

Prepared by craigh. 8/29/22: W:\Projects\Duwamish AOC\GIS\Maps and Analyses\Phase 1\30 Percent Design\BODR\Fig 05-1a 7392 REA tech assignments RM 3-4.mxd



Lower Duwamish Waterway Group
 Port of Seattle / City of Seattle / King County / The Boeing Company

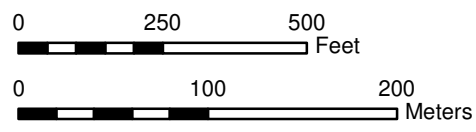
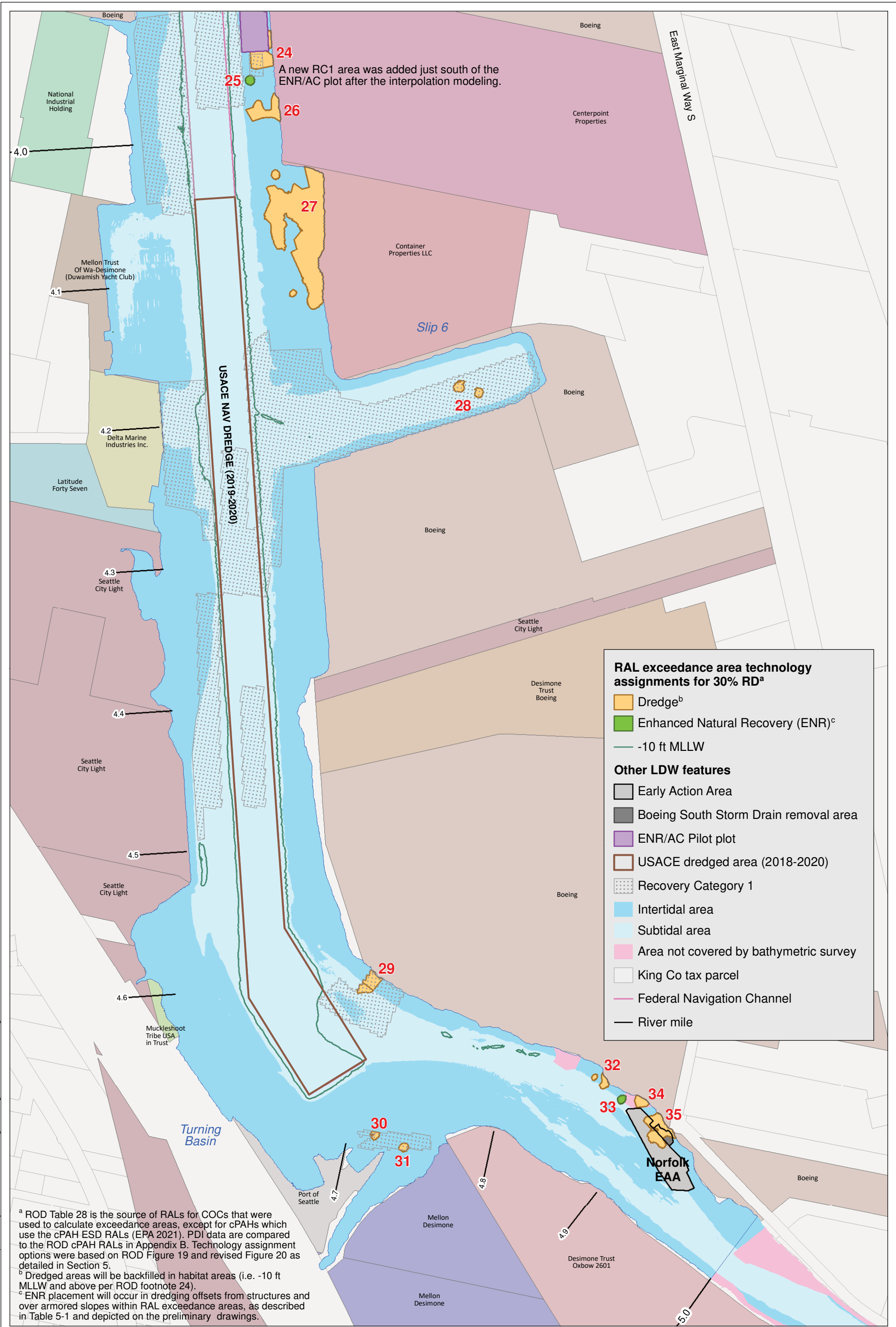


Figure 5-1a. Technology assignment by RAL exceedance area, RM 3.0 to RM 4.0

30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH
 AUGUST 29, 2022



RAL exceedance area technology assignments for 30% RD^a

- Dredge^b
- Enhanced Natural Recovery (ENR)^c
- 10 ft MLLW

Other LDW features

- Early Action Area
- Boeing South Storm Drain removal area
- ENR/AC Pilot plot
- USACE dredged area (2018-2020)
- Recovery Category 1
- Intertidal area
- Subtidal area
- Area not covered by bathymetric survey
- King Co tax parcel
- Federal Navigation Channel
- River mile

^a ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance areas, except for cPAHs which use the cPAH ESD RALs (EPA 2021). PDI data are compared to the ROD cPAH RALs in Appendix B. Technology assignment options were based on ROD Figure 19 and revised Figure 20 as detailed in Section 5.

^b Dredged areas will be backfilled in habitat areas (i.e. -10 ft MLLW and above per ROD footnote 24).

^c ENR placement will occur in dredging offsets from structures and over armored slopes within RAL exceedance areas, as described in Table 5-1 and depicted on the preliminary drawings.

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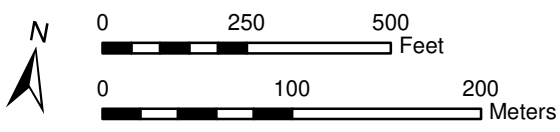


Figure 5-1b. Technology assignment by RAL exceedance area, RM 4.0 to RM 5.0

30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH

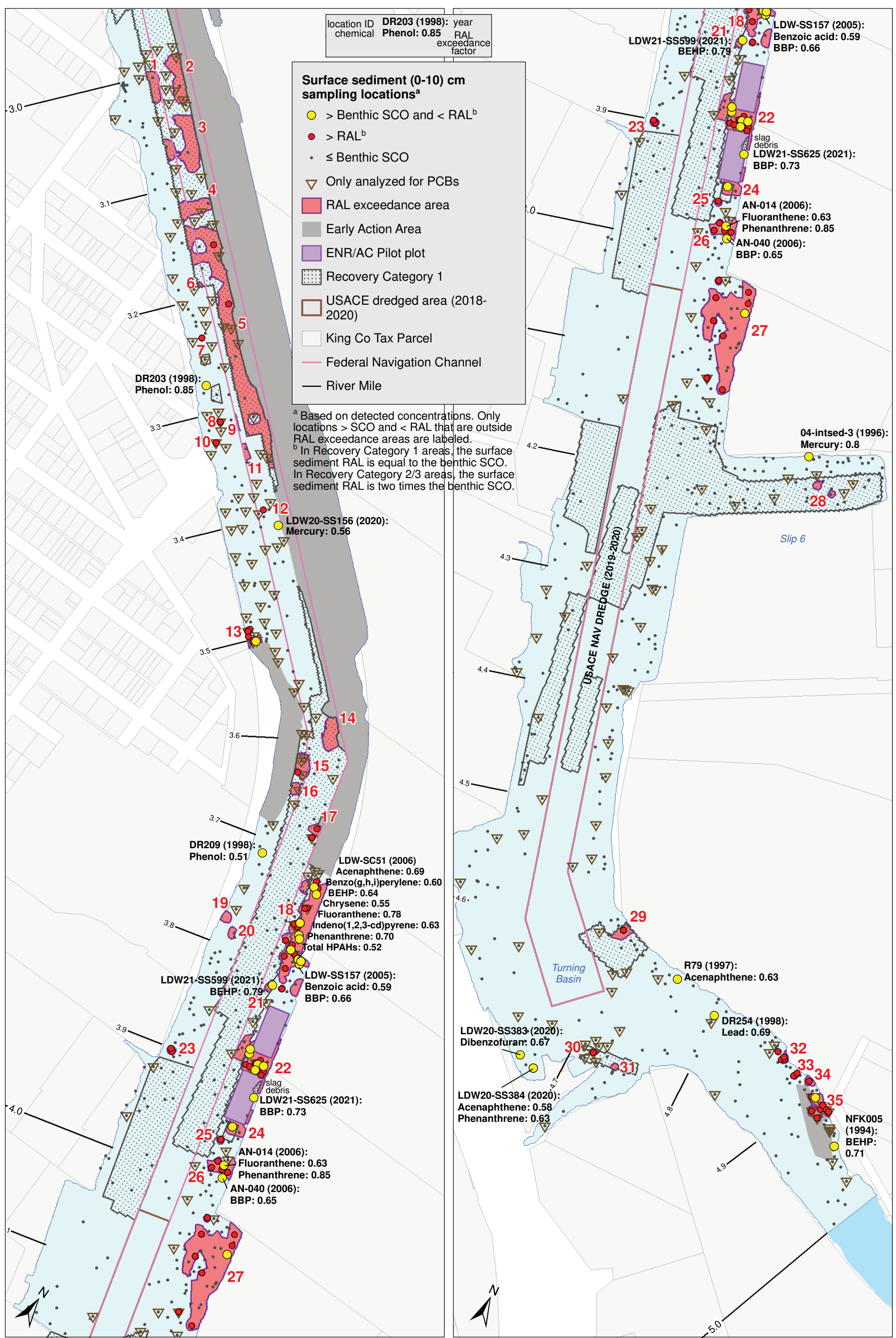
AUGUST 29, 2022

location ID	DR203 (1998):	year	
chemical	Phenol:	0.85	RAL exceedance factor

Surface sediment (0-10) cm sampling locations^a

- > Benthic SCO and < RAL^b
- > RAL^b
- ≤ Benthic SCO
- ▽ Only analyzed for PCBs
- RAL exceedance area
- Early Action Area
- ENR/AC Pilot plot
- Recovery Category 1
- USACE dredged area (2018-2020)
- King Co Tax Parcel
- Federal Navigation Channel
- River Mile

^a Based on detected concentrations. Only locations > SCO and < RAL that are outside RAL exceedance areas are labeled.
^b In Recovery Category 1 areas, the surface sediment RAL is equal to the benthic SCO. In Recovery Category 2/3 areas, the surface sediment RAL is two times the benthic SCO.



Prepared by: craigh. 8/29/22: W:\Projects\Duwamish AOC\GIS\Maps and Analyses\Phase II\30 Percent Design\BODR\Fig 05-2 7305 Phil SCO vs RAL exceedances.mxd

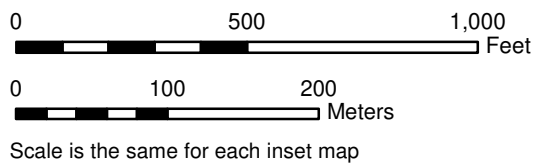


Figure 5-2. MNR to benthic SCO locations
 30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH
 AUGUST 29, 2022



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Horizontal Datum: Washington State Plane, North Zone, North American Datum of 1983/91, U.S. Survey Feet; WSDOT MON GP17005-176 & GP17005-181

Vertical Datum: Mean Lower Low Water (MLLW), MLLW Converted from NAD88 (NAVD88 + 2.34' to MLLW)

Note: Remedial Action Areas will be developed into Sediment Management Areas at a later design stage.

Legend:

- Federal Navigation Channel
- 250+00 | Channel Centerline
- - - - - LDW Upper Reach Approximate Boundary
- ENR/AC Pilot Plot Boundary
- RAL Exceedance Area Boundary
- Remedial Action Area
- 1/2/3 Remedial Action Area Numbers

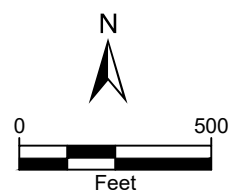


Figure 6-1a.
Remedial Action Areas, RM 3.0 to RM 4.0



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Horizontal Datum: Washington State Plane, North Zone, North American Datum of 1983/91, U.S. Survey Feet; WSDOT MON GP17005-176 & GP17005-181

Vertical Datum: Mean Lower Low Water (MLLW), MLLW Converted from NAD88 (NAVD88 + 2.34' to MLLW)

Note: Remedial Action Areas will be developed into Sediment Management Areas at a later design stage.

Legend:

- Federal Navigation Channel
- Channel Centerline
- LDW Upper Reach Approximate Boundary
- ENR/AC Pilot Plot Boundary
- RAL Exceedance Area Boundary
- Remedial Action Area
- 1/2/3 Remedial Action Area Numbers

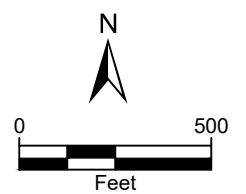
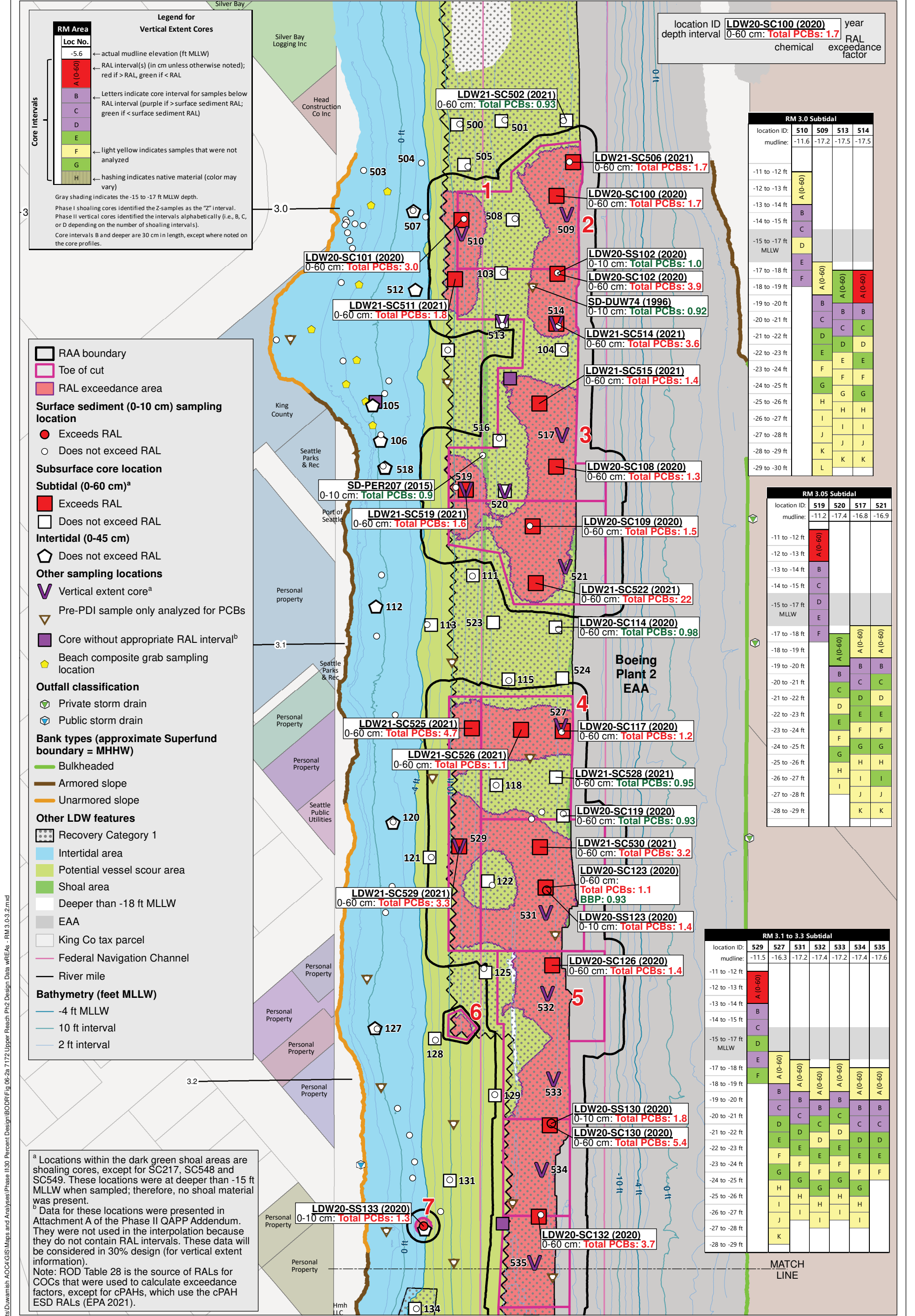


Figure 6-1b
Remedial Action Areas, RM 4.0 to RM 5.0

30% BASIS OF DESIGN REPORT FOR THE LOWER DUWAMISH WATERWAY UPPER REACH

AUGUST 29, 2022



Legend for Vertical Extent Cores

RM Area

Loc No. -5.6 ← actual mudline elevation (ft MLLW)

A (0-60) ← RAL interval(s) (in cm unless otherwise noted); red if > RAL, green if < RAL

B ← Letters indicate core interval for samples below RAL interval (purple if > surface sediment RAL; green if < surface sediment RAL)

C

D

E

F ← light yellow indicates samples that were not analyzed

G

H ← hashing indicates native material (color may vary)

Gray shading indicates the -15 to -17 ft MLLW depth.

Phase I shoaling cores identified the Z-samples as the "Z" interval. Phase II vertical cores identified the intervals alphabetically (i.e., B, C, or D depending on the number of shoaling intervals).

Core intervals B and deeper are 30 cm in length, except where noted on the core profiles.

RAA boundary

Toe of cut

RAL exceedance area

Surface sediment (0-10 cm) sampling location

● Exceeds RAL

○ Does not exceed RAL

Subsurface core location

Subtidal (0-60 cm)^a

■ Exceeds RAL

□ Does not exceed RAL

Intertidal (0-45 cm)

○ Does not exceed RAL

Other sampling locations

∇ Vertical extent core^a

▽ Pre-PDI sample only analyzed for PCBs

■ Core without appropriate RAL interval^b

● Beach composite grab sampling location

Outfall classification

⊙ Private storm drain

⊙ Public storm drain

Bank types (approximate Superfund boundary = MHHW)

— Bulkheaded

— Armored slope

— Unarmored slope

Other LDW features

■ Recovery Category 1

■ Intertidal area

■ Potential vessel scour area

■ Shoal area

■ Deeper than -18 ft MLLW

■ EAA

■ King Co tax parcel

— Federal Navigation Channel

— River mile

Bathymetry (feet MLLW)

— -4 ft MLLW

— 10 ft interval

— 2 ft interval

^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.

^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpoll because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).

Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

location ID: LDW20-SC100 (2020) year: 2020

depth interval: 0-60 cm: Total PCBs: 1.7 RAL exceedance factor

RM 3.0 Subtidal

location ID:	510	509	513	514
mudline:	-11.6	-17.2	-17.5	-17.5
-11 to -12 ft				
-12 to -13 ft	A (0-60)			
-13 to -14 ft	B			
-14 to -15 ft	C			
-15 to -17 ft MLLW	D			
-17 to -18 ft	E			
-18 to -19 ft	F	A (0-60)	A (0-60)	A (0-60)
-19 to -20 ft	B	B	B	
-20 to -21 ft	C	C	C	
-21 to -22 ft	D	D	D	
-22 to -23 ft	E	E	E	
-23 to -24 ft	F	F	F	
-24 to -25 ft	G	G	G	
-25 to -26 ft	H	H	H	
-26 to -27 ft	I	I	I	
-27 to -28 ft	J	J	J	
-28 to -29 ft	K	K	K	
-29 to -30 ft	L			

RM 3.05 Subtidal

location ID:	519	520	517	521
mudline:	-11.2	-17.4	-16.8	-16.9
-11 to -12 ft	A (0-60)			
-12 to -13 ft	B			
-13 to -14 ft	C			
-14 to -15 ft	D			
-15 to -17 ft MLLW	E			
-17 to -18 ft	F	A (0-60)	A (0-60)	A (0-60)
-18 to -19 ft	B	B	B	
-19 to -20 ft	C	C	C	
-20 to -21 ft	D	D	D	
-21 to -22 ft	E	E	E	
-22 to -23 ft	F	F	F	
-23 to -24 ft	G	G	G	
-24 to -25 ft	H	H	H	
-25 to -26 ft	I	I	I	
-26 to -27 ft	J	J	J	
-27 to -28 ft	K	K	K	
-28 to -29 ft				

RM 3.1 to 3.3 Subtidal

location ID:	529	527	531	532	533	534	535
mudline:	-11.5	-16.3	-17.2	-17.4	-17.2	-17.4	-17.6
-11 to -12 ft	A (0-60)						
-12 to -13 ft	B						
-13 to -14 ft	C						
-14 to -15 ft	D						
-15 to -17 ft MLLW	E						
-17 to -18 ft	F	A (0-60)	A (0-60)	A (0-60)	A (0-60)	A (0-60)	A (0-60)
-18 to -19 ft	B	B	B	B	B	B	
-19 to -20 ft	C	C	C	C	C	C	
-20 to -21 ft	D	D	D	D	D	D	
-21 to -22 ft	E	E	E	E	E	E	
-22 to -23 ft	F	F	F	F	F	F	
-23 to -24 ft	G	G	G	G	G	G	
-24 to -25 ft	H	H	H	H	H	H	
-25 to -26 ft	I	I	I	I	I	I	
-26 to -27 ft	J	J	J	J	J	J	
-27 to -28 ft	K						

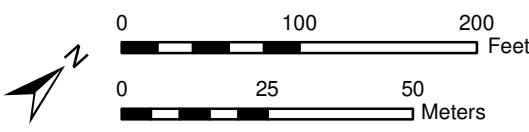


Figure 6-2a. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 3.0 to RM 3.2

30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH

AUGUST 29, 2022

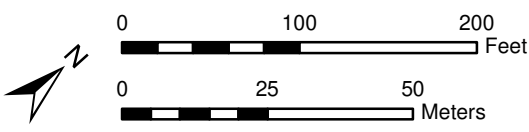
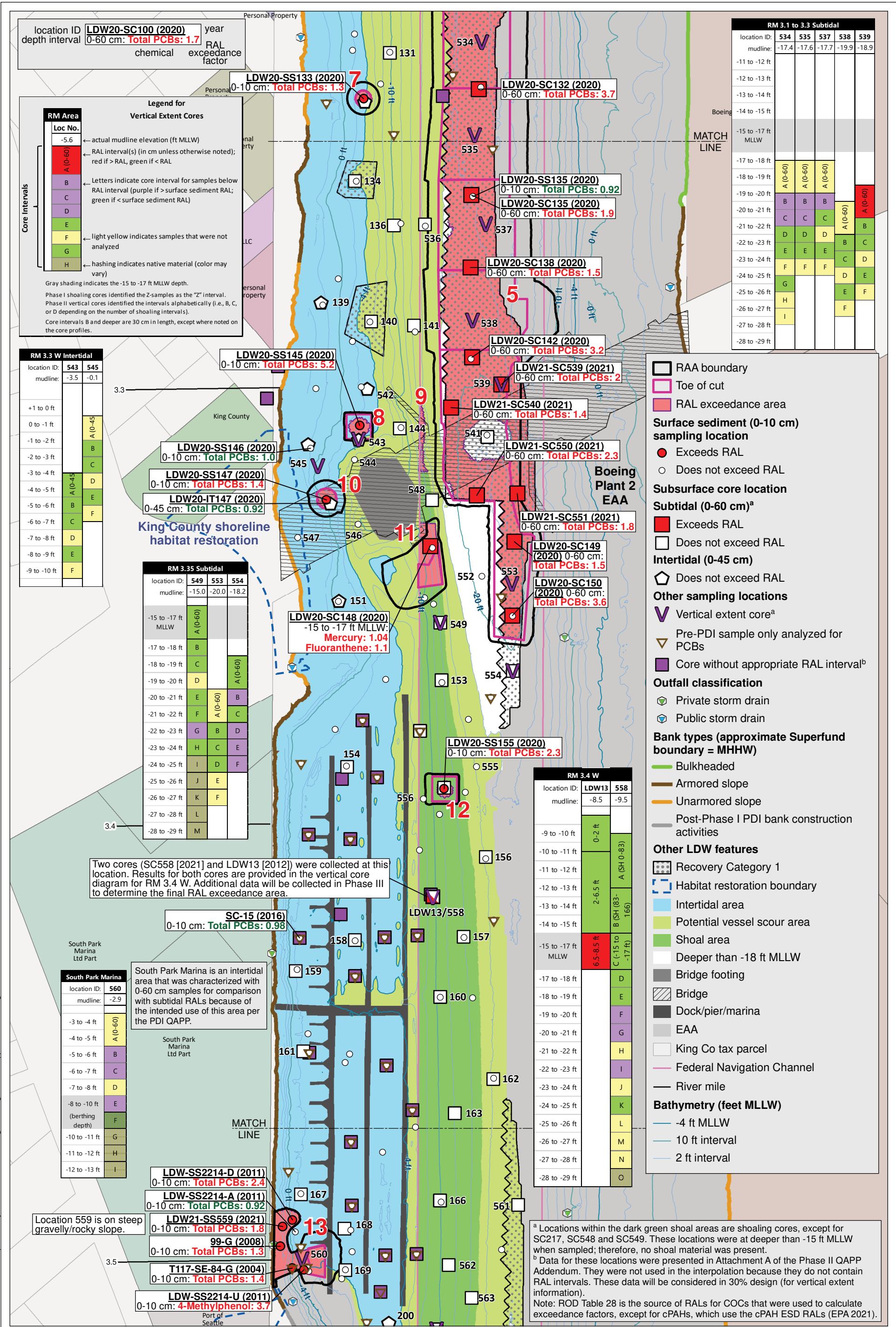
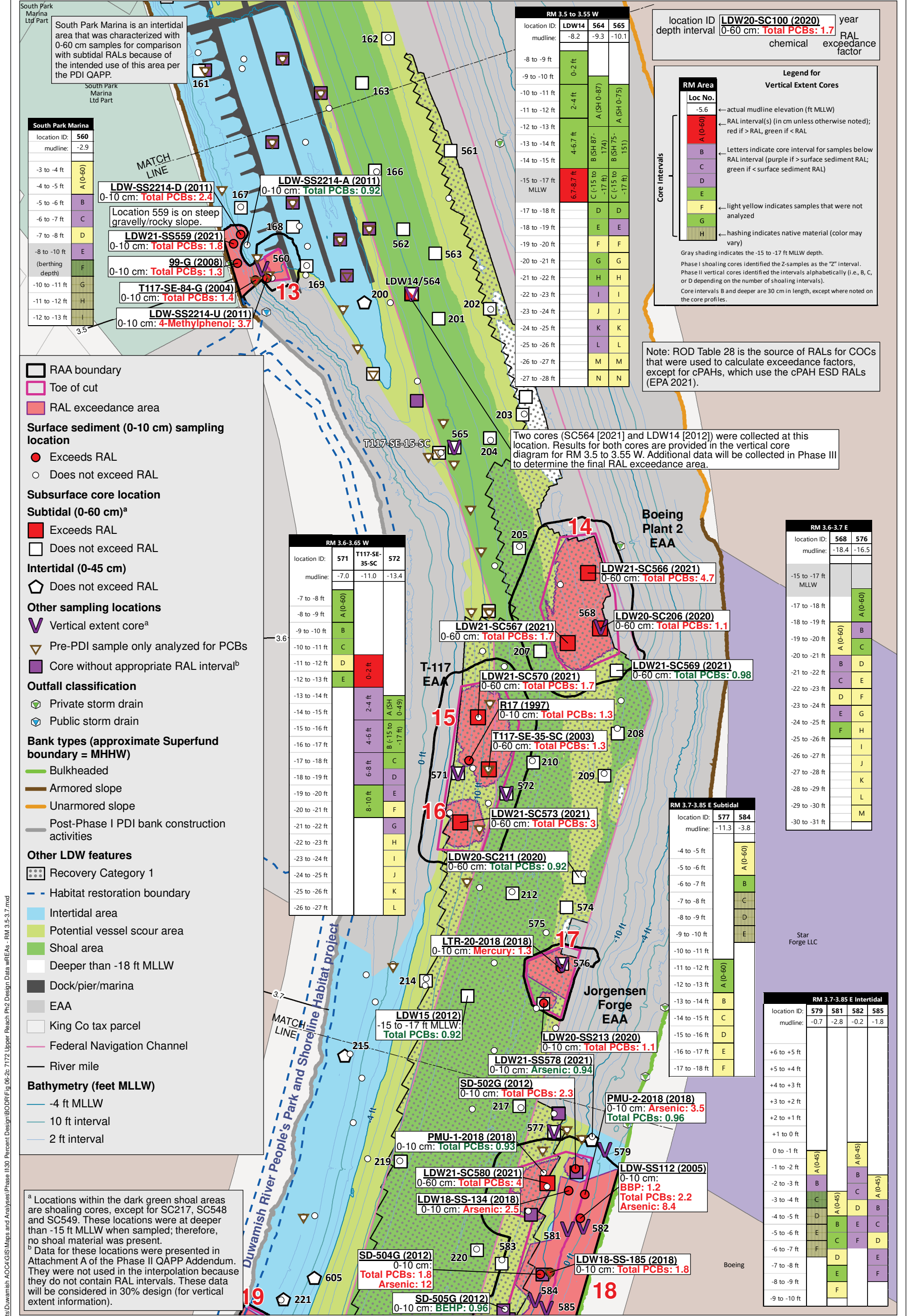


Figure 6-2b. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 3.2 to RM 3.5



South Park Marina is an intertidal area that was characterized with 0-60 cm samples for comparison with subtidal RALs because of the intended use of this area per the PDI QAPP.

location ID:	560
mudline:	-2.9
-3 to -4 ft	A (0-60)
-4 to -5 ft	B
-5 to -6 ft	C
-6 to -7 ft	D
-7 to -8 ft	E
-8 to -10 ft (berthing depth)	F
-10 to -11 ft	G
-11 to -12 ft	H
-12 to -13 ft	I

LDW-SS2214-D (2011)
0-10 cm: **Total PCBs: 2.4**

Location 559 is on steep gravelly/rocky slope.

LDW21-SS559 (2021)
0-10 cm: **Total PCBs: 1.8**

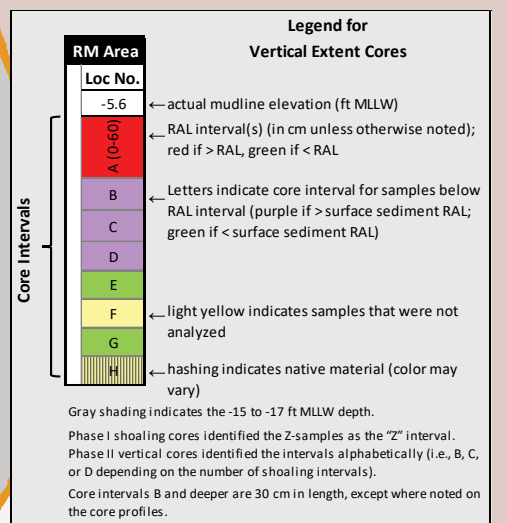
99-G (2008)
0-10 cm: **Total PCBs: 1.3**

T117-SE-84-G (2004)
0-10 cm: **Total PCBs: 1.4**

LDW-SS2214-U (2011)
0-10 cm: **4-Methylphenol: 3.7**

RM 3.5 to 3.55 W			
location ID:	LDW14	564	565
mudline:	-8.2	-9.3	-10.1
-8 to -9 ft	0-2 ft		
-9 to -10 ft			
-10 to -11 ft	2-4 ft	A (SH 0-87)	A (SH 0-75)
-12 to -13 ft			
-13 to -14 ft	4-6.7 ft	B (SH 87-174)	B (SH 75-151)
-14 to -15 ft			
-15 to -17 ft MLLW	6.7-8.7 ft	C (-15 to -17 ft)	C (-15 to -17 ft)
-17 to -18 ft		D	D
-18 to -19 ft		E	E
-19 to -20 ft		F	F
-20 to -21 ft		G	G
-21 to -22 ft		H	H
-22 to -23 ft		I	I
-23 to -24 ft		J	J
-24 to -25 ft		K	K
-25 to -26 ft		L	L
-26 to -27 ft		M	M
-27 to -28 ft		N	N

location ID **LDW20-SC100 (2020)** year
depth interval **0-60 cm: Total PCBs: 1.7** RAL
chemical **PCBs** exceedance factor



Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

Two cores (SC564 [2021] and LDW14 [2012]) were collected at this location. Results for both cores are provided in the vertical core diagram for RM 3.5 to 3.55 W. Additional data will be collected in Phase III to determine the final RAL exceedance area.

RM 3.6-3.65 W			
location ID:	571	T117-SE-35-SC	572
mudline:	-7.0	-11.0	-13.4
-7 to -8 ft			
-8 to -9 ft	A (0-60)		
-9 to -10 ft	B		
-10 to -11 ft	C		
-11 to -12 ft	D	0-2 ft	
-12 to -13 ft	E		
-13 to -14 ft		2-4 ft	A (SH 0-49)
-14 to -15 ft			
-15 to -16 ft		4-6 ft	B (-15 to A SH -17 ft)
-16 to -17 ft			
-17 to -18 ft		6-8 ft	C
-18 to -19 ft			
-19 to -20 ft		8-10 ft	D
-20 to -21 ft			
-21 to -22 ft			
-22 to -23 ft			
-23 to -24 ft			
-24 to -25 ft			
-25 to -26 ft			
-26 to -27 ft			

RM 3.6-3.7 E			
location ID:	568	576	
mudline:	-18.4	-16.5	
-15 to -17 ft MLLW			
-17 to -18 ft			A (0-60)
-18 to -19 ft			B
-19 to -20 ft			C
-20 to -21 ft			D
-21 to -22 ft			E
-22 to -23 ft			F
-23 to -24 ft			G
-24 to -25 ft			H
-25 to -26 ft			I
-26 to -27 ft			J
-27 to -28 ft			K
-28 to -29 ft			L
-29 to -30 ft			M

RM 3.7-3.85 E Subtidal			
location ID:	577	584	
mudline:	-11.3	-3.8	
-4 to -5 ft			A (0-60)
-5 to -6 ft			B
-6 to -7 ft			C
-7 to -8 ft			D
-8 to -9 ft			E
-9 to -10 ft			
-10 to -11 ft			
-11 to -12 ft			A (0-60)
-12 to -13 ft			B
-13 to -14 ft			C
-14 to -15 ft			D
-15 to -16 ft			E
-16 to -17 ft			F
-17 to -18 ft			

RM 3.7-3.85 E Intertidal				
location ID:	579	581	582	585
mudline:	-0.7	+2.8	-0.2	-1.8
+6 to +5 ft				
+5 to +4 ft				
+4 to +3 ft				
+3 to +2 ft				
+2 to +1 ft				
+1 to 0 ft				
0 to -1 ft				
-1 to -2 ft	A (0-45)		A (0-45)	
-2 to -3 ft	B		B	
-3 to -4 ft	C		C	
-4 to -5 ft	D	A (0-45)	D	B
-5 to -6 ft	E	B	E	C
-6 to -7 ft	F	C	F	D
-7 to -8 ft		D		E
-8 to -9 ft		E		F
-9 to -10 ft		F		

- RAA boundary
- Toe of cut
- RAL exceedance area
- Surface sediment (0-10 cm) sampling location
 - Exceeds RAL
 - Does not exceed RAL
- Subsurface core location
 - Subtidal (0-60 cm)^a
 - Exceeds RAL
 - Does not exceed RAL
 - Intertidal (0-45 cm)
 - Does not exceed RAL
- Other sampling locations
 - Vertical extent core^a
 - Pre-PDI sample only analyzed for PCBs
 - Core without appropriate RAL interval^b
- Outfall classification
 - Private storm drain
 - Public storm drain
- Bank types (approximate Superfund boundary = MHHW)
 - Bulkheaded
 - Armored slope
 - Unarmored slope
 - Post-Phase I PDI bank construction activities
- Other LDW features
 - Recovery Category 1
 - Habitat restoration boundary
 - Intertidal area
 - Potential vessel scour area
 - Shoal area
 - Deeper than -18 ft MLLW
 - Dock/pier/marina
 - EAA
 - King Co tax parcel
 - Federal Navigation Channel
 - River mile
- Bathymetry (feet MLLW)
 - 4 ft MLLW
 - 10 ft interval
 - 2 ft interval

^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.

^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).

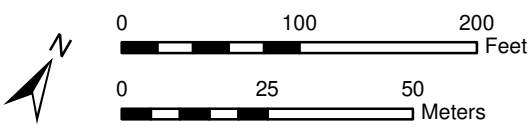
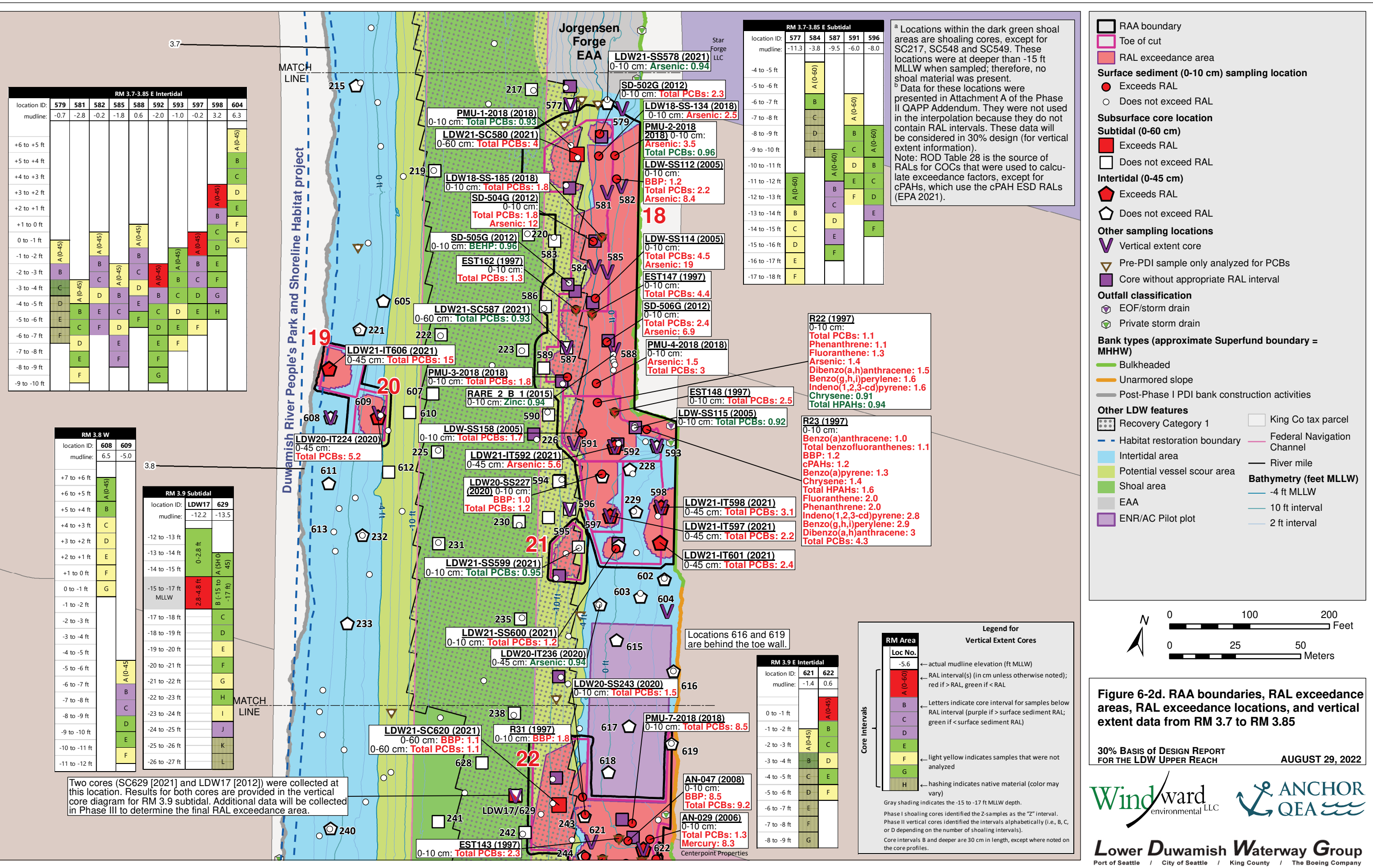
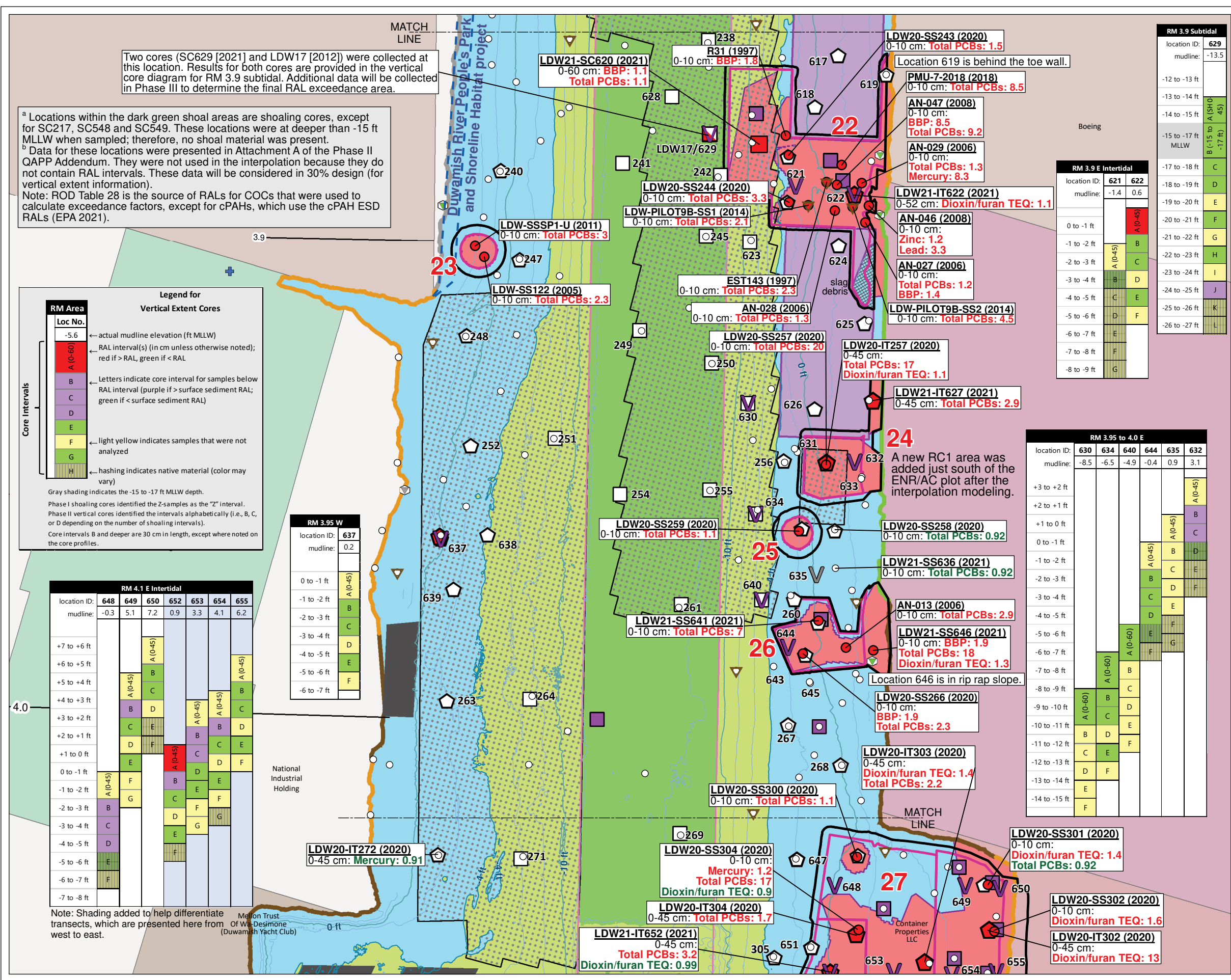


Figure 6-2c. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 3.5 to RM 3.7
30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH
AUGUST 29, 2022





Legend

- RAA boundary
- Toe of cut
- RAL exceedance area

Surface sediment (0-10 cm) sampling location

- Exceeds RAL
- Does not exceed RAL

Subsurface core location

Subtidal (0-60 cm)

- Exceeds RAL
- Does not exceed RAL

Intertidal (0-45 cm)

- Exceeds RAL
- Does not exceed RAL

Other sampling locations

- Vertical extent core^a
- Vertical archive
- Pre-PDI sample only analyzed for PCBs
- Core without appropriate RAL interval

Outfall classification

- Private storm drain
- Pipe of unresolved origin and/or use
- Stream, channel, or ditch

Bank types (approximate Superfund boundary = MHW)

- Bulkheaded
- Armored slope
- Unarmored slope
- Post-Phase I PDI bank construction activities

Other LDW features

- Recovery Category 1
- Habitat restoration boundary
- Intertidal area
- Potential vessel scour area
- Shoal area
- Dock/pier/marina
- ENR/AC Pilot plot

Bathymetry (feet MLLW)

- 4 ft MLLW
- 10 ft interval
- 2 ft interval

Other symbols

- King Co tax parcel
- Federal Navigation Channel
- River mile

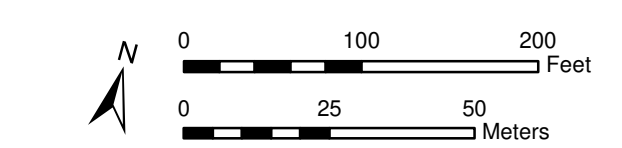
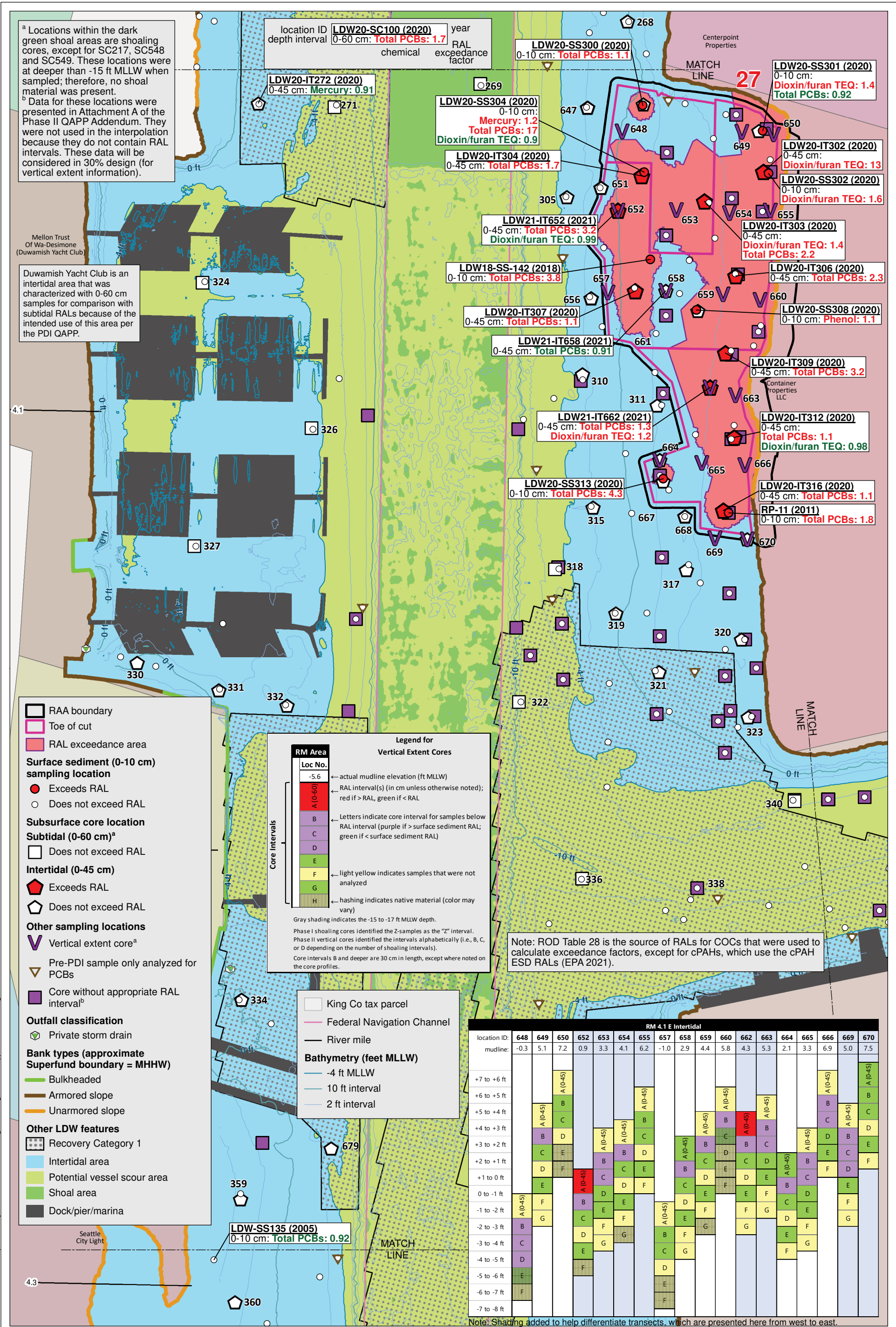


Figure 6-2e. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 3.85 to RM 4.05

30% BASIS of DESIGN REPORT FOR THE LDW UPPER REACH AUGUST 29, 2022



RM 4.1 E Intertidal

location ID:	648	649	650	652	653	654	655	657	658	659	660	662	663	664	665	666	669	670
mudline:	-0.3	5.1	7.2	0.9	3.3	4.1	6.2	-1.0	2.9	4.4	5.8	4.3	5.3	2.1	3.3	6.9	5.0	7.5
+7 to +6 ft			A (0-45)															A (0-45)
+6 to +5 ft																		B
+5 to +4 ft		A (0-45)	B															C
+4 to +3 ft			C															D
+3 to +2 ft		B	D		A (0-45)													E
+2 to +1 ft																		F
+1 to 0 ft																		G
0 to -1 ft																		H
-1 to -2 ft																		I
-2 to -3 ft																		J
-3 to -4 ft																		K
-4 to -5 ft																		L
-5 to -6 ft																		M
-6 to -7 ft																		N
-7 to -8 ft																		O

Note: Shading added to help differentiate transects, which are presented here from west to east.

^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.
^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).

Duwamish Yacht Club is an intertidal area that was characterized with 0-60 cm samples for comparison with subtidal RALs because of the intended use of this area per the PDI QAPP.

- RAA boundary
- Toe of cut
- RAL exceedance area
- Surface sediment (0-10 cm) sampling location**
 - Exceeds RAL
 - Does not exceed RAL
- Subsurface core location**
 - Subtidal (0-60 cm)^a
 - Does not exceed RAL
 - Intertidal (0-45 cm)
 - Exceeds RAL
 - Does not exceed RAL
- Other sampling locations**
 - Vertical extent core^a
 - Pre-PDI sample only analyzed for PCBs
 - Core without appropriate RAL interval^b
- Outfall classification**
 - Private storm drain
- Bank types (approximate Superfund boundary = MHHW)**
 - Bulkheaded
 - Armored slope
 - Unarmored slope
- Other LDW features**
 - Recovery Category 1
 - Intertidal area
 - Potential vessel scour area
 - Shoal area
 - Dock/pier/marina

Legend for Vertical Extent Cores

RM Area
 Loc No.
 -5.6 ← actual mudline elevation (ft MLLW)
 A (0-60) ← RAL interval(s) (in cm unless otherwise noted); red if > RAL, green if < RAL
 B ← Letters indicate core interval for samples below RAL interval (purple if > surface sediment RAL; green if < surface sediment RAL)
 C
 D
 E
 F ← light yellow indicates samples that were not analyzed
 G ← hashing indicates native material (color may vary)

Gray shading indicates the -15 to -17 ft MLLW depth.
 Phase I shoaling cores identified the Z-samples as the "Z" interval.
 Phase II vertical cores identified the intervals alphabetically (i.e., B, C, or D depending on the number of shoaling intervals).
 Core intervals B and deeper are 30 cm in length, except where noted on the core profiles.

- King Co tax parcel
- Federal Navigation Channel
- River mile
- Bathymetry (feet MLLW)**
 - 4 ft MLLW
 - 10 ft interval
 - 2 ft interval

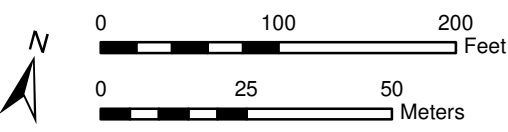
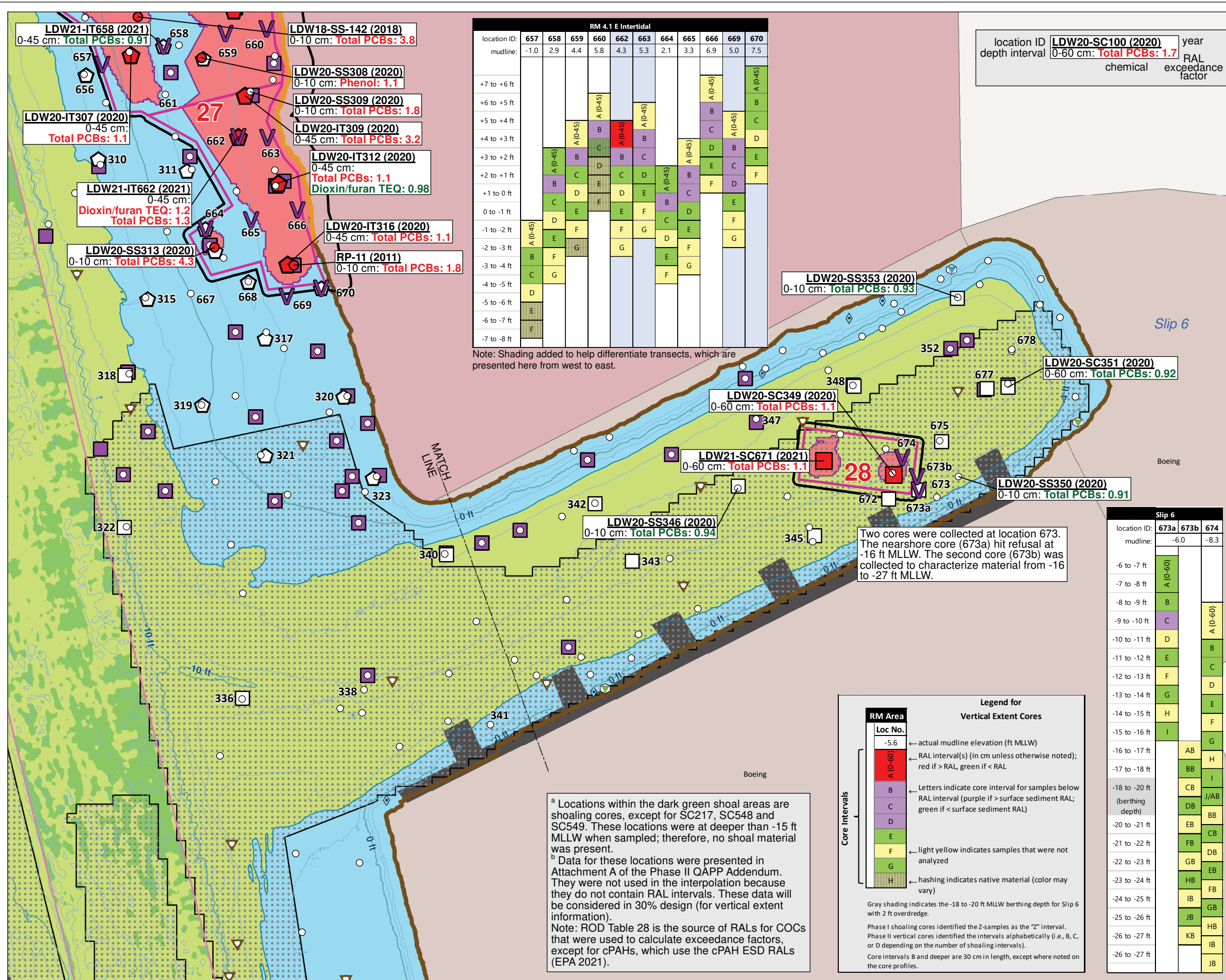


Figure 6-2f. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 4.05 to RM 4.3
 30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH
 AUGUST 29, 2022

Prepared by craigh, 8/29/22, W:\Projects\Duwamish AOC\GIS\Maps and Analysis\Phase II\30 Percent Design\BOD\Fig 06-2g 7172 Upper Reach Ph2 Design Data wREAs - Slip 6.mxd



RM 4.1 E Intertidal											
location ID:	657	658	659	660	662	663	664	665	666	669	670
mudline:	-1.0	2.9	4.4	5.8	4.3	5.3	2.1	3.3	6.9	5.0	7.5
+7 to +6 ft											
+6 to +5 ft											
+5 to +4 ft											
+4 to +3 ft											
+3 to +2 ft											
+2 to +1 ft											
0 to -1 ft											
-1 to -2 ft											
-2 to -3 ft											
-3 to -4 ft											
-4 to -5 ft											
-5 to -6 ft											
-6 to -7 ft											
-7 to -8 ft											

Note: Shading added to help differentiate transects, which are presented here from west to east.

location ID	LDW20-SC100 (2020)	year	
depth interval	0-60 cm: Total PCBs: 1.7	chemical	RAL exceedance factor

- RAA boundary
- Toe of cut
- RAL exceedance area
- Surface sediment (0-10 cm) sampling location**
 - Exceeds RAL
 - Does not exceed RAL
- Subsurface core location**
 - Subtidal (0-60 cm)^a**
 - Exceeds RAL
 - Does not exceed RAL
 - Intertidal (0-45 cm)**
 - Exceeds RAL
 - Does not exceed RAL
- Other sampling locations**
 - Vertical extent core^a
 - Pre-PDI sample only analyzed for PCBs
 - Core without appropriate RAL interval^b
- Outfall classification**
 - Private storm drain
 - Public storm drain
 - Abandoned/inactive
- Bank types (approximate Superfund boundary = MHHW)**
 - Armored slope
 - Unarmored slope
- Other LDW features**
 - Recovery Category 1
 - Intertidal area
 - Potential vessel scour area
 - Shoal area
 - Dock/pier/marina
 - King Co tax parcel
 - Federal Navigation Channel
- Bathymetry (feet MLLW)**
 - 4 ft MLLW
 - 10 ft interval
 - 2 ft interval

Slip 6			
location ID:	673a	673b	674
mudline:	-6.0	-8.3	
-6 to -7 ft	A (0-60)		
-7 to -8 ft	B		
-8 to -9 ft	C		
-9 to -10 ft	D		
-10 to -11 ft	E		
-11 to -12 ft	F		
-12 to -13 ft	G		
-13 to -14 ft	H		
-14 to -15 ft	I		
-15 to -16 ft			A (0-60)
-16 to -17 ft	AB	H	
-17 to -18 ft	BB	I	
-18 to -20 ft	CB	J/AB	
-20 to -21 ft	DB	BB	
-21 to -22 ft	EB	CB	
-22 to -23 ft	GB	DB	
-23 to -24 ft	HB	EB	
-24 to -25 ft	IB	FB	
-25 to -26 ft	JB	GB	
-26 to -27 ft	KB	HB	
-26 to -27 ft		IB	
-26 to -27 ft		JB	

Legend for Vertical Extent Cores

RM Area	Loc No.	Interval
	-5.6	← actual mudline elevation (ft MLLW)
	A (0-60)	← RAL interval(s) (in cm unless otherwise noted); red if > RAL, green if < RAL
	B	← Letters indicate core interval for samples below RAL interval (purple if > surface sediment RAL; green if < surface sediment RAL)
	C	
	D	
	E	
	F	← light yellow indicates samples that were not analyzed
	G	
	H	← hashing indicates native material (color may vary)

Gray shading indicates the -18 to -20 ft MLLW berthing depth for Slip 6 with 2 ft overdrudge.

Phase I shoaling cores identified the Z-samples as the "Z" interval. Phase II vertical cores identified the intervals alphabetically (i.e., B, C, or D depending on the number of shoaling intervals).

Core intervals B and deeper are 30 cm in length, except where noted on the core profiles.

^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.

^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).

Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

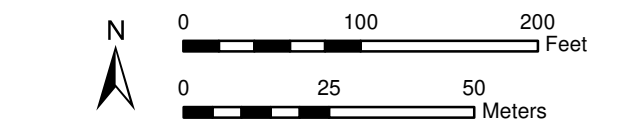
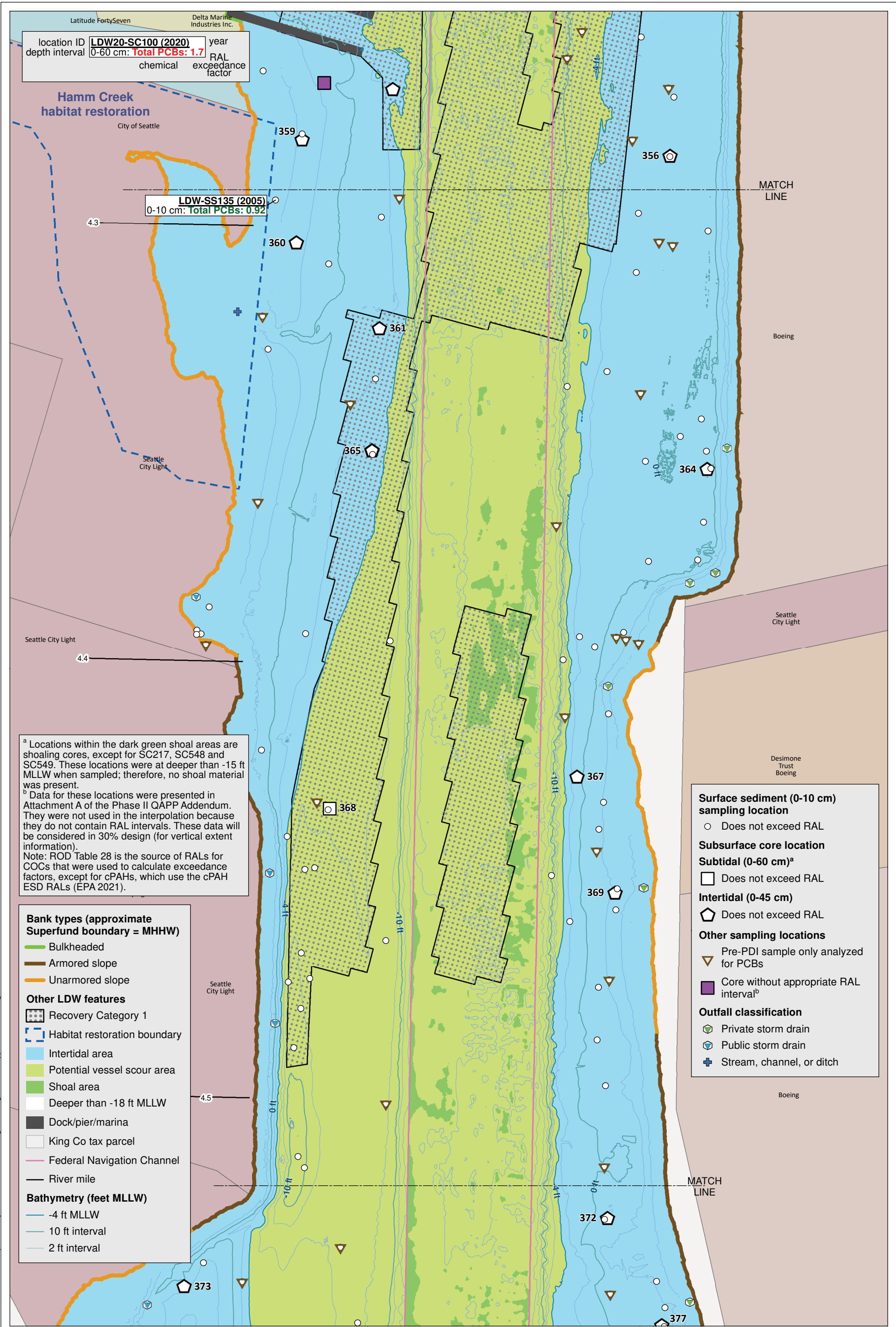


Figure 6-2g. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from Slip 6

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^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.

^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).

Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

- Bank types (approximate Superfund boundary = MHHW)**
- Bulkheaded
 - Armored slope
 - Unarmored slope
- Other LDW features**
- Recovery Category 1
 - Habitat restoration boundary
 - Intertidal area
 - Potential vessel scour area
 - Shoal area
 - Deeper than -18 ft MLLW
 - Dock/pier/marina
 - King Co tax parcel
 - Federal Navigation Channel
 - River mile
- Bathymetry (feet MLLW)**
- 4 ft MLLW
 - 10 ft interval
 - 2 ft interval

- Surface sediment (0-10 cm) sampling location**
- Does not exceed RAL
- Subsurface core location**
- Subtidal (0-60 cm)^a**
- Does not exceed RAL
- Intertidal (0-45 cm)**
- Does not exceed RAL
- Other sampling locations**
- Pre-PDI sample only analyzed for PCBs
 - Core without appropriate RAL interval^b
- Outfall classification**
- Private storm drain
 - Public storm drain
 - Stream, channel, or ditch

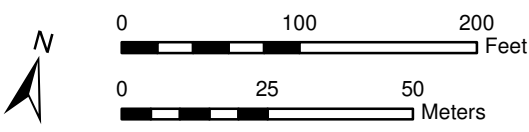
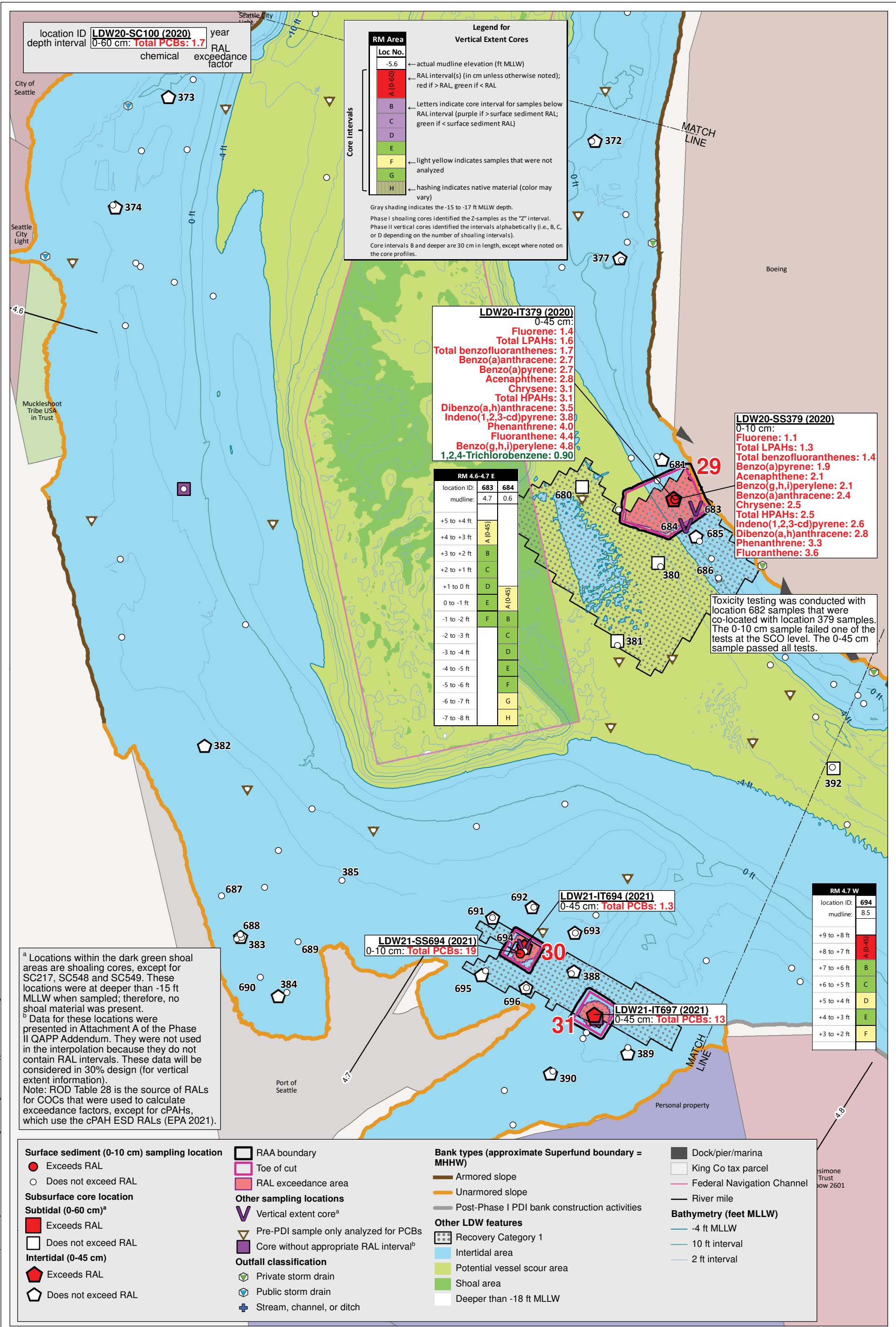


Figure 6-2h. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 4.3 to RM 4.55

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Prepared by craigh. 8/29/22. W:\Projects\Duwamish AOC\GIS\Maps and Analyses\Phase II\30 Percent Design\BOD\Fig 06-2h Upper Reach Ph2 Design Data wREAs - RM 4.3-4.5.mxd



location ID **LDW20-SC100 (2020)** year
 depth interval **0-60 cm: Total PCBs: 1.7** RAL
 chemical exceedance factor

Legend for Vertical Extent Cores

RM Area	Loc No.
-5.6	← actual mudline elevation (ft MLLW)
A (0-60)	← RAL interval(s) (in cm unless otherwise noted); red if > RAL, green if < RAL
B	← Letters indicate core interval for samples below RAL interval (purple if > surface sediment RAL; green if < surface sediment RAL)
C	
D	
E	
F	← light yellow indicates samples that were not analyzed
G	
H	← hashing indicates native material (color may vary)

Gray shading indicates the -15 to -17 ft MLLW depth.
 Phase I shoaling cores identified the Z-samples as the "Z" interval.
 Phase II vertical cores identified the intervals alphabetically (i.e., B, C, or D depending on the number of shoaling intervals).
 Core intervals B and deeper are 30 cm in length, except where noted on the core profiles.

LDW20-IT379 (2020)
 0-45 cm:
 Fluorene: 1.4
 Total LPAHs: 1.6
 Total benzofluoranthenes: 1.7
 Benzo(a)anthracene: 2.7
 Benzo(a)pyrene: 2.7
 Acenaphthene: 2.8
 Chrysene: 3.1
 Total HPAHs: 3.1
 Dibenzo(a,h)anthracene: 3.5
 Indeno(1,2,3-cd)pyrene: 3.8
 Phenanthrene: 4.0
 Fluoranthene: 4.4
 Benzo(g,h,i)perylene: 4.8
 1,2,4-Trichlorobenzene: 0.90

LDW20-SS379 (2020)
 0-10 cm:
 Fluorene: 1.1
 Total LPAHs: 1.3
 Total benzofluoranthenes: 1.4
 Benzo(a)pyrene: 1.9
 Acenaphthene: 2.1
 Benzo(g,h,i)perylene: 2.1
 Benzo(a)anthracene: 2.4
 Chrysene: 2.5
 Total HPAHs: 2.5
 Indeno(1,2,3-cd)pyrene: 2.6
 Dibenzo(a,h)anthracene: 2.8
 Phenanthrene: 3.3
 Fluoranthene: 3.6

RM 4.6-4.7 E	
location ID:	683 684
mudline:	4.7 0.6
+5 to +4 ft	
+4 to +3 ft	A (0-45)
+3 to +2 ft	B
+2 to +1 ft	C
+1 to 0 ft	D
0 to -1 ft	E A (0-45)
-1 to -2 ft	F B
-2 to -3 ft	C
-3 to -4 ft	D
-4 to -5 ft	E
-5 to -6 ft	F
-6 to -7 ft	G
-7 to -8 ft	H

Toxicity testing was conducted with location 682 samples that were co-located with location 379 samples. The 0-10 cm sample failed one of the tests at the SCO level. The 0-45 cm sample passed all tests.

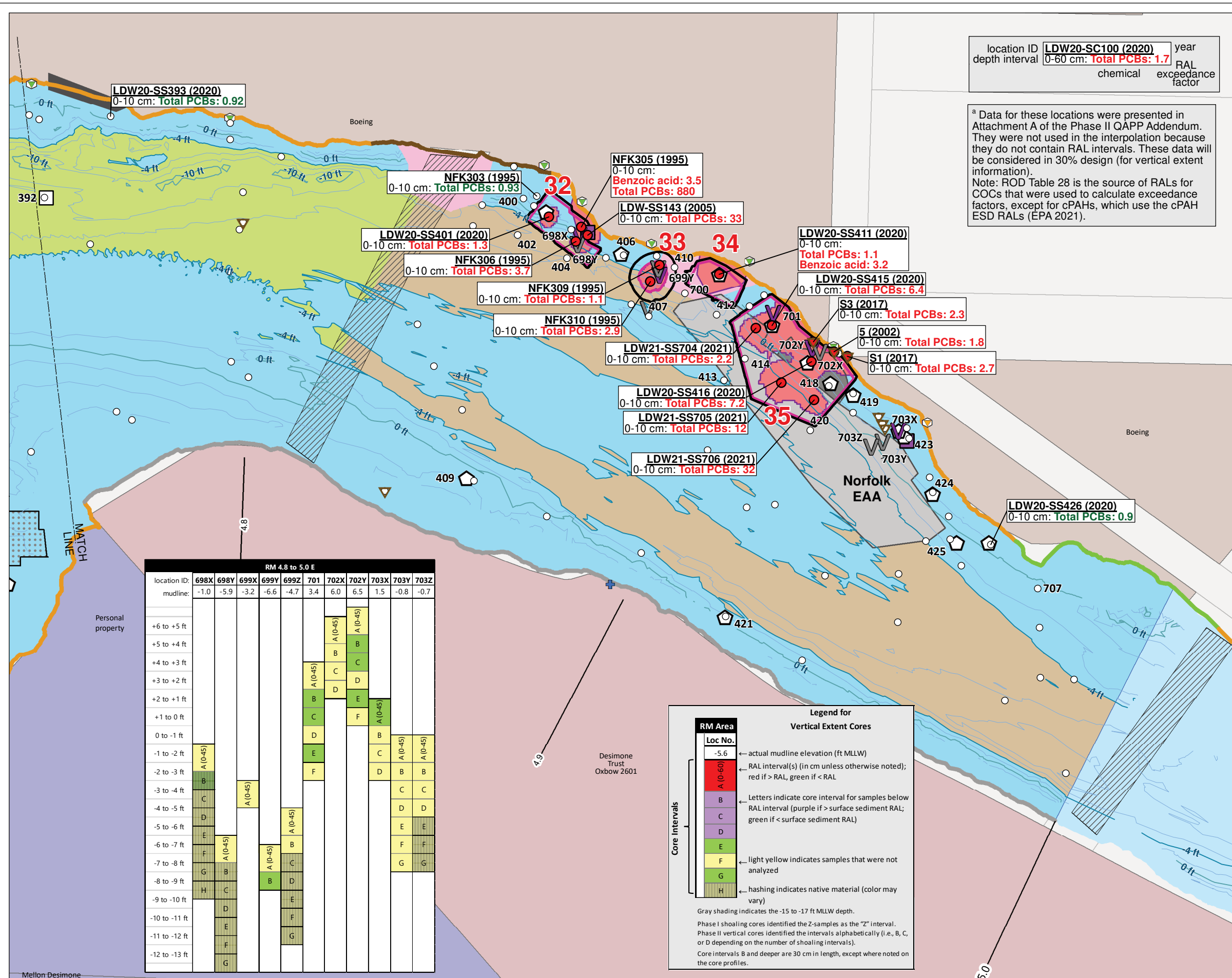
^a Locations within the dark green shoal areas are shoaling cores, except for SC217, SC548 and SC549. These locations were at deeper than -15 ft MLLW when sampled; therefore, no shoal material was present.
^b Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).
 Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

<p>Surface sediment (0-10 cm) sampling location</p> <ul style="list-style-type: none"> ● Exceeds RAL ○ Does not exceed RAL <p>Subsurface core location</p> <p>Subtidal (0-60 cm)^a</p> <ul style="list-style-type: none"> ■ Exceeds RAL □ Does not exceed RAL <p>Intertidal (0-45 cm)</p> <ul style="list-style-type: none"> ◆ Exceeds RAL ◇ Does not exceed RAL 	<p>□ RAA boundary</p> <p>□ Toe of cut</p> <p>■ RAL exceedance area</p> <p>Other sampling locations</p> <ul style="list-style-type: none"> ∇ Vertical extent core^a ∇ Pre-PDI sample only analyzed for PCBs ∇ Core without appropriate RAL interval^b <p>Outfall classification</p> <ul style="list-style-type: none"> ◆ Private storm drain ◆ Public storm drain ◆ Stream, channel, or ditch 	<p>Bank types (approximate Superfund boundary = MHHW)</p> <ul style="list-style-type: none"> ■ Armored slope ■ Unarmored slope ■ Post-Phase I PDI bank construction activities <p>Other LDW features</p> <ul style="list-style-type: none"> ■ Recovery Category 1 ■ Intertidal area ■ Potential vessel scour area ■ Shoal area ■ Deeper than -18 ft MLLW 	<ul style="list-style-type: none"> ■ Dock/pier/marina ■ King Co tax parcel ■ Federal Navigation Channel — River mile <p>Bathymetry (feet MLLW)</p> <ul style="list-style-type: none"> — -4 ft MLLW — 10 ft interval — 2 ft interval
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Figure 6-2i. RAA boundaries, RAL exceedance areas, RAL exceedance locations, and vertical extent data from RM 4.55 to RM 4.8

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Prepared by craigh. 8/29/22. W:\Projects\Duwamish ACC4\GIS\Maps and Analysis\Phase II\30 Percent Design\BODR\Fig 06-2j 1772 Upper Reach Ph2 Design Data wREAs - RM 4.8-5.0.mxd



location ID **LDW20-SS100 (2020)** year
 depth interval **0-60 cm: Total PCBs: 1.7** RAL
 chemical exceedance factor

^a Data for these locations were presented in Attachment A of the Phase II QAPP Addendum. They were not used in the interpolation because they do not contain RAL intervals. These data will be considered in 30% design (for vertical extent information).
 Note: ROD Table 28 is the source of RALs for COCs that were used to calculate exceedance factors, except for cPAHs, which use the cPAH ESD RALs (EPA 2021).

- RAA boundary
- Toe of cut
- RAL exceedance area

Surface sediment (0-10 cm) sampling

- Exceeds RAL
- Does not exceed RAL

Subsurface core location

Subtidal (0-60 cm)

- Does not exceed RAL

Intertidal (0-45 cm)

- Does not exceed RAL

Other sampling locations

- V Vertical extent core
- ∇ Vertical archive
- ▽ Pre-PDI sample only analyzed for PCBs
- Core without appropriate RAL interval

Outfall classification

- ◇ CSO/storm drain
- ◇ Private storm drain
- ◇ Abandoned/inactive
- + Stream, channel, or ditch

Bank types (approximate Superfund boundary =)

- Bulkheaded
- Armored slope
- Unarmored slope
- Post-Phase I PDI bank construction

Other LDW features

- Recovery Category 1
- Bridge
- Dock/pier/marina
- Intertidal area
- Potential vessel scour area
- Subtidal with no subsurface RAL
- Area not covered by bathymetric survey
- Boeing South Storm Drain removal area
- EAA
- King Co tax parcel
- River mile

Bathymetry (feet MLLW)

- -4 ft MLLW
- 10 ft interval
- 2 ft interval

RM 4.8 to 5.0 E											
location ID:	698X	698Y	699X	699Y	699Z	701	702X	702Y	703X	703Y	703Z
mudline:	-1.0	-5.9	-3.2	-6.6	-4.7	3.4	6.0	6.5	1.5	-0.8	-0.7
+6 to +5 ft											
+5 to +4 ft											
+4 to +3 ft											
+3 to +2 ft											
+2 to +1 ft											
+1 to 0 ft											
0 to -1 ft											
-1 to -2 ft											
-2 to -3 ft											
-3 to -4 ft											
-4 to -5 ft											
-5 to -6 ft											
-6 to -7 ft											
-7 to -8 ft											
-8 to -9 ft											
-9 to -10 ft											
-10 to -11 ft											
-11 to -12 ft											
-12 to -13 ft											

Legend for Vertical Extent Cores

RM Area	Loc No.	Interval
	-5.6	← actual mudline elevation (ft MLLW)
	A (0-60)	← RAL interval(s) (in cm unless otherwise noted); red if > RAL, green if < RAL
	B	← Letters indicate core interval for samples below RAL interval (purple if > surface sediment RAL; green if < surface sediment RAL)
	C	
	D	
	E	
	F	← light yellow indicates samples that were not analyzed
	G	
	H	← hashing indicates native material (color may vary)

Gray shading indicates the -15 to -17 ft MLLW depth.

Phase I shoaling cores identified the Z-samples as the "Z" interval. Phase II vertical cores identified the intervals alphabetically (i.e., B, C, or D depending on the number of shoaling intervals). Core intervals B and deeper are 30 cm in length, except where noted on the core profiles.

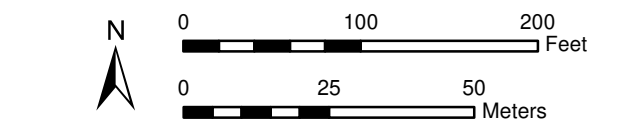


Figure 6-2j. RAL exceedance areas from RM 4.8 to RM 5.0 with RAL exceedances and vertical extent data in the design dataset

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Prepared by craigh. 8/29/22. W:\Projects\Duwamish ACCA\GIS\Maps and Analyses\Phase II\30 Percent Design\BOD\Fig 06-3a 7216 Combined PH1\K\Near RALS - RM 3.0 to 3.7.mxd

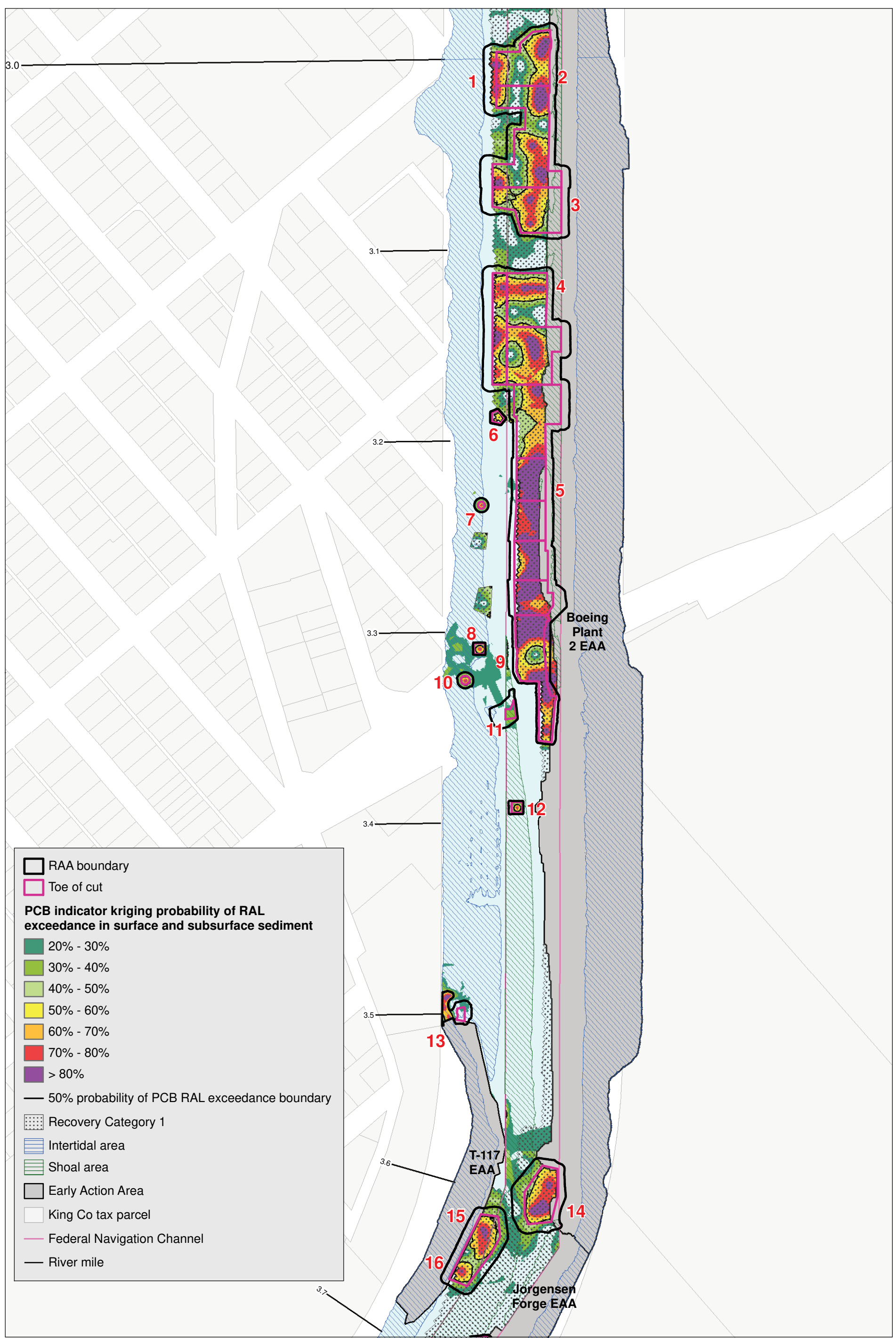
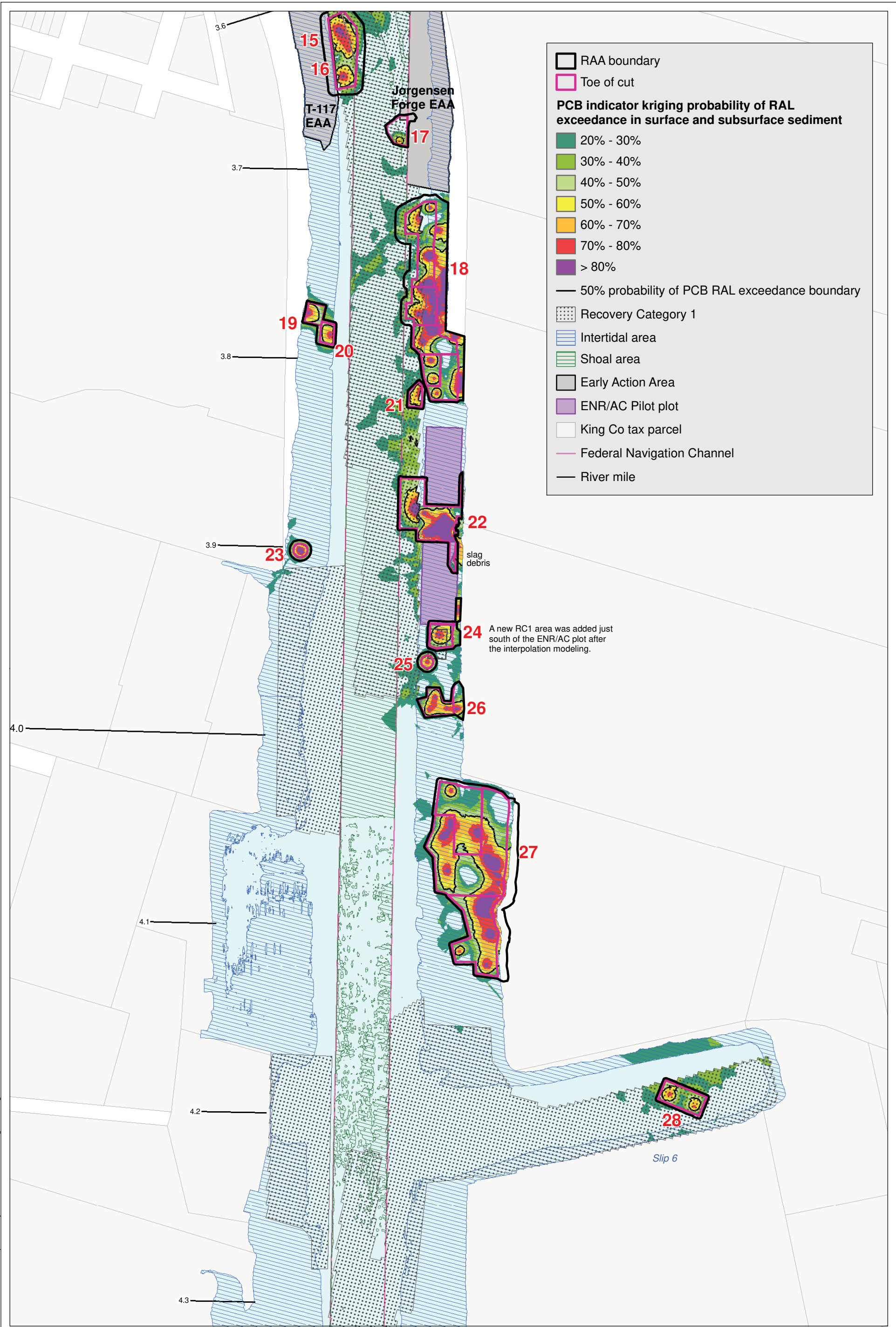


Figure 6-3a. Total PCB combined surface and subsurface sediment indicator kriging interpolation with RAA boundaries, RM 3.0 to RM 3.7
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 AUGUST 29, 2022



Prepared by craigh. 8/29/22. W:\Projects\Duwamish ACCA\GIS\Maps and Analyses\Phase II\30 Percent Design\BOD\Fig 06-3b-7216 Combined PHU IK wNear RAUS - RM 3.7 to 4.3.mxd

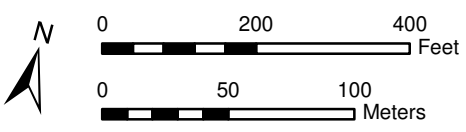
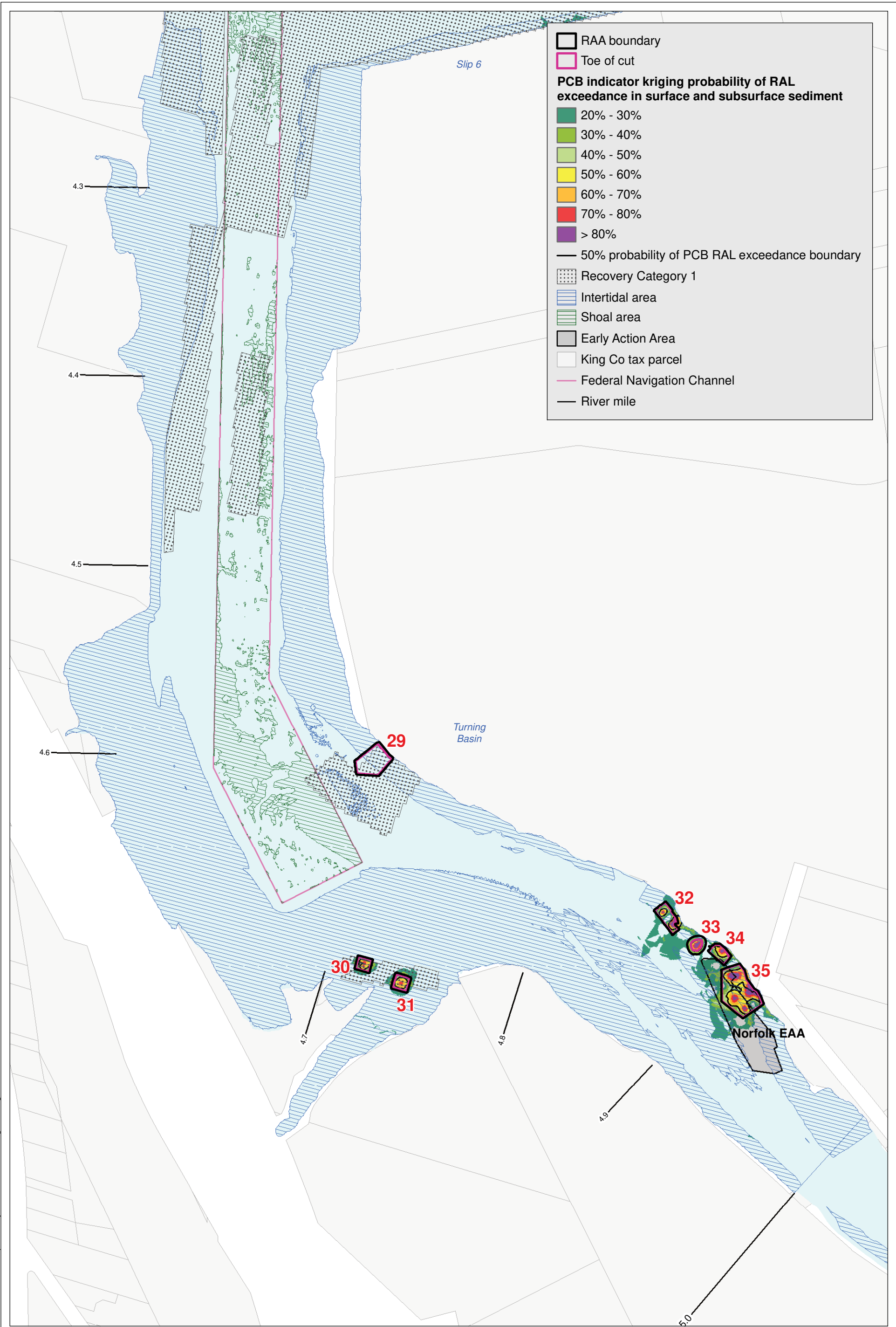


Figure 6-3b. Total PCB combined surface and subsurface sediment indicator kriging interpolation with RAA boundaries, RM 3.7 to RM 4.3
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 AUGUST 29, 2022



Prepared by craigh. 8/29/22: W:\Projects\Duwamish AOC\GIS\Maps and Analyses\Phase II\30 Percent Design\BOD\Fig 06-3c: 7216 Combined Phil\IK wNear FALS - RM 4.3 to 5.0.mxd

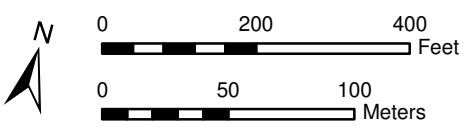
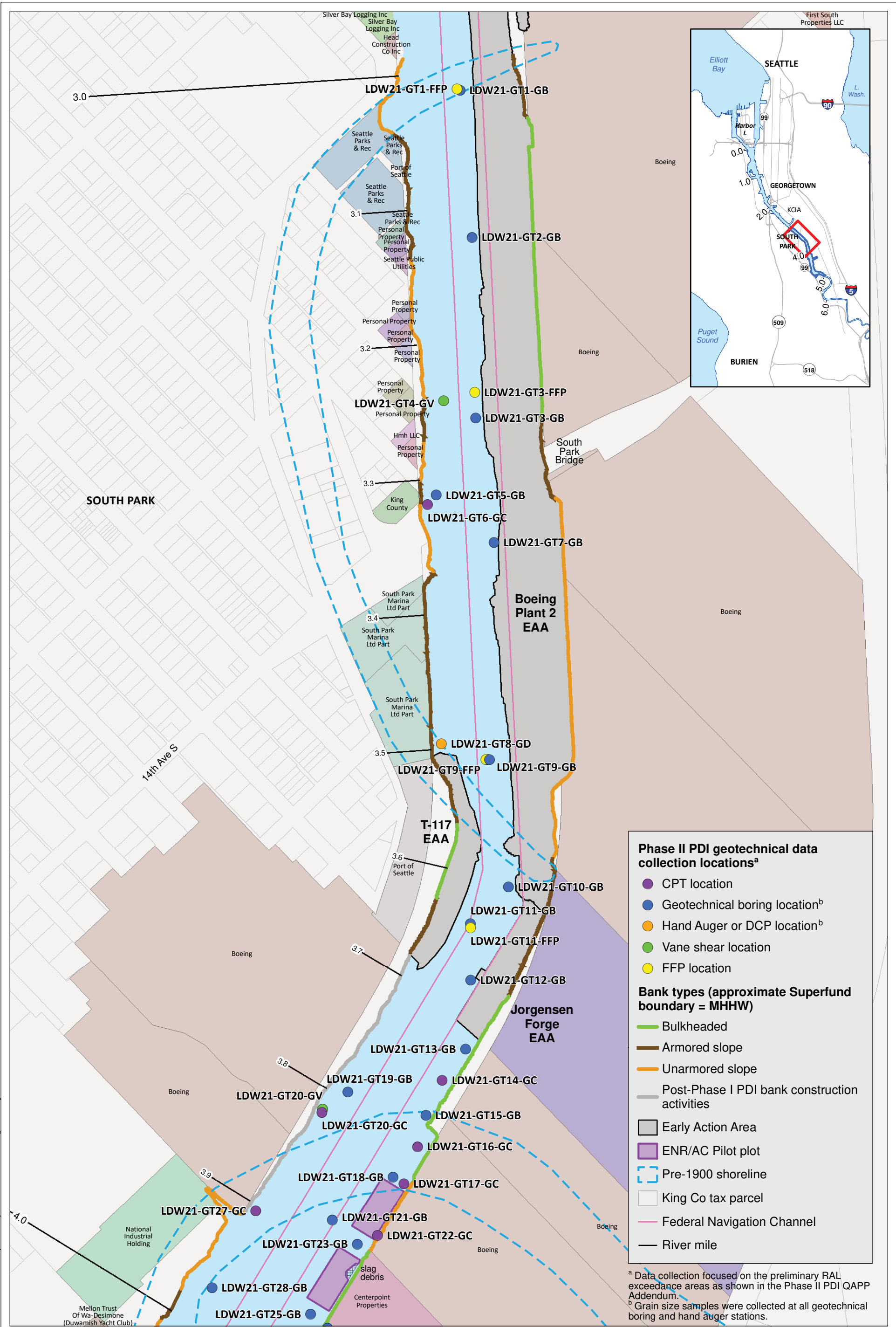


Figure 6-3c. Total PCB combined surface and subsurface sediment indicator kriging interpolation with RAA boundaries, RM 4.3 to RM 5.0
 30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH
 AUGUST 29, 2022



Phase II PDI geotechnical data collection locations^a

- CPT location
- Geotechnical boring location^b
- Hand Auger or DCP location^b
- Vane shear location
- FFP location

Bank types (approximate Superfund boundary = MHHW)

- Bulkheaded
- Armored slope
- Unarmored slope
- Post-Phase I PDI bank construction activities
- Early Action Area
- ENR/AC Pilot plot
- Pre-1900 shoreline
- King Co tax parcel
- Federal Navigation Channel
- River mile

^a Data collection focused on the preliminary RAL exceedance areas as shown in the Phase II PDI QAPP Addendum.
^b Grain size samples were collected at all geotechnical boring and hand auger stations.

Prepared by craigh. 8/29/22: W:\Projects\Duwamish\AOC\GIS\Maps and Analyses\Phase II\30 Percent Design\BODR\Fig 08-1a 7281 PDI PDI Geotech locations RM3-4.mxd

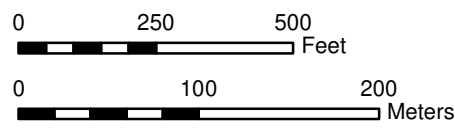
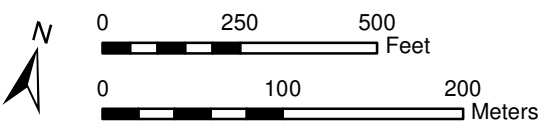
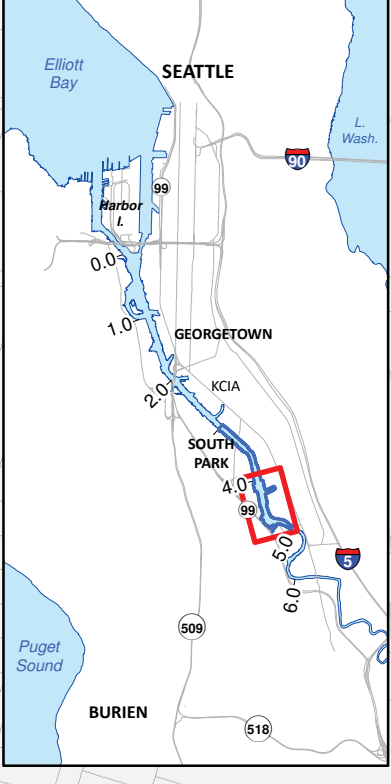
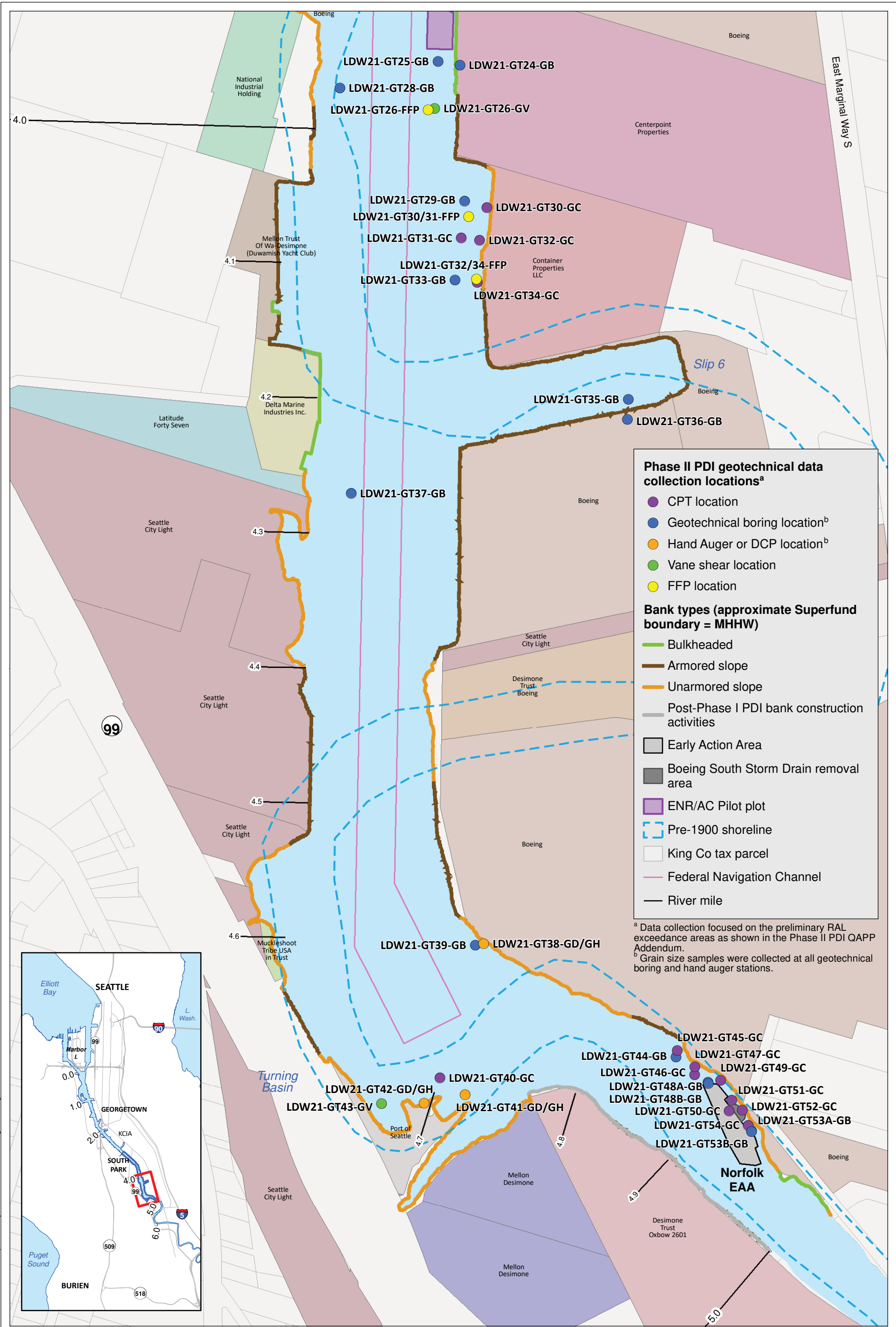
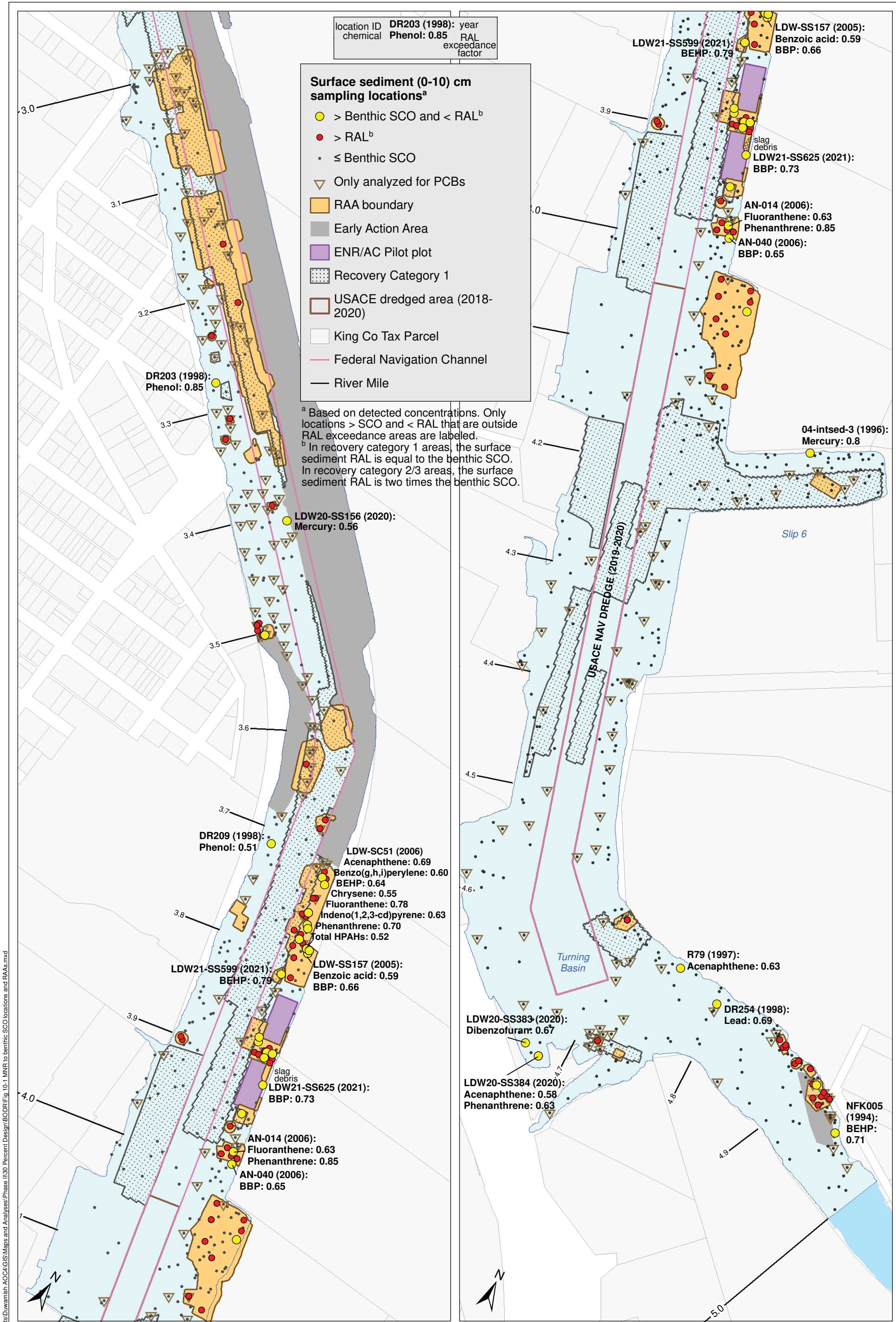


Figure 8-1a. Phase II PDI geotechnical data locations, RM 3.0 to RM 4.0

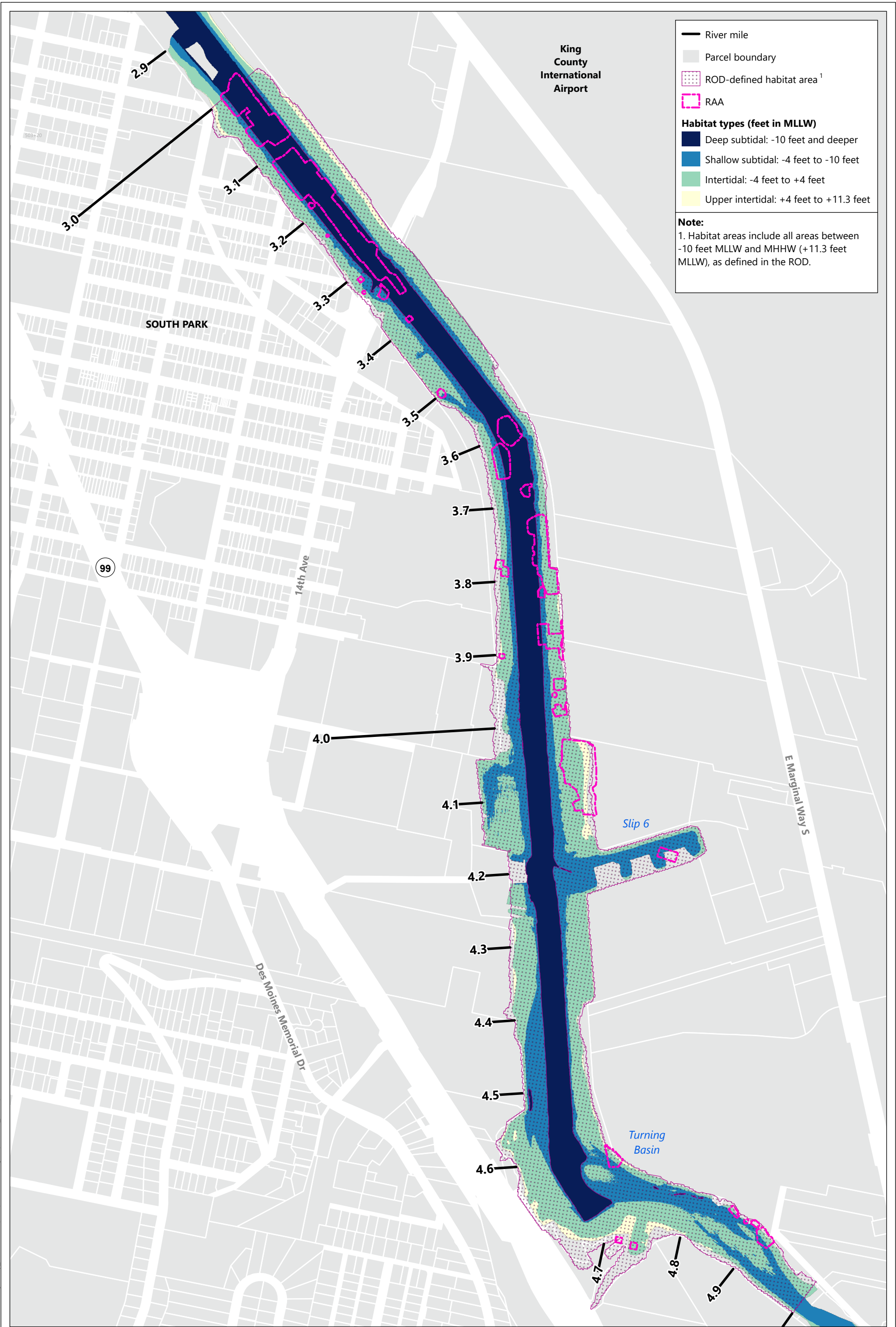
30% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH AUGUST 29, 2022



Prepared by craigh. 8/29/22. W:\Projects\Duwamish\AOC4\GIS\Maps and Analyses\Phase II\30 Percent Design\BODR\Fig 08-1b 7281 PDI Geotech Locations RM4-5.mxd



Prepared by craigh. 8/29/22. W:\Projects\Duwamish AOC\GIS\Maps and Analyses\Phase II\30 Percent Design\BODR\Fig 10-1 MNR to benthic SCO locations and RAAs.mxd



— River mile

▭ Parcel boundary

▭ ROD-defined habitat area¹

▭ RAA

Habitat types (feet in MLLW)

- ▭ Deep subtidal: -10 feet and deeper
- ▭ Shallow subtidal: -4 feet to -10 feet
- ▭ Intertidal: -4 feet to +4 feet
- ▭ Upper intertidal: +4 feet to +11.3 feet

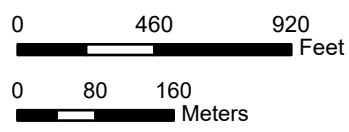
Note:
 1. Habitat areas include all areas between -10 feet MLLW and MHHW (+11.3 feet MLLW), as defined in the ROD.

Prepared by JIanson, 8/19/2022, I:\projects\GIS\Jobs\KingCounty_0067\LDW\Maps\Reports\BasisDesign\Report\LDW_BDR.aprx

Windward
 environmental LLC

ANCHOR
 QEA

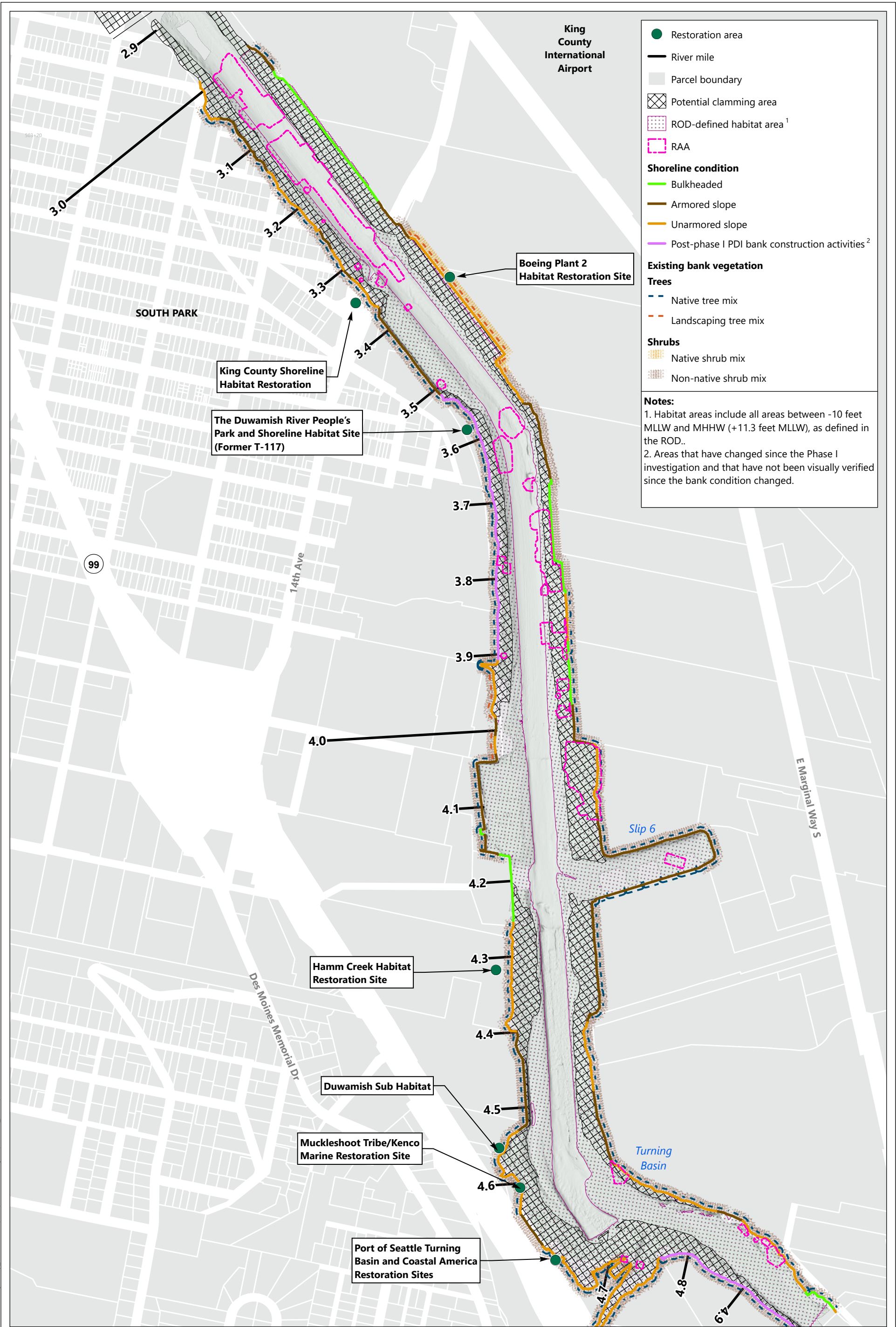
Lower Duwamish Waterway Group
 Port of Seattle / City of Seattle / King County / The Boeing Company



Map 11-1a
Habitat types and ROD-defined habitat areas that overlap with RAAs

BASIS OF DESIGN REPORT FOR THE
 LDW UPPER REACH

AUGUST 29, 2022





Note: This conceptual preliminary construction schedule is based on Preliminary (30%) RD production rate estimates of dredging, material placement, and structural activities and as defined by the in-water work windows. A third construction season may be required depending on the overall construction sequencing of the work and actual production rates. Production rates and the anticipated project schedule will be refined in the Intermediate (60%) RD.