Date:	July 24, 2014
To:	Allison Hiltner, EPA and Ron Timm, Ecology
From:	Lower Duwamish Waterway Group
Subject:	Candidate Plot Locations for Enhanced Natural Recovery-Activated Carbon Pilot Study

This memorandum provides key tables, figures, and summary documentation of the methods and criteria used to identify potential candidate plot locations for the Enhanced Natural Recovery (ENR)-Activated Carbon (AC) Pilot Study. Candidate plots identified through this process will be sampled for polychlorinated biphenyl (PCB) aroclors later this year. Final plot locations will be selected from the candidate plots in collaboration between the Lower Duwamish Waterway Group (LDWG), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) after new surface sediment samples have been collected to refine the distribution of PCB concentrations in the candidate plots. The pilot study will evaluate three types of candidate areas, each representing different physical conditions: subtidal, intertidal, and scour mitigation (areas of scour potential identified in the Feasibility Study).

In this memorandum, candidate plot locations were identified in a two-step screening process. First, potential pilot areas were identified that meet all of the following criteria:

1) Located in Area of Potential Concern 1 (AOPC 1).
2) Located in Recovery Category 2/3 (or in Category 1 area with "light" scour potential considered for the scour mitigation areas).
3) Located within EPA's Proposed Plan partial dredge and cap, cap, or ENR footprint.
4) Contained point-based surface PCB concentration data greater than the sediment quality standards (SQS) and less than the cleanup screening level (CSL).

Areas that meet these first criteria are identified with a green hatch pattern on Figures 1 through 3, using GIS shape files from the *Lower Duwamish Waterway Final Feasibility Study* (AECOM 2012).

Areas were also identified that meet the criteria above except they: 1) contained PCB concentration data greater than the CSL but less than two times the CSL and 2) were located within EPA's Proposed Plan dredge, partial dredge and cap, cap, or ENR footprint. Areas that meet the first two criteria above and these last two criteria are identified with a red hatch pattern on Figures 1 through 3. This extended group was developed because current PCB concentrations may be less than the estimated SWAC (which is based on data from the Feasibility Study).

From this group of potential areas, candidate plots were selected based on consideration of the following conditions[1]:

- **Area**: Each location should accommodate approximately two ½-acre plots, ideally located in similar water depths to avoid steep slopes and changes in the physical conditions (i.e., intertidal vs. subtidal).
- **Ownership**: Plots should be in the waterway with no in-water ownership by a private party to facilitate plot access.
- **Sedimentation**: Preference was given to locations with a modeled net sedimentation rate (NSR) of greater than 1 cm/year in subtidal areas and greater than 0.5 cm/year in intertidal areas to minimize erosion potential.
- **PCB Concentration:** As a general indicator of PCB concentrations, the SWAC for a 1-acre area is greater than the SQS.
- **Berthing Area:** For Category 1 areas considered for scour mitigation plots, sites with very active berthing areas that require maintained navigation depths were not preferred.
- **In-water Structures**: Locations where the majority of the test plot would be covered by an in-water structure were excluded for ease of material placement for the pilot study.
- **Technology and Shoaling**: If technology assignments were based on shoaling in the navigation channel or berthing areas, then the orientation of the plot was adjusted based on bathymetry to avoid those areas. EPA's Proposed Plan technology assignments within each candidate plot are listed in Table 1.
- **Recontamination Potential**: Sites with a greater potential for recontamination were generally avoided (based on FS Appendix J, Figure J-9a).

[1] Two areas with elevated contaminant concentrations were excluded from this analysis: 1) Industrial Containers/Trotsky/NW Cooperage and 2) Glacier Northwest/Reichhold.

A total of 13 candidate plot areas were identified. For each plot category (subtidal, intertidal, and scour mitigation), at least three candidate plots were identified. Physical and chemical conditions for each candidate plot are summarized in Tables 1 and 2, respectively.

Figures 1 through 3 show the candidate plot locations, with information listed for each one detailing concentrations of PCBs, cPAHs, dioxin/furans, number of chemicals exceeding SQS (not including PCBs), and the NSR. The average PCB, cPAH, and dioxin/furan data presented were calculated using all available data from the Feasibility Study[2]. SWACs were calculated for the entire 1 acre shown (i.e., the SWAC for both test plots combined). The left panel provides supporting conceptual site model information and EPA Proposed Plan technology assignments and the right panel of each figure identifies the candidate plot areas.

In addition, the geometry of the candidate plots was adjusted, where possible, to include the entire remedial action planned for that footprint (per the EPA Proposed Plan) to minimize future disturbance of the area. A larger dashed outline is shown for each candidate plot, indicating the area needed to actively "remediate" in the vicinity of candidate test plots (based on the EPA Proposed Plan footprints). These footprints vary in size from 0.8 to 4.5 acres.

The locations of the areas in relation to physical constraints used to screen the plots (berthing areas, water depth, etc.) are shown on Figure 4. Aerial photographs showing the approximate extent of the candidate plots are included in Attachment 1. Sun illumination maps based on 2003 bathymetric data are included in Attachment 2 for the three scour mitigation areas. These were used to assess the possible presence of scour-related and spudding-related features.

Recommended Candidate Plot Locations for Sampling

Two intertidal and two subtidal candidate plot locations are recommended for initial sampling (i.e., collection and PCB analysis of sediment samples) to verify that the correct range of PCB concentrations is present. A third intertidal and a third subtidal location are also recommended as backup locations (where sediment samples will be collected and archived for potential future analysis in the event that sample results indicate the two recommended areas do not have suitable PCB concentrations). Only one scour mitigation site is recommended and two backup sites are identified. In

[2] SWACs were calculated in GIS using samples from the FS baseline dataset that were located both inside and adjacent to the proposed plots.

summary, LDWG recommends sampling the following areas (shown on Figures 1 through 3):

- Intertidal areas: Area 3, Area 12, backup Area 13;
- Subtidal areas: Area 4, Area 8, backup Area 10; and
- Scour mitigation areas: Area 1 (and potentially Area 6[3]), backup Areas 2 and 7.

Next Steps

Following receipt and validation of PCB aroclor verification sample data, LDWG will submit the data electronically to EPA/Ecology for review. In addition, a brief report will be prepared and submitted for review. A meeting will be held between LDWG and EPA/Ecology to review the data and determine which of the sampled candidate areas will be used for the full study. These locations will be incorporated into the design report.

Attachments

Table 1 – Summary of Site Conditions for Each Candidate Plot Area
Table 2 – Summary of Existing Sample Data for Each Candidate Plot Area
Figure 1 – Reach 1: Potential ENR/Carbon Pilot Treatment Areas
Figure 2 – Reach 2: Potential ENR/Carbon Pilot Treatment Areas
Figure 3 – Reach 3: Potential ENR/Carbon Pilot Treatment Areas
Figure 4 – Information Used for Candidate Plot Screening
Attachment 1 – Aerial photographs
Attachment 2 – Sun Illumination Maps for Scour Mitigation Areas

[3] Although Area 6 is not included in Recovery Category 1 in the EPA Proposed Plan, it may make a suitable scour mitigation plot area given the amount of vessel traffic known to occur in Slip 1.

Table 1: Summary of Site Conditions for Each Candidate Plot Area

Plot Type	Area	Location	Physical Features										Plot Size		Nearest Outfalls				
			Recovery Category	EPA Proposed Plan Assigned Technology	Located in Beach Play Area?	Located in Clamming Area?	Overwater Structure or Pilings Present?	Intertidal Armored Slope?[1]	Berthing Area?	Elevation in Footprint[2]	Modeled Net Sedimentation Rate	Empirical Net Sedimentation Rate[3]	Study Plot Area (as Shown on Figures 1 to 3)	Area to Remediate Full Footprint[4]	Distance to Nearest Outfall[5]	Outfall ID(s)[6]	Outfall Status[6]	Outfall Owner[6]	Outfall Stormwater or Storm Drain Solids Sampled[6]?
Intertidal Areas	Area 3	RM 0.6W	Category 3	ENR	No	Yes	Yes, widely spaced piles	No	No	-5 to 3 ft MLLW	1.1 cm/yr	No core available	1 acre	4.5 acres	667 feet downstream	n/a	n/a	n/a	n/a
	Area 5	RM 0.9W	Category 3	ENR	Partial[7]	Yes	No	No	No	-3 to 8 ft MLLW	0.9 cm/yr	No core available	1 acre	3.7 acres	360 feet upstream	n/a	n/a	n/a	n/a
	Area 9[8]	RM 1.3E	Category 1/3	ENR, Cap, Dredge	No	Yes	No	Yes	No	-21 to 5 ft MLLW	2.2 cm/yr	0.9 to 2.6 cm/yr	1 acre	1.1 acres	25 feet downstream of southern plot (located between plots)	2009, 2010	Active	King County - Saint Gobain Containers	No
	Area 12	RM 2.6E	Category 3	ENR	No	Yes	No	Yes	No	-14 to 4 ft MLLW	2.7 cm/yr	0.5 to 3.0 cm/yr	1 acre	1.7 acres	0 feet	2040, 2038, 2039	2038, 2039 - Presumed Inactive 2040 - Active	Cleanscapes - Puget Sound Truck Lines (lease)	No
	Area 13	RM 3.9W	Category 2	Dredge	No	Yes	Yes, 1 dolphin/cluster	No	No	-6.9 to 8.8 ft MLLW	2.5 cm/yr	0.5 to 0.9 cm/yr	1 acre	2.7 acres	0 feet	2074, 2075, 2076, 2077	2074, 2076 - Abandoned 2075, 2077 - Active	2077- Boeing 2074, 2075, 2076 - Merrill Creek Holdings	Yes
Subtidal Areas	Area 4	RM 0.7	Category 3	ENR, Dredge	No	No	No	n/a	No	-35 to -28 ft MLLW	1.1 cm/yr	No core available	1 acre	4.3 acres	165 feet east	n/a	n/a	n/a	n/a
	Area 6[9]	RM 1.0E	Category 2	ENR, PDC	No	No	No	n/a	No	-28 to -22 ft MLLW	1.7 cm/yr	No core available	0.9 acres	3.6 acres	60 feet north (in Slip 1)	2245, 5000, 5001	Presumed Active	Federal - Federal Center South	No
	Area 8	RM 1.2	Category 3	ENR	No	No	No	n/a	No	-36 to -31 ft MLLW	1.2 cm/yr	No core available	1.2 acres	1.2 acres	200 feet west	n/a	n/a	n/a	n/a
	Area 10	RM 1.5	Category 3	ENR, PDC	No	No	No	n/a	No	-37 to -30 ft MLLW	1.7 cm/yr	No core available	1 acre	2.4 acres	250 feet east	n/a	n/a	n/a	n/a
	Area 11	RM 2.1	Category 2/3	ENR	No	No	No	n/a	Yes	-25.5 to -15 ft MLLW	3.0 cm/yr	No core available	0.9 acres	3.7 acres	237 feet upstream	n/a	n/a	n/a	n/a
Scour Mitigation Areas	Area 1	RM 0.1E	Category 1/2	Cap, Dredge	No	No	Yes, partial overwater structure	n/a	Yes	-32 to -1 ft MLLW	0.5 cm/yr	No rate	1 acre	1.6 acres	85 feet downstream	2154	Active	Port of Seattle - T-104 Foreign Trade Zone 5	No
	Area 2	RM 0.2E	Category 1	Cap, Dredge	No	No	Yes - partial overwater structure	n/a	Yes	-38 to -14 ft MLLW	0.7 cm/yr	1.1 to 1.7 cm/yr	1 acre	4.2 acres	700 feet downstream	n/a	n/a	n/a	n/a
	Area 7	RM 1.0W	Category 1	PDC	No	No	No	n/a	Yes	-32 to -26 ft MLLW	1.3 cm/yr	2.3 to 4.9 cm/yr	1 acre	0.8 acres	360 feet east (across river)	n/a	n/a	n/a	n/a

Notes:

1) Based on Figure 2-29 - Shoreline Conditions from the final Feasibility Study (AECOM 2012).

2) Based on 2007 bathymetric survey.

3) Based on Figure F-2 from Appendix F of the final Feasiblity Study (AECOM 2012).

4) Area based on those shown on Figures 1 through 3 as required to actively remediate a discrete technology assignment footprint per EPA's Proposed Plan.

5) Outfall location is listed relative to the test plot area. For example "667 feet downstream" indicates the nearest outfall is 667 feet downstream from the plot, on the same side of the river. Also "200 feet west" indicates the outfall is located on the bank 200 feet west of the plot.

6) Based on *Lower Duwamish Waterway - Outfall Inventory Update, January 2012 - February 2014* by Leidos dated March 2014, downloaded from Ecology website. ID, status, and ownership are only listed for outfalls within 150 feet of the test plot.

7) Area 5 footprint is shown adjacent to and partially within a beach area.

8) Area 9 consists of approximately half subtidal and half intertidal areas.

9) Although Area 6 is not included in Recovery Category 1 in the EPA Proposed Plan, it may make a suitable scour mitigation plot area given the amount of vessel traffic known to occur in Slip 1.

cm/yr - centimeters per year
ENR - Enhanced Natural Recovery
MLLW - mean lower low water
n/a - not applicable
PDC - Partial Dredge and Cap
RM - river mile

Table 2: Summary of Existing Sample Data for Each Candidate Plot Area

River Mile	Area	Plot Type	PCB Surface Concentrations (0 to 10 cm)										PCB Subsurface Concentrations (0 to 2 ft)				cPAH Surface Concentrations (0 to 10 cm)			Sediment Toxicity Test Results	Other Contaminants Detected Exceeding SQS[4]
			Plot Area PCB SWAC (µg/kg dw)[1]	Location ID	Sample Date	PCB Conc. (µg/kg dw)	PCB OC Normalized Concentration (mg/kg OC)	TOC (%)	PCB SQS Exeedance Factor[2]	Surface PCBs Resampled?	Older Station Sample ID (PCB Concentration µg/kg dw) [Sample Year]	Newer Station Sample ID (PCB Concentration µg/kg dw) [Sample Year]	Number of PCB cores in Footprint	Max PCB Concentration in Core inside footprint, 0 to 2 ft (µg/kg dw) [mg/kg OC]	Distance to Nearest Core (if none present in plot)[3]	Max PCB Concentration in Nearest Core, 0 to 2 ft (µg/kg dw) [mg/kg OC]	Plot cPAH SWAC (µg TEQ/kg dw)	Sample ID	cPAH Conc. (µg/kg TEQ dw)		
0 to 1	Area 1	Scour	678	LDW-SS305	10/3/2006	590 J	20	3.01	1.7	No	n/a	n/a	1	1,380 [150]	n/a	n/a	543	LDW-SS305	840		Arsenic Lead Zinc Bis(2-ethylhexyl)phthalate
				LDW-SS6	3/10/2005	1,920	183	1.05	15									LDW-SS6	140		
				LDW-SS7	3/9/2005	240	8.82	2.72	0.74									LDW-SS7	560		
				DR001	8/31/1998	99	3.3	3.01	0.28									DR001	610	Fail:CSL	
	Area 2	Scour	240	DR003	8/11/1998	267 J	12.6	2.12	1.1	No	n/a	n/a	1	490 [25]	n/a	n/a	639	DR003	600	n/a	none
	Area 3	I	267	DR043	8/12/1998	270	Note 5	4.48	2.1	No	n/a	n/a	0	n/a	380 ft	Note 6	192	DR043	200	n/a	Butyl benzyl phthalate
	Area 4	S	490	TRI-026	8/8/2006	300 J	19	1.61	1.6	No	n/a	n/a	0	n/a	450 ft	Note 6	622	TRI-026	400	2 x Pass	
				LDW-SS26	1/18/2005	650	36	1.81	3									LDW-SS26	300		Butyl benzyl phthalate
	Area 5	I	287	DR047	9/14/1998	158	11.3	1.4	0.94	No	n/a	n/a	0	n/a	525 ft	Note 6	429	DR047	1,100	n/a	Fluoranthene Phenol
				WIT290	9/16/1997	540	32	1.67	2.7												
	Area 6	S[5]	287	DR018	9/2/1998	265 J	12	2.21	1	No	n/a	n/a	0	n/a	20 ft	330 [16]	580	DR018	500	n/a	Mercury
1 to 2	Area 7	Scour	213	LDW-SS322	10/4/2006	280 J	37	0.766	3.1	No	n/a	n/a	1	250 [13]	n/a	n/a	705	LDW-SS322	570 J	n/a	Butyl benzyl phthalate Bis(2-ethylhexyl)phthalate Benzo(a)anthracene Fluoranthene Chrysene Pyrene
				DR050	8/31/1998	240 J	Note 5	4.12	1.8									DR050	1,300		
	Area 8	S	277	CH0030	10/16/1997	83 J	4.3	1.94	0.36	Yes	DR088 (1,010) [1998]	LDW-SS40 (510) [2005]	0	n/a	175 ft	Note 6	258	LDW-SS40	95	Fail:CSL	
				LDW-SS40	1/18/2005	510 J	27	1.89	2.3									DR089	530		Bis(2-ethylhexyl)phthalate
				DR089	8/12/1998	271	14.1	1.92	1.2												
	Area 9	I	362	LDW-SS202	1/24/2005	370	19	1.94	1.6	Yes	DR030 (4800) [1998]	LDW-SS50 (590) [2005]	1	3,300 [260]	n/a	n/a	438	LDW-SS202-010	460	Fail:CSL	
				LDW-SS325	10/4/2006	270	13	2.11	1.1									LDW-SS325-010	490		
				LDW-SS50	1/24/2005	790	41	1.94	3.4									LDW-SS50-010	380		Benzyl Alcohol
	Area 10	S	270	Note 6			n/a	2.06	n/a	No	n/a	n/a	0	n/a	270 ft	n/a	403	n/a	Note 6	n/a	none
2 to 3	Area 11	S	249	DR148	8/18/1998	279 J	Note 7	4.51	2.1	No	n/a	n/a	1	Note 8	n/a	n/a	188	DR148	89	n/a	none
	Area 12	I	326	EST176	10/22/1997	120	13	0.93	1.1	Yes	EIT074 (450) [1997]	LDW-SS88 (660) [2005]	1	4 [0.59]	n/a	n/a	128	LDW-SS88	190 J	Fail:CSL	
				LDW-SS88	1/25/2005	660	38	1.75	3.2									DR172	75		Mercury
				DR172	8/18/1998	40 UJ	Note 7	0.24	0.31												
3 to 4	Area 13	I	331	AN-018	10/24/2006	350 J	19	1.8	1.6	Yes (2 locations resampled)	EIT061 (2,400) [1997]	LDW-SS121 (1,060) [2005]	2	1,500, 3,000 [97,130]	n/a	n/a	162	AN-018	310	Pass, Fail: SQS	Lead Butyl benzyl phthalate
				AN-019	10/24/2006	770	48	1.59	4									AN-019	67		
				AN-020	10/24/2006	220 J	12	1.9	1									AN-020	230		
				AN-021	10/25/2006	390	27	1.43	2.3									AN-021	170		
				AN-022	10/25/2006	420	27	1.55	2.3		EST144 (1,500) [1997]	LDW-SS123 (149) [2005] (resampled, see below)						AN-022	190 J		
				AN-023	10/25/2006	190	16	1.18	1.3									AN-023	28 J		
				AN-025	10/25/2006	560 J	35	1.62	2.9									AN-025	150		
				AN-026	10/26/2006	150	7.2	2.08	0.6									AN-026	140		
				AN-027	10/25/2006	260	14	1.86	1.2									AN-027	450		
				B9b	8/13/2004	210	12	1.74	1									B9b	94		
				LDW-SS120	1/19/2005	630 J	32	1.94	2.7		LDW-SS123 (149) [2005]	AN-019 (770) [2006]						LDW-SS120	410		
				LDW-SS121	1/25/2005	1,060 J	57	1.86	4.8									LDW-SS121	180 J		
				R34	10/9/1997	91 J	7	1.3	0.58									R34	170		
				R35	10/11/1997	127	9.1	1.4	0.76									R35	130		

Notes:

1) PCB SWAC calculated in GIS utilizing inverse distance weighted average using samples from the FS baseline dataset that were located both inside and adjacent to the proposed plots.

2) SQS exceedance factor for point data is based on measured TOC (or lowest apparent effects threshold, as applicable).

3) If no core was located in footprint, nearest core within 150 ft was evaluated. Given the heterogeneous nature observed in the data, PCB concentrations for borings only within 150 feet from the test plot are shown. Larger distances may not be representative.

4) "Other Contaminants" excludes total PCBs.

5) Although Area 6 is not included in Recovery Category 1 in the EPA Proposed Plan, it may make a suitable scour mitigation plot area given the amount of vessel traffic known to occur in Slip 1.

6) Only sample in the footprint was from the 2009/2010 dioxin/furan sampling technical memorandum (Windward 2010), and it was not analyzed for total PCBs or cPAHs.

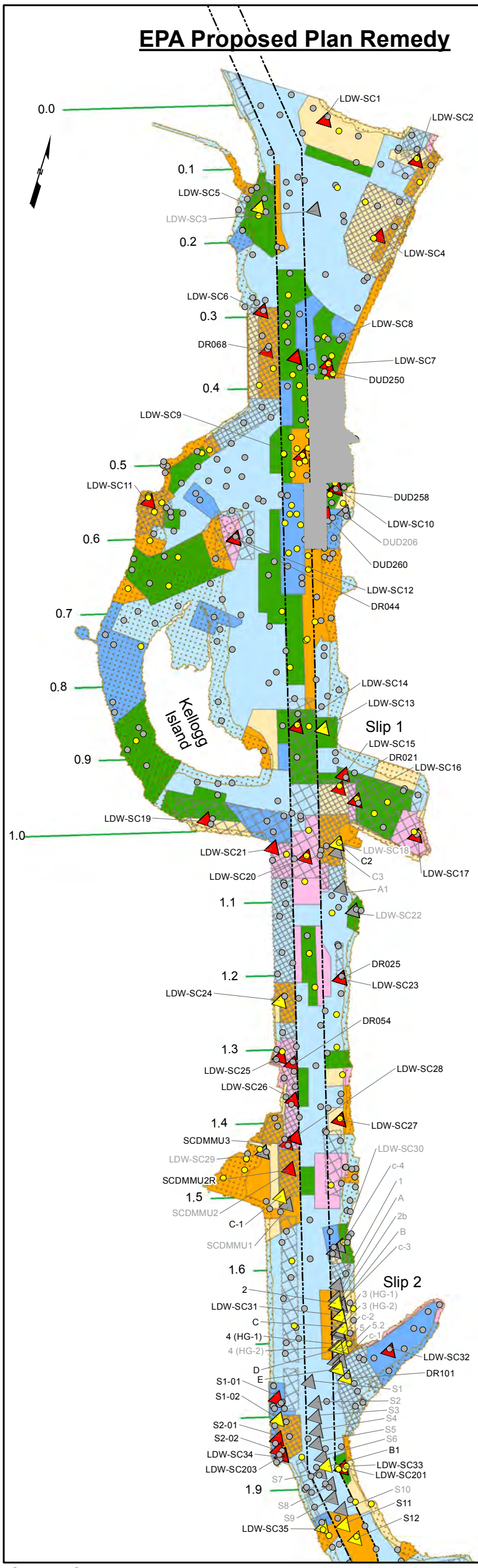
7) TOC exceeds the threshold where carbon normalization is performed.

8) Core not sampled and/or analyzed from 0 to 2 ft below mudline.

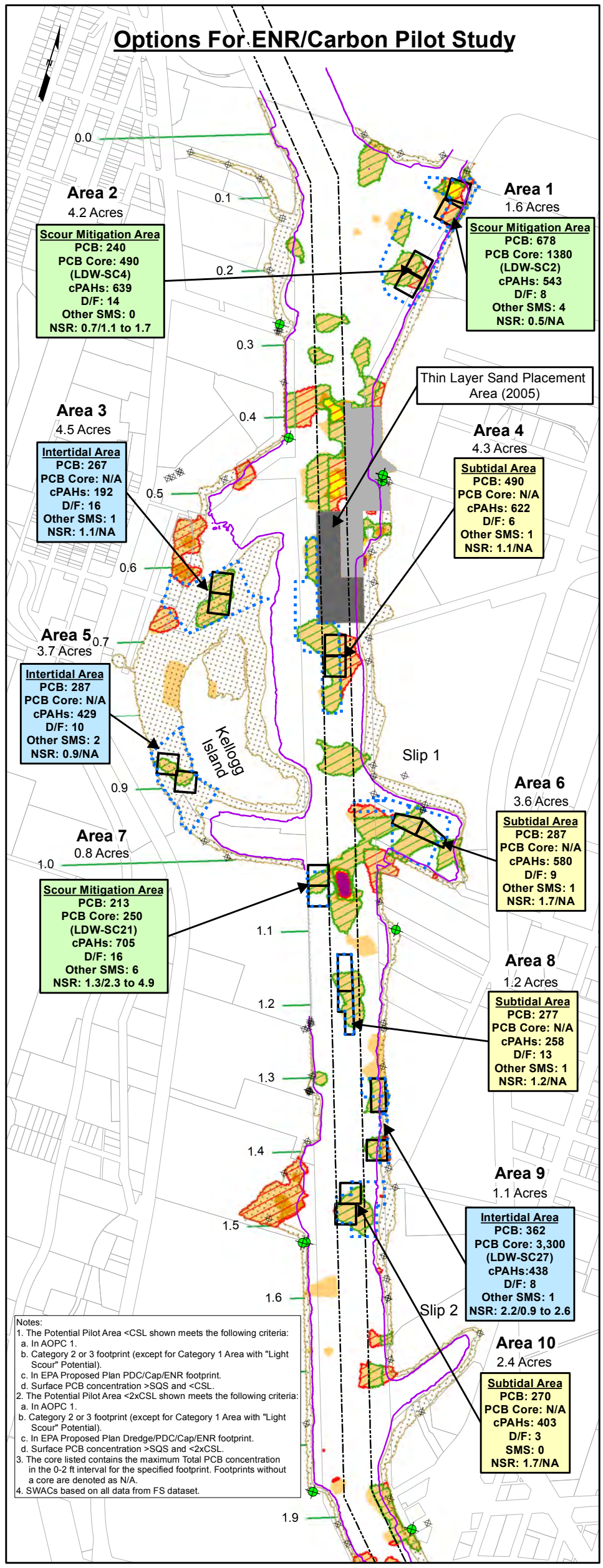
Plot Type: I = Intertidal; S = Subtidal; Scour = Recovery Category 1

cPAH - carcinogenic polyaromatic hydrocarbons
cm/yr - centimeters per year
CSL - cleanup screening level
EF - exceedance factor
µg/kg dw - micrograms per kilograms dry weight
n/a - none applicable
mg/kg OC - milligrams per kilogram organic carbon
PCB - polychlorinated biphenyl
SQS - sediment quality standards
SWAC - spatially weighted average concentration
TEQ - toxic equivalent
TOC - total organic carbon

EPA Proposed Plan Remedy



Options For ENR/Carbon Pilot Study



Notes:
1. The Potential Pilot Area <CSL shown meets the following criteria:
   a. In AOPC 1.
   b. Category 2 or 3 footprint (except for Category 1 Area with "Light Scour" Potential).
   c. In EPA Proposed Plan PDC/Cap/ENR footprint.
   d. Surface PCB concentration >SQS and <CSL.
2. The Potential Pilot Area <2xCSL shown meets the following criteria:
   a. In AOPC 1.
   b. Category 2 or 3 footprint (except for Category 1 Area with "Light Scour" Potential).
   c. In EPA Proposed Plan Dredge/PDC/Cap/ENR footprint.
   d. Surface PCB concentration >SQS and <2xCSL.
3. The core listed contains the maximum Total PCB concentration in the 0-2 ft interval for the specified footprint. Footprints without a core are denoted as N/A.
4. SWACs based on all data from FS dataset.

Legend

Surface Sediment PCB Exceedance Location

- >Proposed Plan RALs
- <Proposed Plan RALs or Non-detect

Subsurface Exceedance Location and ID

- > CSL, detected
- > SQS and ≤ CSL, detected
- <SQS or Non-detect

Station ID Labeled in Black

Station ID Labeled in Grey

- Contour -10 ft MLLW
- Navigation Channel
- River Mile Marker
- Property Boundary
- Outfall Location

Feet
0 200 400 800

Proposed Plan Technology Assignment

- Dredge (64 acres)
- Partial Dredge and Cap (20 acres)
- Cap (24 acres)
- ENR/*in situ* (48 acres)
- Monitored Natural Recovery (Surface Sediment >SQS) (33 acres)
- Monitored Natural Recovery (Surface Sediment <SQS) (215 acres)
- Early Action Area (29 acres)

Recovery Category

- Category 1: Recovery Presumed to be Limited
- Category 2: Recovery Less Certain
- Category 3: Predicted to Recover
- Modeled Redistributed Lateral Load Discharge Location

- Potential Pilot Area < CSL: 32 acres (See note 1 for criteria)
- Potential Pilot Area < 2xCSL: 53 acres (See note 2 for criteria)
- Candidate Plot Area
- Proposed Plan Footprint(s)
- Intertidal Area > -4 ft MLLW

Surface Sediment Total PCB Concentration (µg/kg dw)

- < 240
- > 240 - 720
- > 720 - 1,300
- > 1,300 - 2,600
- > 2,600

4.2 Acres ← Proposed Plan Footprint Size

Intertidal Area ← Study Area Plot Type
PCB: 362 ← PCB SWAC (µg/kg dw)
PCB Core: 3,300 ← Maximum Total PCB Concentration (µg/kg dw) in 0-2 ft Interval of Core
(LDW-SC27) ← Core ID
cPAHs:438 ← cPAH SWAC (µg TEQ/kg dw)
D/F: 8 ← Dioxin/Furan SWAC (ng TEQ/kg dw)
Other SMS: 0 ← Number of Chemicals other than PCBs that exceed SQS
NSR: 2.2/0.9 to 2.6

↑ Modeled/Empirical Net Sedimentation Rate (cm/yr)

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

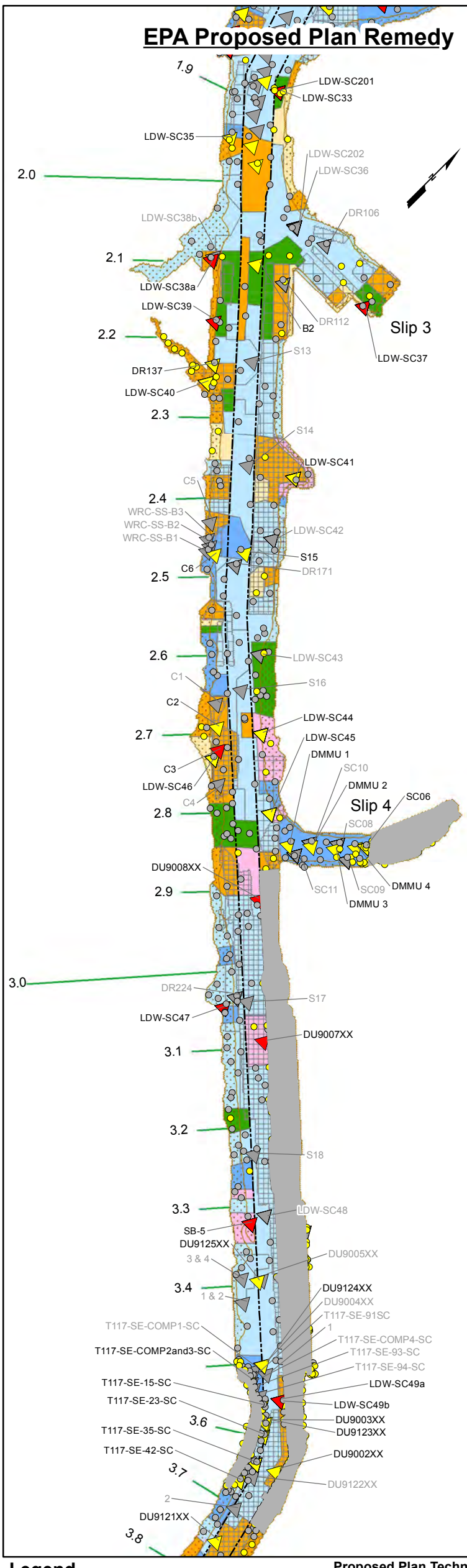
Lower Duwamish Waterway
Pre-design Studies
60150279-9.8

Reach 1: Potential ENR/Carbon Pilot Treatment Areas

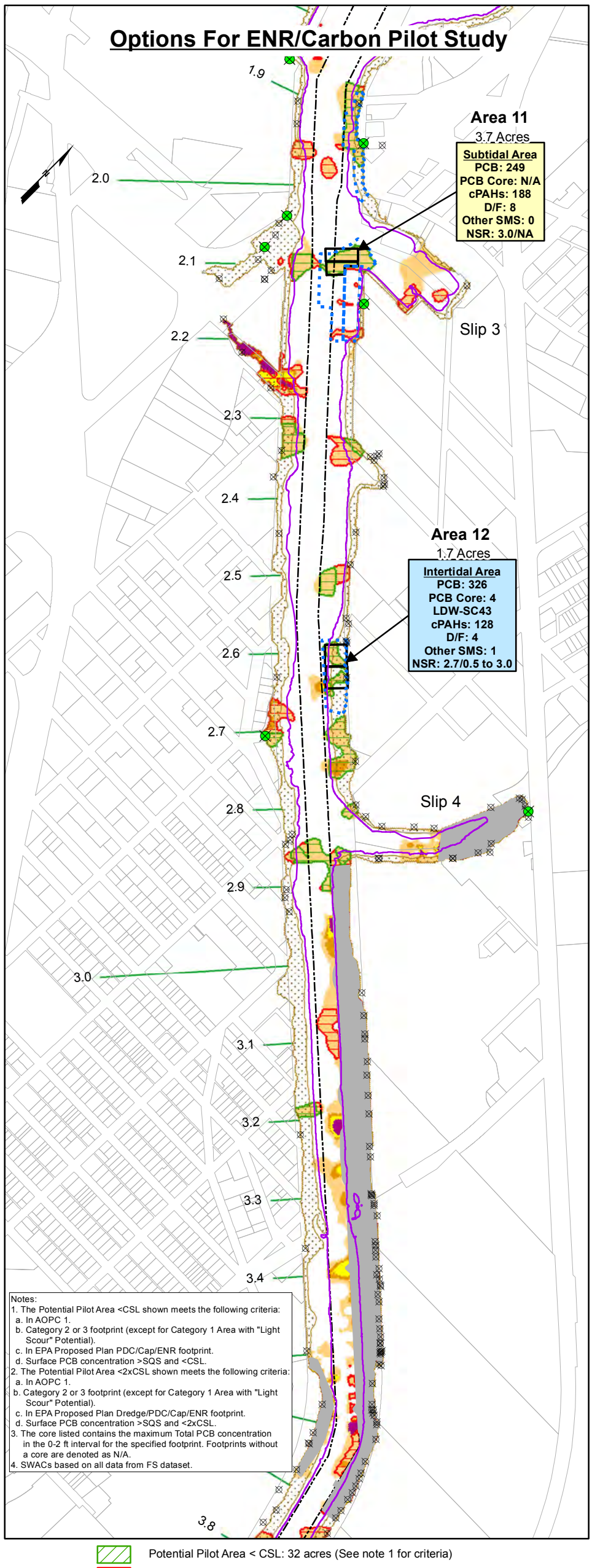
DATE: 7/24/2014 | DWRN:MVI/sea | Revision: 3 | **FIGURE 1**

Path: Q:\GIS_ENV\Lower Duwamish FS\EPA Proposed Plan\MXDs\PilotStudyAreas072213\Figure1_Reach1PilotFtprntV4.mxd

EPA Proposed Plan Remedy



Options For ENR/Carbon Pilot Study



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   d. Surface PCB concentration >SQS and <CSL.
2. The Potential Pilot Area <2xCSL shown meets the following criteria:
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   b. Category 2 or 3 footprint (except for Category 1 Area with "Light Scour" Potential).
   c. In EPA Proposed Plan Dredge/PDC/Cap/ENR footprint.
   d. Surface PCB concentration >SQS and <2xCSL.
3. The core listed contains the maximum Total PCB concentration in the 0-2 ft interval for the specified footprint. Footprints without a core are denoted as N/A.
4. SWACs based on all data from FS dataset.

Legend

Surface Sediment PCB Exceedance Location
- >Proposed Plan RALs
- < Proposed Plan RALs or Non-detect

Subsurface Exceedance Location and ID
- > CSL, detected
- > SQS and ≤ CSL, detected
- <SQS or Non-detect

Station ID Labeled in Black
Station ID Labeled in Grey

- Contour -10 ft MLLW
- Navigation Channel
- River Mile Marker
- Property Boundary
- Outfall Location

Feet
0 200 400 800

Proposed Plan Technology Assignment
- Dredge (64 acres)
- Partial Dredge and Cap (20 acres)
- Cap (24 acres)
- ENR/*in situ* (48 acres)
- Monitored Natural Recovery (Surface Sediment >SQS) (33 acres)
- Monitored Natural Recovery (Surface Sediment <SQS) (215 acres)
- Early Action Area (29 acres)

Recovery Category
- Category 1: Recovery Presumed to be Limited
- Category 2: Recovery Less Certain
- Category 3: Predicted to Recover
- Modeled Redistributed Lateral Load Discharge Location

- Potential Pilot Area < CSL: 32 acres (See note 1 for criteria)
- Potential Pilot Area < 2xCSL: 53 acres (See note 2 for criteria)
- Candidate Plot Area
- Proposed Plan Footprint(s)
- Intertidal Area > -4 ft MLLW

Surface Sediment Total PCB Concentration (µg/kg dw)
- < 240
- > 240 - 720
- > 720 - 1,300
- > 1,300 - 2,600
- > 2,600

4.2 Acres ← Proposed Plan Footprint Size

Intertidal Area
PCB: 362
PCB Core: 3,300
(LDW-SC27)
cPAHs:438
D/F: 8
Other SMS: 0
NSR: 2.2/0.9 to 2.6

- ← Study Area Plot Type
- ← PCB SWAC (µg/kg dw)
- ← MaximumTotal PCB Concentration (µg/kg dw) in 0-2 ft Interval of Core
- ← Core ID
- ← cPAH SWAC (µg TEQ/kg dw)
- ← Dioxin/Furan SWAC (ng TEQ/kg dw)
- ← Number of Chemicals other than PCBs that exceed SQS

↑ Modeled/Empirical Net Sedimentation Rate (cm/yr)

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Pre-design Studies
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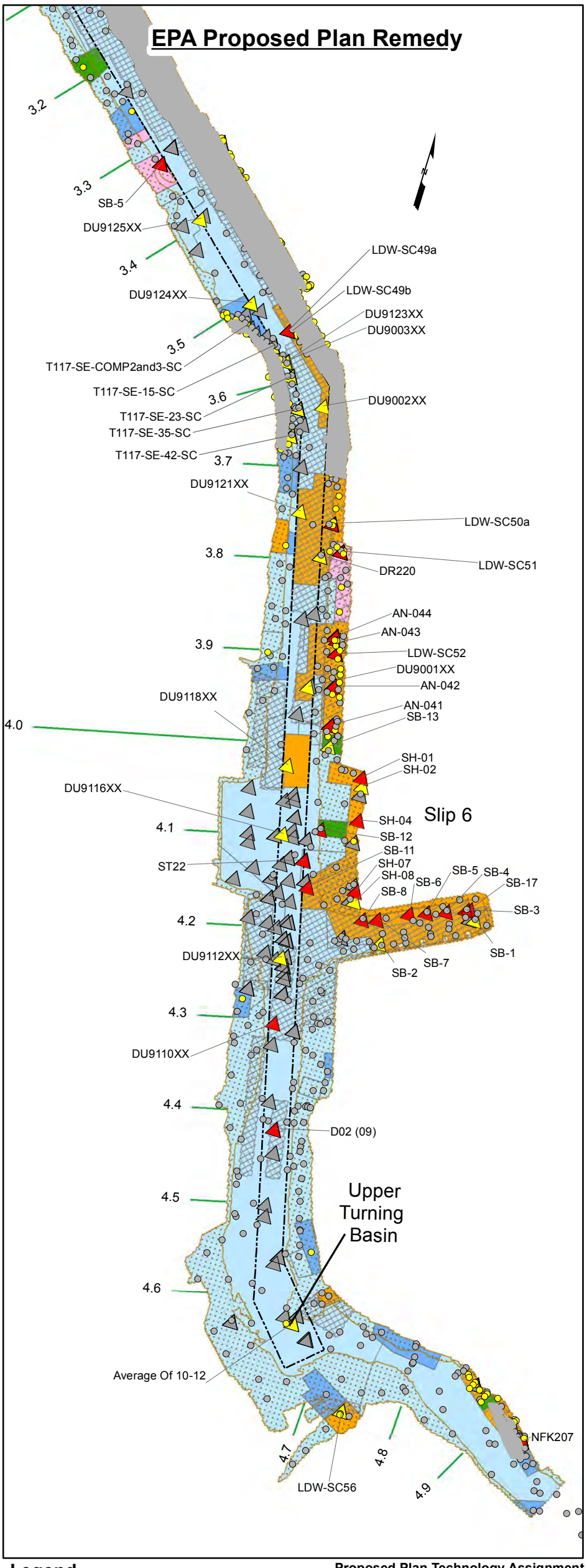
Reach 2: Potential ENR/Carbon Pilot Treatment Areas

DATE: 7/23/2014 | DWRN:MVI/sea | Revision: 3

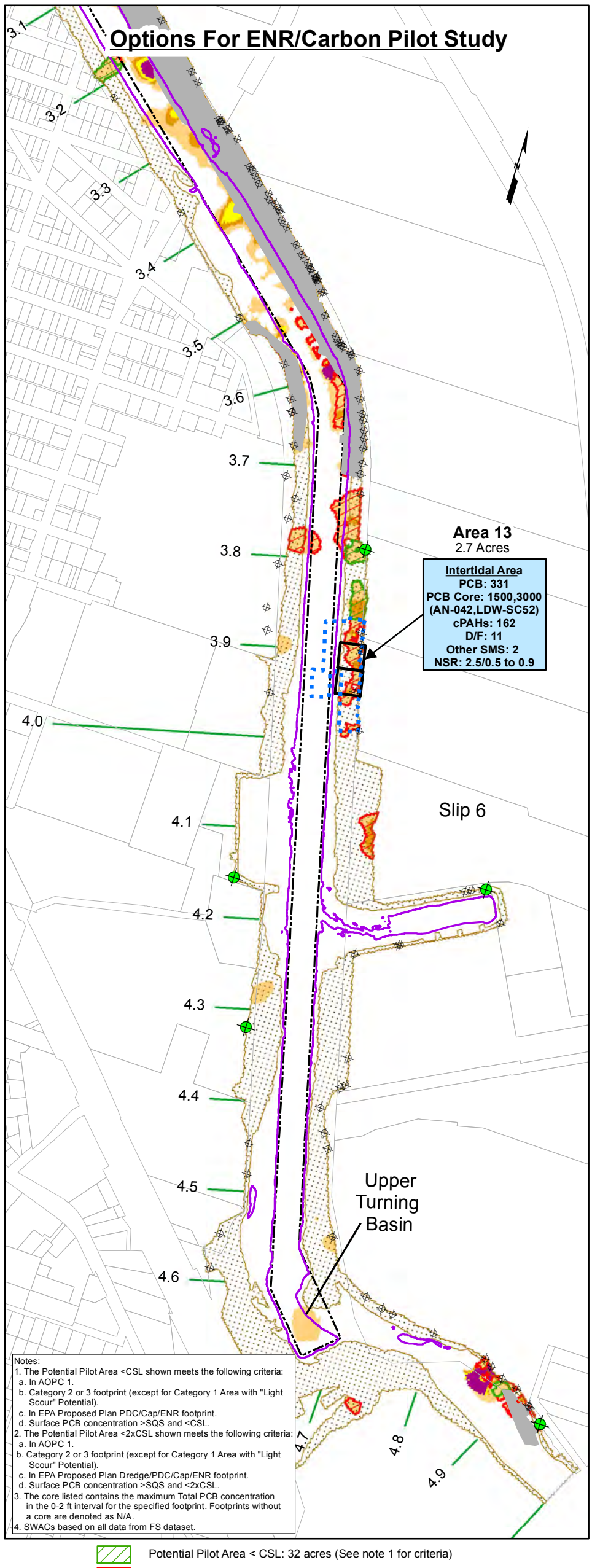
FIGURE 2

Path: Q:\GIS_ENV\Lower Duwamish FS\EPA Proposed Plan\MXDs\PilotStudyAreas072213\Figure2_Reach2PilotFtprntV4.mxd

EPA Proposed Plan Remedy



Options For ENR/Carbon Pilot Study



Notes:
1. The Potential Pilot Area <CSL shown meets the following criteria:
   a. In AOPC 1.
   b. Category 2 or 3 footprint (except for Category 1 Area with "Light Scour" Potential).
   c. In EPA Proposed Plan PDC/Cap/ENR footprint.
   d. Surface PCB concentration >SQS and <CSL.
2. The Potential Pilot Area <2xCSL shown meets the following criteria:
   a. In AOPC 1.
   b. Category 2 or 3 footprint (except for Category 1 Area with "Light Scour" Potential).
   c. In EPA Proposed Plan Dredge/PDC/Cap/ENR footprint.
   d. Surface PCB concentration >SQS and <2xCSL.
3. The core listed contains the maximum Total PCB concentration in the 0-2 ft interval for the specified footprint. Footprints without a core are denoted as N/A.
4. SWACs based on all data from FS dataset.

Legend

Surface Sediment PCB Exceedance Location
- >Proposed Plan RALs
- <Proposed Plan RALs or Non-detect

Subsurface Exceedance Location and ID
- > CSL, detected
- > SQS and ≤ CSL, detected
- <SQS or Non-detect

Station ID Labeled in Black / Station ID Labeled in Grey

- Contour -10 ft MLLW
- Navigation Channel
- River Mile Marker
- Property Boundary
- Outfall Location

Feet
0 200 400 800

Proposed Plan Technology Assignment
- Dredge (64 acres)
- Partial Dredge and Cap (20 acres)
- Cap (24 acres)
- ENR/*in situ* (48 acres)
- Monitored Natural Recovery (Surface Sediment >SQS) (33 acres)
- Monitored Natural Recovery (Surface Sediment <SQS) (215 acres)
- Early Action Area (29 acres)

Recovery Category
- Category 1: Recovery Presumed to be Limited
- Category 2: Recovery Less Certain
- Category 3: Predicted to Recover
- Modeled Redistributed Lateral Load Discharge Location

- Potential Pilot Area < CSL: 32 acres (See note 1 for criteria)
- Potential Pilot Area < 2xCSL: 53 acres (See note 2 for criteria)
- Candidate Plot Area
- Proposed Plan Footprint(s)
- Intertidal Area > -4 ft MLLW

Surface Sediment Total PCB Concentration (µg/kg dw)
- < 240
- > 240 - 720
- > 720 - 1,300
- > 1,300 - 2,600
- > 2,600

4.2 Acres — Proposed Plan Footprint Size

Intertidal Area
PCB: 362
PCB Core: 3,300
(LDW-SC27)
cPAHs:438
D/F: 8
Other SMS: 0
NSR: 2.2/0.9 to 2.6

- Study Area Plot Type
- PCB SWAC (µg/kg dw)
- MaximumTotal PCB Concentration (µg/kg dw) in 0-2 ft Interval of Core
- Core ID
- cPAH SWAC (µg TEQ/kg dw)
- Dioxin/Furan SWAC (ng TEQ/kg dw)
- Number of Chemicals other than PCBs that exceed SQS
- Modeled/Empirical Net Sedimentation Rate (cm/yr)

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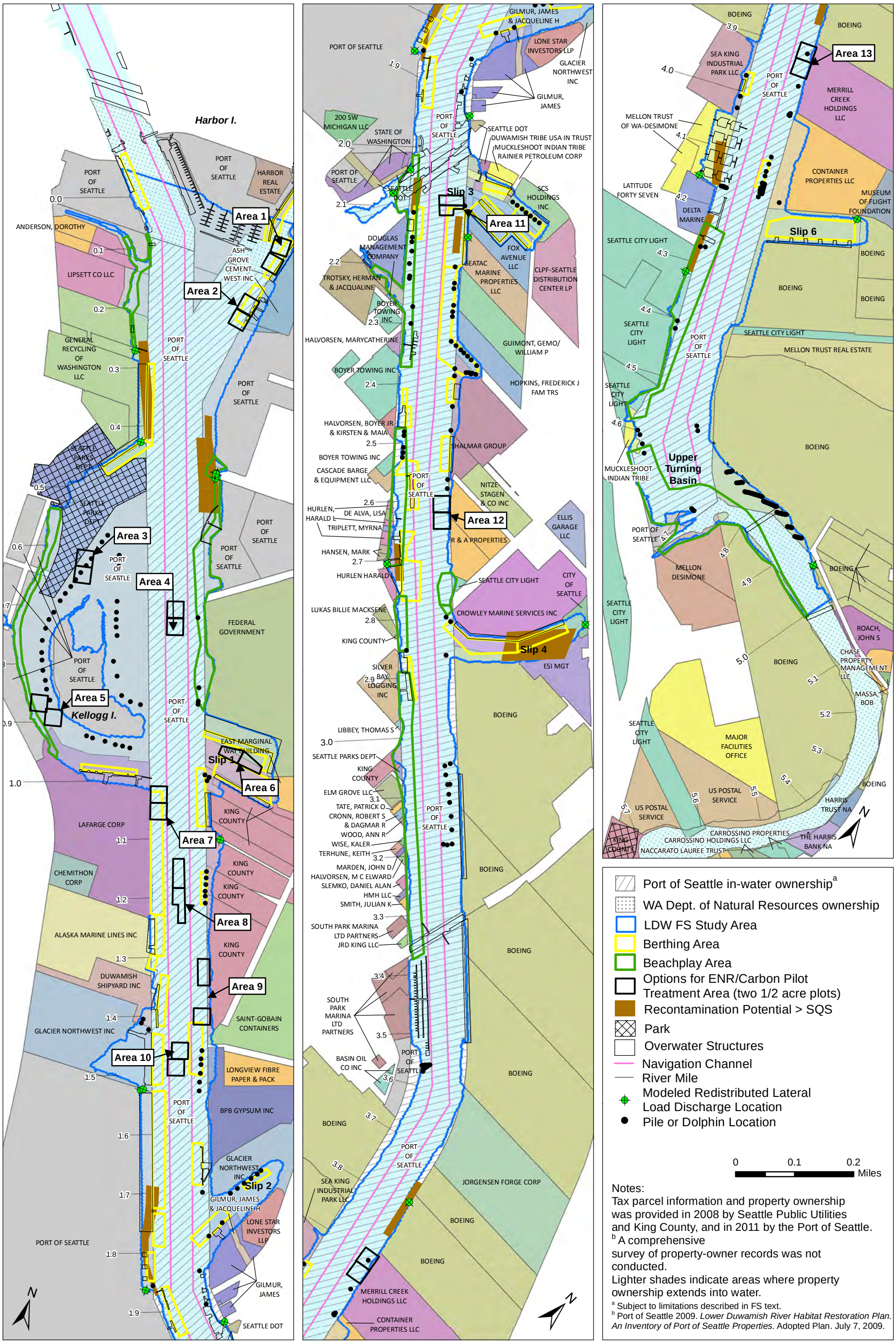
Reach 3: Potential ENR/Carbon Pilot Treatment Areas

DATE: 7/23/2014 | DWRN:MVI/sea | Revision: 3

FIGURE 3

Path: Q:\GIS_ENV\Lower Duwamish FS\EPA Proposed Plan\MXDs\PilotStudyAreas072213\Figure3_Reach3PilotFtprntV4.mxd



Notes:
Tax parcel information and property ownership was provided in 2008 by Seattle Public Utilities and King County, and in 2011 by the Port of Seattle.
[b] A comprehensive survey of property-owner records was not conducted.
Lighter shades indicate areas where property ownership extends into water.

[a] Subject to limitations described in FS text.
[b] Port of Seattle 2009. *Lower Duwamish River Habitat Restoration Plan. An Inventory of Port of Seattle Properties.* Adopted Plan. July 7, 2009.

Prepared by: imamm, 7/23/2014; Q:\GIS_ENV\Lower Duwamish FSEPA Proposed Plan\MXDs\PilotStudyAreas\072213\Figure4 Land and water ownership.mxd

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Information Used for Candidate Plot Screening

DATE: 7/23/2014	DRWN: mvi/SEA	Revision: 0	Project No.: 60150279	**FIGURE 4**

Attachment 1 – Aerial Photographs

Notes:

1. Plot locations (shown in orange) are approximate and are not geo-referenced.
2. Photo scale varies

Area 1 –Scour Mitigation

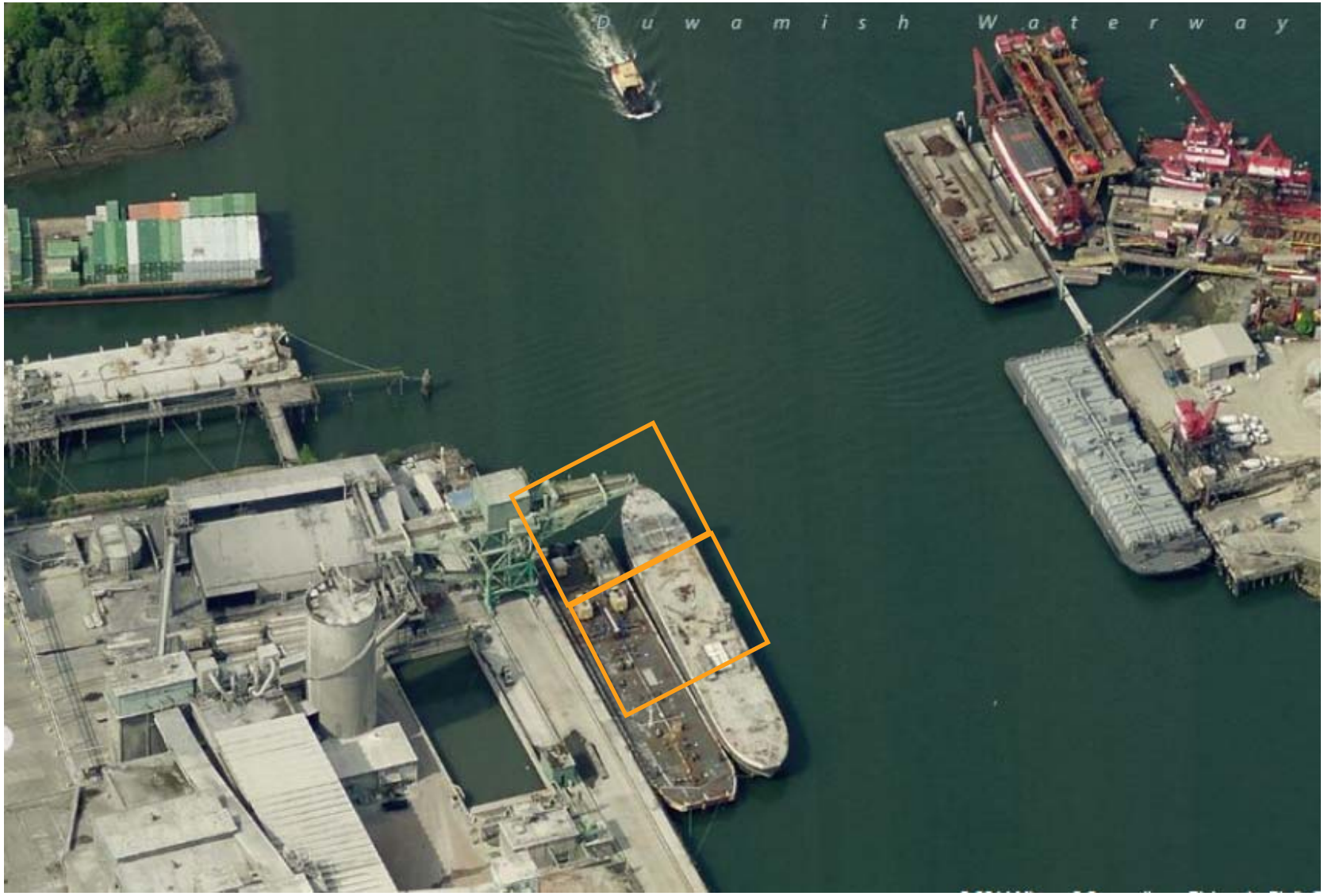
Area 2 - Scour Mitigation

Area 3 - Intertidal

Area 4 - Subtidal

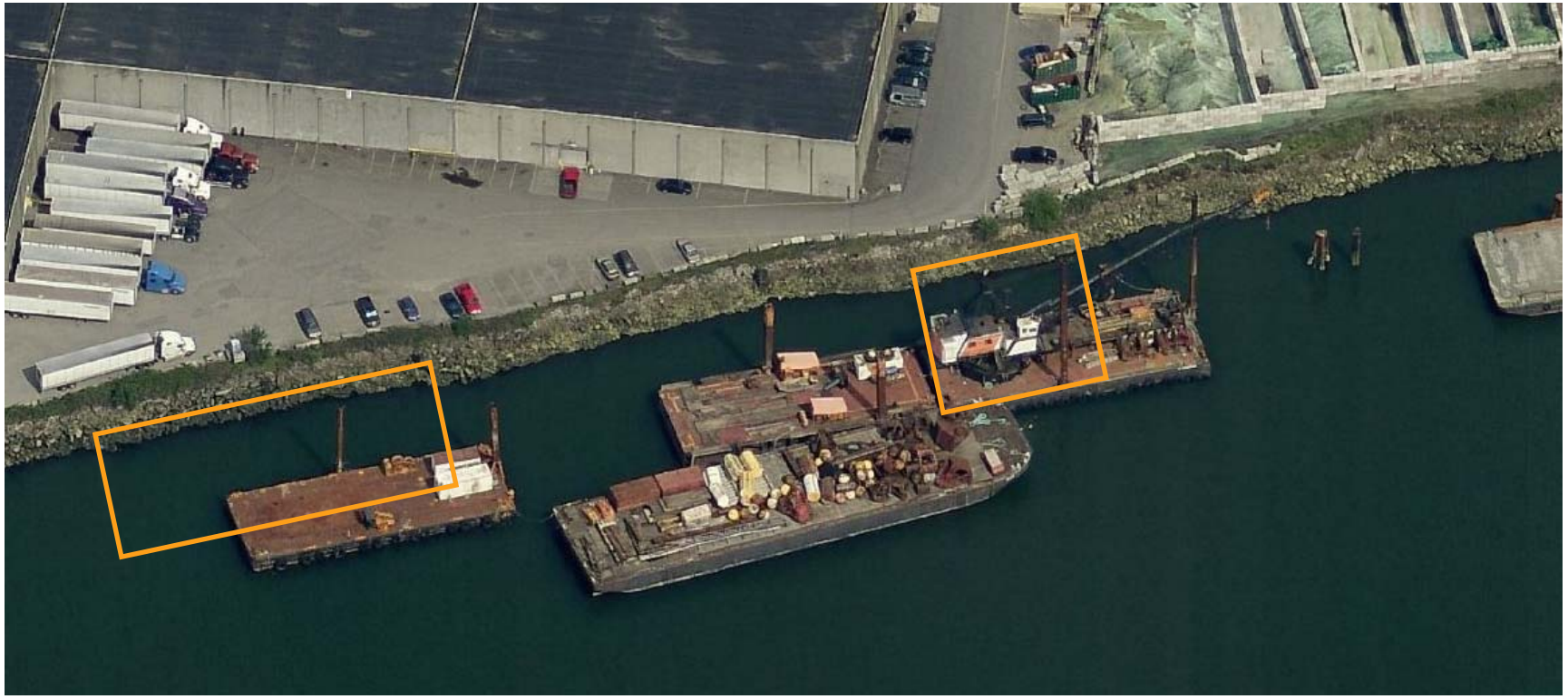
Area 5 - Intertidal

Area 6 - Subtidal



Area 7 –Scour Mitigation

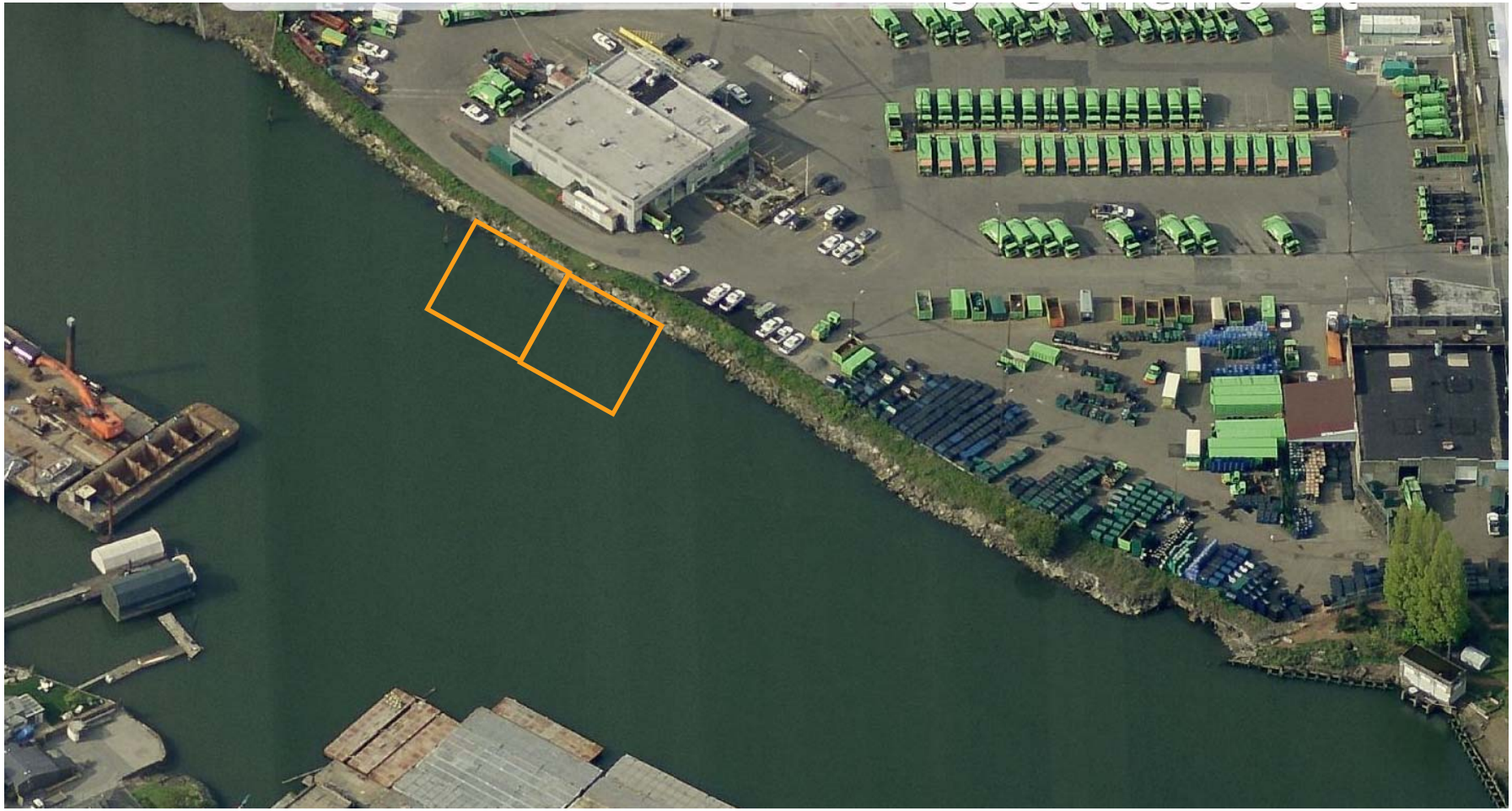
Area 8 - Subtidal



Area 9 - Intertidal

Area 10 - Subtidal

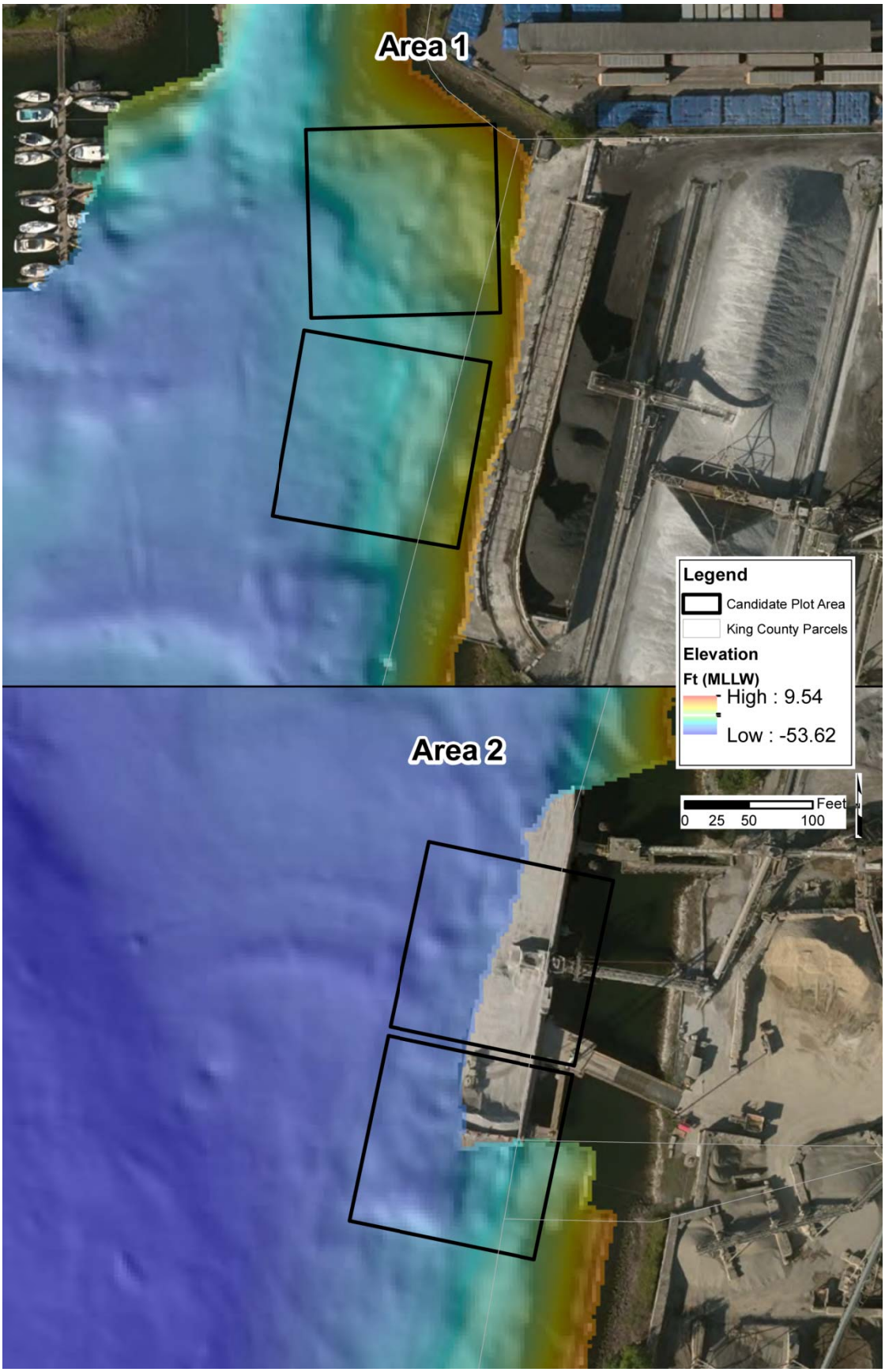
Area 11 - Subtidal

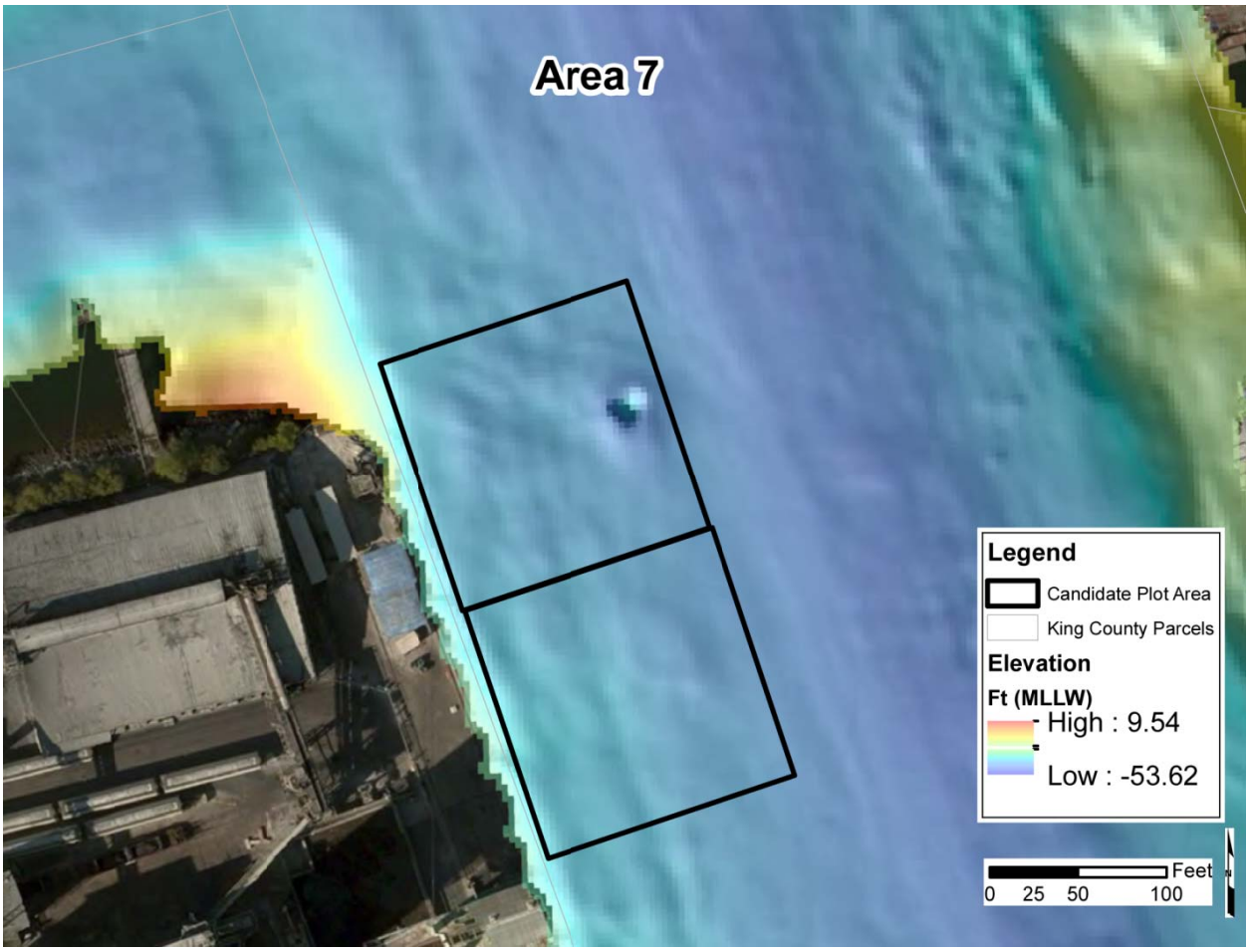


Area 12 - Intertidal

Area 13 - Intertidal

Attachment 2 – Sun Illumination Maps for Scour Mitigation Areas


Area 1
Area 2
Legend
Candidate Plot Area
King County Parcels
Elevation
Ft (MLLW)
High : 9.54
Low : -53.62
Feet
0 25 50 100


Area 7
Legend
Candidate Plot Area
King County Parcels
Elevation
Ft (MLLW)
High : 9.54
Low : -53.62
Feet
0 25 50 100