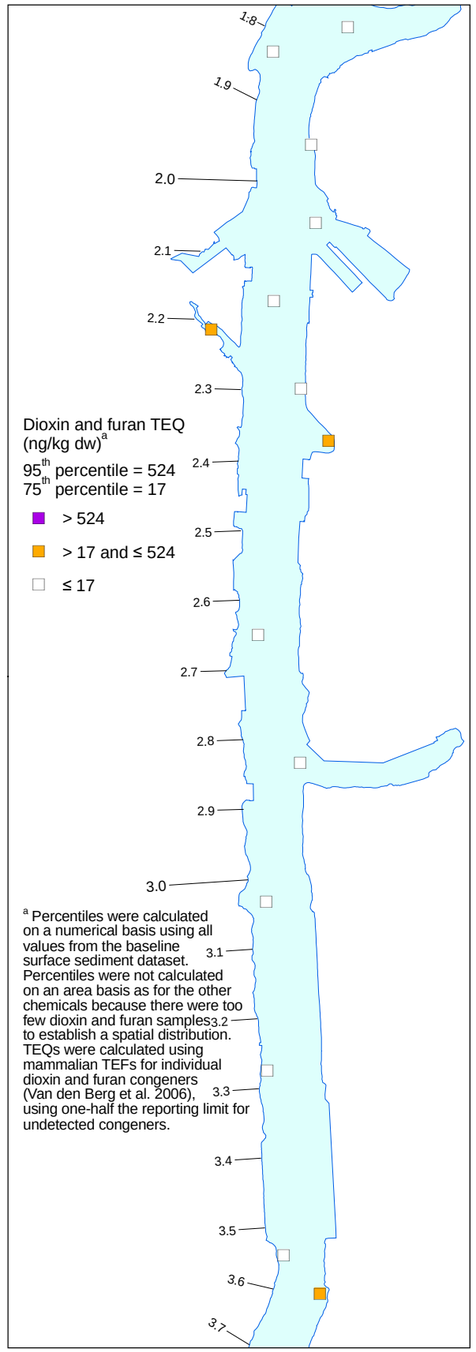
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 25 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 1,100 µg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. TEQs were calculated with mammalian PEFs for seven individual PAH compounds (California EPA 1994), using one-half the RL for undetected compounds.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has Thiessen polygon values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has Thiessen polygon concentrations ≤ 990 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on a numerical basis using all values from the baseline surface sediment dataset. Percentiles were not calculated on an area basis as for the other chemicals because there were too few dioxin and furan samples to establish a spatial distribution. TEQs were calculated using mammalian TEFs for individual dioxin and furan congeners (Van den Berg et al. 2006), using one-half the reporting limit for undetected congeners.

Wind Ward LLC environmental

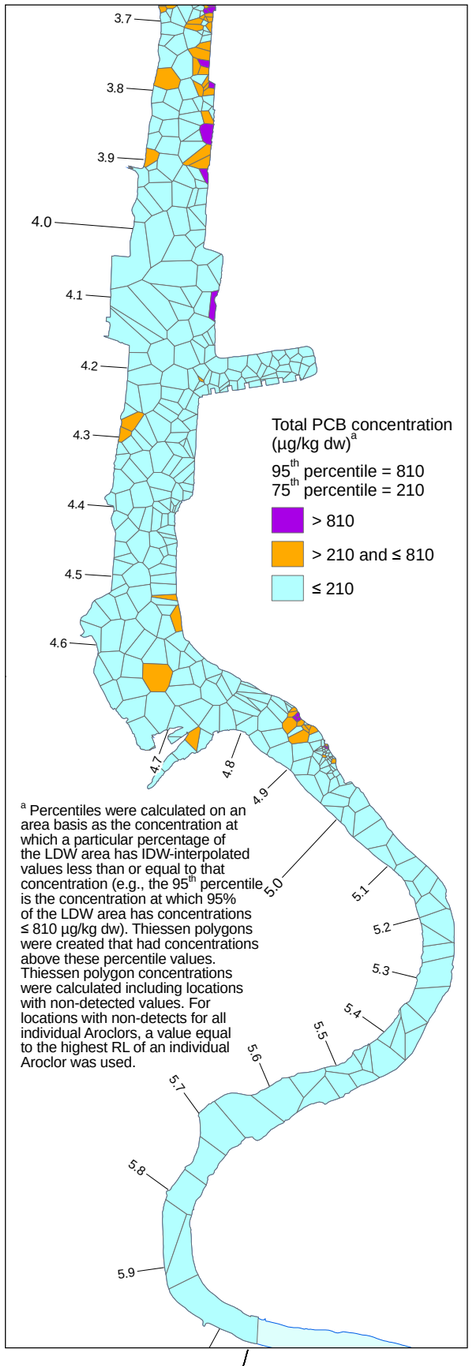
0 1,000 2,000 Feet

0 250 500 Meters

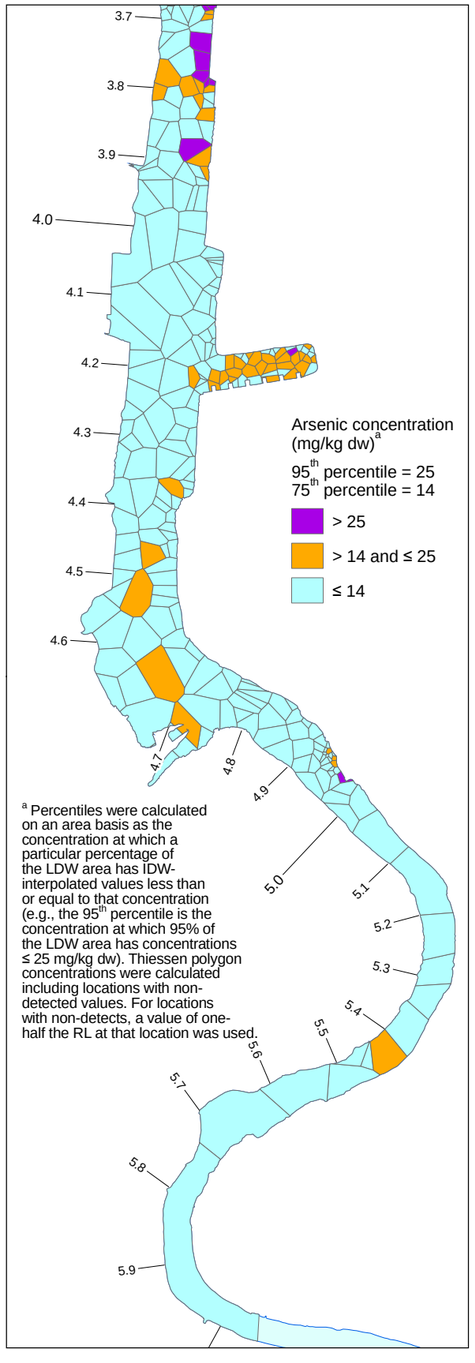
Scale is the same for each inset map

Map ES-2b. 95th and 75th Percentiles of risk driver chemicals, RM 1.8 to RM 3.7

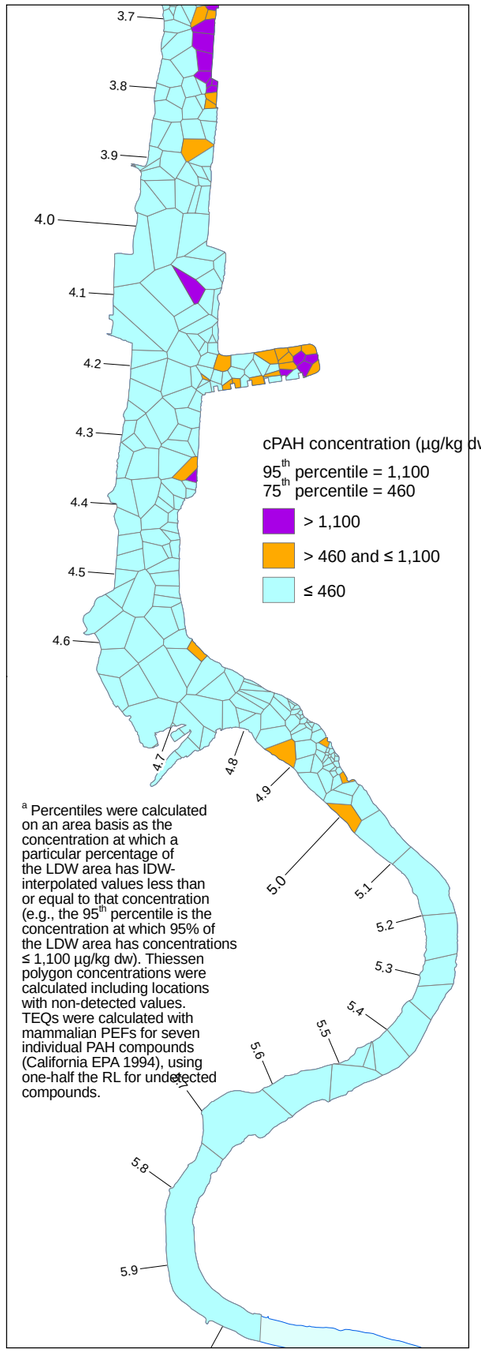
Produced by CEH, 06/28/2010, MAP 3056, W:\Projects\100-09-08_Duwamish_RI\data\GIS\Press2 RI\Intro - Env Setting



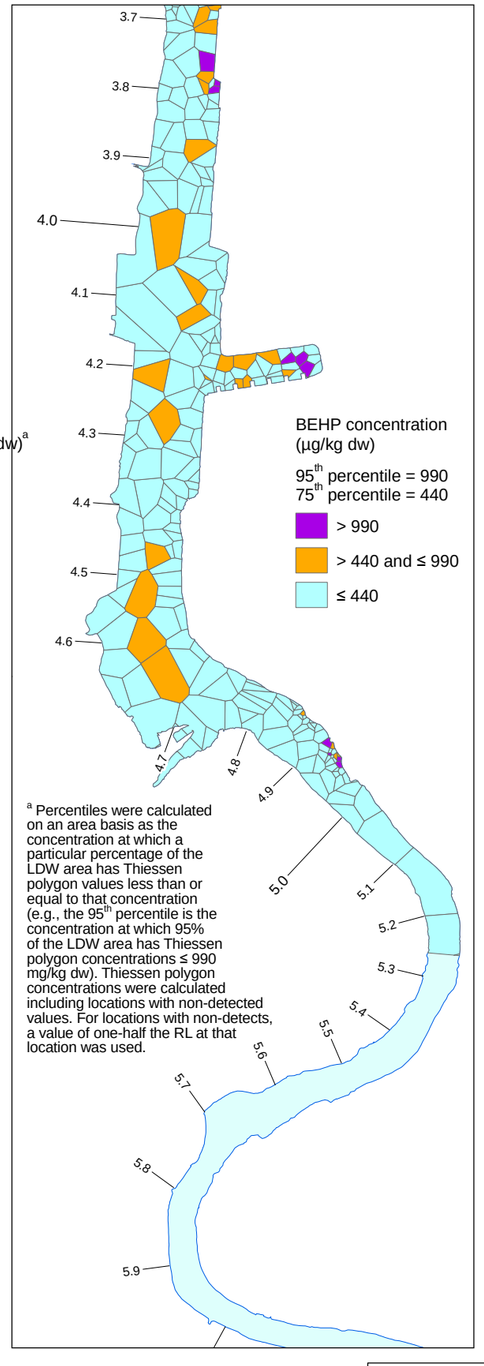
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 810 µg/kg dw). Thiessen polygons were created that had concentrations above these percentile values. Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects for all individual Aroclors, a value equal to the highest RL of an individual Aroclor was used.



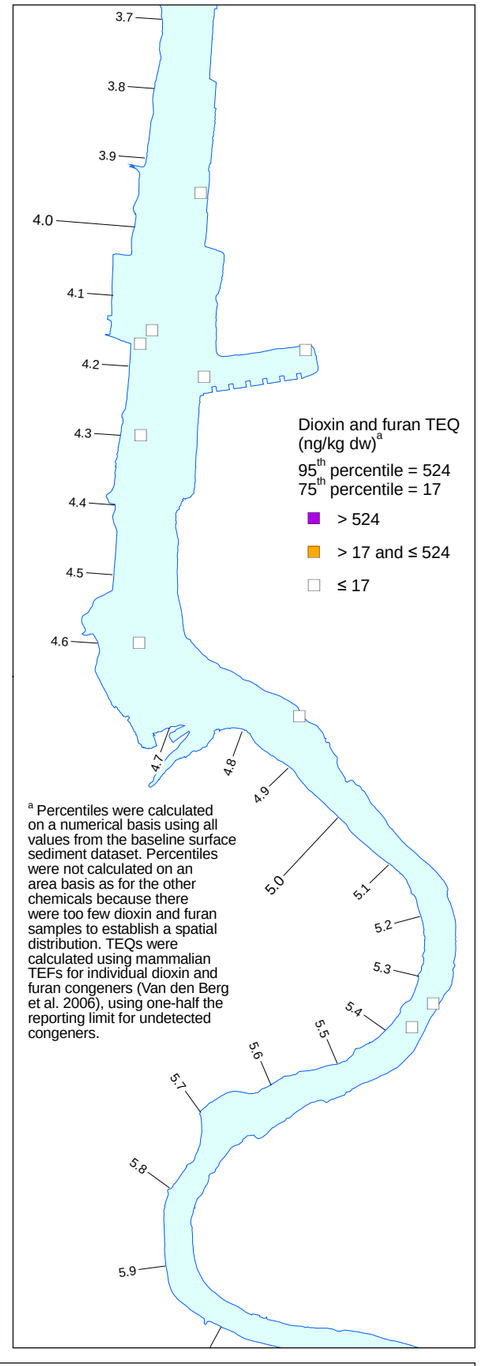
[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 25 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has IDW-interpolated values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has concentrations ≤ 1,100 µg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. TEQs were calculated with mammalian PEFs for seven individual PAH compounds (California EPA 1994), using one-half the RL for undetected compounds.



[a] Percentiles were calculated on an area basis as the concentration at which a particular percentage of the LDW area has Thiessen polygon values less than or equal to that concentration (e.g., the 95th percentile is the concentration at which 95% of the LDW area has Thiessen polygon concentrations ≤ 990 mg/kg dw). Thiessen polygon concentrations were calculated including locations with non-detected values. For locations with non-detects, a value of one-half the RL at that location was used.



[a] Percentiles were calculated on a numerical basis using all values from the baseline surface sediment dataset. Percentiles were not calculated on an area basis as for the other chemicals because there were too few dioxin and furan samples to establish a spatial distribution. TEQs were calculated using mammalian TEFs for individual dioxin and furan congeners (Van den Berg et al. 2006), using one-half the reporting limit for undetected congeners.

Wind Ward environmental LLC

0 1,000 2,000 Feet

0 250 500 Meters

Scale is the same for each inset map

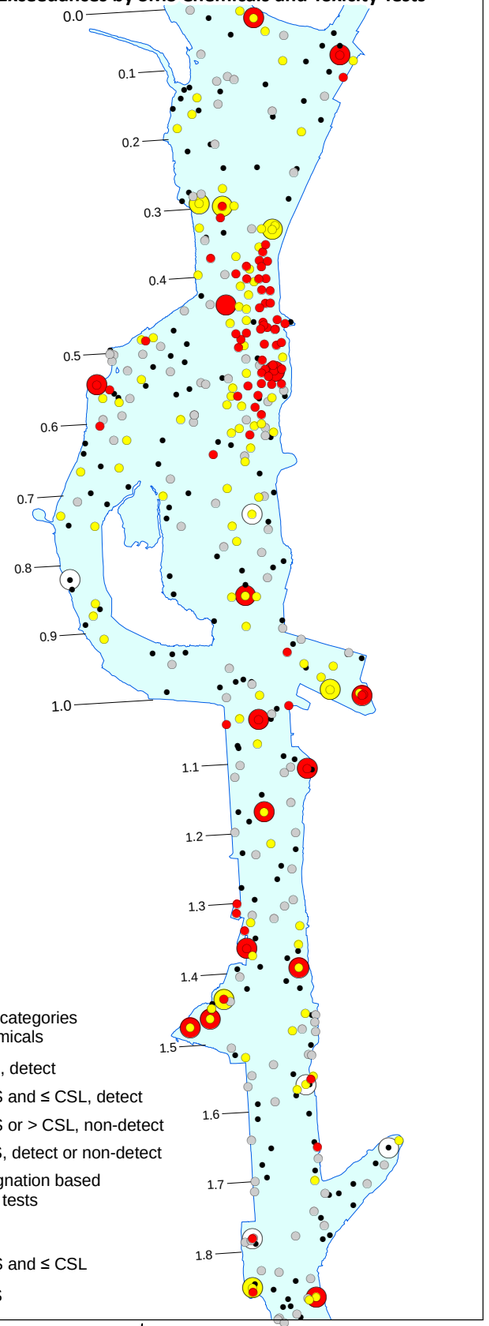
N

Map ES-2c. 95th and 75th Percentiles of risk driver chemicals, RM 3.7 to RM 6.0

Produced by CEH, 06/28/2010, MAP 3056, W:\Projects\00-09-06_Duwamish_Rfdata\GIS\Phase2 RI\mxd - Env Setting

For the Norfolk Early Action Area, surface sediment data in the baseline dataset represent samples collected before dredging, capping, or thin-layer placement in 2003 and 2004.

SQS/CSL Exceedances by SMS Chemicals and Toxicity Tests



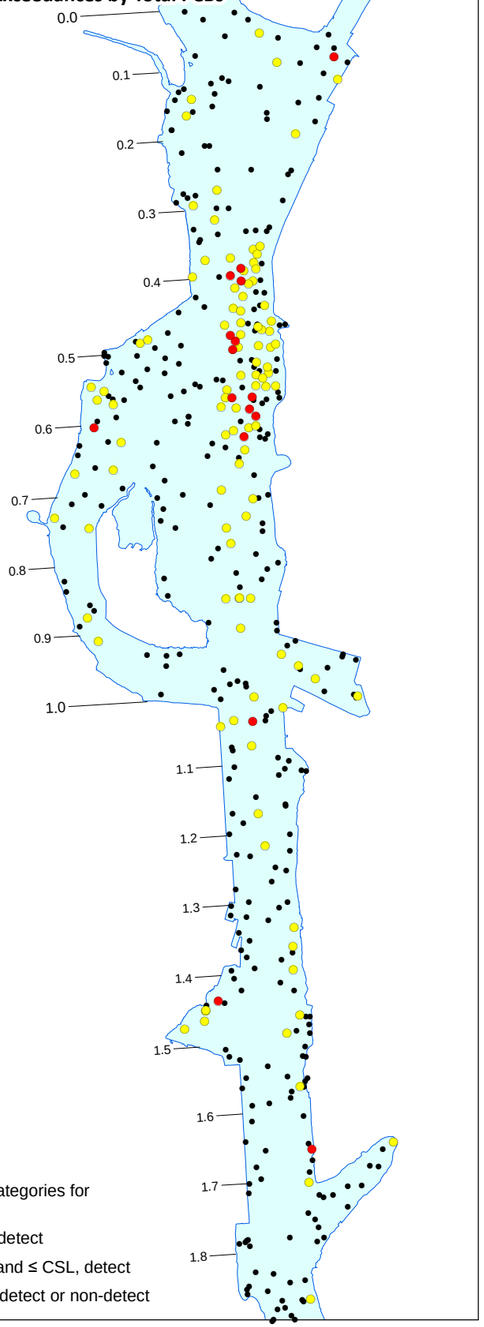
SQS/CSL categories for all chemicals

- > CSL, detect
- > SQS and ≤ CSL, detect
- > SQS or > CSL, non-detect
- ≤ SQS, detect or non-detect

SMS designation based on toxicity tests

- > CSL
- > SQS and ≤ CSL
- ≤ SQS

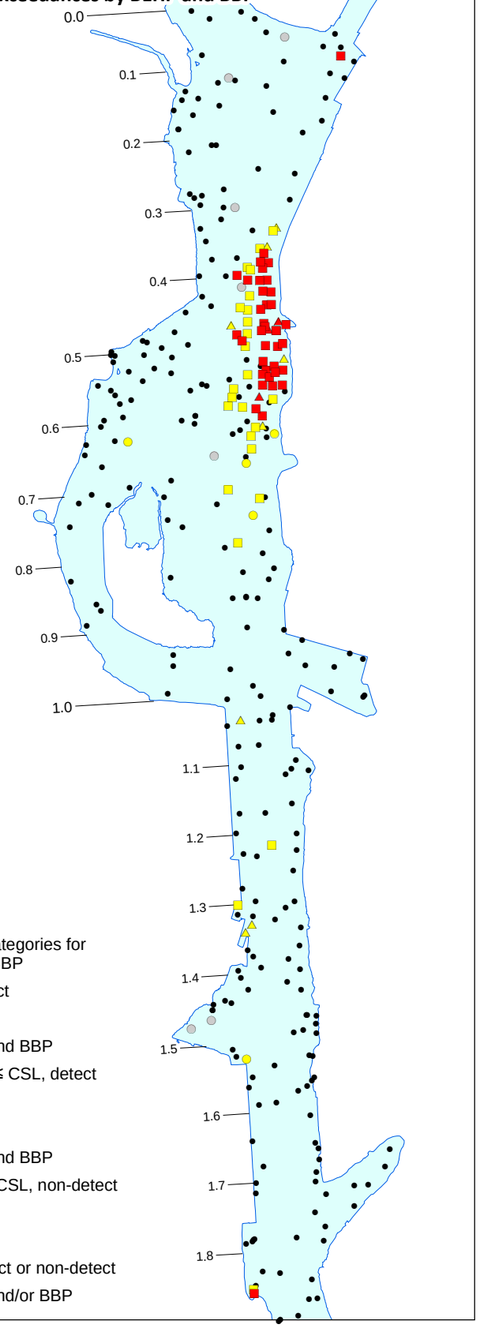
SQS/CSL Exceedances by Total PCBs



SQS/CSL categories for total PCBs

- > CSL, detect
- > SQS and ≤ CSL, detect
- ≤ SQS, detect or non-detect

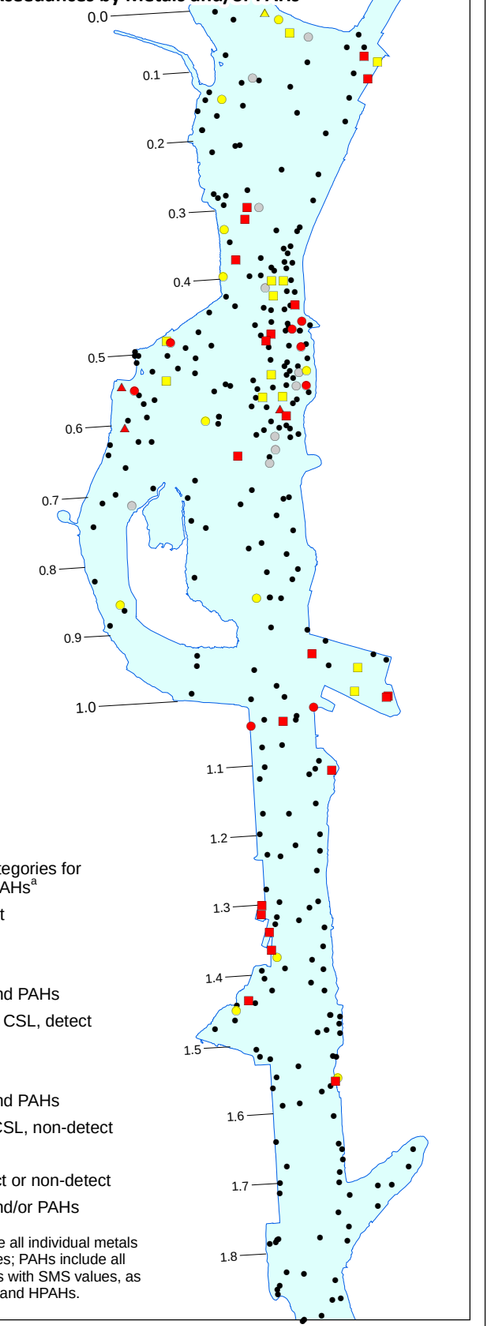
SQS/CSL Exceedances by BEHP and BBP



SQS/CSL categories for BEHP and BBP

- > CSL, detect
  - BEHP
  - BEHP and BBP
- > SQS and ≤ CSL, detect
  - BEHP
  - BBP
  - BEHP and BBP
- > SQS or > CSL, non-detect
  - BEHP
  - BBP
- ≤ SQS, detect or non-detect
  - BEHP and/or BBP

SQS/CSL Exceedances by Metals and/or PAHs



SQS/CSL categories for Metals and PAHs[a]

- > CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS and ≤ CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS or > CSL, non-detect
  - PAHs
- ≤ SQS, detect or non-detect
  - Metals and/or PAHs

[a] Metals include all individual metals with SMS values; PAHs include all individual PAHs with SMS values, as well as LPAHs and HPAHs.

Produced by CEH, 06/28/2010, MAP #3375, W:\Projects\50-08-06_Duwamish_Ridistalgia\Phase2 FI\Intro - Env Setting

Wind Ward LLC environmental

0 1,000 2,000 Feet

0 250 500 Meters

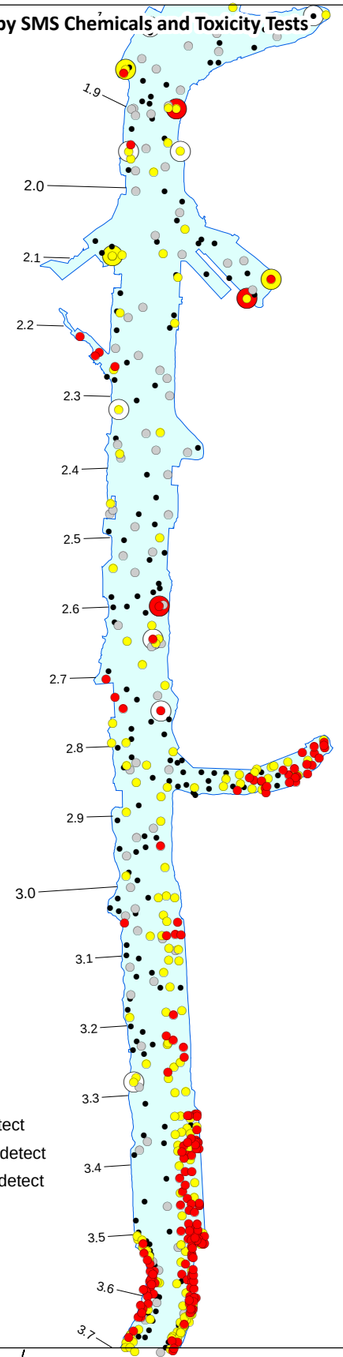
Scale is the same for each inset map

N

Map ES-3a. Exceedances of SMS criteria in LDW surface sediment, RM 0.0 to RM 1.8

For the Duwamish/Diagonal Early Action Area, surface sediment data in the baseline dataset represent samples collected before dredging, capping, or thin-layer placement in 2003 to 2005.

SQS/CSL Exceedances by SMS Chemicals and Toxicity Tests



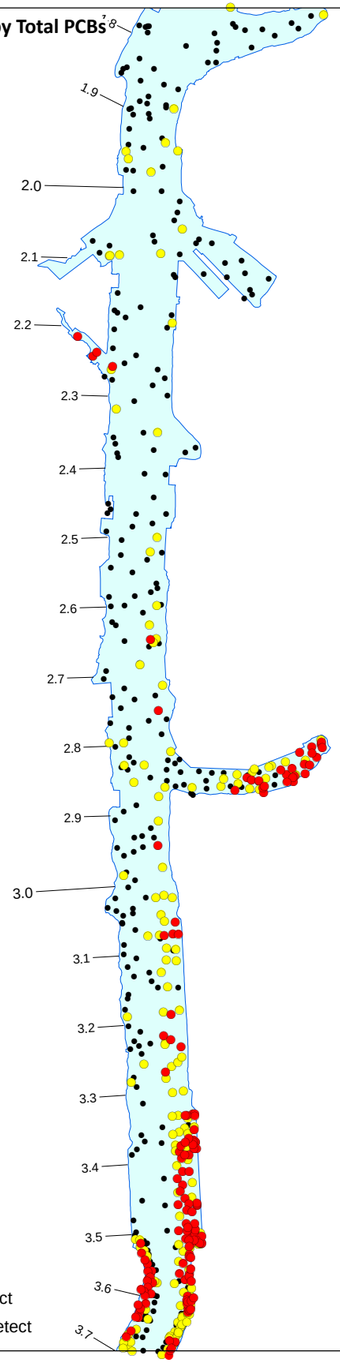
SQS/CSL categories for all chemicals

- > CSL, detect
- > SQS and ≤ CSL, detect
- > SQS or > CSL, non-detect
- ≤ SQS, detect or non-detect

SMS designation based on toxicity tests

- > CSL
- > SQS and ≤ CSL
- ≤ SQS

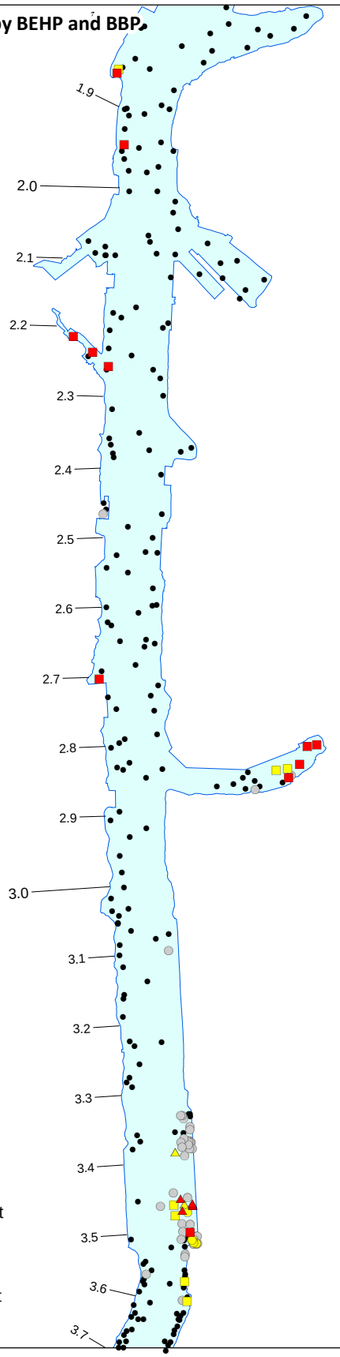
SQS/CSL Exceedances by Total PCBs



SQS/CSL categories for total PCBs

- > CSL, detect
- > SQS and ≤ CSL, detect
- ≤ SQS, detect or non-detect

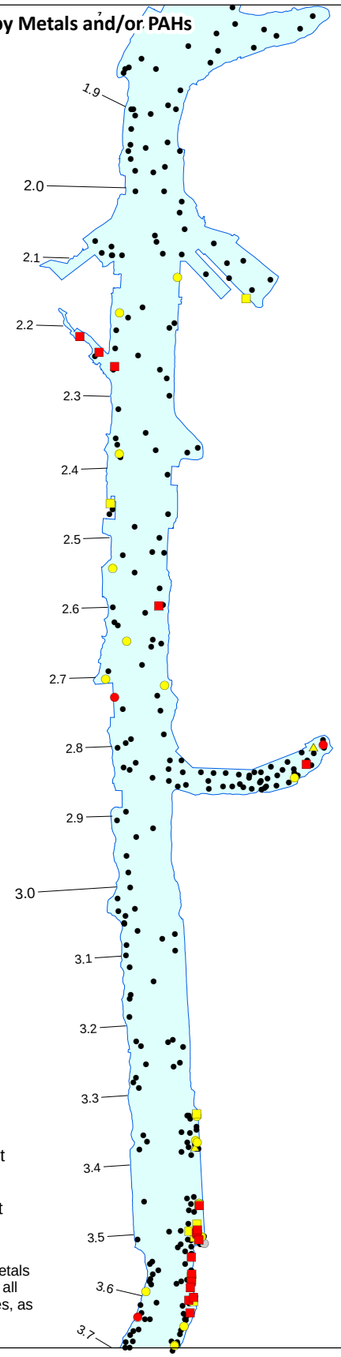
SQS/CSL Exceedances by BEHP and BBP



SQS/CSL categories for BEHP and BBP

- > CSL, detect
  - BEHP
  - BEHP and BBP
- > SQS and ≤ CSL, detect
  - BEHP
  - BBP
  - BEHP and BBP
- > SQS or > CSL, non-detect
  - BEHP
  - BBP
- ≤ SQS, detect or non-detect
  - BEHP and/or BBP

SQS/CSL Exceedances by Metals and/or PAHs



SQS/CSL categories for Metals and PAHs[a]

- > CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS and ≤ CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS or > CSL, non-detect
  - PAHs
- ≤ SQS, detect or non-detect
  - Metals and/or PAHs

[a] Metals include all individual metals with SMS values; PAHs include all individual PAHs with SMS values, as well as LPAHs and HPAHs.

Wind Ward environmental LLC

0 1,000 2,000 Feet

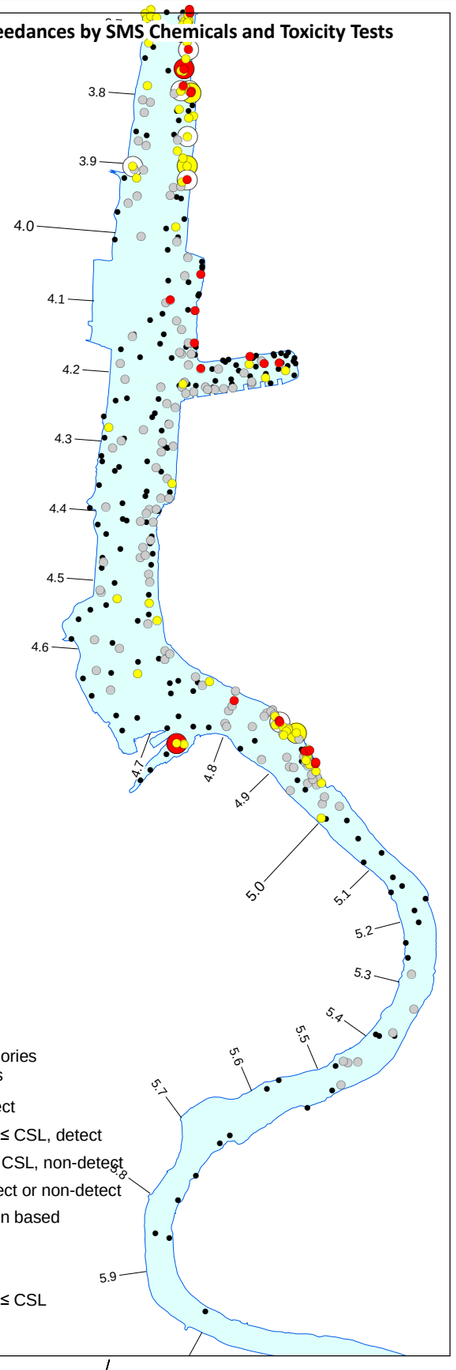
0 250 500 Meters

Scale is the same for each inset map

Map ES-3b. Exceedances of SMS criteria in LDW surface sediment, RM 1.8 to RM 3.7

Produced by CEH, 06/26/2019, MAP #3375, W:\Projects\00-08-06_Duwamish_Rivbank\gis\Phase2 Rivmnp - Env Setting

SQS/CSL Exceedances by SMS Chemicals and Toxicity Tests



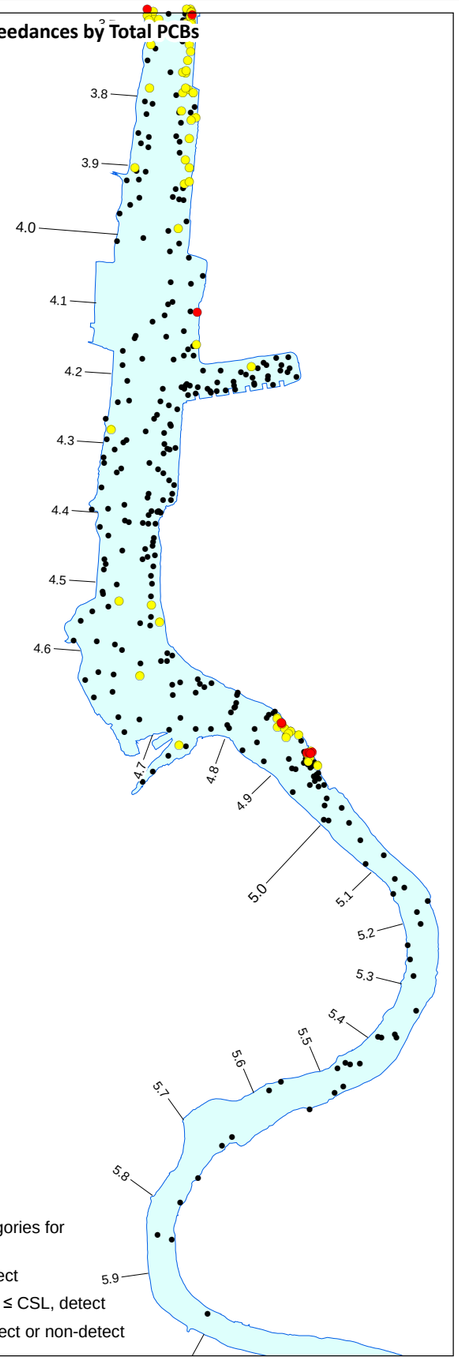
SQS/CSL categories for all chemicals

- > CSL, detect
- > SQS and ≤ CSL, detect
- > SQS or > CSL, non-detect
- ≤ SQS, detect or non-detect

SMS designation based on toxicity tests

- > CSL
- > SQS and ≤ CSL
- ≤ SQS

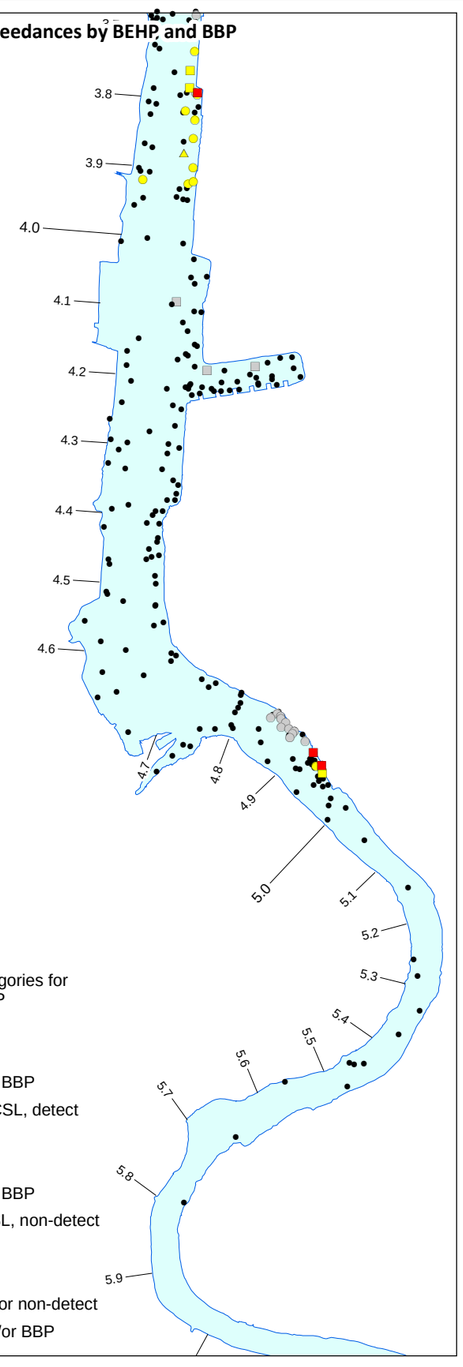
SQS/CSL Exceedances by Total PCBs



SQS/CSL categories for total PCBs

- > CSL, detect
- > SQS and ≤ CSL, detect
- ≤ SQS, detect or non-detect

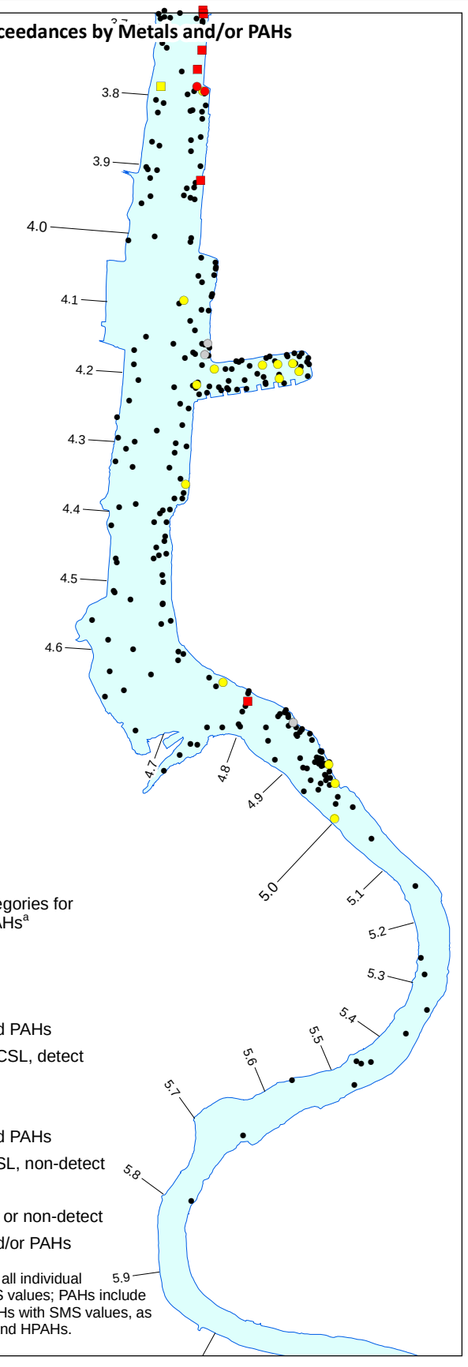
SQS/CSL Exceedances by BEHP and BBP



SQS/CSL categories for BEHP and BBP

- > CSL, detect
  - BEHP
  - BEHP and BBP
- > SQS and ≤ CSL, detect
  - BEHP
  - BBP
  - BEHP and BBP
- > SQS or > CSL, non-detect
  - BEHP
  - BBP
- ≤ SQS, detect or non-detect
  - BEHP and/or BBP

SQS/CSL Exceedances by Metals and/or PAHs



SQS/CSL categories for Metals and PAHs[a]

- > CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS and ≤ CSL, detect
  - Metals
  - PAHs
  - Metals and PAHs
- > SQS or > CSL, non-detect
  - PAHs
- ≤ SQS, detect or non-detect
  - Metals and/or PAHs

[a] Metals include all individual metals with SMS values; PAHs include all individual PAHs with SMS values, as well as LPAHs and HPAHs.

Wind Ward environmental LLC

0 1,000 2,000 Feet

0 250 500 Meters

Scale is the same for each inset map

N

Map ES-3c. Exceedances of SMS criteria in LDW surface sediment, RM 3.7 to RM 6.0

For the Norfolk Early Action Area, surface sediment data in the baseline dataset represent samples collected before dredging, capping, or thin-layer placement in 2003 and 2004.

Harbor I.

Kellogg I.

Slip 1

Slip 2

Slip 3

Slip 4

Slip 6

Upper Turning Basin

> CSL toxicity or
> CSL chemistry if no toxicity data[a]

> SQS and ≤ CSL toxicity or
> SQS and ≤ CSL chemistry if no toxicity data[a]

≤ SQS toxicity or
≤ SQS chemistry if no toxicity data[a]

Outside LDW study area

Road

River mile

Navigation channel

[a] Exceedances of the SQS and CSL chemical criteria are based on detected concentrations. For chemicals whose SQS and CSL are on an organic carbon normalized basis, if the TOC was < 0.5% or > 4.0%, the dry weight concentration of that chemical was compared to the LAET and 2LAET, and exceedances of the LAET and 2LAET were equated with exceedances of the SQS and CSL, respectively.

0 0.1 0.2 Miles

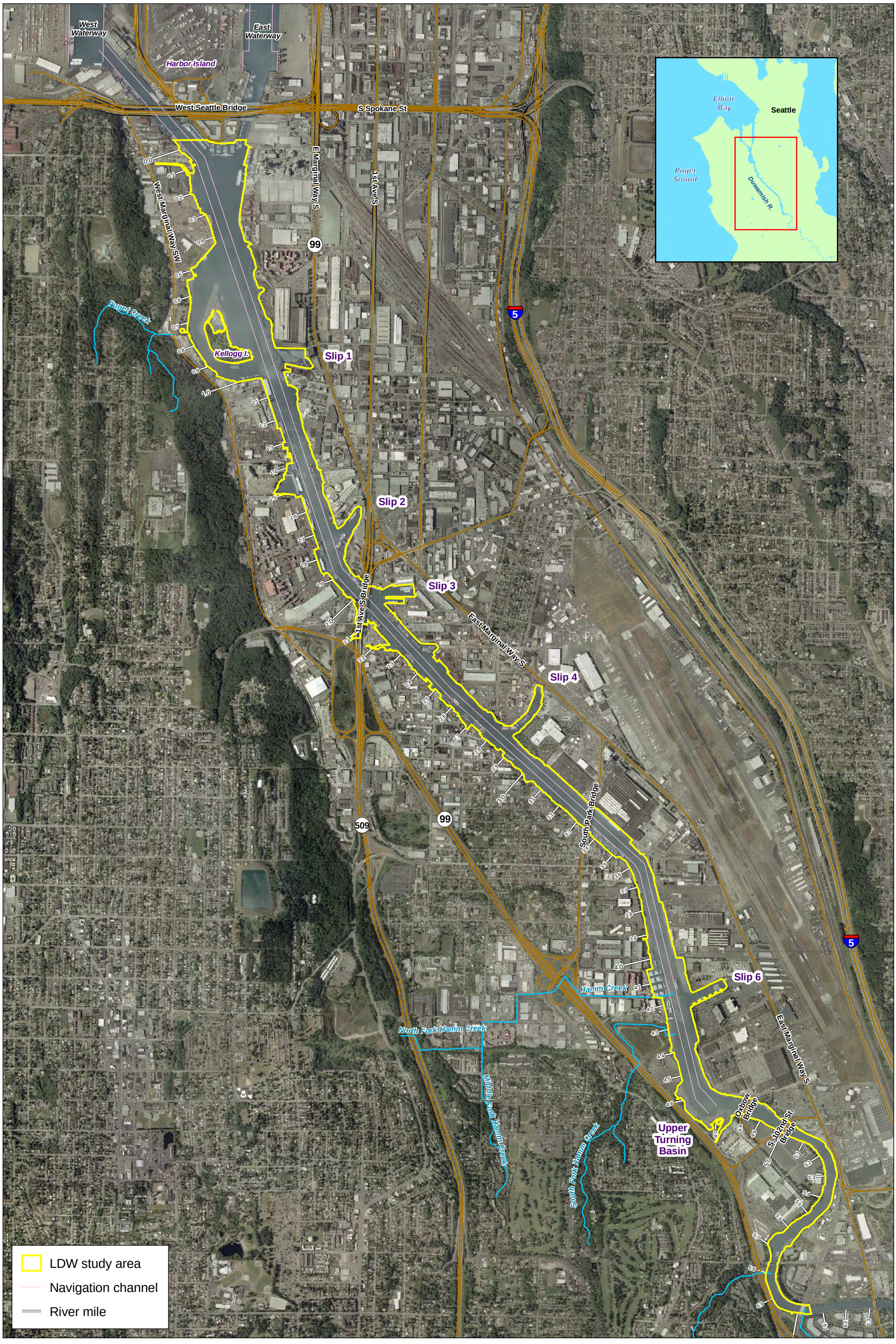
0 0.1 0.2 Kilometers

Scale is the same for each inset map

Wind Ward environmental LLC

Map ES-4. Exceedances of SQS and CSL (chemical criteria and toxicity combined) using Thiessen polygons for the baseline surface sediment dataset

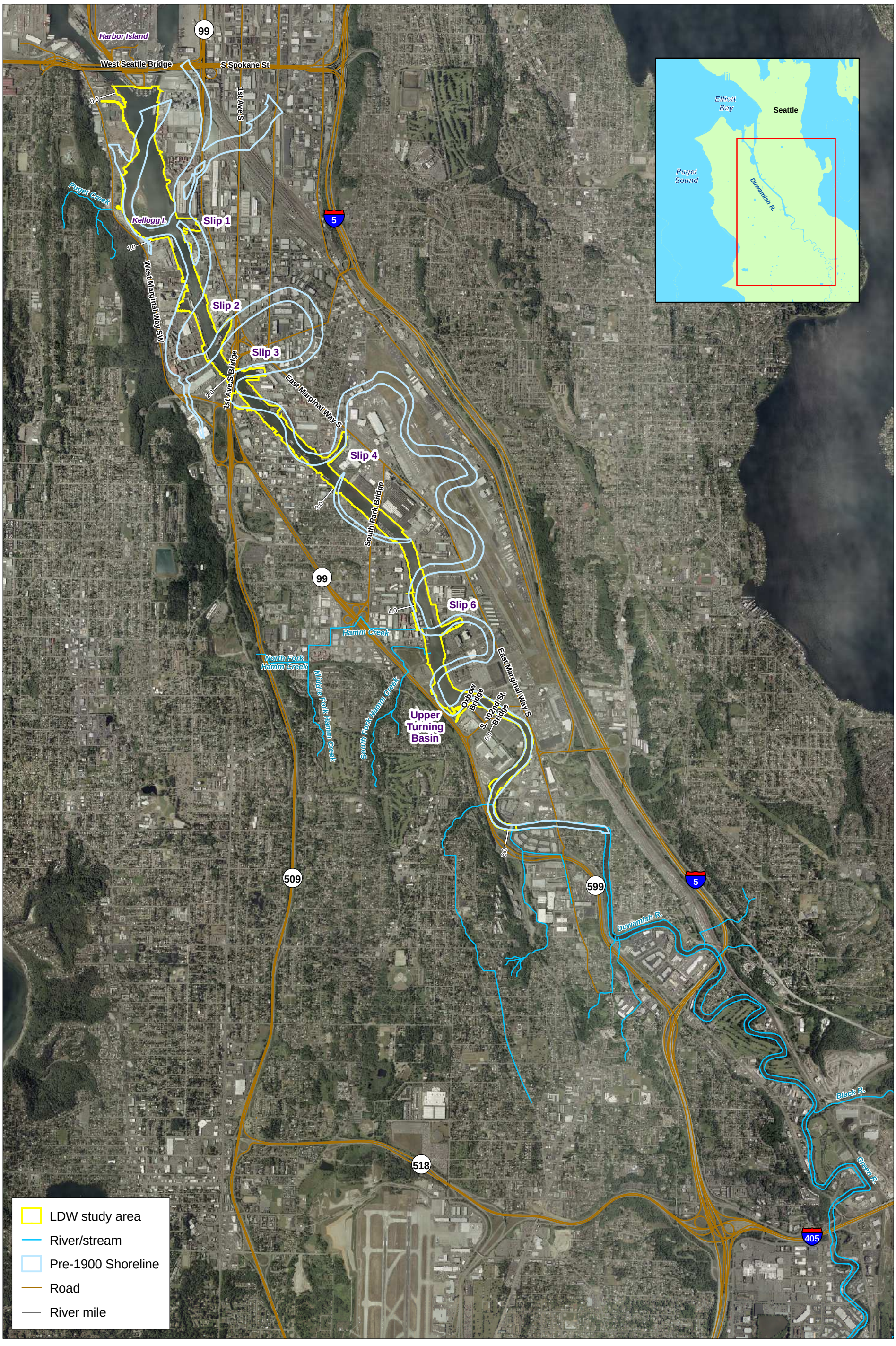
Prepared by CEH, 06/28/2010. MAP #2383. W:\Projects\00-08-06_Duwamish_R\data\GIS\Phase2 R\Intro - Env Setting



Wind Ward LLC environmental

Map 1-1. Lower Duwamish Waterway

Prepared by CEH 06/28/2010; MAP #2387; W:\Projects\00-08-06 Duwamish R\data\gis\Phase2 RI\Intro - Env Setting



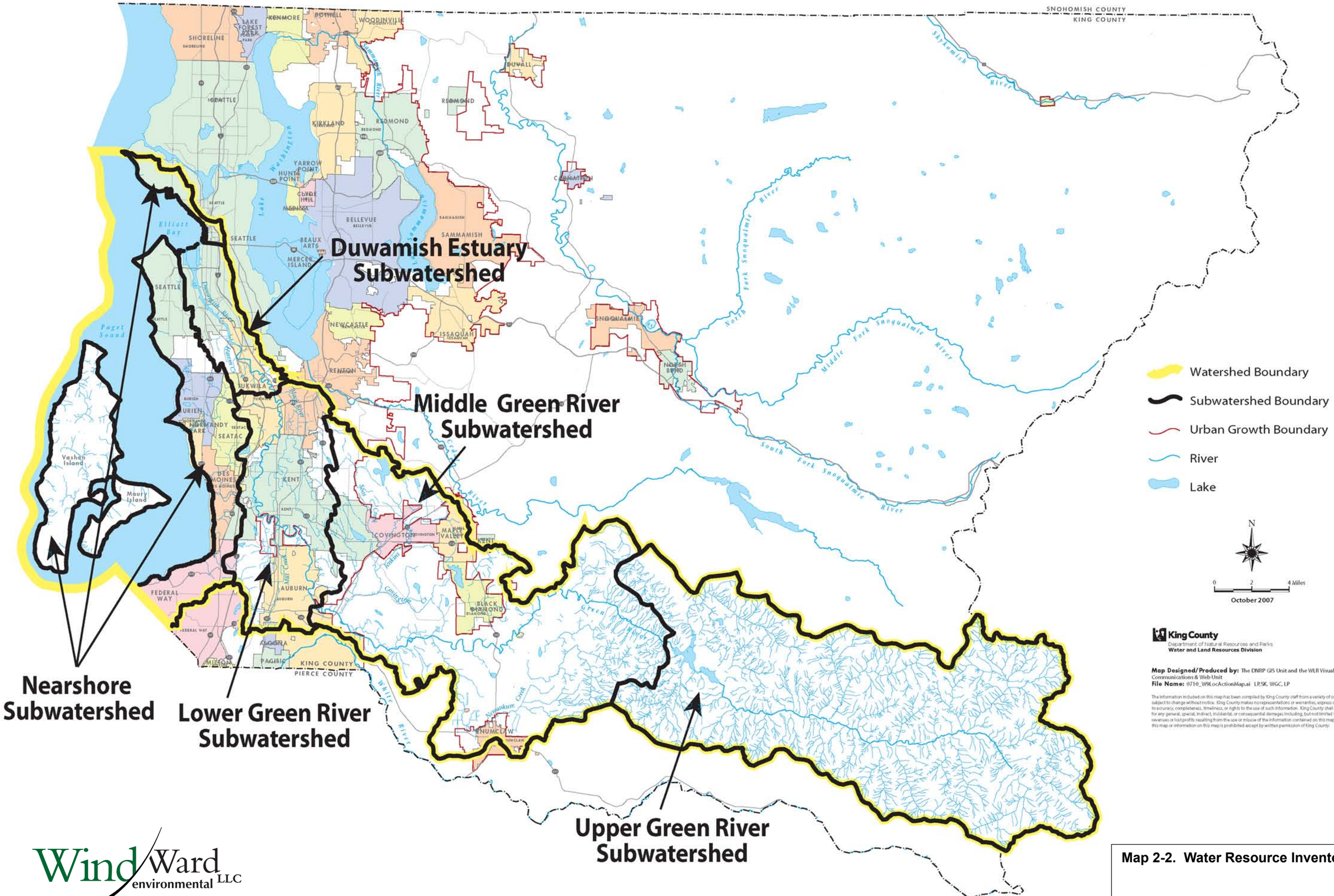
Wind Ward environmental LLC

N

0 0.5 1 Miles

0 0.5 1 Kilometers

Map 2-1. LDW and historical meanders



Wind Ward environmental LLC

Map 2-2. Water Resource Inventory Area 9

Harbor I.

Kellogg I.

Slip 1

Slip 2

Slip 3

Slip 4

Slip 6

Upper Turning Basin

N

Bathymetry[a]

- 10 ft interval
- 2 ft interval
- River mile
- Navigation channel

[a] David Evans and Associates, 2003

0 0.1 0.2 Miles

0 0.1 0.2 Kilometers

Scale is the same for each inset map

Map 2-3. LDW bathymetry contours

Wind Ward environmental LLC

Prepared by CEH, 06/28/2010. MAP #3318. W:\Projects\00-08-06_Duwamish_R\fdata\GIS\Phase2 R\\Intro - Env Setting

Harbor I.
0.0
0.1
0.2
0.3
0.4
0.5
DUWAMISH DIAGONAL, 2004
0.6
0.7
0.8
Kellogg I.
Slip 1
0.9
1.0
LEHIGH NORTHWEST, 2004
1.1
1.2
1.3
DUWAMISH SHIPYARD
1.4
LONE STAR NORTHWEST, 1986 & 1993
GLACIER NW, 2005
1.5
LONE STAR-HARDIE/ KAISER, 1996
Slip 2
1.6
JAMES HARDIE, 1999
1.7
GLACIER READY-MIX, 2001
1.8
TERMINAL 115, 1993
1.9
N
GLACIER READY-MIX, 2001
TERMINAL 115, 1993
1.9
2.0
Slip 3
2.1
2.2
2.3
2.4
BOYER, 1998
BOYER, 2004
2.5
2.6
HURLEN, 1998
2.7
2.8
Slip 4
CROWLEY, 1996
MORTON, 1992
2.9
3.0
3.1
3.2
3.3
USACE, 1992
3.4
SOUTH PARK MARINA, 1993
USACE, 1999
3.5
3.6
USACE, 1999
3.7
3.8
3.9
USACE, 1990
USACE, 1996 (north)
N
3.9
4.0
USACE, 1990
USACE, 1996 (north)
4.1
DUWAMISH YACHT CLUB, 1999
4.2
DELTA MARINE 3, 2004
USACE, 1986
DELTA MARINE 1 & 2, 2008
4.3
USACE, 1997
USACE, 2002, 2008
Slip 6
USACE, 2004
USACE, 1994
4.4
USACE, 1987
4.5
USACE, 1996 (south)
4.6
Upper Turning Basin
4.7
4.8
BOEING SOUTH, 2003
NORFOLK, 1999
4.9
5.0
5.1
5.2
5.3
5.4
5.5
5.6
5.7
N
Dredged area
Dredged and capped area
Dredged and thin-layer placement
Thin-layer placement
River mile
Navigation channel
Note: Navigation channel dredging event dates and locations are provided in Table 2-1.
USACE labels mark the northern extent of the dredge event; the southern extent for all USACE dredge events is RM 4.65, except for the 1996 event which ends at RM 4.48 as marked.
0 0.1 0.2 Miles
0 0.1 0.2 Kilometers
Scale is the same for each inset map
Wind Ward environmental LLC
Map 2-4. Locations of LDW dredging events, 1986 to present
Prepared by CEH, 06/28/2010. MAP #3317: W:\Projects\00-08-06_Duwamish_R\data\GIS\Phase2 R\Intro - Env Setting
Dredging information provided by AECOM.

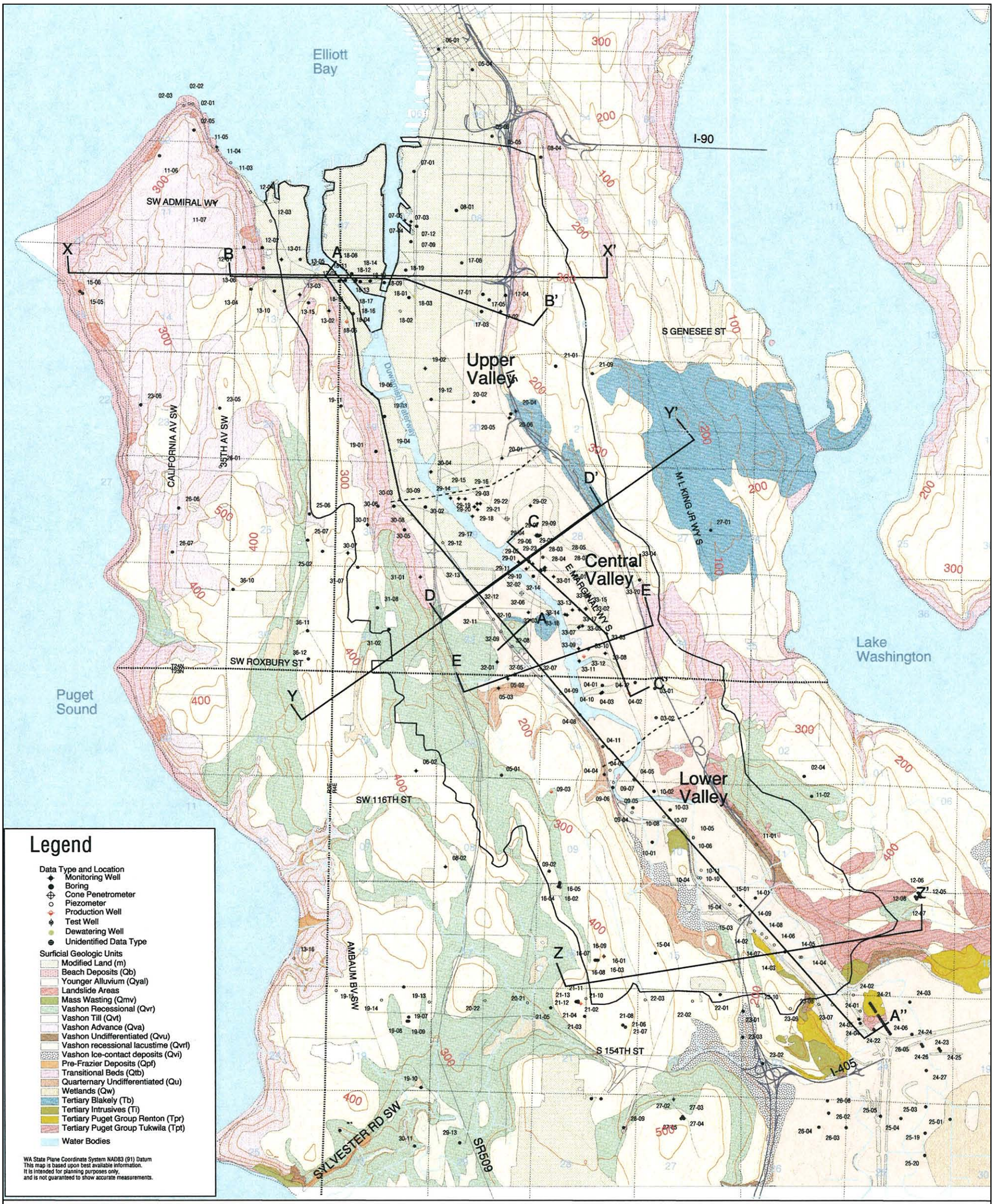


Plate 2. Surficial Geology Map with Cross-Section Locations

Duwamish Hydrogeologic Pathways Project

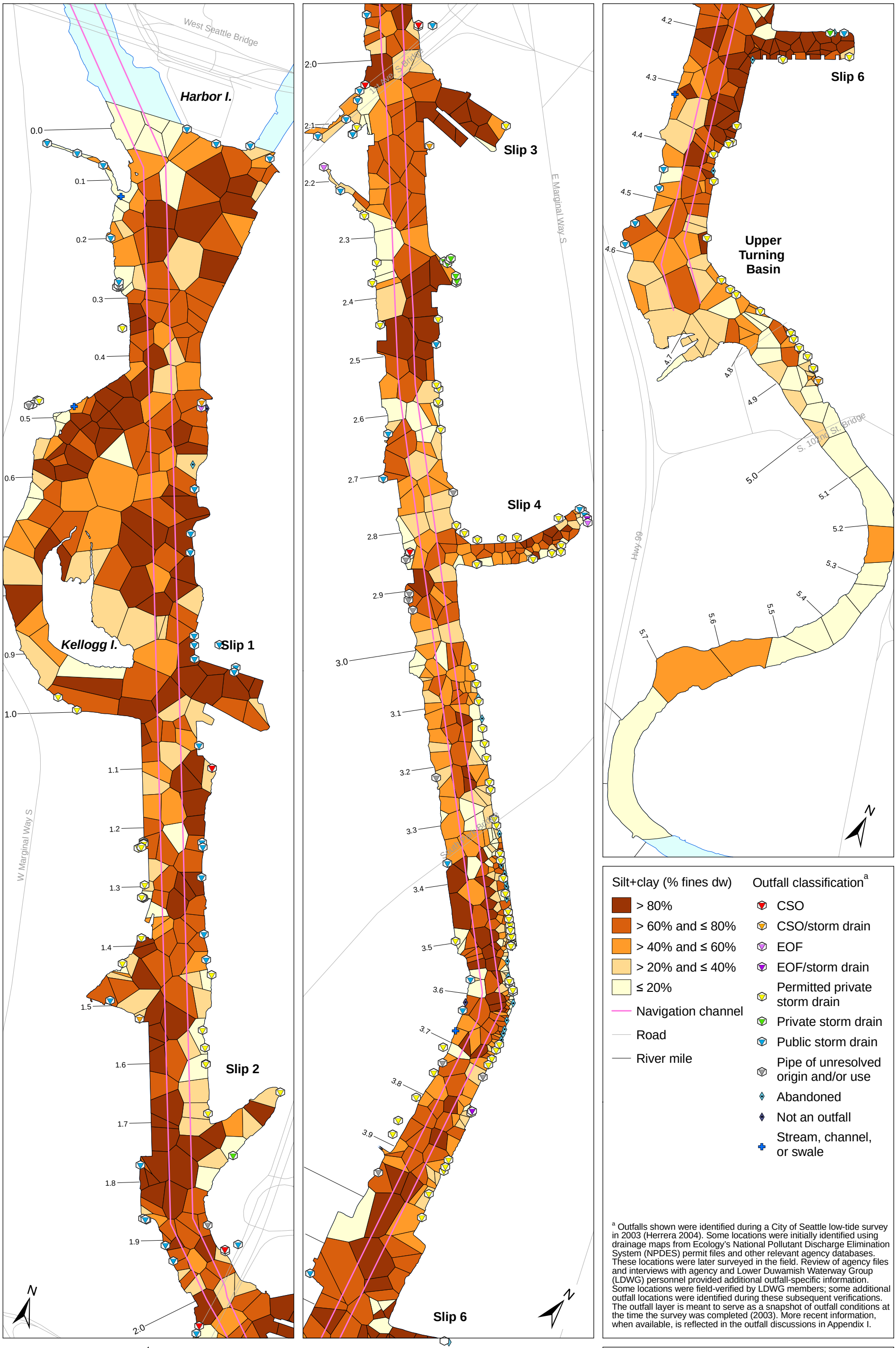
City of Seattle Office of Economic Development
King County Office of Budget and Strategic Planning

March 1998

Floyd & Snider Hart Crowser Black & Veatch Gambrell Urban University of Washington

Wind Ward environmental LLC

Map 2-5. Surficial geology in the Greater Duwamish Valley and associated cross section locations



Silt+clay (% fines dw)

- > 80%
- > 60% and ≤ 80%
- > 40% and ≤ 60%
- > 20% and ≤ 40%
- ≤ 20%
- Navigation channel
- Road
- River mile

Outfall classification[a]

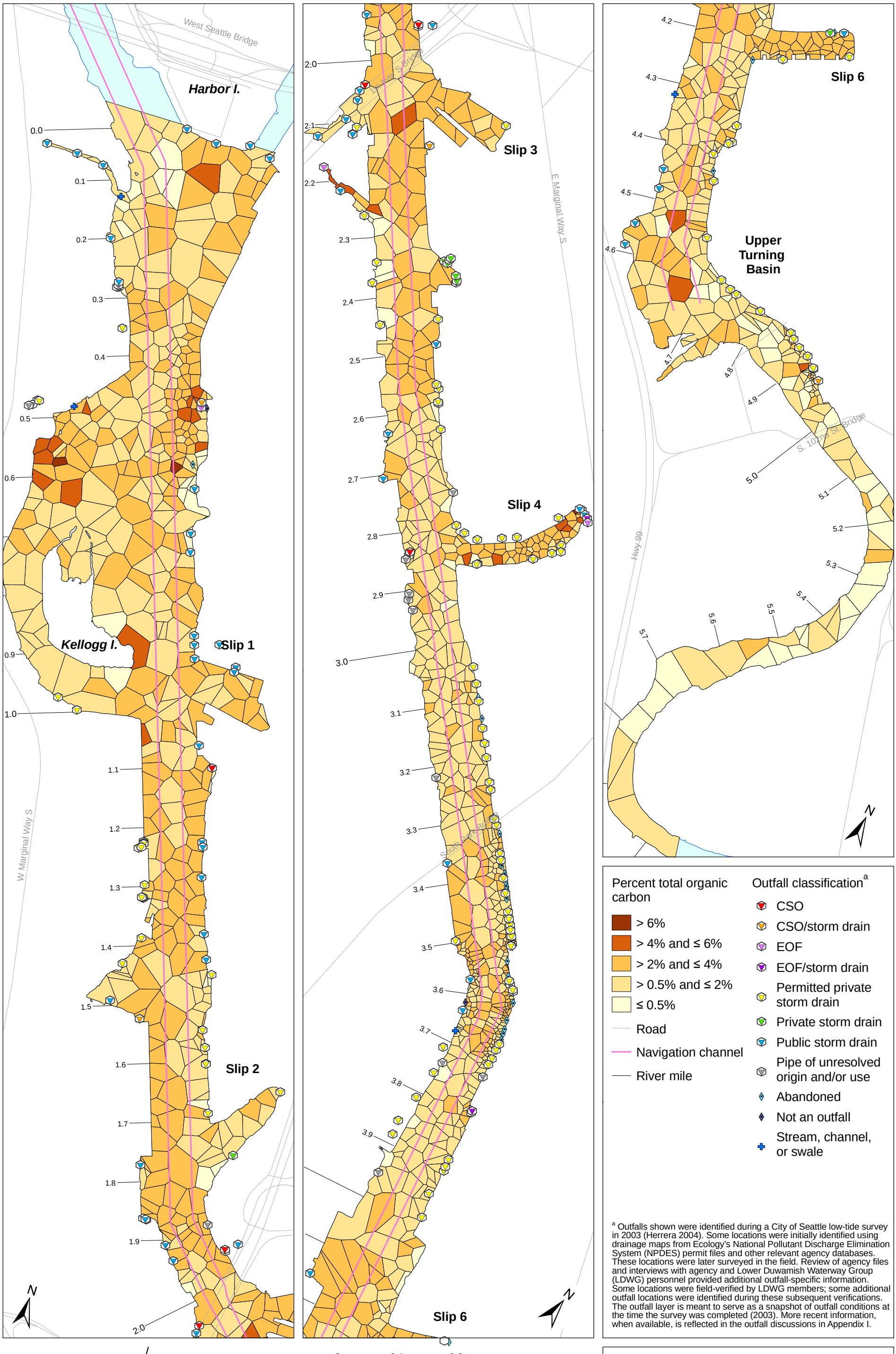
- CSO
- CSO/storm drain
- EOF
- EOF/storm drain
- Permitted private storm drain
- Private storm drain
- Public storm drain
- Pipe of unresolved origin and/or use
- Abandoned
- Not an outfall
- Stream, channel, or swale

[a] Outfalls shown were identified during a City of Seattle low-tide survey in 2003 (Herrera 2004). Some locations were initially identified using drainage maps from Ecology's National Pollutant Discharge Elimination System (NPDES) permit files and other relevant agency databases. These locations were later surveyed in the field. Review of agency files and interviews with agency and Lower Duwamish Waterway Group (LDWG) personnel provided additional outfall-specific information. Some locations were field-verified by LDWG members; some additional outfall locations were identified during these subsequent verifications. The outfall layer is meant to serve as a snapshot of outfall conditions at the time the survey was completed (2003). More recent information, when available, is reflected in the outfall discussions in Appendix I.

Map 2-6. Grain size distribution in surface sediment using Thiessen polygons

Wind Ward environmental LLC

Prepared by CEH 06/28/2010; Map 2865; W:\Projects\00-08-06_Duwamish_RI\data\gis\Phase2 RI\Intro - Env Setting



Percent total organic carbon

- > 6%
- > 4% and ≤ 6%
- > 2% and ≤ 4%
- > 0.5% and ≤ 2%
- ≤ 0.5%
- Road
- Navigation channel
- River mile

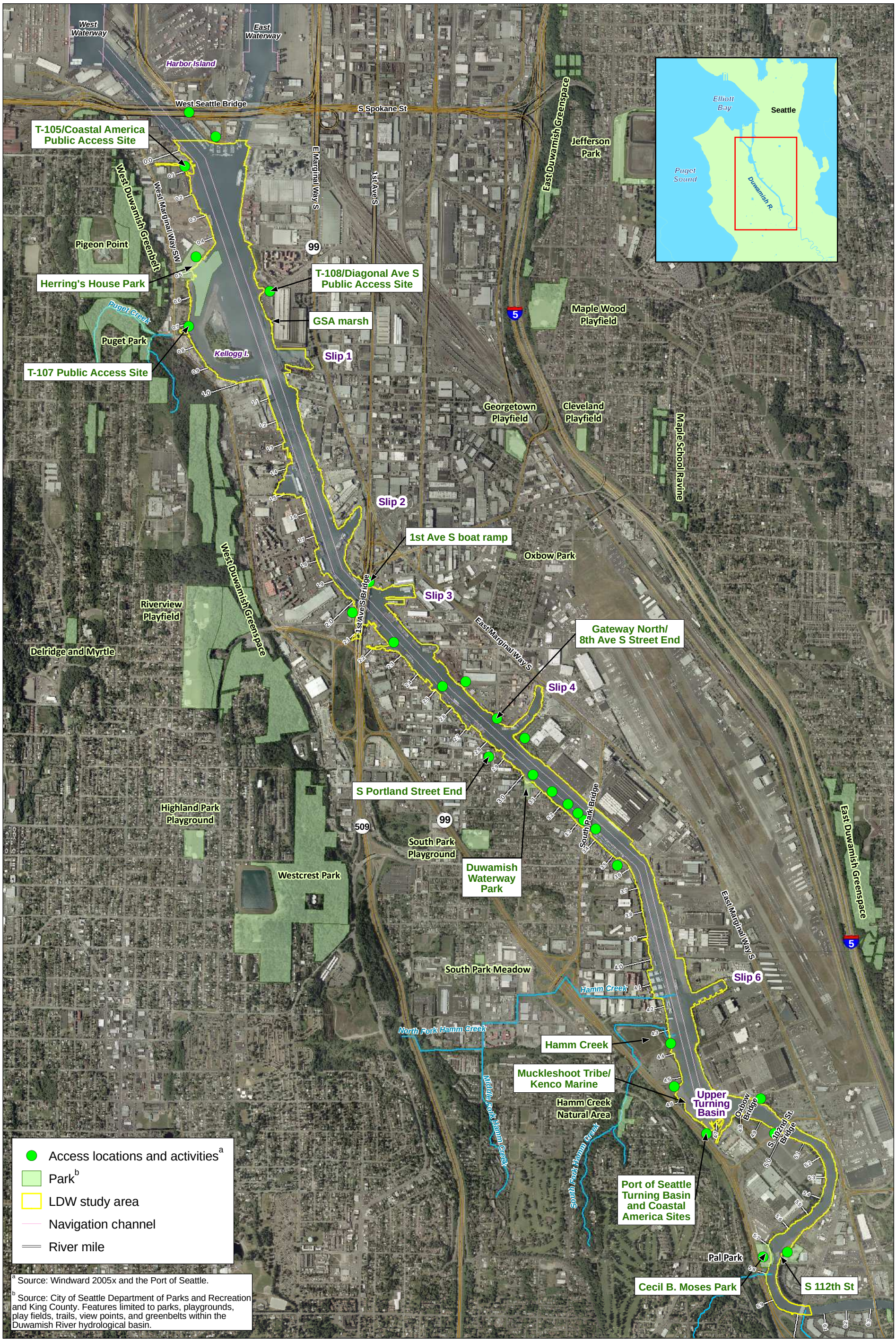
Outfall classification[a]

- CSO
- CSO/storm drain
- EOF
- EOF/storm drain
- Permitted private storm drain
- Private storm drain
- Public storm drain
- Pipe of unresolved origin and/or use
- Abandoned
- Not an outfall
- Stream, channel, or swale

[a] Outfalls shown were identified during a City of Seattle low-tide survey in 2003 (Herrera 2004). Some locations were initially identified using drainage maps from Ecology's National Pollutant Discharge Elimination System (NPDES) permit files and other relevant agency databases. These locations were later surveyed in the field. Review of agency files and interviews with agency and Lower Duwamish Waterway Group (LDWG) personnel provided additional outfall-specific information. Some locations were field-verified by LDWG members; some additional outfall locations were identified during these subsequent verifications. The outfall layer is meant to serve as a snapshot of outfall conditions at the time the survey was completed (2003). More recent information, when available, is reflected in the outfall discussions in Appendix I.

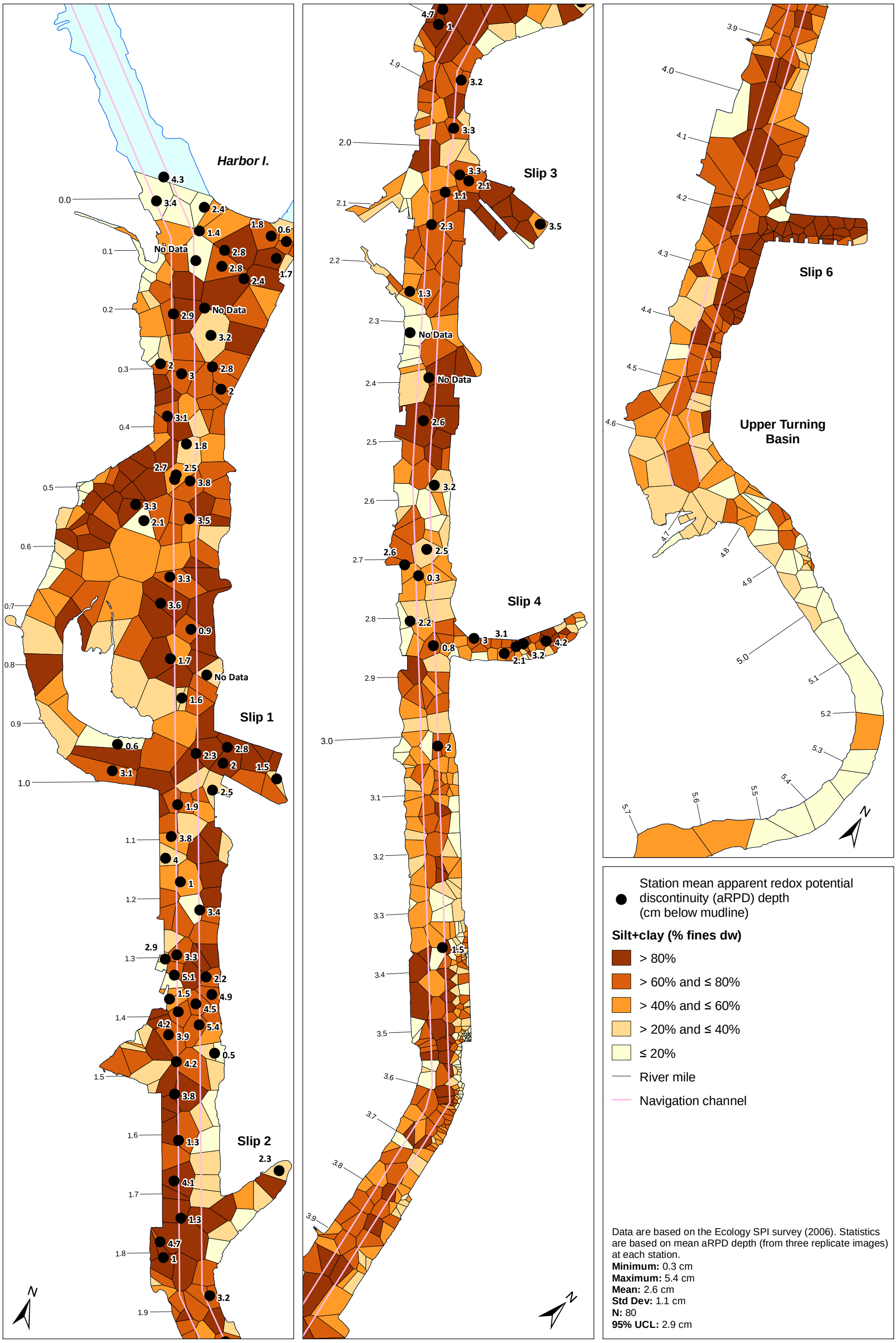
Map 2-7. Percent total organic carbon in surface sediment using Thiessen polygons

Wind Ward environmental LLC



Map 2-8. LDW restoration areas and parks

Photo source: "USGS High Resolution Orthoimage, Seattle/Tacoma, WA", United States Geological Survey, 2003. Distributed by King County GIS. Photo date 06/11/2002.



Station mean apparent redox potential discontinuity (aRPD) depth (cm below mudline)

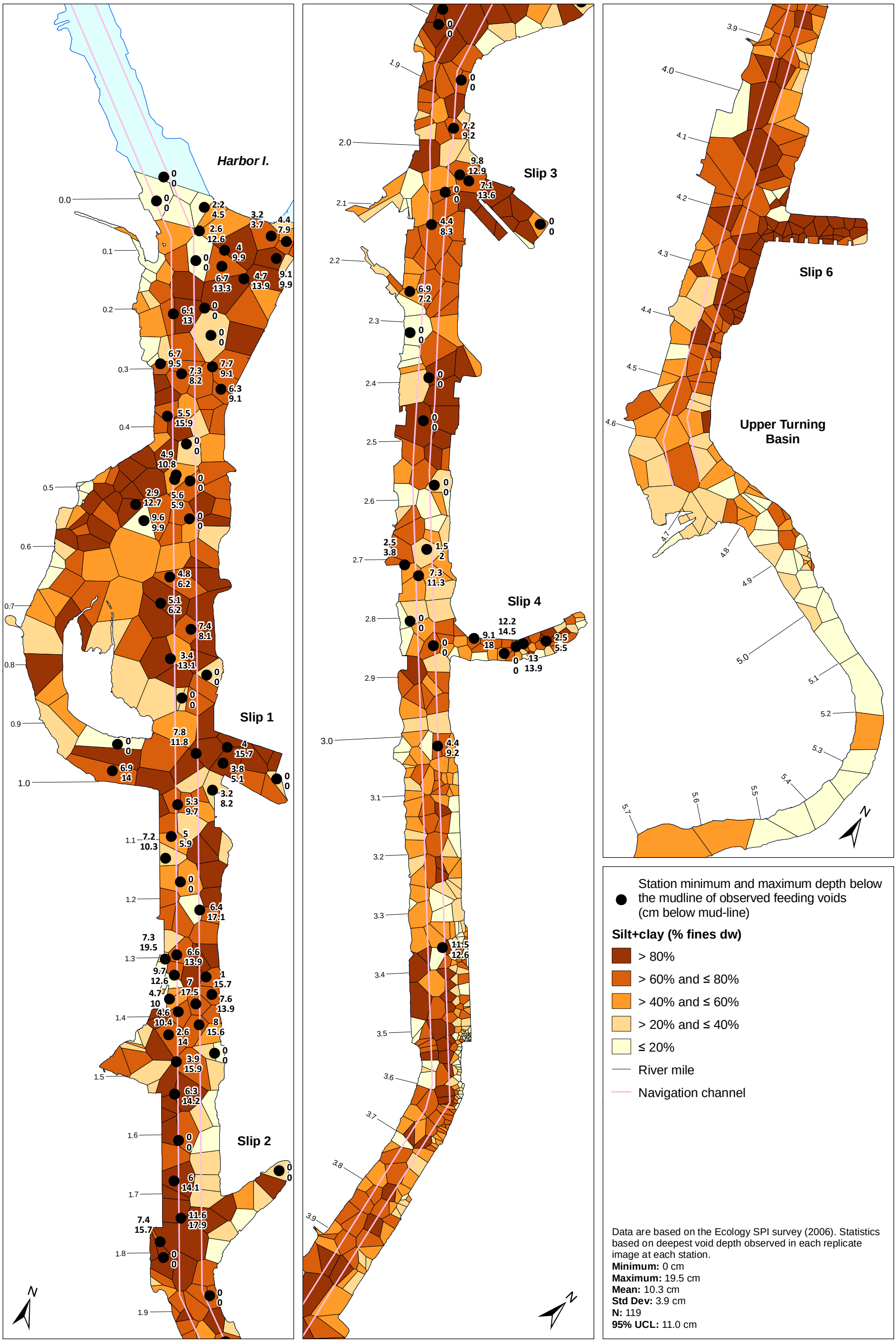
Silt+clay (% fines dw)

- > 80%
- > 60% and ≤ 80%
- > 40% and ≤ 60%
- > 20% and ≤ 40%
- ≤ 20%
- River mile
- Navigation channel

Data are based on the Ecology SPI survey (2006). Statistics are based on mean aRPD depth (from three replicate images) at each station.
Minimum: 0.3 cm
Maximum: 5.4 cm
Mean: 2.6 cm
Std Dev: 1.1 cm
N: 80
95% UCL: 2.9 cm

Map 2-9. SPI station mean aRPD depth with percent fines using Thiessen polygons

Wind Ward environmental LLC



Map 2-10. SPI station minimum and maximum void depth with percent fines using Thiessen polygons

Prepared by CEH, 06/28/2010, MAP #3780 W:\Projects\00-08-06_Duwamish_R\Data\GIS\Phase2 R\Intro - Env Setting

Harbor I.

Slip 1

Slip 2

Slip 3

Slip 4

Slip 6

Upper Turning Basin

Successional Stage

- Early Colonizing Communities
- Transitional Communities
- Mature Communities
- Indeterminate

Silt+clay (% fines dw)

- > 80%
- > 60% and ≤ 80%
- > 40% and ≤ 60%
- > 20% and ≤ 40%
- ≤ 20%
- River mile
- Navigation channel

Data are based on the Ecology SPI survey (2006).

0 0.1 0.2 Miles

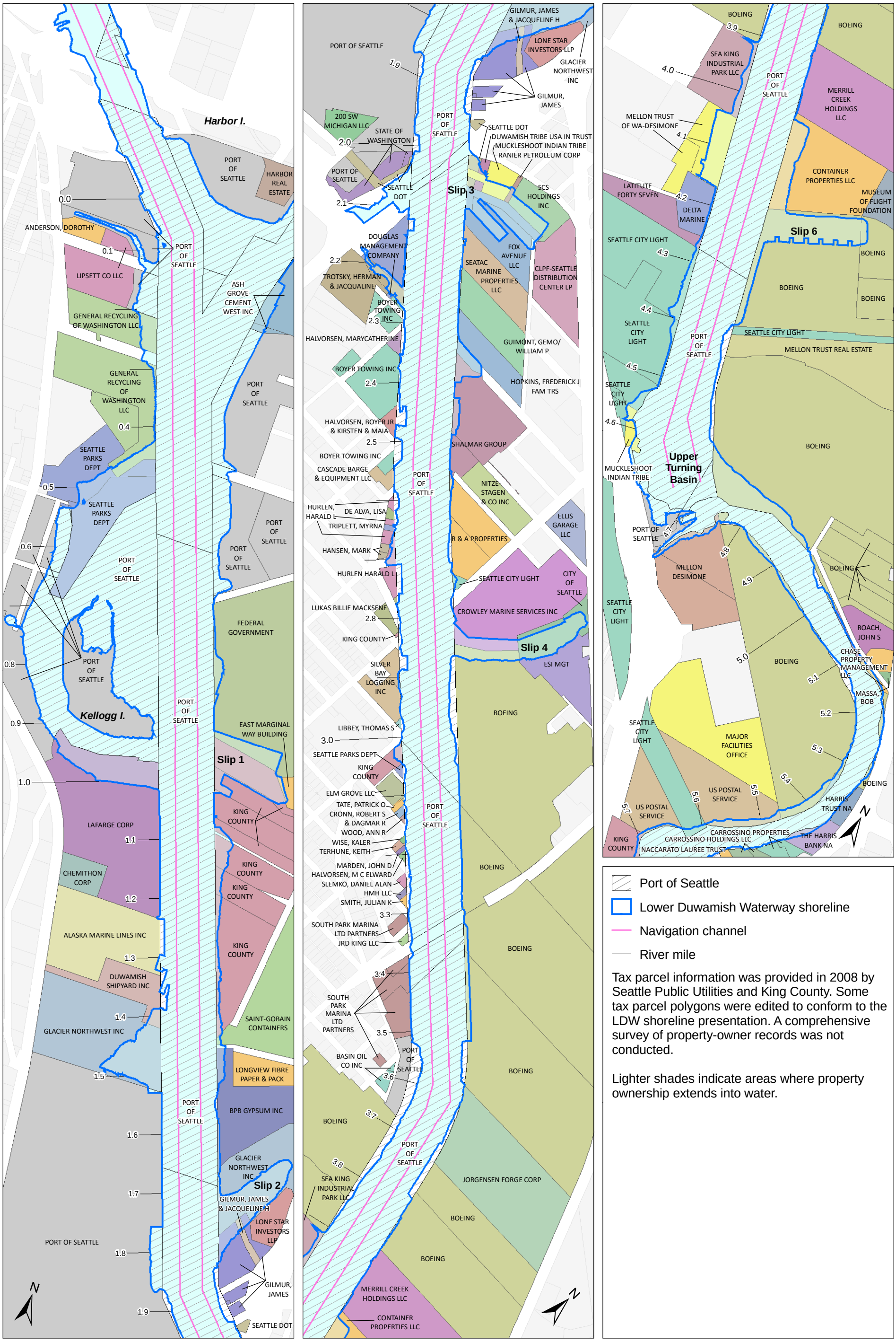
0 0.1 0.2 Kilometers

Scale is the same for each inset map

Map 2-11. SPI station successional stages with percent fines using Thiessen polygons

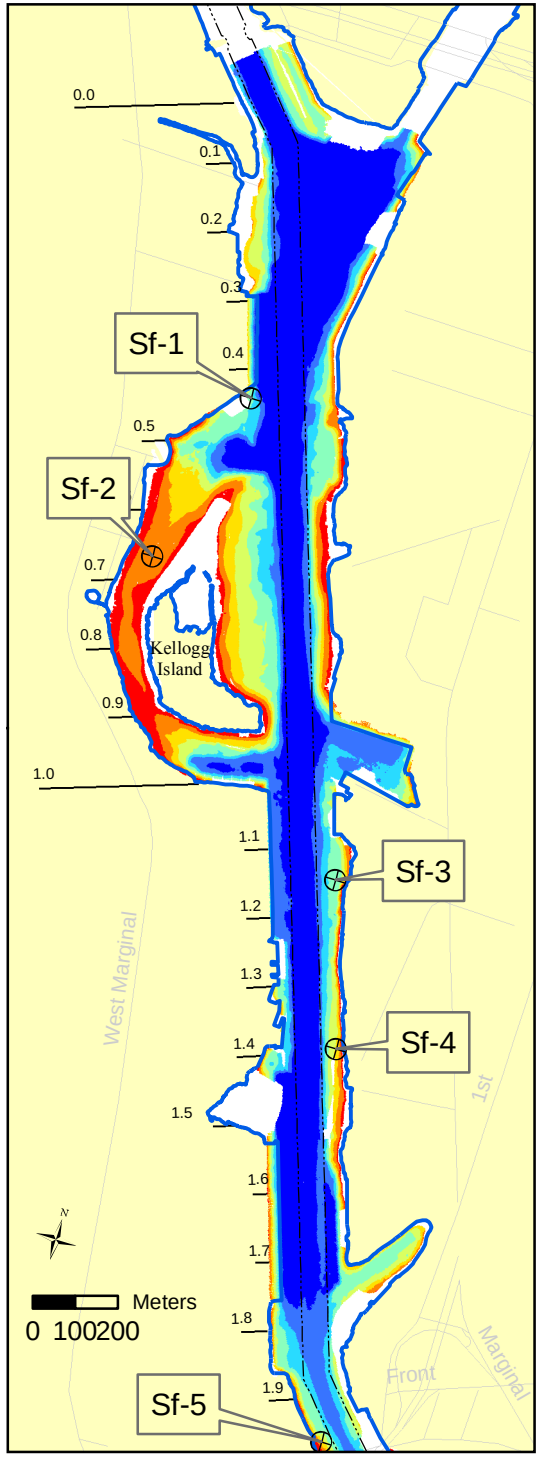
Wind Ward environmental LLC

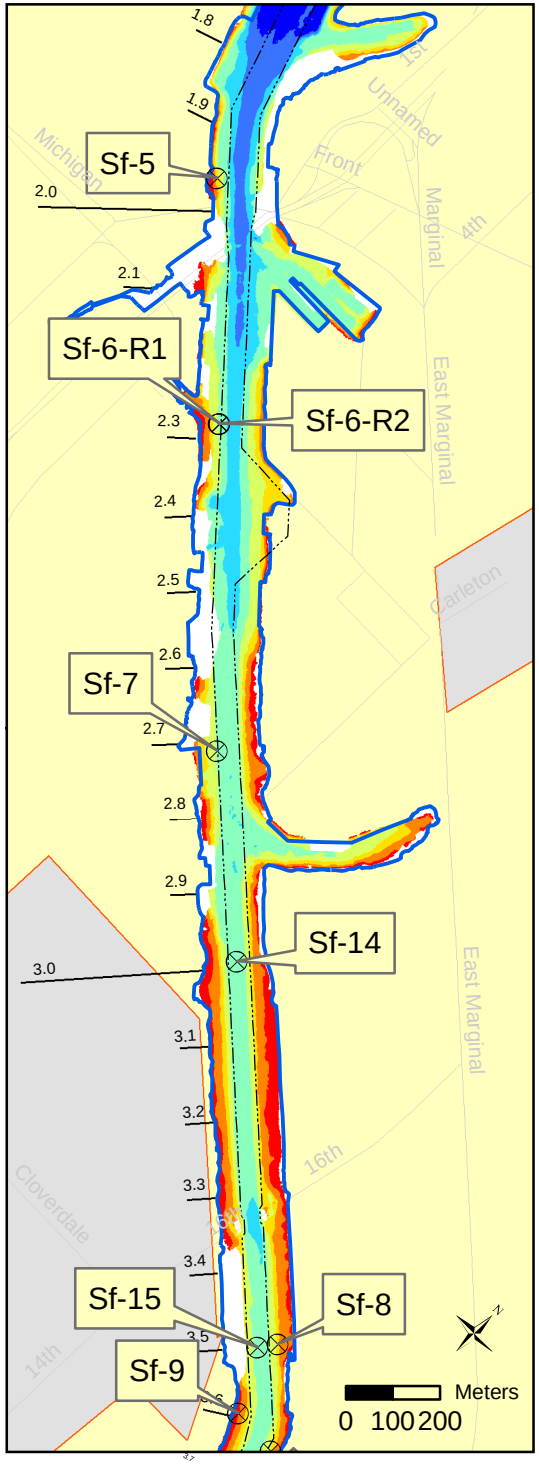
Prepared by CEH, 06/28/2010, MAP #3757, W:\Projects\00-08-06_Duwamish_Rl\data\GIS\Phase 2 Rl\Intro - Env Setting

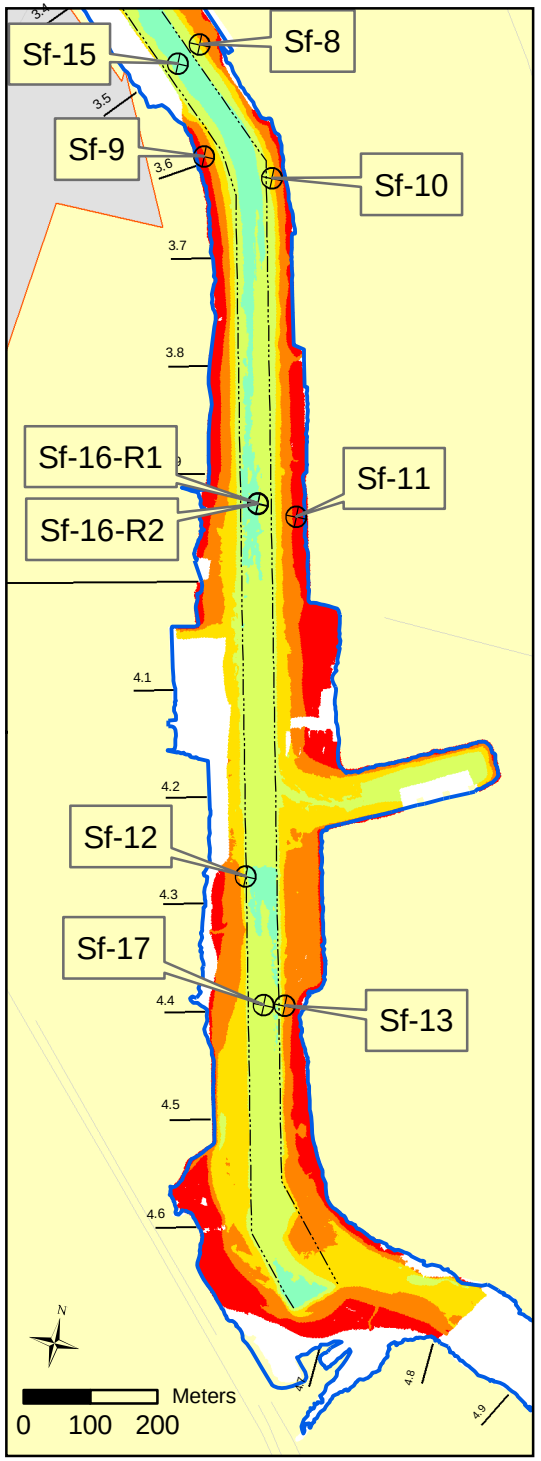


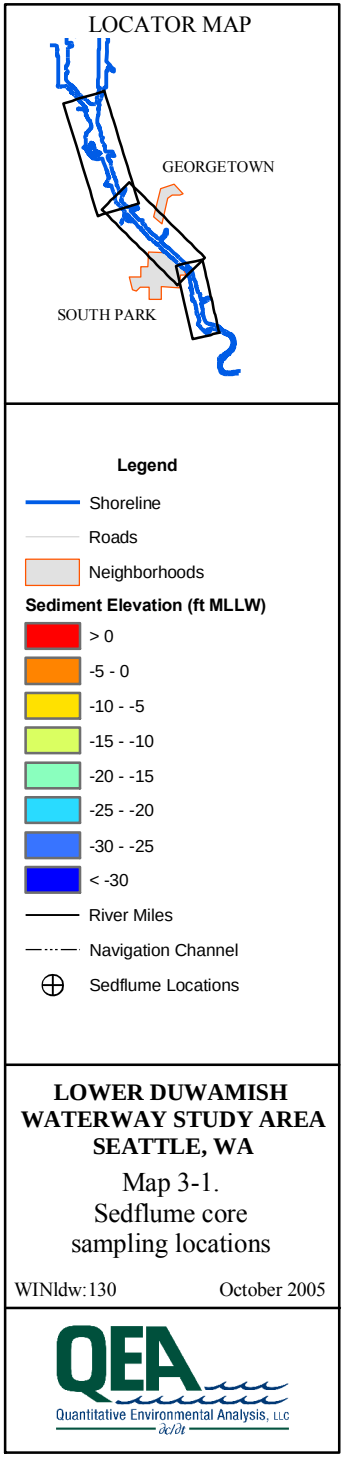
Map 2-12. Upland, intertidal, and subtidal land ownership

Prepared by CEH, 06/28/2010; MAP #2851; W:\Projects\00-08-06 Duwamish RI\data\gis\Phase2 RI\Intro - Env Setting









LOWER DUWAMISH WATERWAY STUDY AREA
SEATTLE, WA

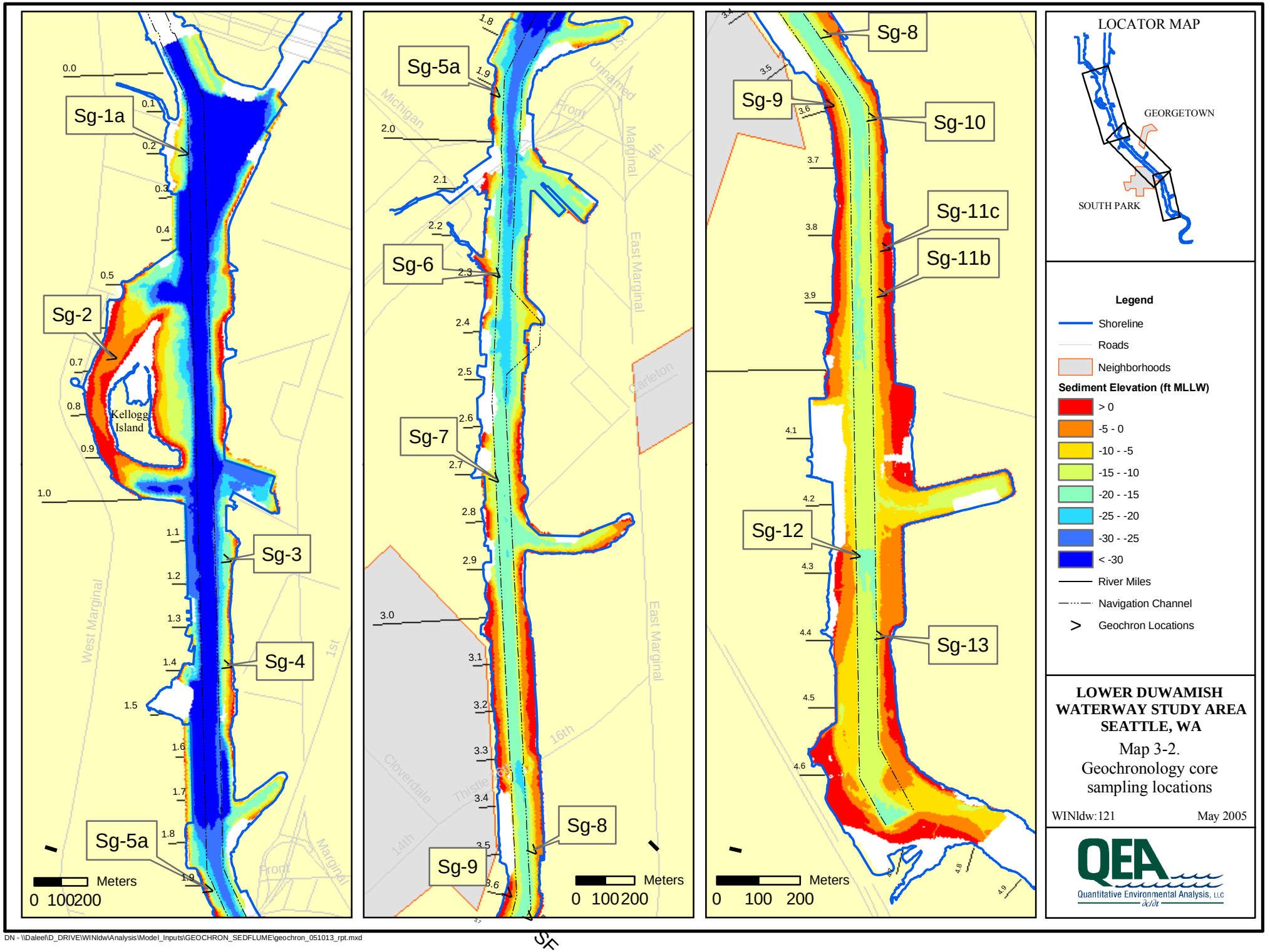
Map 3-1.
Sedflume core sampling locations

WINldw:130 October 2005

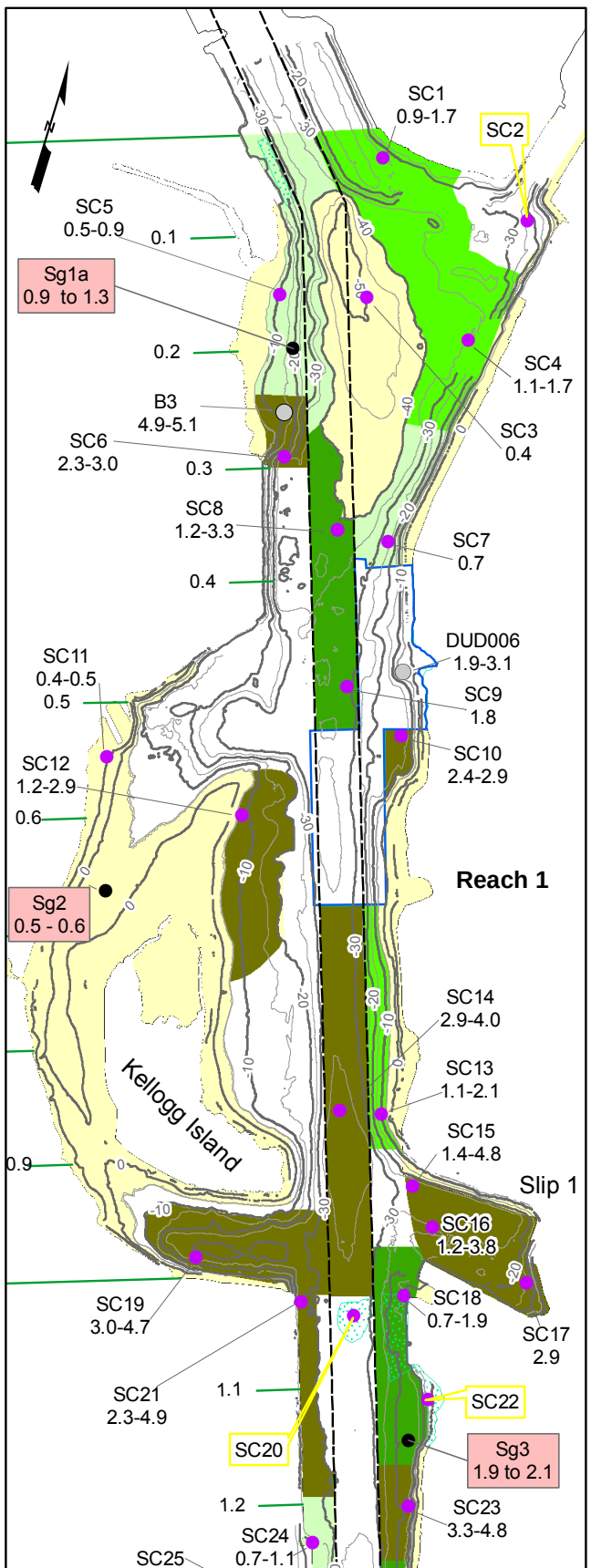
QEA
Quantitative Environmental Analysis, LLC

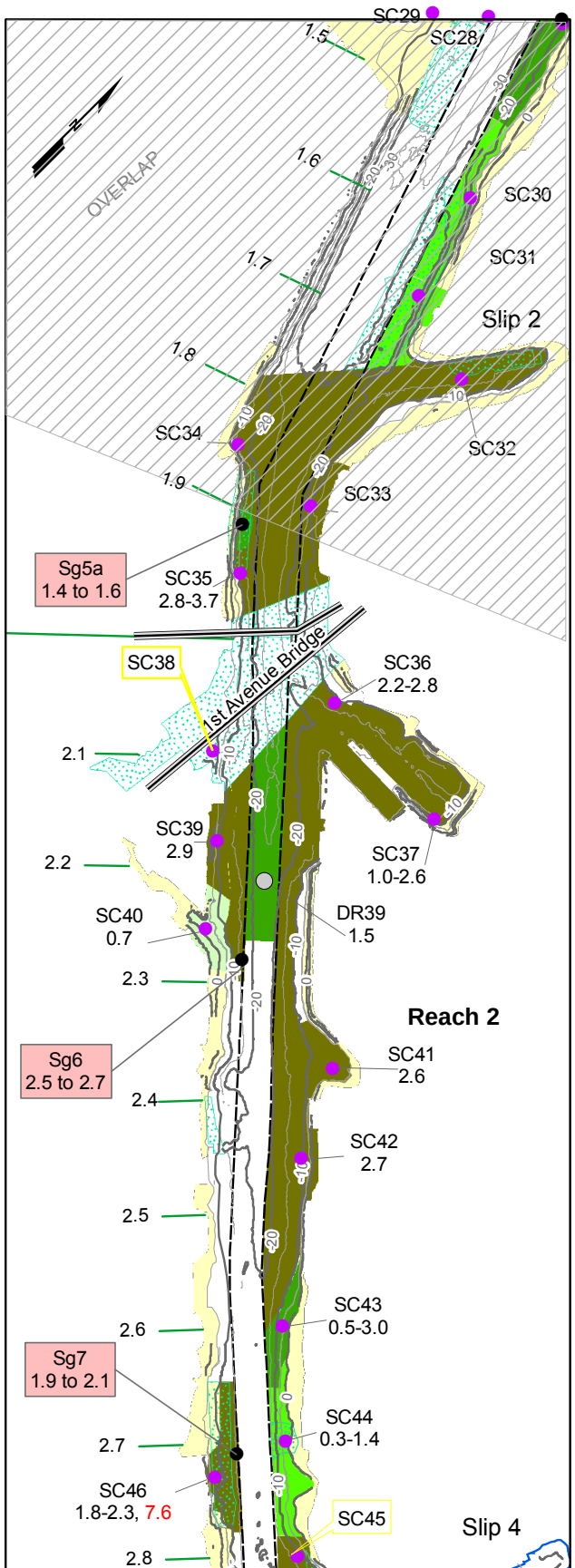
DN - \\Daleel\D_DRIVE\WINldw\Analysis\Model_Inputs\GEOCHRON_SEDFLUME\sedflume_051013_rpt.mxd

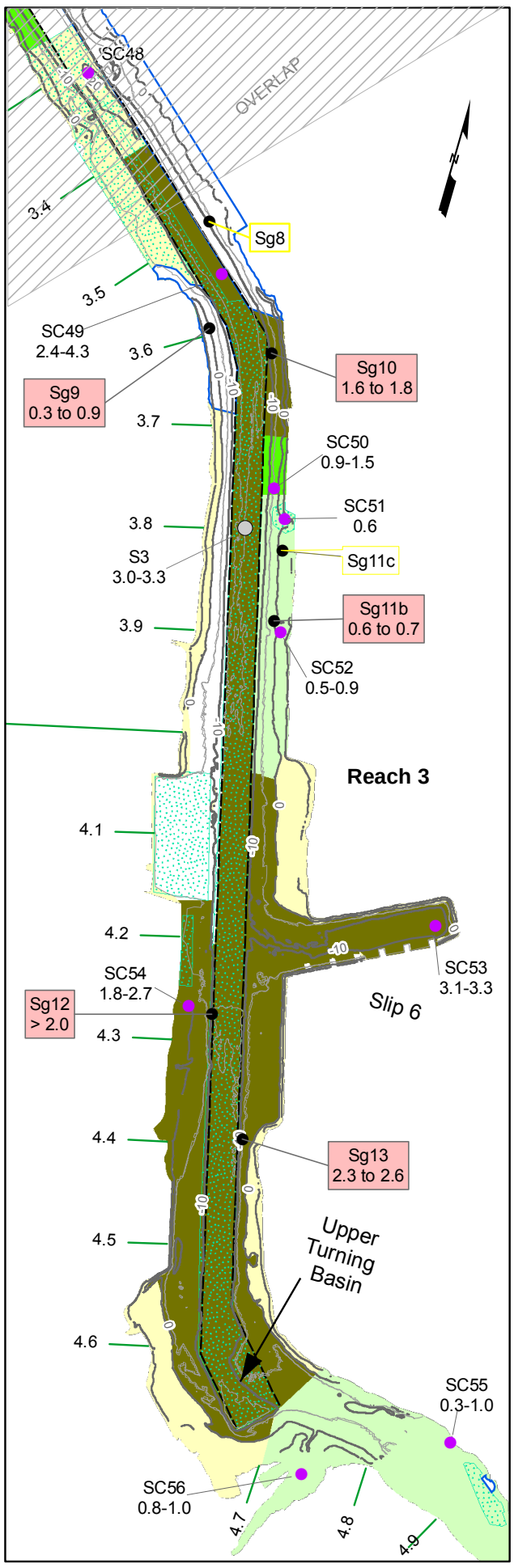
SF



DN - \\Daleel\D_DRIVE\WINldw\Analysis\Model_Inputs\GEOCHRON_SEDFLUME\geochron_051013_rpt.mxd







LEGEND

- River Mile Marker
- Navigation Channel
- -10 Bathymetric Contour (ft MLLW)
- SC8 2006 Core
- Sg1a 2004 Radioisotope Core
- B3 Historical Core
- SC20 No Rate Calculated for Core
- In-water Dredged/Potentially Disturbed Area[6]
- Early Action Area

Estimated Net Sedimentation Rate (cm/yr)

- < 0.5
- ≥0.5 and <1.0
- ≥1.0 and <1.5
- ≥1.5 and <2.0
- ≥ 2.0
- No Data/Atypical Trends

Core Number
SC46
1.8-2.3,7.6[7]
Net Sedimentation Rate (cm/yr)

0 400 800 Feet

Notes:

1. Bathymetry data provided by Windward Environmental LLC based on waterway-wide October 2003 survey.
2. Estimated net sedimentation rates calculated from radioisotope core data provided by QEA LLC; 2006 core chemistry data and historical core data provided by Windward Environmental LLC; and historical dredge event data provided by USACE.
3. Numerous time markers used to calculate estimated net sedimentation rates are from radioisotope, physical, and chemical geochronology profiles.
4. Areas generally delineated within Reaches 1, 2, and 3; the east and west bench areas; and the navigation channel. Water depth, grain size, and distance to other cores also considered.
5. Ranges shown are calculated from recovered depths.
6. Potentially disturbed areas include documented dredge events after 1980, notes from USACE bathymetry surveys, or in-water debris/disturbances evident in the core logs.
7. Red font represents rate from dredge event marker outside range of other rates.

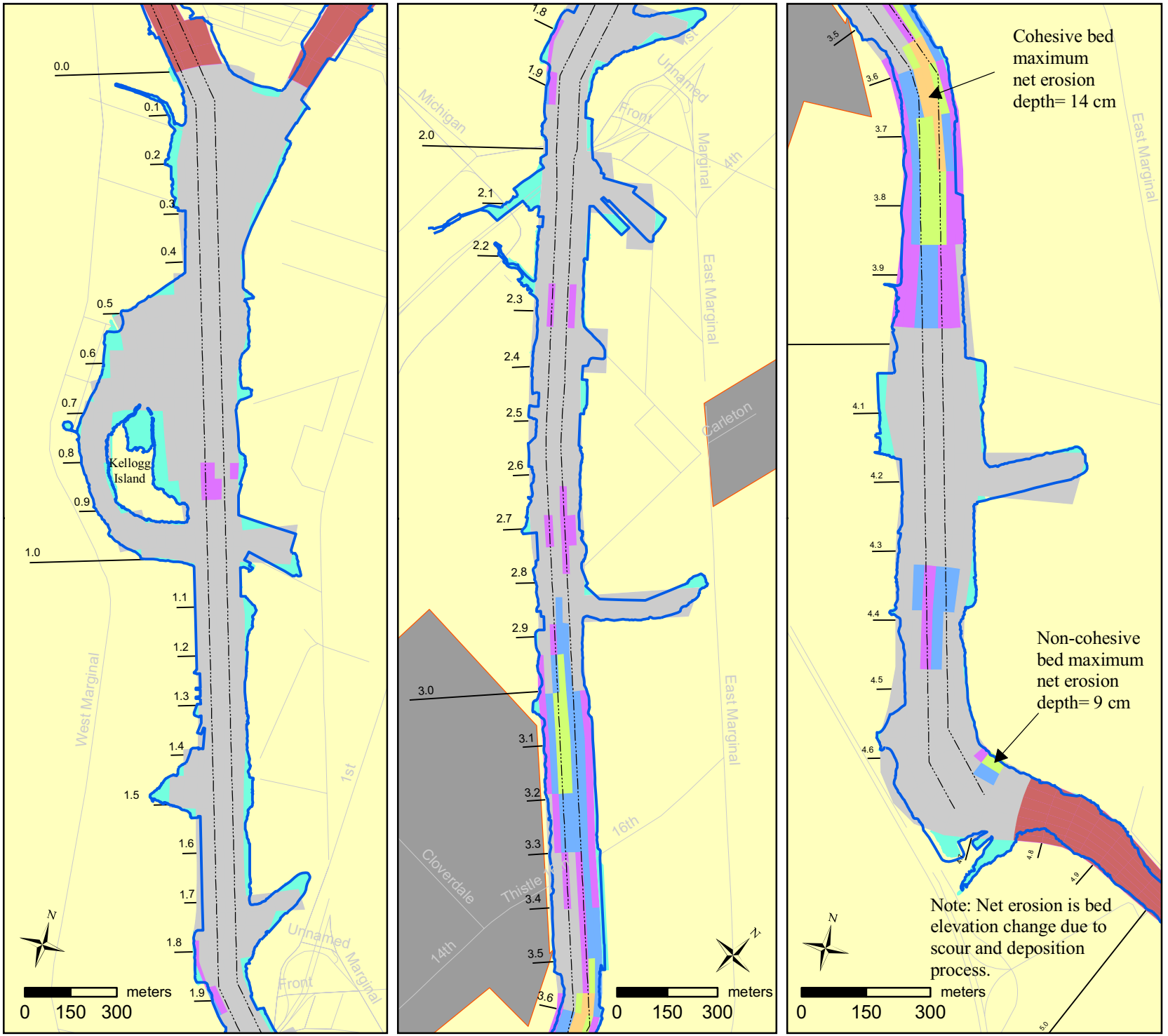
ENSR | AECOM
Merged with ENSR in 2007 RETEC
Lower Duwamish Waterway Group
Port of Seattle / City of Seattle / King County / The Boeing Company

LOWER DUWAMISH WATERWAY
SEDIMENT TRANSPORT ANALYSIS REPORT
05482015-611

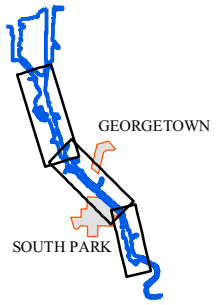
GENERALIZED ESTIMATES OF NET SEDIMENTATION RATES IN THE LDW

DATE: 10/15/08 | DWN. BY: MVI/sea | **Map 3-3**

F:\PROJECTS\GIS\Lower Duwamish FS\Projects\Sediment Transport Model\SedimentTransAnalysisReport\Figure5.mxd : Created using ArcGIS 9.2



LOCATOR MAP



LEGEND

Net erosion depth (cm)

- > 10
- 6 - 10
- 2 - 6
- 0 - 2
- Net deposition
- Navigation channel
- Shore line
- River miles
- Roads
- Neighborhoods
- Outside model domain
- Hard bottom area

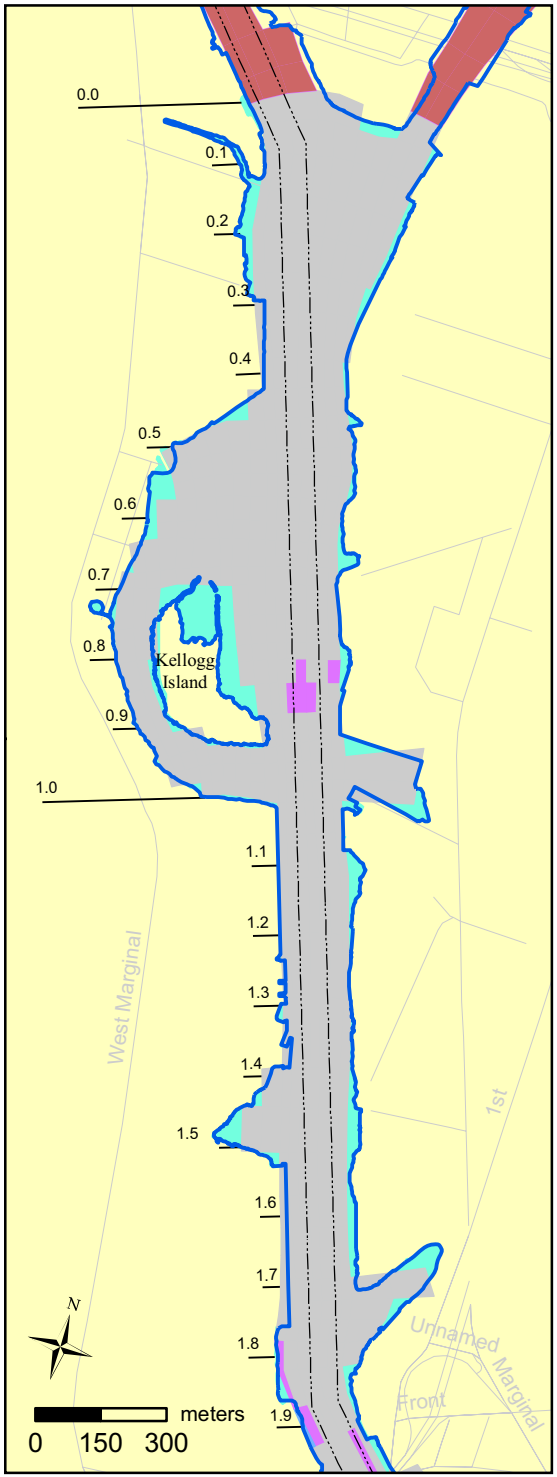
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

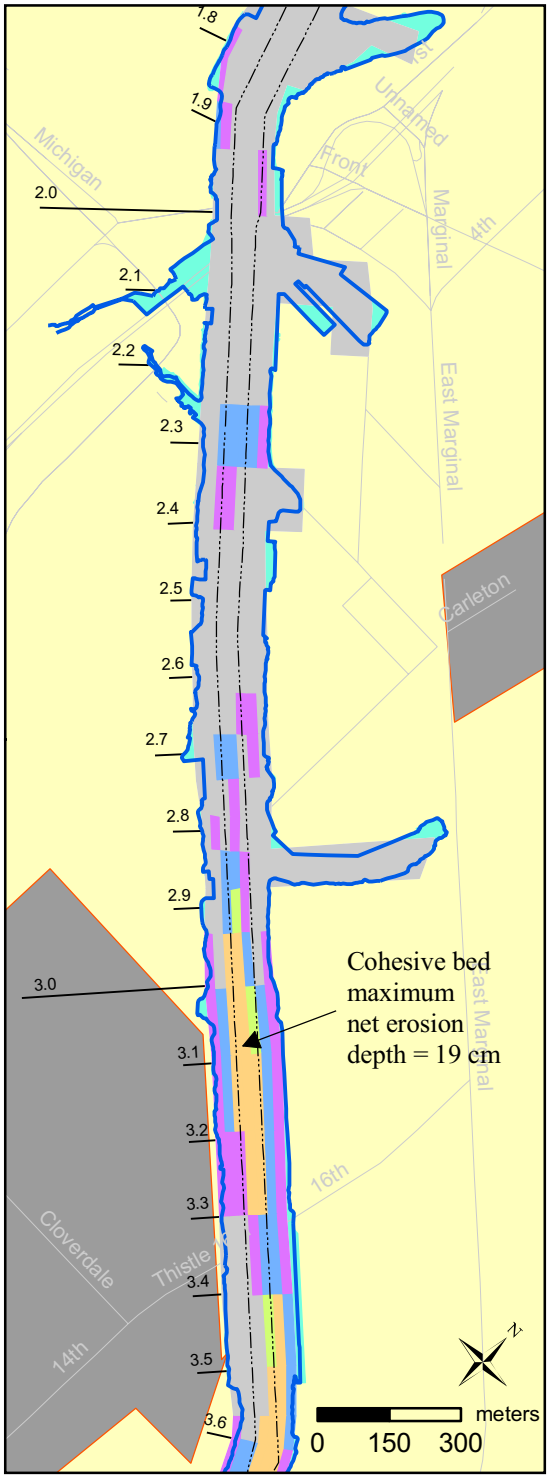
Map 3-4.
Spatial distribution of predicted net erosion during 2-year high-flow event.

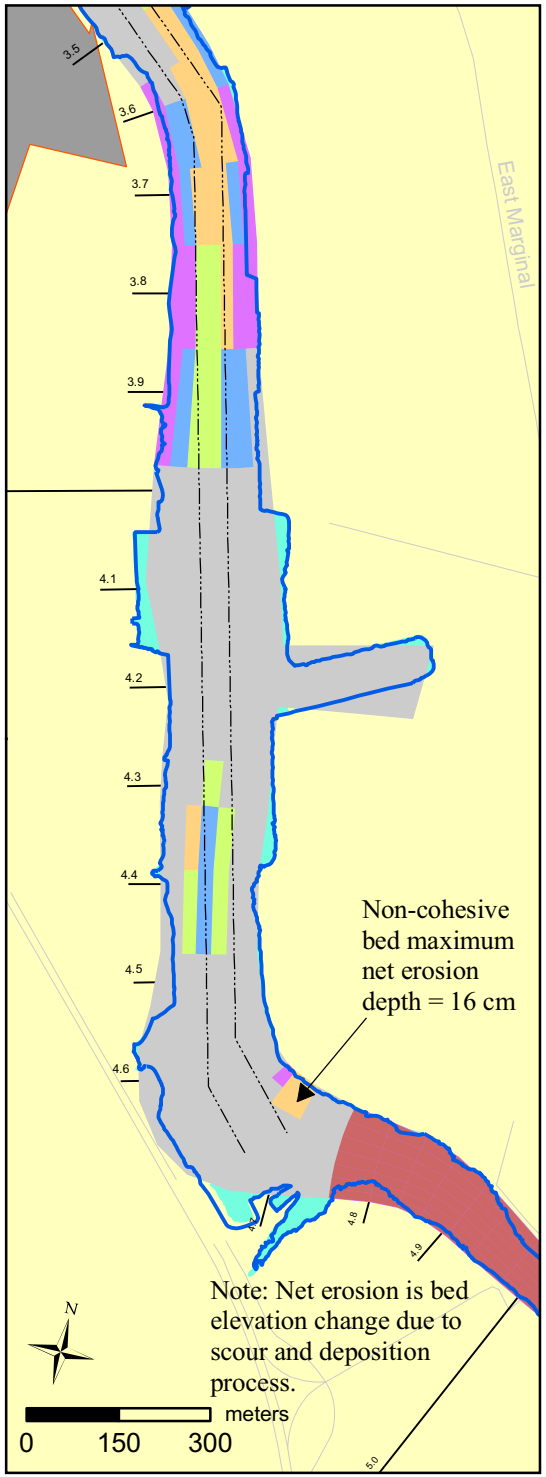
June 2008

QEA
Quantitative Environmental Analysis, LLC

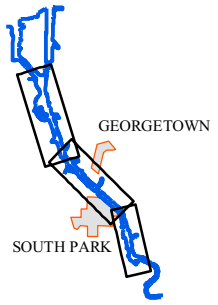
FC/AC - \\gis_station\d_drive\Private\RETldw\GIS_plot\sensitivity_plot_04102008.mxd







LOCATOR MAP



LEGEND

Net erosion depth (cm)

- > 10
- 6 - 10
- 2 - 6
- 0 - 2
- Net deposition
- Navigation channel
- Shore line
- River miles
- Roads
- Neighborhoods
- Outside model domain
- Hard bottom area

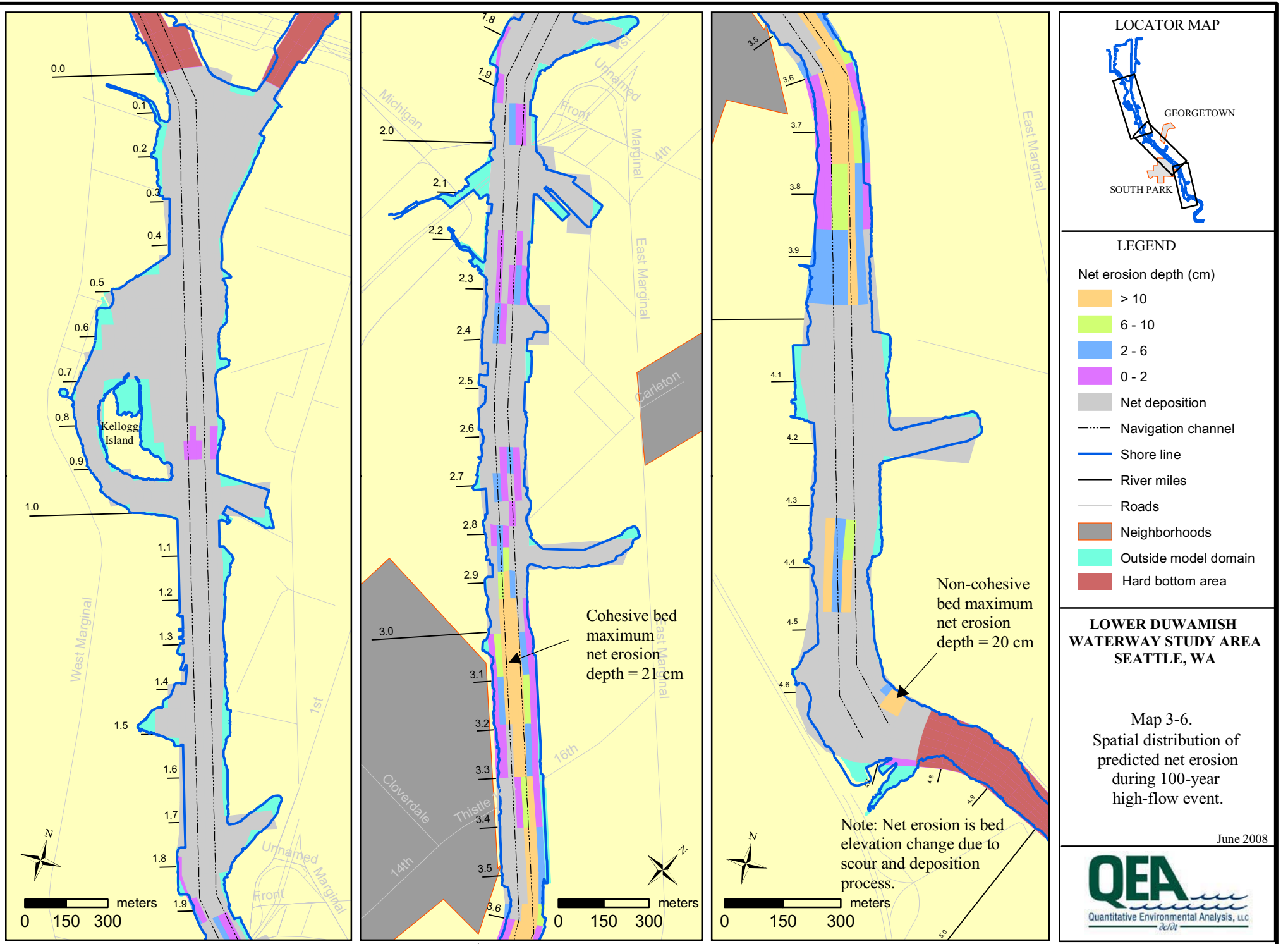
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

Map 3-5.
Spatial distribution of predicted net erosion during 10-year high-flow event.

June 2008

QEA
Quantitative Environmental Analysis, LLC

FC/AC - \\gis_station\d_drive\Private\RETldw\GIS_plot\sensitivity_plot_04102008.mxd



LOCATOR MAP

LEGEND

Net erosion depth (cm)

- > 10
- 6 - 10
- 2 - 6
- 0 - 2
- Net deposition
- Navigation channel
- Shore line
- River miles
- Roads
- Neighborhoods
- Outside model domain
- Hard bottom area

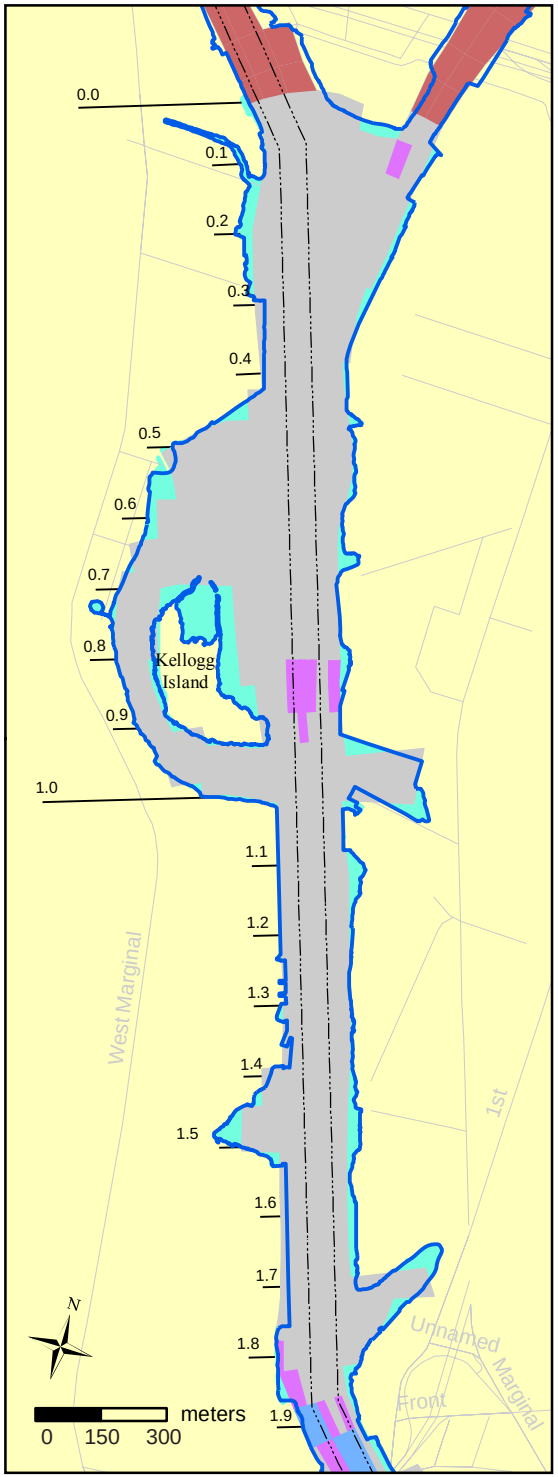
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

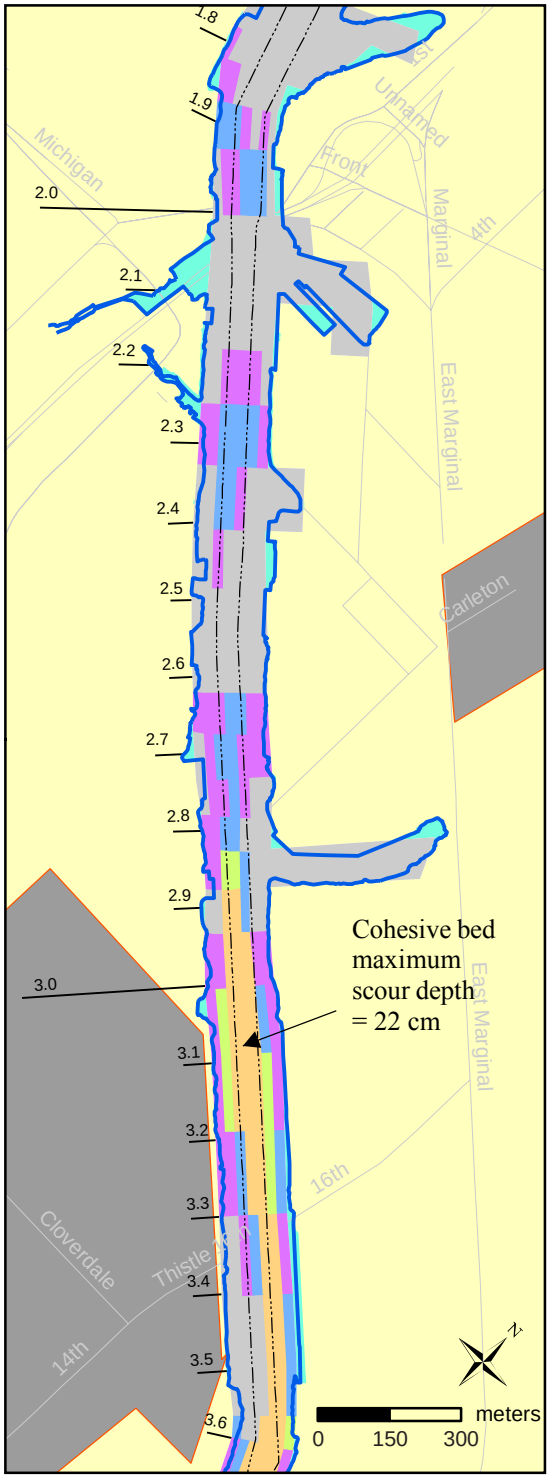
Map 3-6.
Spatial distribution of predicted net erosion during 100-year high-flow event.

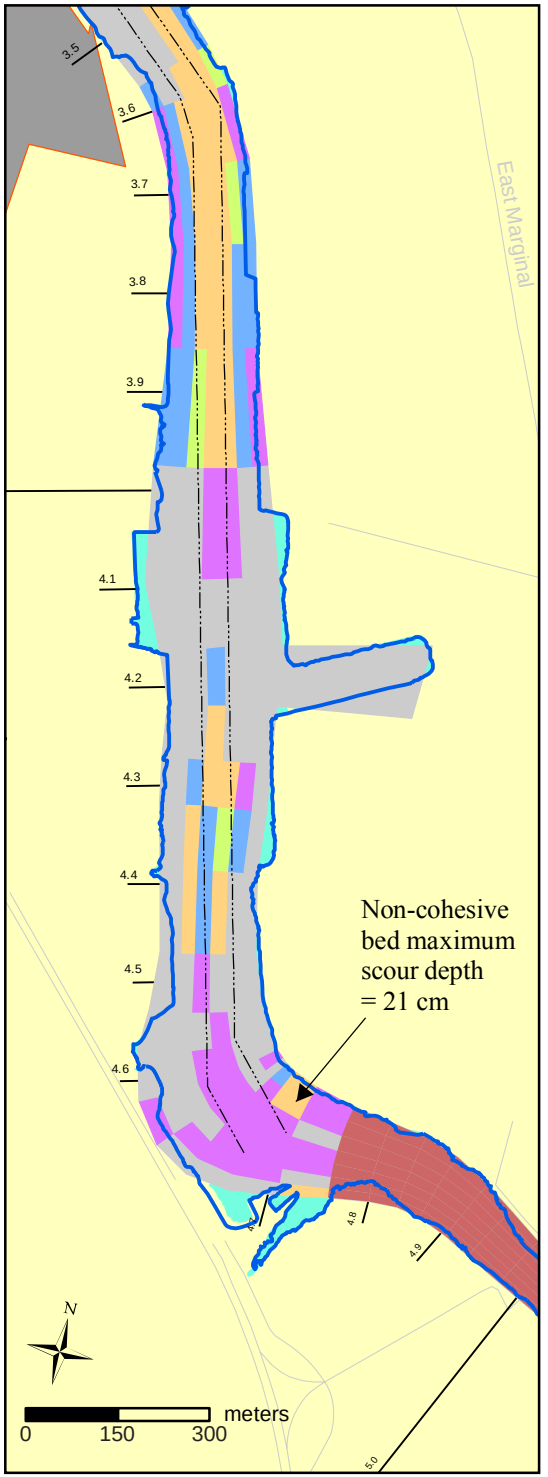
June 2008

QEA
Quantitative Environmental Analysis, LLC

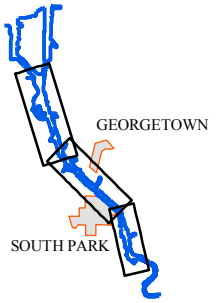
FC/AC - \\gis_station\d_drive\Private\RETldw\GIS_plot\sensitivity_plot_04102008.mxd







LOCATOR MAP



LEGEND

Maximum scour depth (cm)

- > 10
- 6 - 10
- 2 - 6
- 0 - 2
- 0
- Navigation channel
- Shore line
- River mile
- Roads
- Neighborhoods
- Outside model domain
- Hard bottom area

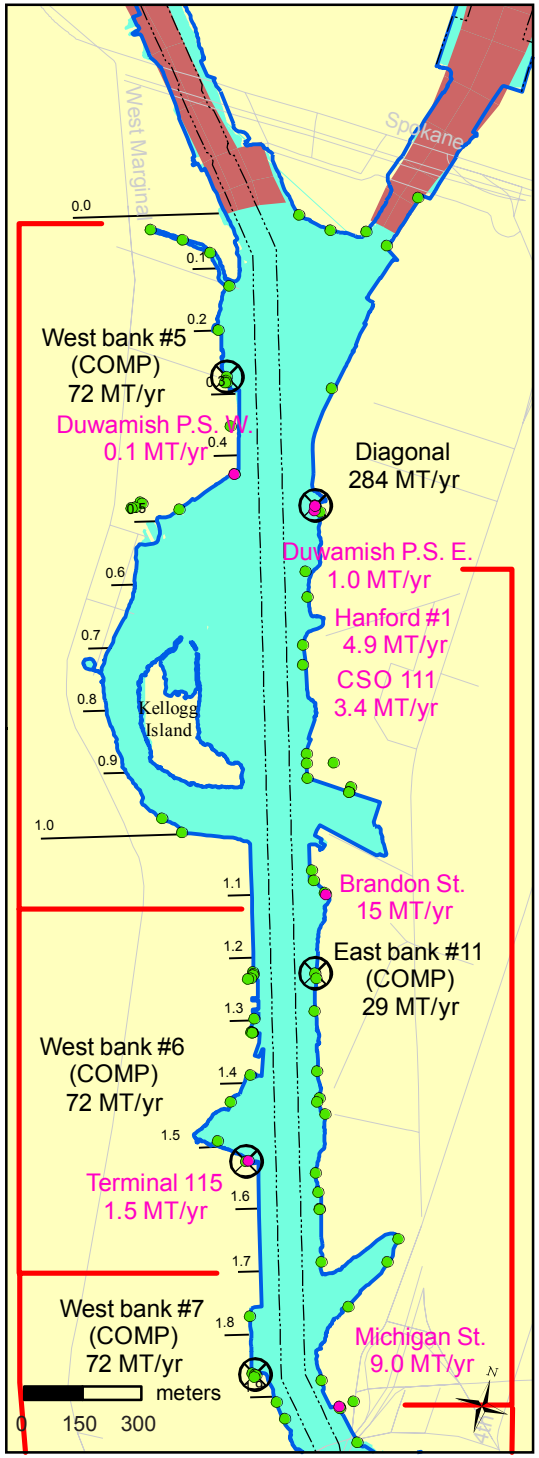
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

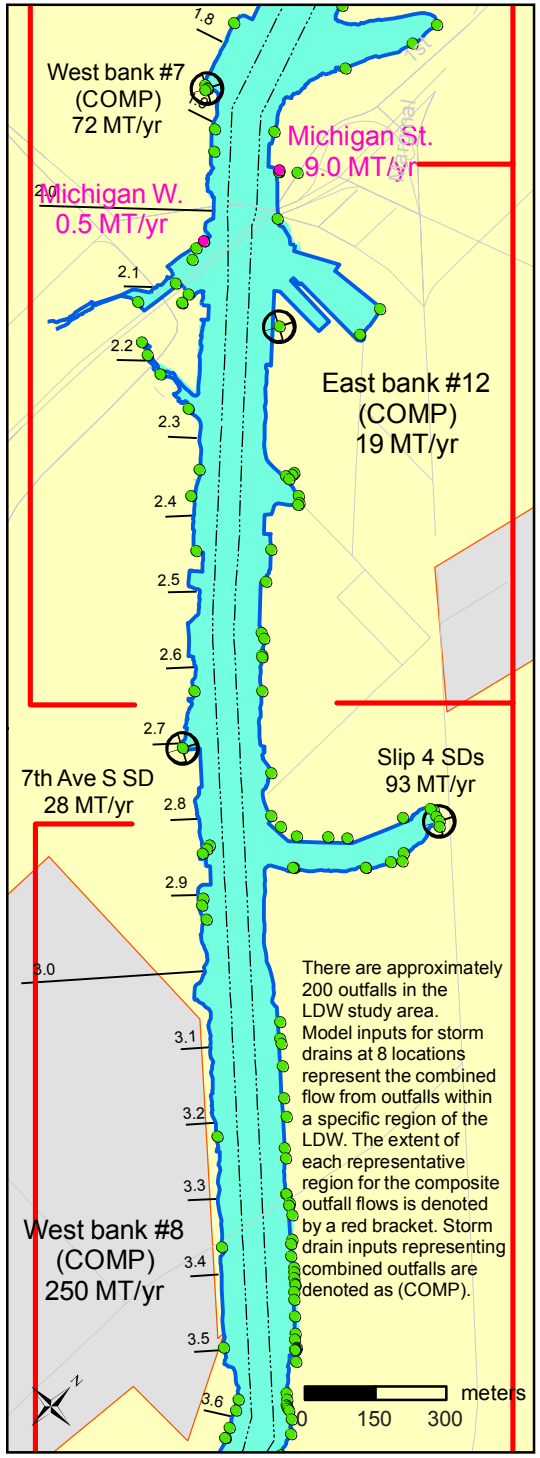
Map 3-7.
Spatial distribution of predicted maximum bed scour depth during 100-year high-flow event.

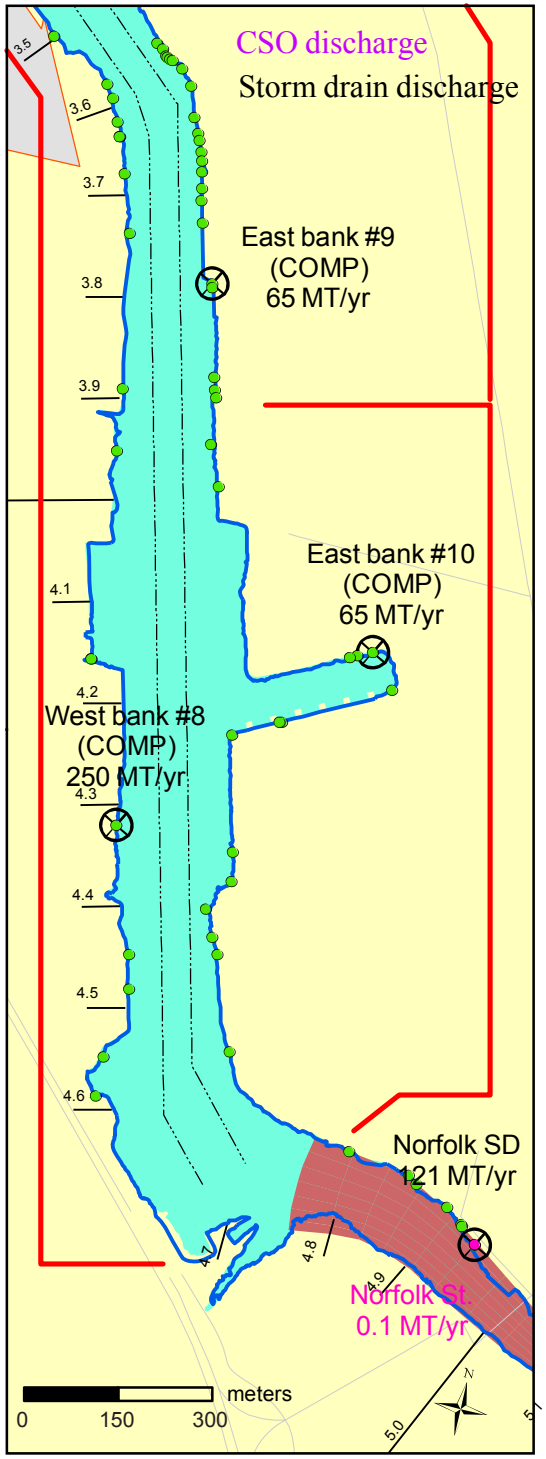
June 2008

QEA
Quantitative Environmental Analysis, LLC

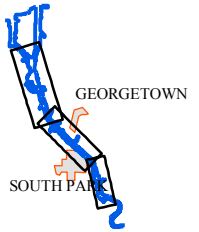
FC/AC - \\gis_station\d_drive\Private\RETIdw\GIS_plot\sensitivity_plot_04102008.mxd







LOCATOR MAP



LEGEND

- CSO Locations
- Outfall Locations
- Storm Drain Locations
- Navigation Channel
- Shore Line
- River Mile
- Roads
- Neighborhoods
- MT metric tons

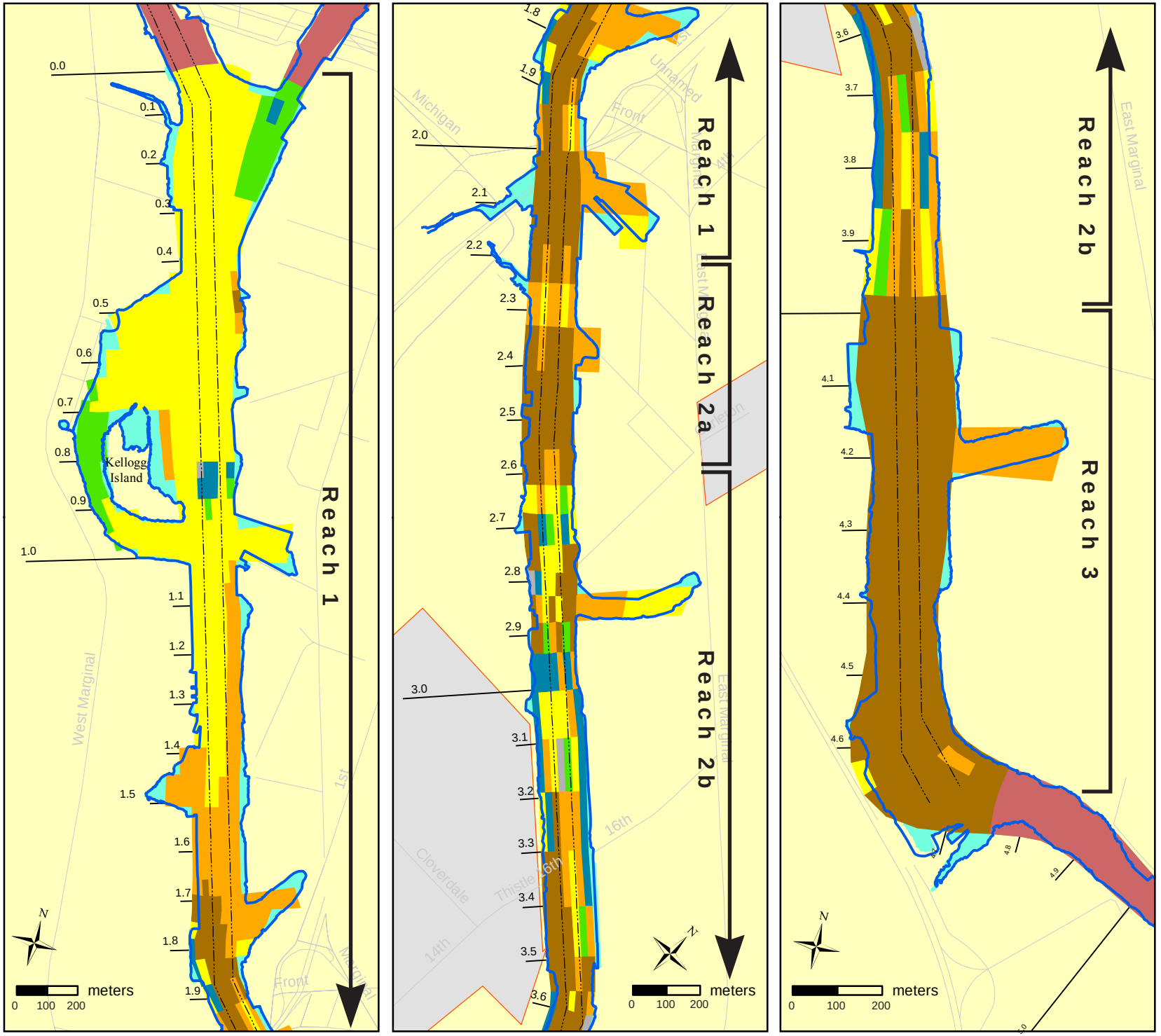
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

Map 3-8. Representative locations of and annual loads for lateral sediment sources.

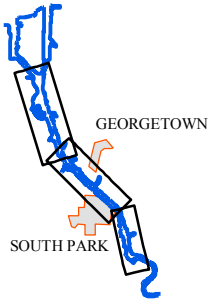
April 2008

QEA Quantitative Environmental Analysis, LLC

FC - \\Gis_station\D_DRIVE\Private\RETldw\GIS_plot\LatSourcePlot.mxd



LOCATOR MAP



LEGEND

- Navigation Channel
- Shore Line
- River Miles
- Roads
- Hard Bottom
- Neighborhoods
- Outside model domain

Model Predicted NSR (cm/yr)

- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0
- Net Erosion

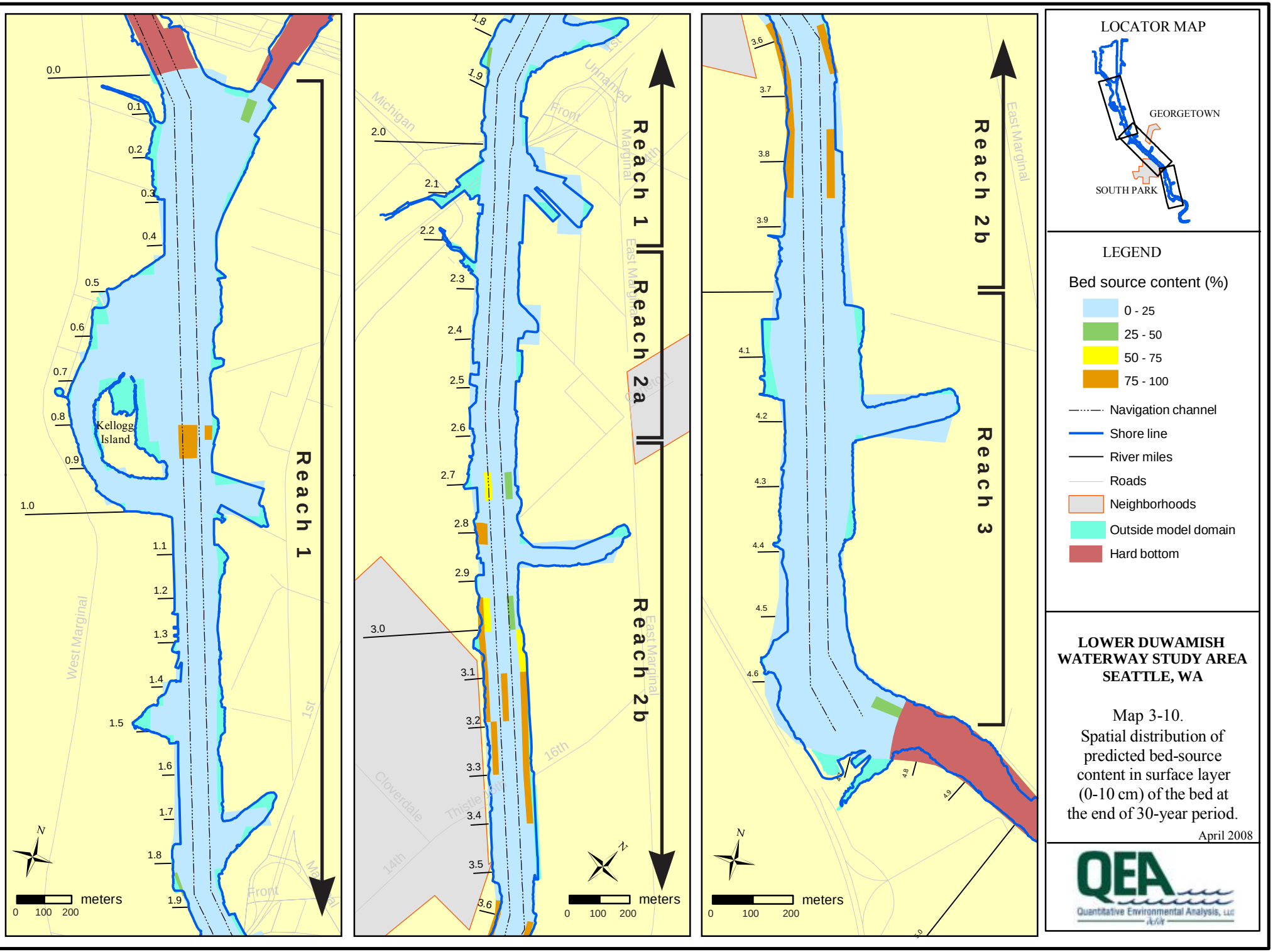
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

Map 3-9.
Spatial distribution of predicted net sedimentation rate (NSR) for 30-year period.

June 2008

QEA
Quantitative Environmental Analysis, LLC

FC- \\Gis_station\D_DRIVE\Private\RETldw\GIS_plot\layout_bed_elv_chg_070205.mxd



LOWER DUWAMISH WATERWAY STUDY AREA
SEATTLE, WA

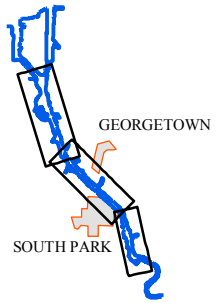
Map 3-10.
Spatial distribution of predicted bed-source content in surface layer (0-10 cm) of the bed at the end of 30-year period.

April 2008

QEA
Quantitative Environmental Analysis, LLC

FC- \\Gis_station\D_DRIVE\Private\RETldw\GIS_plot\layout_bed_elv_chg_070205.mxd

LOCATOR MAP



LEGEND

Upstream source content (%)

- 0 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- Navigation channel
- Shore line
- River miles
- Roads
- Neighborhoods
- Outside model domain
- Hard bottom

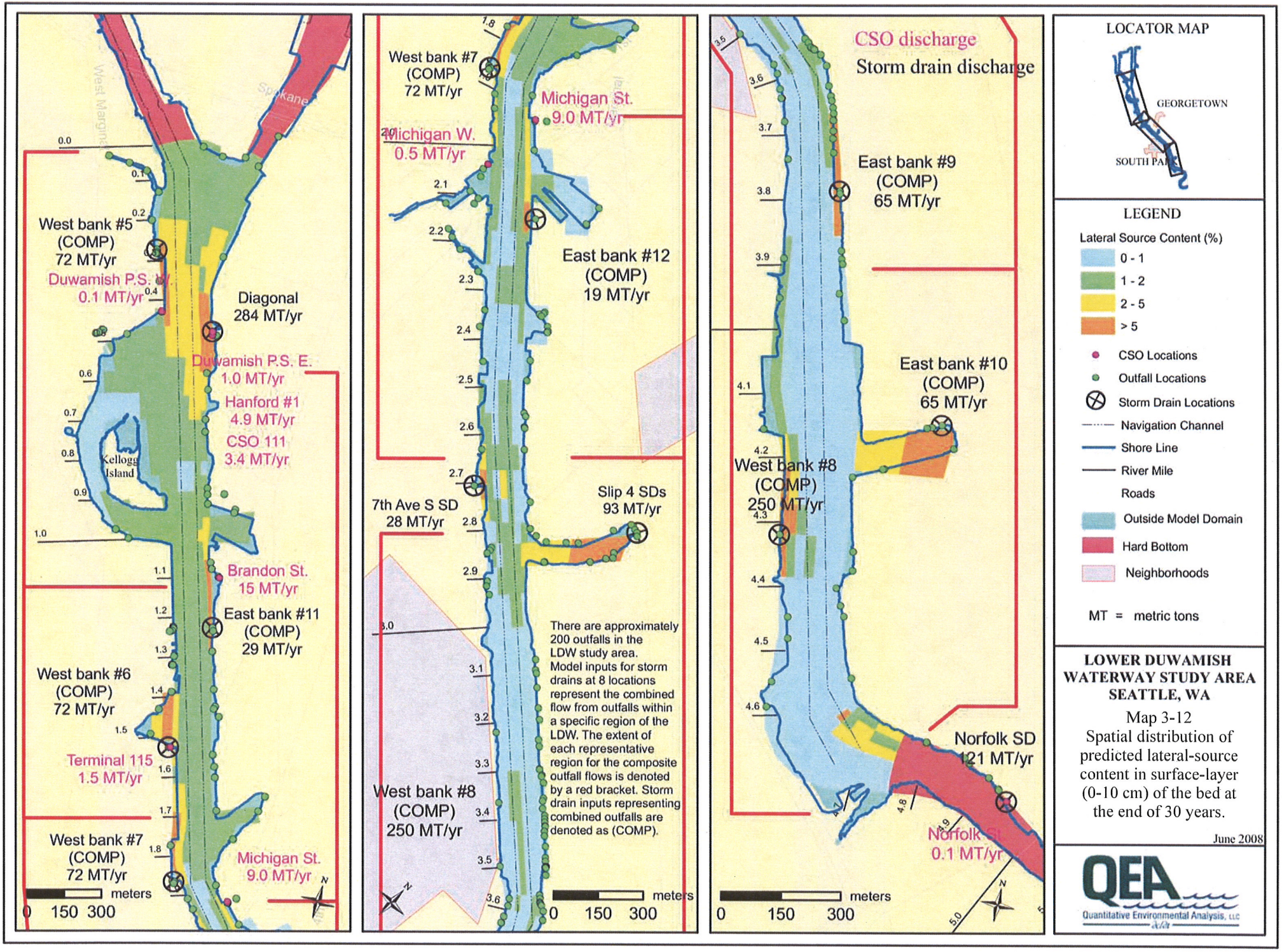
LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

Map 3-11.
Spatial distribution of predicted upstream-source content in surface layer (0-10 cm) of the bed at the end of 30-year period.

April 2008

QEA
Quantitative Environmental Analysis, LLC

FC- \\Gis_station\D_DRIVE\Private\RETldw\GIS_plot\layout_bed_elv_chg_070205.mxd



LOWER DUWAMISH WATERWAY STUDY AREA SEATTLE, WA

Map 3-12
Spatial distribution of predicted lateral-source content in surface-layer (0-10 cm) of the bed at the end of 30 years.

June 2008

QEA
Quantitative Environmental Analysis, LLC