

Attachment A

Phase II Sampling for cPAHs

1 Introduction

As described in the Phase I Pre-Design Investigation (PDI) data evaluation report (DER) for the middle reach of the Lower Duwamish Waterway (LDW) (Anchor QEA and Windward 2023), remedial action level (RAL) exceedance areas were developed by comparing data in the design dataset with RALs, as defined in the U.S. Environmental Protection Agency's (EPA's) 2014 LDW Record of Decision (ROD) (EPA 2014) for all contaminants of concern, except carcinogenic polycyclic aromatic hydrocarbons (cPAHs). The LDW Explanation of Significant Differences (ESD) (EPA 2021) provides the RALs that require remedial action in the LDW for cPAHs. EPA's ESD for cPAHs updated the cPAH RALs, cleanup levels, and target tissue levels to reflect the latest scientific understanding of cPAH toxicity.

Appendix H of the Phase I PDI DER for the middle reach (Anchor QEA and Windward 2023) presents an evaluation of whether additional RAL exceedance areas would be identified if the 2014 ROD (EPA 2014) RALs for cPAHs were used, rather than those in the LDW ESD (EPA 2021). This evaluation was conducted because the Lower Duwamish Waterway Group (LDWG) is voluntarily preparing a design to address RAL exceedance areas identified using the 2014 ROD RALs for cPAHs (pre-ESD) that would otherwise not be remediated. This appendix describes Phase II samples to be collected to inform the design for these additional cPAH-only 2014 ROD RAL exceedance areas.

2 Phase II PDI Sampling Locations

As presented in Appendix H of the Phase I PDI DER for the middle reach (Anchor QEA and Windward 2023), use of the 2014 ROD (EPA 2014) RALs—rather than the RALs presented in the LDW ESD (EPA 2021)—identifies seven additional or expanded RAL exceedance areas. These exceedance areas, shown as orange polygons on Maps B-1a and B-1b, occur in areas with only cPAH ROD RAL exceedances. cPAH data compared with cPAH 2014 ROD RALs result in a small increase in the size of four RAL exceedance areas and in three new cPAH-only RAL exceedance areas. Table A-1 presents an evaluation of these seven areas to determine whether additional Phase II PDI samples are needed; identified cPAH data gaps are shown in bold.

Table A-1
Evaluation of Phase II Data Gaps for Areas Identified using the 2014 ROD RAL for cPAHs

cPAH-only Area	Evaluation of Data Gaps and Proposed Phase II Sampling ¹
C1 – intertidal area at RM 2.9 West (new area)	Subsurface exceedance of the 2014 ROD RAL (EFs above the upper limit for ENR). Area is well bounded horizontally but is unbounded vertically. Collect vertical extent core in this area to vertically bound this exceedance. Both cPAHs and arsenic will be analyzed in this core because of an arsenic EF of 0.98.
C2 – expanded portion of RAL exceedance area 5 at RM 2.7 West	Surface and subsurface exceedances of the 2014 ROD RAL (EFs below the upper limit for ENR). PAHs will be added to the Tier 1 analyte list for the 0–10-cm interval, and a 0–45-cm sample (and archive vertical extent core) will be collected at location 1516.
C3 – expanded portion of RAL exceedance area 9 at RM 2.6 East	Subsurface exceedance of the 2014 ROD RAL (EF below the upper limit for ENR). Phase II intertidal samples in this area are already being analyzed for PAHs, and the results will be used to bound this intertidal area north of Beach 6 horizontally and (if needed) vertically.
C4 – intertidal area at RM 2.6 West (new area)	Surface-only exceedance of the 2014 ROD RAL (EF below the upper limit for ENR). Subsurface samples collected at this location and adjacent locations have had cPAH TEQs below 2014 ROD RALs. Collect two surface sediment samples to further bound this area horizontally (upstream and downstream).
C5 – expanded portion of RAL exceedance area 14 at RM 2.4 East	Surface and subsurface exceedances of the 2014 ROD RAL at locations under structure. Phase II samples in this area will already be analyzed for PAHs; no additional Phase II data gaps exist.
C6 – expanded portion of RAL exceedance area 18/19/22 at RM 2.3 East	Surface-only exceedance of the 2014 ROD RAL (EF below the upper limit for ENR). Phase II RAL interval samples collected in this area are already being analyzed for PAHs. The results will be used to bound this area horizontally and confirm that there are no subsurface exceedances (nearby samples were below the 2014 cPAH ROD RAL).
C7 – shoaling area in FNC at RM 1.6 (new area)	No cPAH-specific remedy is needed in this area, ² so no Phase II data gaps were identified.

Notes:

1. **Bold text** indicates additional Phase II sampling or analytes based on the evaluation of Phase II data gaps for the cPAH-only areas.
2. The material with 2014 ROD RAL exceedances is beneath shoaled material. If subsurface sediment at this location were dredged during USACE maintenance dredging, it would qualify for open-water disposal based on PDI data.

cPAH: carcinogenic polycyclic aromatic hydrocarbon

EF: exceedance factor

ENR: enhanced natural recovery

FNC: Federal Navigation Channel

PAH: polycyclic aromatic hydrocarbon

PDI: Pre-Design Investigation

RAL: remedial action level

RM: river mile

ROD: Record of Decision

TEQ: toxic equivalent

USACE: U.S. Army Corps of Engineers

As indicated in Table A-1, Phase II sampling specifically to address the cPAH-only areas will occur at four locations. Sampling will include the collection of samples at three new cPAH-only

locations, plus the collection of additional samples at one existing Phase II location. These locations are as follows:

- Area C1 – One vertical extent core will be added (one new cPAH-only location).
- Area C3 – cPAHs will be added as an analyte for the 0- to 10-cm Phase II sample from location 1516; in addition, a 0- to 45-cm sample and archive vertical core will be added at location 1516.
- Area C4 – Two surface sediment samples will be added (two new cPAH-only locations).

Samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs), total solids, and total organic carbon (TOC). Although TOC is not needed for the RAL comparison (because the cPAH RAL is presented on a dry weight basis), TOC will be analyzed so individual PAH concentration data can be compared to RALs for individual PAHs, which will be presented as carbon-normalized values. Additional details regarding these new cPAH-only samples are presented on Maps A-1a and A-1b and in Tables A-2 and A-3.

Table A-2
Sample Location Rationale and Analytes for cPAH-only Area Samples

Location No.	RM	Tidal Category	Sample Type(s)					Recovery Category	In the FNC?	Shoaling Area	Potential Vessel Scour Area	Mudline Elevation (feet MLLW) ¹	Rationale					Notes	Analytes by Sample Type ²		
			RAL Intervals				Vertical Extent						Horizontal Bounding	Vertical Extent	Side Slope	Reoccupation	Other		Surface Sediment Samples (0–10 cm)	Subsurface Sediment Samples (0–45 cm, 0–60 cm, or Shoaling Intervals)	Analytes for Vertical Extent Samples
			0–10 cm	0–45 cm	0–60 cm	Shoal															
1587	2.6	Subtidal	x				3	No	No	No	0.2	x						PAHs	--	--	
1588	2.6	Subtidal	x				3	No	No	No	No data	x						PAHs	--	--	
1516	2.6	Subtidal		x			3	No	No	No	No data	x	a				PAHs will also be added as a Tier 1 analyte for the 0–10-cm sample, which is described in Attachment B.	--	PAHs	Archive	
1589	2.9	Intertidal		a			3	No	No	No	-0.2		x				Approximately co-located with IT1264. Vertical extent core will also be analyzed for arsenic (arsenic EF of 0.98 in 0–45-cm sample at this location).	--	Archive	PAHs, arsenic	

Notes:
 1. Mudline elevations are based on the 2021/2023 bathymetry survey data. Locations where this column indicates “no data” are outside of the bathymetry survey area (typically at a higher elevation than could be surveyed).
 2. The columns indicating analytes by sample type are color coded: green shading indicates that the sample interval(s) will be collected and analyzed in Tier 1, and gray shading indicates that the sample interval(s) will be collected and archived. A dash (--) indicates that a given interval will not be collected.
 a: archive
 cPAH: carcinogenic polycyclic aromatic hydrocarbon
 EF: exceedance factor
 FNC: Federal Navigation Channel
 MLLW: mean lower low water
 PAH: polycyclic aromatic hydrocarbon
 PCB: polychlorinated biphenyl
 RAL: remedial action level
 RM: river mile
 ROD: Record of Decision

Table A-3
Sample Location Details for cPAH-only Area Samples

Location No.	RM	Tidal Category	Sample Type(s)					Reoccupation?	Bioassay? ¹	In the FNC?	Mudline Elevation (feet MLLW) ²	Vertical Extent Details				Estimated Shoal Thickness	Target Coordinates			
			0–10 cm	0–45 cm	0–60 cm	Shoal	Vertical Extent					Vertical Category	Authorized or Operating Depth	Target Elevation or Length	Estimated Core Length		X	Y	Longitude	Latitude
1587	2.6	Intertidal	x				-	-	No	0.2	-	-	-	-	-	1271503	199164	-122.326895	47.536183	
1588	2.6	Intertidal	x				-	-	No	No data	-	-	-	-	-	1271621	199033	-122.326407	47.535830	
1516	2.6	Intertidal		x			-	-	No	No data	Intertidal	-	7.5-foot core	7.5 feet	-	1271776	198836	-122.325762	47.535301	
1589	2.9	Intertidal		a			-	-	No	-0.2	Intertidal	-	7.5-foot core	7.5 feet	-	1272740	197984	-122.321796	47.533015	

Notes:
 1. As described in Section 4.1.5, the determination of whether a toxicity test will be conducted will be based on the expedited chemistry results. During sample collection, sufficient sediment will be collected for potential toxicity testing.
 2. Mudline elevations are based on the 2021/2023 bathymetry survey data. Locations where this column indicates “no data” are outside of the bathymetry survey area (typically at a higher elevation than could be surveyed).
 cPAH: carcinogenic polycyclic aromatic hydrocarbon
 FNC: Federal Navigation Channel
 MLLW: mean lower low water
 RM: river mile
 TBD: to be determined

3 References

- Anchor QEA, Windward. 2023. Phase I pre-design investigation data evaluation report for the Lower Duwamish Waterway - middle reach. Draft. Submitted to EPA December 18, 2023. Anchor QEA and Windward Environmental LLC, Seattle, WA.
- EPA. 2014. Record of Decision. Lower Duwamish Waterway Superfund Site. US Environmental Protection Agency.
- EPA. 2021. Proposed explanation of significant differences. September 2021. Lower Duwamish Waterway Superfund site. US Environmental Protection Agency Region 10, Seattle, WA.