Lower Duwamish Waterway Group

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

QUALITY ASSURANCE PROJECT PLAN:
SURFACE SEDIMENT SAMPLING FOR CHEMICAL ANALYSES OF THE LOWER DUWAMISH WATERWAY

DIOXIN/FURAN ADDENDUM

FINAL

For submittal to:

The US Environmental Protection Agency
Region 10
Seattle, WA

The Washington State Department of Ecology
Northwest Regional Office
Bellevue, WA

December 15, 2009

Prepared by: Windward environmental LLC

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TITLE AND APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN: SURFACE SEDIMENT SAMPLING FOR CHEMICAL ANALYSES OF THE LOWER DUWAMISH WATERWAY – DIOXIN/FURAN ADDENDUM

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1 Sampling Objectives and Schedule

This document is an addendum to the quality assurance project plan (QAPP) for the surface sediment sampling of the Lower Duwamish Waterway (LDW) (Windward 2005). The purpose of this addendum is to provide specifications for the collection and chemical analyses of 47 LDW surface sediment samples for dioxins and furans and for additional chemical analyses on a subset of those samples. Data from this study will be used in the feasibility study to help identify an appropriate range of remedial action levels and aid in the understanding of the spatial distribution of dioxins and furans in the LDW, both of which may affect the configuration of the remedial alternatives.

Two types of samples will be collected as part of the additional dioxin and furan sediment sampling: discrete grab samples and composite samples. The discrete grab samples will be collected during the week of December 14, 2009. The composite samples will be collected in January 2010 after final decisions are made regarding number of samples per composite, sample locations, methods for composite formation, sampling depth, and analytes. Details on composite sampling will be presented in a separate memorandum prepared prior to the January sampling event.

This QAPP addendum provides details that are specific to the additional sediment sampling and chemical analyses for dioxins and furans. The original QAPP (Windward 2005) is referenced, as appropriate, for details that remain unchanged from the original sampling plan. Sampling will be conducted in accordance with the health and safety plan presented in the original QAPP (Windward 2005).

The sediment samples will be chemically analyzed for dioxins and furans by Axys Analytical Services, Ltd. (Axys), with a turn-around time of 6 weeks from the date of sample receipt. The sediment samples will also be analyzed for total organic carbon (TOC), grain size, and percent solids at Analytical Resources, Inc. (ARI), with a turn-around time of 3 weeks from the date of sample receipt. A subset of samples will be archived for potential future analyses of polychlorinated biphenyl (PCB) Aroclors, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), semivolatile organic compounds (SVOCs), and metals at ARI) with a turn-around time of 3 weeks from the date analyses are started. Analytical data will be validated by Laboratory Data Consultants, Inc. (LDC), within 3 weeks of receiving data packages from the respective laboratories. A brief technical memorandum and data CD containing results of sample analyses will be prepared.

2 Project Management

This section presents key personnel and contact information. Additional details on project management, including information on roles of key personnel, data quality objectives and criteria, special training requirements and certification, and documents and recordkeeping can be found in Section 2.0 of the original QAPP (Windward 2005).

The Lower Duwamish Waterway Group (LDWG), the US Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) will be involved in all aspects of this project, including the discussion, review, and approval of the QAPP addendum. This sampling effort will be performed by Windward Environmental LLC (Windward). Key personnel, roles, and contact information are as follows:

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3 Sampling Locations and Methods

3.1 Sampling Locations

Surface sediment samples will be collected from 47 locations that were identified by EPA, Ecology, and LDWG. Table 3-1 lists each location and the rationale for its selection. Specific sampling locations are shown on Map 1, and their coordinates are presented in Table 3-2. Historical dioxin and furan data are shown on Map 2. In some instances, permission from landowners may be required to access specific locations. If access is denied, or if debris or structures prevent access, alternative sampling locations may need to be identified. These alternative locations will be selected in consultation with EPA and Ecology.

Table 3-1. Locations selected for additional surface sediment sampling for dioxins and furans

River Mile	Location ID	Spatial Coverage	Beach Area	Area of Interest	Description/Rationale
0.0 east	LDW-SS501			X	northern boundary of site; potentially in area of aerial deposition from Ash Grove Cement
0.2 west	LDW-SS502	X	X[a]	X	in restoration area - swale
0.2 west	LDW-SS503	X	X[a]	X	in beach area
0.1 center	LDW-SS504	X			deepest area of turning basin – spatial coverage
0.1 east	LDW-SS505			X	near Ash Grove Cement in area offshore of former pond
0.3 east	LDW-SS506	X			spatial coverage – east bank
0.4 west	LDW-SS507	X			spatial coverage outside of EAA
0.6 east	LDW-SS508		X[b]	X	beach area near Duwamish Diagonal – sample north of RM 0.7 in area with finer materials than those present south of RM 0.7

River Mile	Location ID	Spatial Coverage	Beach Area	Area of Interest	Description/Rationale
0.5 west	LDW-SS509		X[b]	X	adjacent to park near high concentrations of PAHs (former Seaboard Lumber site)
0.75 channel	LDW-SS510	X			spatial coverage south of EAA in navigation channel
Slip 1 north	LDW-SS511			X	stormwater discharge from area that potentially received aerial deposition from former boiler
0.9 west	LDW-SS512			X	bounding elevated TEQs near LaFarge
Slip 1 head	LDW-SS513			X	area near PAH and metals exceedances
0.9 west	LDW-SS514			X	bounding elevated TEQs near LaFarge
1.1 east	LDW-SS515			X	Brandon Street combined sewer overflow
1.25 channel	LDW-SS516	X			spatial coverage in navigation channel
1.3 east	LDW-SS517	X			spatial coverage in east bank area
1.5 channel	LDW-SS518			X	bounding hot spot at RM 1.5 (Glacier)
1.6 west	LDW-SS519			X	bounding hot spot at RM 1.5 (Glacier)
Slip 2	LDW-SS520	X			spatial coverage in slip
1.7 channel	LDW-SS521	X			spatial coverage in navigation channel
Slip 3	LDW-SS522	X			spatial coverage in slip – near outfall
2.0 west	LDW-SS523	X	X[b]	X	spatial coverage near bridge, near First Avenue storm drain and combined sewer overflow
2.15 east	LDW-SS524				near Brighton Street storm drain outfall
2.2 west	LDW-SS525		X[b]	X	outside boundary of EAA 2
2.35 west	LDW-SS526		X[b]	X	spatial coverage in beach area outside of EAA 2
2.45 east	LDW-SS527	X			spatial coverage near Seattle Iron & Metals
Slip 4	LDW-SS528			X	within boundary of EAA toward head of slip in a depositional area, avoiding debris
2.75 east	LDW-SS529		X[a]		spatial coverage for beach area
2.7 west	LDW-SS530		X[b]	X	Seventh Avenue storm drain; spatial coverage in beach area
2.8 west	LDW-SS531		X[a]		spatial coverage for beach area
3.1 east	LDW-SS532	X		X	near outfall in Boeing Plant 2/Jorgensen EAA
3.0 west	LDW-SS533		X[a]		spatial coverage for beach area
3.15 channel	LDW-SS534	X			spatial coverage in navigation channel
3.35 east	LDW-SS535	X		X	near outfall in Boeing Plant 2/Jorgensen EAA
3.4 channel	LDW-SS536			X	outside boundary of Boeing Plant 2/Jorgensen EAA
3.45 west	LDW-SS537			X	spatial coverage of area outside boundary of T117 EAA
3.5 east	LDW-SS538	X		X	near outfall in Boeing Plant 2/Jorgensen EAA

River Mile	Location ID	Spatial Coverage	Beach Area	Area of Interest	Description/Rationale
3.6 channel	LDW-SS539			X	outside boundary of Boeing Plant 2/Jorgensen and T117 EAAs
3.65 west	LDW-SS540	X		X	near outfall in T117 EAA
3.7 channel	LDW-SS541			X	outside boundary of Boeing Plant 2/Jorgensen EAA
3.9 west	LDW-SS542	X			spatial coverage for west bank area
4.35 east	LDW-SS543	X			spatial coverage on east bank
4.5 west	LDW-SS544		X[a]	X	spatial coverage for beach area, including storm drains
4.7 east	LDW-SS545	X			spatial coverage on east bank
4.9 east	LDW-SS546			X	storm drain discharge at Norfolk
4.7 west	LDW-SS547		X[b]	X	restoration site with anomalous PCB exceedance

[a] Composite samples will be collected from these beach areas.

[b] Discrete grab samples will be collected from these beach areas.

EAA – early action area
ID – identification
PCB – polychlorinated biphenyl
PAH – polycyclic aromatic hydrocarbon
RM – river mile
TEQ – toxicity equivalent

Table 3-2. Surface sediment sampling location coordinates

Location ID	X Coordinate[a]	Y Coordinate[a]	Latitude[b]	Longitude[b]	Estimated Depth Above (+) or Below (-) MLLW (ft)[c]
LDW-SS501	1267164	211254	47.569089	-122.345418	0
LDW-SS502	c	c	c	c	c
LDW-SS503	c	c	c	c	c
LDW-SS504	1266433	210638	47.567363	-122.34833	-50
LDW-SS505	1267046	210623	47.567354	-122.345848	na
LDW-SS506	1266889	209889	47.565333	-122.346424	-26
LDW-SS507	1266591	209082	47.563106	-122.347568	-34
LDW-SS508	1267244	208449	47.561407	-122.344872	2
LDW-SS509[d]	1265896	208303	47.560933	-122.350318	6
LDW-SS510	1267272	207564	47.558983	-122.344687	-32
LDW-SS511	1268127	206756	47.556813	-122.341161	-28
LDW-SS512	1267204	206499	47.55606	-122.344878	-8
LDW-SS513[e]	1268449	206550	47.556266	-122.339841	-16
LDW-SS514	1266591	206442	47.55587	-122.347358	-4
LDW-SS515	1268108	205990	47.554713	-122.341178	-10
LDW-SS516	1268071	205142	47.552386	-122.34126	-36

Location ID	X Coordinate[a]	Y Coordinate[a]	Latitude[b]	Longitude[b]	Estimated Depth Above (+) or Below (-) MLLW (ft)[c]
LDW-SS517	1268339	204985	47.55197	-122.340164	-14
LDW-SS518	1268422	203897	47.548993	-122.339741	-36
LDW-SS519	1268460	203398	47.547626	-122.339547	-34
LDW-SS520	1269538	203298	47.547409	-122.335173	-12
LDW-SS521	1268839	202847	47.546138	-122.337967	-32
LDW-SS522	1270700	201639	47.542926	-122.330339	-12
LDW-SS523	1269525	201243	47.541777	-122.335063	na
LDW-SS524	1270256	201060	47.541314	-122.332092	-18
LDW-SS525	1270429	200277	47.539179	-122.331329	2
LDW-SS526	1270708	199995	47.538418	-122.330176	na
LDW-SS527	1271355	199940	47.538303	-122.327555	-8
LDW-SS528[f]	1273448	199166	47.536293	-122.319022	-6
LDW-SS529	c	c	c	c	c
LDW-SS530	1271937	198674	47.534865	-122.325099	na
LDW-SS531	c	c	c	c	c
LDW-SS532	1273597	197751	47.532423	-122.318309	2
LDW-SS533	c	c	c	c	c
LDW-SS534	1273850	197251	47.531066	-122.317245	-18
LDW-SS535	1274623	196836	47.529969	-122.314084	0
LDW-SS536	1274834	196353	47.528656	-122.313194	-16
LDW-SS537	1274924	196015	47.527735	-122.312802	na
LDW-SS538	1275532	195943	47.527568	-122.310337	-6
LDW-SS539	1275628	195673	47.526833	-122.309926	-18
LDW-SS540	1275568	195398	47.526076	-122.310151	2
LDW-SS541	1275838	195145	47.525397	-122.309038	-14
LDW-SS542	1275927	194186	47.522775	-122.308603	-2
LDW-SS543	1276850	191834	47.516376	-122.304686	-4
LDW-SS544	c	c	c	c	c
LDW-SS545	1277541	190499	47.512752	-122.301786	-8
LDW-SS546	1278567	190208	47.512009	-122.297613	na
LDW-SS547[g]	1277573	189993	47.511367	-122.301618	na

[a] Coordinates are in Washington State Plane N, NAD83, US ft.

[b] Coordinates are in degrees, minutes, and decimal seconds, NAD83.

[c] Depth estimated from recent bathymetry data (Windward and DEA 2004).

[d] LDW-SS509 is co-located with historical location LDW-SS24.

[e] LDW-SS513 is co-located with historical location LDW-SS31.

[f] Coordinates for LDW-SS528 are approximate and will be finalized prior to sampling.

[g] LDW-SS547 is co-located with historical location LDW-SS148.

ID – identification

LDW – Lower Duwamish Waterway

MLLW – mean lower low water

na – not available (bathymetry data were not available because the area was too shallow to be surveyed or because barges were present during the bathymetry survey)

c – composite location to be described in separate memorandum

3.2 SAMPLING METHODS

Sediment sampling will be conducted using sampling procedures presented in the original QAPP (Windward 2005). There may be contingencies during field activities that will require modification of the general procedures outlined in this section. Modification of procedures will be at the discretion of the FC after consultation with the Windward PM and the boat operator, if applicable. EPA and Ecology will be consulted immediately in the event that significant deviations from the sampling design are required (e.g., significant relocation of a sample). All modifications will be recorded in the field logbook.

Each surface sediment sampling location will be assigned a unique alphanumeric location identification (ID) number. The first three characters of the location ID will be "LDW" to identify the LDW project area. The next characters will be "SS" to indicate the type of samples to be collected (surface sediment), followed by a consecutive number beginning with 501 to identify the specific location within the LDW.

The sample ID will be similar to the location ID but will include a suffix of "010" to indicate that sediment from the 0-to-10-cm depth range is included in the sample. For example, the sediment sample collected at location LDW-SS501 from the 0-to-10-cm depth range will be identified as LDW-SS501-010. Field duplicates will be identified using location numbers starting with 601. For example, the first field duplicate sample from the 0-to-10-cm depth range would be identified as LDW-SS601-010. The rinsate blank sample will be assigned the same characters as the location identifier, followed by the identifier "RB." For example, the rinsate blank collected at LDW-SS501 would be LDW-SS501-RB.

All samples will be collected by boat using a single van Veen grab sampler following methods described in Section 3.2.3 of the original QAPP (Windward 2005), with the exception of 10 samples from beach areas. Four samples from beach areas (LDW-SS509, LDW-SS508, LDW-SS523, and LDW-SS530) will be collected as discrete grab samples using trowels by field personnel on foot at low tide by methods described in Section 3.2.3 of the original QAPP. Methods for sampling the remaining six composite beach samples targeted for collection in January (LDW-SS502, LDW-SS503, LDW-SS529, LDW-SS531, LDW-SS533, and LDW-SS544) have not been finalized and will be described in a separate memorandum prepared prior to that sampling event.

Samples from all locations will be collected for analysis of dioxins and furans, TOC, grain size, and total solids using appropriate containers as specified in Table 3-3. At LDW-SS527, samples will also be collected, frozen, and archived for analysis of PCB

Aroclors, SVOCs (including cPAHs), and metals using containers specified in Table 3-3. At the seven beach locations identified for discrete grab sampling (see Table 3-1), samples will be collected, frozen, and archived for potential future analysis of PCB Aroclors, SVOCs (including cPAHs), and metals; the analyte list has not yet been finalized for these beach locations. The analyte list has also not yet been finalized for the remaining six beach locations identified for composite sampling. The final analyte list for all 13 beach locations will be described in a separate memorandum. All analyses for PCB Aroclors, SVOCs (including cPAHs), and metals (i.e., on samples from LDW-SS527 plus the 13 beach locations) will be conducted upon completion of the January sampling event.

Table 3-3. Sample containers and laboratory responsible for conducting chemical analyses

PARAMETER	CONTAINER	LABORATORY
Sediment Samples		
Dioxins/furans	8-oz glass jar	Axys
PCB Aroclors, SVOCs including cPAHs, and selected SVOCs by SIM[a]	16-oz glass jar	ARI
Metals, TOC, and total solids[b]	4 or 8-oz glass jar	ARI
Grain size [c]	16-oz HDPE or glass jar	ARI
Rinsate Blank Sample[d]		
PCB Aroclors, SVOCs including cPAHs	three 500-mL glass amber bottles	ARI
Metals	500-mL HDPE bottle preserved with nitric acid to pH <2	ARI

[a] Duplicate sample volume should be collected at a rate of 1 per 20 samples for MS/MSD. A 16-oz glass jar may be substituted for two 8-oz glass jars.

[b] A 4-oz jar will be used for locations where only TOC and total solids will be analyzed. An 8-oz. jar will be used for locations where metals will also be analyzed.

[c] Triplicate sample volume should be collected at a rate of 1 per 20 samples for laboratory duplicate and triplicate samples.

[d] One rinsate blank sample will be collected.

ARI – Analytical Resources, Inc.

Axys – Axys Analytical Services, Ltd.cPAH – carcinogenic polycyclic aromatic hydrocarbon

HDPE – high-density polyethylene

MS/MSD – matrix spike/matrix spike duplicate

PCB – polychlorinated biphenyl

SIM – selective ion monitoring

SVOC – semivolatile organic compound

TOC – total organic carbon

Axys will conduct the dioxin and furan analyses, and ARI will conduct all other analyses (Table 3-3). Field equipment, decontamination procedures, sample handling and custody, and shipping methods are described in Sections 3.2 and 3.3 of the original QAPP (Windward 2005). In addition, analytical methods and data quality indicators are discussed in detail in Section 3.4 of the original QAPP (Windward 2005).

Split samples of the homogenized sediment from all locations will be collected for use in the chemically-activated luciferase expression (CALUX) assay to be conducted by a

contractor to the USACE. These samples will collected in separate 8-oz glass jars and archived at ARI. USACE will arrange for the analyses of those samples and will provide results at a later date.

4 Data Quality and Management

QA/QC for the field and laboratory analyses is discussed in detail in Section 3.5 of the original QAPP (Windward 2005). Methods for documenting field observations, requirements for laboratory records, and methods for data reduction are described in Sections 2.6.1 through 2.6.3 of the original QAPP. Quality control criteria, instrument calibration and inspection, data management, and assessment and oversight are described in detail in Sections 3.5 through 3.10 and Section 4.0 of the original QAPP (Windward 2005).

Field duplicate samples will be collected to evaluate variability attributable to sample homogenization and subsequent sample handling for PCB Aroclors, SVOCs (including cPAHs), metals, grain size, TOC, and percent solids per the QA/QC requirements listed in Table 3-11 of the original QAPP (Windward 2005). Field duplicate samples will be collected from the same homogenized material as the original sample and analyzed as a separate sample; this type of field QA/QC sample is also referred to as a field split sample (PSEP 1997). A minimum of 1 field duplicate sample will be analyzed for every 20 samples. Field duplicate samples will not be collected for dioxin and furan analyses; instead, laboratory duplicates will provide the measure of precision for these analyses. One rinsate blank sample will be collected and analyzed for PCB Aroclors, SVOCs (including cPAHs), and metals.

Toxic equivalency factors (TEFs) for dioxin and furan congeners were updated by Van den Berg (2006) after the original QAPP was prepared in 2005. These updated TEFs are presented in Appendix E of the RI (Windward 2009) and will be used to calculate toxic equivalents for the dioxin and furan samples collected as part of this addendum.

5 Data Validation and Usability

Independent third-party data review and validation of the analytical data will be conducted by LDC as described in Section 5.0 of the original QAPP (Windward 2005) following EPA guidance (2004, 2005, 2008, 1995). All dioxin and furan data will undergo full-level data validation. For all other analytical results, a minimum of 20% of samples or one sample delivery group will undergo full-level data validation. If no discrepancies are found between reported results and raw data in the set that undergoes full-level data validation, then validation can proceed as a summary-level validation on the rest of the data using all the QC forms submitted in the laboratory data package.

6 References

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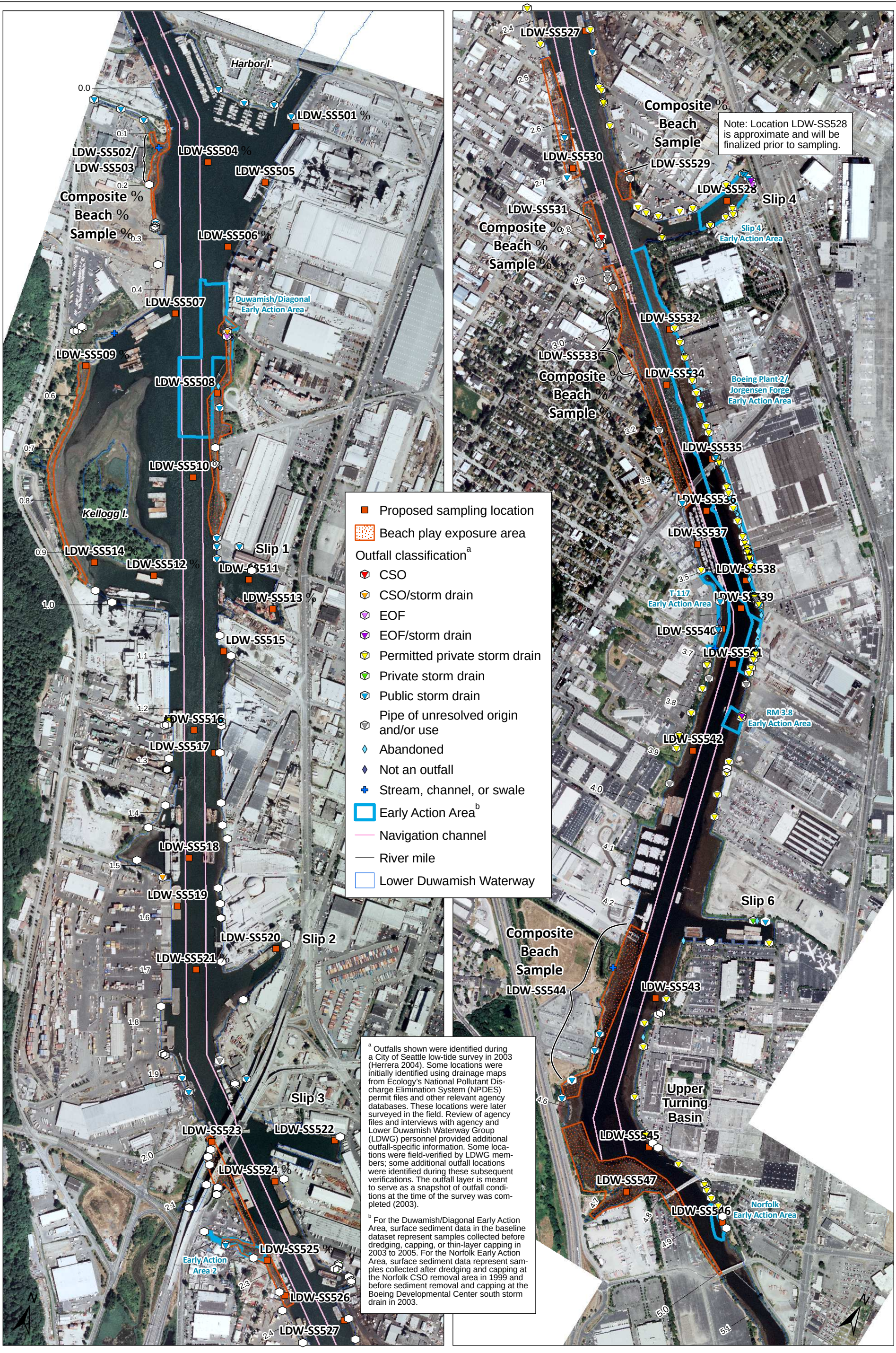


[a] Outfalls shown were identified during a City of Seattle low-tide survey in 2003 (Herrera 2004). Some locations were initially identified using drainage maps from Ecology's National Pollutant Discharge Elimination System (NPDES) permit files and other relevant agency databases. These locations were 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 of the survey was completed (2003).

[b] For the Duwamish/Diagonal Early Action Area, surface sediment data in the baseline dataset represent samples collected before dredging, capping, or thin-layer capping in 2003 to 2005. For the Norfolk Early Action Area, surface sediment data represent samples collected after dredging and capping at the Norfolk CSO removal area in 1999 and before sediment removal and capping at the Boeing Developmental Center south storm drain in 2003.

Wind Ward environmental LLC

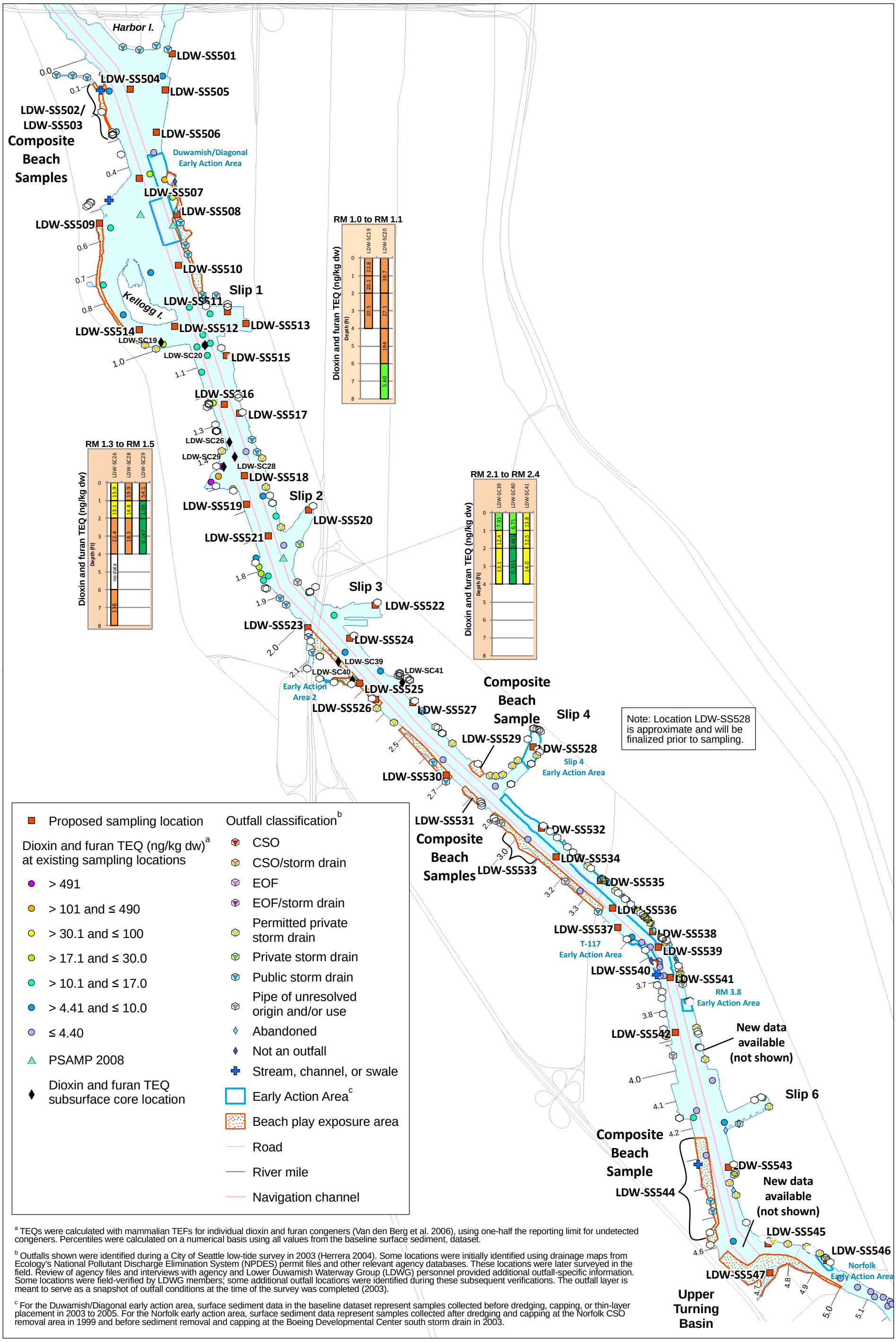
0 1,000 2,000 Feet

0 200 400 Meters

Scale is the same for each inset map

Map 1. Proposed surface sediment sampling locations for dioxin and furan analyses

Prepared by CEH, 12/15/2009; MAP #4023; W:\Projects\00-08-06_Duwamish_RI\data\GIS\Communications\Dioxin and Furan sampling 2009



[a] TEQs were calculated with mammalian TEFs for individual dioxin and furan congeners (Van den Berg et al. 2006), using one-half the reporting limit for undetected congeners. Percentiles were calculated on a numerical basis using all values from the baseline surface sediment, dataset.

[b] 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 of the survey was completed (2003).

[c] 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. For the Norfolk early action area, surface sediment data represent samples collected after dredging and capping at the Norfolk CSO removal area in 1999 and before sediment removal and capping at the Boeing Developmental Center south storm drain in 2003.

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N

0 0.25 0.5 Miles

0 0.2 0.4 Kilometers

Map 2. Proposed surface sediment sampling locations for dioxin and furan analyses with historical data