Table 1. Overview of Pre-Remedial Design Investigation Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

PDI Study Element	General Approach and Rationale
Bathymetric Survey	Current bed elevations to support the CSM, evaluating changes in sediment bed elevation, and run through decision tree.
Surface Sediment Sampling for Baseline and SMA Delineation	For SMA delineation and Baseline with Site Total sample count of 640 within Site: 428 random; Full ROD Table 17 Sediment COC list 212 SMA samples; Focused COCs only (1) Split 4 segments in half for 8 segment, plus Swan Island. 3-point composite (over small area) Additional sample locations may be considered for reoccupation
SMB Fish Tissue Sampling for Baseline	Smallmouth bass fish tissue sampling at 95 stations in the Site Individual whole body samples, derive fillet values through relationship Full ROD Table 17 Tissue COCs
Surface Water Sampling for Baseline	Seven transects, 3 seasonal events, 3 subsamples per transect Vertical and horizontal compositing along transect Sample with high volume XAD samplers for low MDLs and peristaltic pump for select analytes Full ROD Table 17 Surface Water COCs, total and dissolved
Subsurface Sediment Coring to Refine Remedial Footprint Boundaries	90 sediment cores typically 10 to 15-ft deep and 6-ft in nearshore areas 2-ft sample increments Archive deeper intervals in 1 ft increments, as practical Focused COCs only (1), plus TOC and grain size
Fish Acoustic Tracking Study	Year long study of acoustic tracking of SMB fish movements
Downtown/Upriver Reach: Sediment, Surface Water, Tissue, and Trap Sampling to assess incoming loads	60 sediment samples collected between RM 11.8 to RM 28.4 targeting fine-grained sediment (30 samples Downtown Reach, 30 samples Upriver Reach) 40 SMB samples (20 in Downtown Reach; 20 in Upriver Reach) Surface water transects at RM 11.8 and RM 16.2 3 seasonal sampling events for surface water Two sediment traps per transect at RM 11.81 and 16.5 (match SW program) Full ROD Table 17 COCs for each media; all data will be considered; assumes sufficient sediment and fish present
Background Porewater Sampling	10 locations with 3 composites per location Target placement in representative background areas, locations TBD Naturally-occurring COC metals - arsenic and manganese

Notes:
(1): Focused COCs include PCBs, DDx, PAHs, and Dioxins and Furans

Abbreviations:
COCs - contaminants of concern; SW - surface water; SMA - Sediment Management Area; TOC - Total Organic Carbon; MDL - method detection limits; SMB - smallmouth bass; PCB - polychlorinated biphenyls; DDx - sum of dichlorodiphenyltrichloroethane and its derivatives; PAHs - polycyclic aromatic hydrocarbons; CSM - Conceptual Site Model

Table 21. Sediment RALs and PTW Thresholds for Selected Remedy

Contaminants	Site Wide RALs[1]	PTW Thresholds [2]	Navigation Channel RALs
Focused COCs			
PCBs	75	200	1,000
Total PAHs [4]	13,000	NA	170,000
2,3,7,8-TCDD	0.0006	0.01	0.002
1,2,3,7,8-PeCDD	0.0008	0.01	0.003
2,3,4,7,8-PeCDF	0.2	0.2	1
DDx	160	7,050	650
Additional Contaminants			
2,3,7,8-TCDF	NA	0.6	NA
1,2,3,4,6,7,8-HxCDF	NA	0.04	NA
cPAHs (BaP Eq)	NA	106,000	NA
Chlorobenzene	NA	>320	NA
Naphthalene	NA	>140,000	NA

Notes:
1 – Site wide includes all areas of the Site except the navigation channel. FMD areas are subject to these RALs.
2 – PTW thresholds are based on highly toxic PTW values (10^{-5} risk) except chlorobenzene and naphthalene, which are threshold values for not reliably contained PTW.

Abbreviations:
BaP Eq – benzo(a)pyrene equivalent
cPAH –carcinogenic polycyclic aromatic hydrocarbon
COC – Contaminant of concern
DDx – dichlorodiphenyldichloroethane + dichlorodiphenyldichloroethene + dichlorodiphenyltrichloroethane
FMD – future maintenance dredge
HxCDF - hexachlorodibenzofuran
NA – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PeCDD – pentachlorodibenzo-p-dioxin
PeCDF – pentachlorodibenzofuran
PTW – principal threat waste
RAL – remedial action level
TCDD – tetrachlorodibenzo-p-dioxin
TCDF – tetrachlorodibenzofuran
µg/kg – microgram per kilogram
> – greater than

Table 3. Summary of Cleanup Levels or Targets by Media
Portland Harbor Pre-Remedial Design Investigation Work Plan
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Table 17. Summary of Cleanup Levels or Targets by Media

	Surface Water (1)			Groundwater (2)			River Bank Soil/Sediment (3)			Fish Tissue (4)		
Contaminant	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**
Aldrin	µg/L	0.00000077	A				µg/kg	2	R	µg/kg	0.06	R
Arsenic	µg/L	0.018	A	µg/L	0.018	A	mg/kg	3	B	mg/kg	0.001	R
Benzene				µg/L	0.44	A						
BEHP	µg/L	0.2	A				µg/kg	135	R	µg/kg	72	R
Cadmium				µg/L	0.091	A/R(5)	mg/kg	0.51	R			
Chlordanes	µg/L	0.000081	A				µg/kg	1.4	R	µg/kg	3	R
Chlorobenzene				µg/L	64	R						
Chromium	µg/L	100	A	µg/L	11	A						
Copper	µg/L	2.74	A	µg/L	2.74	A/R	mg/kg	359	R			
Cyanide				µg/L	4	A						
DDx	µg/L	0.01	R	µg/L	0.001	A	µg/kg	6.1	R	µg/kg	3	R
DDD	µg/L	0.000031	A	µg/L	0.000031	A	µg/kg	114	R			
DDE	µg/L	0.000018	A	µg/L	0.000018	A	µg/kg	226	R			
DDT	µg/L	0.000022	A	µg/L	0.000022	A	µg/kg	246	R			
1,1-Dichloroethene				µg/L	7	A						
cis-1,2-Dichloroethene				µg/L	9.9	A						
Dieldrin							µg/kg	0.07	R	µg/kg	0.06	R
2,4-Dichlorophenoxyacetic acid				µg/L	70	A						
Ethylbenzene	µg/L	7.3	R	µg/L	7.3	R						
Hexachlorobenzene	µg/L	0.000029	A				µg/kg			µg/kg	0.6	R
Lindane							µg/kg	5	R			
Lead				µg/L	0.54	A/R	mg/kg	196	R			
Manganese				µg/L	430	R						
MCPP	µg/L	16	R									
Mercury							mg/kg	0.085	R	mg/kg	0.031	A
Pentachlorophenol	µg/L	0.03	A	µg/L	0.03	A				µg/kg	2.5	R
Perchlorate				µg/L	15	A						
PBDEs										µg/kg	26	R
PCBs	µg/L	0.0000064	A	µg/L	0.014	A/R	µg/kg	9	B	µg/kg	0.25 (6)	R
PAHs							µg/kg	23000				
cPAHs (BaP eq)	µg/L	0.00012	A	µg/L	0.00012	A	µg/kg	12 (7)	B	µg/kg	7.1	R
Acenaphthene				µg/L	23	R						
Acenaphthylene												
Anthracene				µg/L	0.73	R						
Benzo(a)anthracene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(a)pyrene	µg/L	0.00012	A	µg/L	0.00012	A						
Benzo(b)fluoranthene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene	µg/L	0.0013	A	µg/L	0.0013	A						
Chrysene	µg/L	0.0013	A	µg/L	0.0013	A						
Dibenz(a,h)anthracene	µg/L	0.00012	A	µg/L	0.00012	A						
Fluoranthene												
Fluorene												
Indeno(1,2,3-c,d)pyrene	µg/L	0.0012	A	µg/L	0.0012	A						
2-Methylnaphthalene												
Naphthalene	µg/L	12	R									
Phenanthrene												
Pyrene												
Dioxins/Furans (2,3,7,8-TCDD eq)	µg/L	0.0000000005	A									
1,2,3,4,7,8-HxCDF							µg/kg	0.0004	B	µg/kg	0.00008	R
1,2,3,7,8-PeCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
2,3,4,7,8-PeCDF							µg/kg	0.0003	B	µg/kg	0.00003	R
2,3,7,8-TCDF							µg/kg	0.00040658	R	µg/kg	0.00008	R
2,3,7,8-TCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
Tetrachloroethene				µg/L	0.24	A						
Toluene				µg/L	9.8	R						
TPH-Diesel							mg/kg	91	R			
TPH-Diesel (C10-C12 Aliphatic)				µg/L	2.6	R						
Tributyltin	µg/L	0.063	A				µg/kg	3080	R			
Trichloroethene				µg/L	0.6	A						
2,4,5-Trichlorophenol				µg/L	50	A						
Vanadium				µg/L	20	R						
Vinyl Chloride				µg/L	0.022	A						
Xylenes				µg/L	13	R						
Zinc	µg/L	36.5	R	µg/L	36.5	R	mg/kg	459	R			

Notes:
(1) Surface Water Cleanup Levels - RAOs 3 and 7
(2) Groundwater Cleanup Levels - RAOs 4 and 8
(3) Sediment Cleanup Levels - RAOs 1 and 5
(4) Fish Tissue Targets - RAOs 2 and 6
(5) A/R indicates that the ARARs-based number and the risk-based number are the same.
(6) The tissue target is a risk-based number and does not represent background levels. Additional data will be collected to determine background fish tissue concentrations for PCBs during design and construction of the Selected Remedy.
(7) The cleanup level for cPAHs of 12 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment. The cleanup level applicable to sediments in the navigation channel is 3,950 µg/kg and is based on human consumption of clams.

Abbreviations:
A- ARAR-based number
ARAR - applicable or relevant and appropriate requirement
B - Background-based number
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
C - carbon
Conc - concentration
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - 1,2,3,7,8,9-hexachlorodibenzofuran
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbon
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
R - risk-based number
RAO - remedial action objective
TCDD - 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

Table 4. Project Goals for Pre-Remedial Design Investigation Scope of Work
Portland Harbor Pre-Remedial Design Investigation Work Plan
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#	Project Goals	Spatial Scale	Media	Questions to Answer
1	Obtain SMA baseline characterization data adequate to refine the remedial footprint for allocation purposes	SMA specific	Discrete sediment grabs (0 to 30 cm), bathymetry, sediment cores	· Have the active remedial footprints changed since the FS? Can we refine the footprints and reduce uncertainty? · Have the elevations changed since the FS, hence the footprint changes through the ROD technology decision tree? · What are the extent of footprints above RALs?
2	Establish current baseline conditions (SWACs, CSM) to evaluate future remedy performance and progress towards RAOs	Site-wide, segments, rolling RM	Surface sediment, fish tissue (SMB), surface water	· What are concentrations of COCs prior to remedial activities? · Do results support refinement of the remedial footprint? · What are current baseline risks?
3	Evaluate recovery changes within the Site	Site-wide, segments	Surface sediment, fish tissue (SMB), surface water	· Are Site conditions improving since the RI/FS datasets? · Do improvements support the narrative of MNR?
4	Update Downtown and Upriver Reach datasets	RM 11.8 to 28.4	Surface sediment, fish tissue (SMB), surface water; porewater	· What are upstream concentrations of select COCs in sediment and fish tissue, and have they changed since the RI/FS datasets? · What are background concentrations of naturally-occurring metals COCs in porewater? · How could new data inform future evaluation of remedy performance and what is achievable?

Notes:
(1) Data collected for each project goal may serve multiple data use objectives (DUOs).
Abbreviations:
COCs - chemicals of concern; FS - feasibility study; ROD - Record of Decision; SWAC - surface weighted average concentrations; SMB - small mouth bass

Table 5. Data Use Objectives for Pre-Remedial Design Investigation Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
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Proposed Scope Item		Data Use Objective (DUO)									
# Task	Purpose	Refine CSM	Update SWAC (Site, segments, rolling RM)	Update Baseline Conditions	Recovery Changes Since RI/FS	Active Footprint/ RAL exceedences	Remedial Technology	Recontamination Potential	Support Allocation	Institutional Controls	Future Compliance
Pre-Design Field Investigation Studies											
Site-wide bathymetry survey	footprint	X			X	X	X		X		
Surface sediment sampling	recovery/bkgrd	X	X	X	X	X	X		X		X
Fish tissue sampling	recovery/bkgrd	X		X	X					X	X
Surface water sampling	recovery/bkgrd	X		X	X						
Sediment cores	footprint	X			X	X	X		X		X
Fish acoustic tracking study	fish home range	X									X
Porewater sampling	bkgrd	X				X	X		X		X
Technical Analyses / Reporting											
Evaluate current conditions	footprint	X	X	X	X	X	X		X		X
Evaluate recovery changes	recovery	X		X							
Evaluate upstream levels	recovery	X			X			X			
Refine active footprint	footprint	X	X			X	X		X		X
Evaluate fish home ranges and scale of SWAC estimate	fish home range	X	X								X
Refine the CSM based on current conditions	recovery/footprint	X	X		X	X			X	X	X
Data Interpretation Report	all	X	X		X	X	X		X	X	X

Abbreviations:
IC - institutional controls; bkgrd - background; CSM - conceptual site model; RAL - remedial action level; RM - river mile; SWAC - surface weighted average concentration

Table 6. Summary of Pre-Remedial Design Investigation Media, Sample Counts, and Analyses for Sediment, Tissue, and Surface Water
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Media	Location Count	Sample IDs	Analyte List			
			Parameter	Method	MDL [1,2,3,4,5]	Units
Surface Sediment - Unbiased	428 - within Site; 60 - D/U Reach	PDI-SS-BL-01 to PDI-SS-BL-428	Aldrin	8081B	0.175	µg/kg
			Arsenic	6020B	0.0102	mg/kg
			BEHP	8270C	136	µg/kg
			Cadmium	6020B	0.0053	mg/kg
			Chlordanes	8081B	0.0097	µg/kg
			Copper	6020B	0.0608	mg/kg
			DDx	8081B	0.529	µg/kg
			DDD	8081B	0.17	µg/kg
			DDE	8081B	0.529	µg/kg
			DDT	8081B	0.171	µg/kg
			Dieldrin	8081B	0.158	µg/kg
			Lindane	8081B	0.344	µg/kg
			Lead	6020B	0.024	mg/kg
			Mercury	7471A	0.0037	mg/kg
			PCB congeners [7]	1668	10	ng/kg
			PAHs	8270D SIM	3.3	µg/kg
			cPAHs (BaP eq)	8270D SIM	3.3	µg/kg
			1,2,3,4,7,8-HxCDF	1613B	5	pg/g
			1,2,3,7,8-PeCDD	1613B	5	pg/g
			2,3,4,7,8-PeCDF	1613B	5	pg/g
			2,3,7,8-TCDF	1613B	1	pg/g
			2,3,7,8-TCDD	1613B	1	pg/g
			PCDD/Fs	1613B	5	pg/g
			TPH-Diesel	8015B-DRO	9.9	mg/kg
			Tributyltin	OrganoTin	1.53	µg/kg
			Zinc	6020B	0.144	mg/kg
			TOC	Plumb 1981/ EPA 9060	0.00715	%
			Grain Size	PSEP	0.1	%
Additional Surface Sediment - SMA	212 - within Site	PDI-SS-SMA-01 to PDI-SS-SMA-212	DDx	8081B	0.529	µg/kg
			PCB congeners [7]	1668	10	ng/kg
			PAHs	8270D SIM	3.3	µg/kg
			PCDD/Fs	1613B	5	pg/g
			TOC	Plumb 1981/ EPA 9060	0.00715	%
			Grain Size	PSEP	0.1	%
Subsurface Sediment	90 Cores - within Site	PDI-SC-01 to PDI-SC-90	PCB Aroclors	8082A	0.00138	µg/kg
			PCDD/Fs	1613	2.48	pg/g
			DDx	8081	0.051	µg/kg
			PAHs	8270D SIM	3.3	µg/kg
			TOC	Plumb 1981/ EPA 9060	0.00715	%
			Grain Size	PSEP	0.1	%
Suspended Sediment (Sediment Traps)	4 locations (12 samples over 3 rounds)	PDI-ST-R#-01 to PDI-ST-R#-04	Aldrin	8081B	0.175	µg/kg
			Arsenic	6020B	0.0102	mg/kg
			BEHP	8270C	136	µg/kg
			Cadmium	6020B	0.0053	mg/kg
			Chlordanes	8081B	0.0097	µg/kg
			Copper	6020B	0.0608	mg/kg
			DDx	8081B	0.529	µg/kg
			DDD	8081B	0.17	µg/kg
			DDE	8081B	0.529	µg/kg
			DDT	8081B	0.171	µg/kg
			Dieldrin	8081B	0.158	µg/kg
			Lindane	8081B	0.344	µg/kg
			Lead	6020B	0.024	mg/kg
			Mercury	7471A	0.0037	mg/kg
			PCB congeners [7]	1668	10	ng/kg
			PAHs	8270D SIM	3.3	µg/kg
			cPAHs (BaP eq)	8270D SIM	3.3	µg/kg
			1,2,3,4,7,8-HxCDF	1613B	5	pg/g
			1,2,3,7,8-PeCDD	1613B	5	pg/g
			2,3,4,7,8-PeCDF	1613B	5	pg/g
			2,3,7,8-TCDF	1613B	1	pg/g
			2,3,7,8-TCDD	1613B	1	pg/g
			PCDD/Fs	1613B	5	pg/g
			TPH-Diesel	8015B-DRO	9.9	mg/kg
			Tributyltin	OrganoTin	1.53	µg/kg
			Zinc	6020B	0.144	mg/kg
			TOC	Plumb 1981/ EPA 9060	0.00715	%
			Grain Size	PSEP	0.1	%

Table 6. Summary of Pre-Remedial Design Investigation Media, Sample Counts, and Analyses for Sediment, Tissue, and Surface Water
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

Media	Location Count	Sample IDs	Analyte List			
			Parameter	Method	MDL [1,2,3,4,5]	Units
Fish Tissue (SMB, whole body)	95 - within Site; 40 - D/U Reach	PDI-SMB-BL-01 to PDI-SMB-BL-135	Aldrin	8081B	0.5	µg/kg-wet
			Arsenic	6020B	0.0203	mg/kg-wet
			BEHP	8270D	11.2	µg/kg-wet
			Chlordanes	8081B	0.0194	µg/kg-wet
			DDx	8081B	0.5	µg/kg-wet
			Dieldrin	8081B	0.5	µg/kg-wet
			Hexachlorobenzene	8270D	5	µg/kg-wet
			Mercury	7471A	0.00739	mg/kg
			Pentachlorophenol	8270D	63.1	µg/kg-wet
			PBDEs	1614	50	pg/g-wet
			PCB congeners [7]	1668	2	ng/kg-wet
			1,2,3,4,7,8-HxCDF	1613B	5	pg/g-wet
			1,2,3,7,8-PeCDD	1613B	5	pg/g-wet
			2,3,4,7,8-PeCDF	1613B	5	pg/g-wet
			2,3,7,8-TCDF	1613B	1	pg/g-wet
			2,3,7,8-TCDD	1613B	1	pg/g-wet
			PCDD/Fs	1613B	5	pg/g-wet
			Lipids	DCM extraction gravimetric (NOAA, 1993)	1.5	%
Surface Water[6]	7 transects (21 samples over 3 rounds)	PDI-SW-R#-01 to PDI-SW-R#-07	Aldrin	AXYS Method	0.0048	ng/L
			Arsenic	6020A	0.22	µg/L
			BEHP	8270C	1.6	µg/L
			Chlordanes	AXYS Method	0.0048	ng/L
			Chromium	6020A	0.378	µg/L
			Copper	6020A	1.04	µg/L
			DDx	AXYS Method	0.003	ng/L
			DDD	AXYS Method	0.003	ng/L
			DDE	AXYS Method	0.0024	ng/L
			DDT	AXYS Method	0.0026	ng/L
			Ethylbenzene	8260C	0.252	µg/L
			Hexachlorobenzene	8270D	0.104	µg/L
			MCPP	81515A	290	µg/L
			Pentachlorophenol	8270D	0.271	µg/L
			PCBs	AXYS Method	0.0048-0.0608	pg/L
			cPAHs (BaP eq) [7]	AXYS Method or 8270-SIM	0.2818	ng/L
			Benzo(a)anthracene	AXYS Method or 8270-SIM	0.1234	ng/L
			Benzo(a)pyrene	AXYS Method or 8270-SIM	0.0588	ng/L
			Benzo(b)fluoranthene	AXYS Method or 8270-SIM	0.2818	ng/L
			Benzo(k)fluoranthene	AXYS Method or 8270-SIM	0.2818	ng/L
			Chrysene	AXYS Method or 8270-SIM	0.1334	ng/L
			Dibenz(a,h)anthracene	AXYS Method or 8270-SIM	0.1324	ng/L
			Indeno(1,2,3-c,d)pyrene	AXYS Method or 8270-SIM	0.1264	ng/L
			Naphthalene	AXYS Method or 8270-SIM	0.1622	ng/L
			Dioxins/Furans (2,3,7,8-TCDD eq)	AXYS Method	0.00228	pg/L
			Tributyltin	OrganoTin	0.045	µg/L
			Zinc	6020A	2.65	µg/L
			TSS	2540D	NA	NA
			Turbidity, pH, flow rate velocity, eH, DO	field parameter	NA	NA
Porewater	8	PDI-PW-01 to PDI-PW-08	Arsenic	200.7	0.05	µg/L
			Manganese	200.7	0.264	µg/L
			redox	field parameter	---	---

Notes:
(1) Surface sediment MDLs from EPA RI (2016) Table 5-2.1; PCB 1668 MDL from Vista Analytical.
(2) Subsurface sediment MDLs from EPA RI (2016) Table 5-2.2
(3) Fish tissue MDLs from EPA RI (2016) Table 5-6.1; PCB 1668 MDL from Vista Analytical.
(4) Surface water MDLs from Portland Harbor RI/FS Round 3A Field Sampling Plan Surface Water Sampling (2006) Table 2-4
(5) Porewater MDL for Mn provided by analytical laboratory (TestAmerica), MDLs for As is MRL reported in RI/FS Round 3A Field Sampling Plan Surface Water Sampling (2006) Table 2-4.
(6) Total and dissolved
(7) Where MDLs for totals were not available, the highest MDL for individual analyte was used.

Abbreviations:
BL - baseline; DDx - sum of dichlorodiphenyltrichloroethane and its derivatives; PAHs - polycyclic aromatic hydrocarbon; PCBs - polychlorinated biphenyls; PCDD/Fs - polychlorinated dibenzo-p-dioxins and furans; PDI - Pre-remedial Design Investigation. PSEP - Puget Sound Estuary Protocol; PW - porewater: TOC - total organic carbon; D/U – Downtown/Upriver Reach; SC - subsurface core; SMB - small mouth bass; SS - surface grab; SW - surface water

		45	X			10	8		
		46	X			10	8		
		47	X			10	8		
		48	X			10	8		

Table 7a. Sediment Cores for Pre-Design Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

RM 8 to 8.75W	long band	49		X	C450	10	2	>8.0	PCBs, DDx, Dioxin/Furans
		50	X			20	8	>16.2	
		51	X			20	8		
		52	X			20	8		
RM 9.8W		53	X			15	8	>12.1	PCBs, DDx, Dioxin/Furans
		54	X			15	8		
		55	X			15	2		
		56		X	LWMC24	15	2		
RM11E		57	X			15	8	>10	PCBs, DDx
		58		X	C003	15	2		
		59		X	C023	15	2		
		60	X			15	2		
Proposed Nearshore/ Shallow Area Core Locations									
RM 2E	Evraz	B-1	X			6	3		PCBs, DDx
		B-2	X			6	3		
RM 3.5E	Blob	B-3	X			6	3		PCBs, DDx, Dioxin/Furans
RM 3.8E	Slip	B-4	X			6	3		PCBs
		B-5	X			6	3		
RM 3.9E	Blob	B-6	X			6	3		PCBs, DDx, Dioxin/Furans
		B-7	X			6	3		
RM 4W	Blob	B-8	X			6	3		PAHs
RM 4.52E	Slip	B-9	X			6	3		PCBs, PAHs
RM 4.8W	Blob	B-10	X			6	3		PAHs, PCBs, DDx, Dioxin/Furans
RM 5.5E	Sliver	B-11	X			6	3		PAHs, PCBs, DDx, Dioxin/Furans
RM 5.7W	Sliver	B-12	X			6	3		PAHs, PCBs, DDx, Dioxin/Furans
RM 6.2W	Blob	B-13	X			6	3		PAHs, DDx
RM 6.3E	Blob	B-14	X			6	3		PCBs, PAHs, DDx
RM 6.4W	Blob	B-15	X			6	3		PAHs, DDx
RM 6.5E	Blob	B-16	X			6	3		PCBs, PAHs, DDx
RM 6.7W	Blob	B-17	X			6	3		PCBs, DDx, Dioxin/Furans
RM 6.8E	Blob	B-18	X			6	3		PCBs, PAHs, DDx
RM 7W	Blob	B-19	X			6	3		PCBs, DDx, Dioxin/Furans
		B-20	X			6	3		
RM 8.1W	Blob	B-21	X			6	3		PCBs, DDx, Dioxin/Furans
Swan Island		B-22	X			6	3		PCBs
		B-23	X			6	3		
		B-24	X			6	3		
		B-25	X			6	3		
		B-26	X			6	3		
RM 9E	Sliver	B-27	X			6	3		PCBs
RM 9W	Long band	B-28	X			6	3		PCBs, DDx, Dioxin/Furans
		B-29	X			6	3		
RM 10.2W	Sliver	B-30	X			6	3		PCBs
Total # Deep Cores			**43**	**17**			**448**		
Total # of Nearshore Cores			**30**						
# of QA/QC Samples							***40***		
Total # of Cores/Samples			**90**				**488**		

Notes:
(1) Archive deeper intervals in nearshore areas.
(2) Remedial Action Level Cleanup Concentration:
PCBs = 9.0 µg/kg, total PAHs = 23 mg/kg, DDx = 6.1 µg/kg, 2,3,7,8-TCDD = 0.0002 µg/kg

Abbreviations:
BML - below mudline; COC - contaminant of concern; D/F - dioxins/furans; PAH - polycyclic aromatic hydrocarbons

Table 7b. Rationale for Sediment Core Locations for Pre-Design Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

Alternative F Mod Active Footprint Area / Description		Core #	New Core Station	Re-Occupy Old Station	Summary Rationale	Additional Rationale
RM 2E	Evraz	1	X		Define horizontal extent - north end	Better define horizontal gradient extent towards the north end (cores to the north do not tag bottom).
		2	X			Better define horizontal towards the navigational channel. C600 does not tag bottom.
		3		X	Define vertical extent, unbounded to 10 ft bgs	Define vertical extent, reoccupy C011-2 which remains unbounded to 10 feet bgs with a concentration of 8,200 µg/kg PCB. Samples in proximity (C011-1, RB13, and C602) are all unbounded.
		4		X	Define vertical extent, unbounded to 10 ft bgs	Define vertical extent, reoccupy C019-1 which remains unbounded in vertical direction with a concentration of 1,100 µg/kg PCB; samples in proximity (C019-2, LWMC1, and C604) are all unbounded.
		5	X		Define horizontal extent - southeast end	Better define the horizontal and vertical extent, previously no cores that tag bottom within 250 feet.
RM 2.75E	Blob	6	X		No existing core in the dredge footprint	No existing core in the dredge footprint. Nearby core C061, C613, and C614 are vertically unbounded.
RM 3.5E	Blob	7	X		No existing core in the dredge footprint	No existing core in the dredge footprint. Nearby core C061, C613, and C614 are vertically unbounded.
RM 3.8E	Slip	8	X		Define horizontal extent	Define horizontal extent/improve concentration gradient. Spacing between cores +400 feet.
		9	X			Define Shallow extent.
		10		X	Define vertical extent in Alt I dredge footprint	Define vertical extent, LWMC3 unconfined vertically with a concentration of TPCB at 5,000µg/kg for the entire core depth of 10 feet bgs.
		11	X		Define horizontal extent	Define horizontal extent/improve concentration gradient. Spacing between cores +300 feet.
		12	X		n	Closest sample SED14, is unconfined vertically. Sample approximately 3 ft bgs with a concentration of 1,100 µg/kg. Define horizontal extent between cap and dredge.
RM 4.4W	Blob	13		X	Define vertical extent.	Reoccupy C622 which is vertically unbounded, core went down ~15' bgs with a PAH Concentration of ~150,000 µg/kg.
		14	X		Define horizontal extent in shallow area	Define Horizontal extent in shallow area. Closest core is unbounded C626. Could move sample slightly north into proposed F Mod dredge area that contains no core samples.
RM 4.5E	Slip	-	No cores needed, plenty of data and all shallow exceedances, Alt I dredge			
RM 4.51E	Slip	15		X	Define vertical extent	Reoccupy HC-S-42 which is vertically unbounded, core went to ~5 feet bgs with a PAH concentration of 220,000 µg/kg. Will also help define horizontal extent in shallow area.
RM 4.52E	Slip	-	No cores needed, plenty of data and all shallow exceedances, Alt I dredge			
RM 5 to 6	Blobs	16	X		Define vertical/horizontal extent	Define vertical/horizontal extent with new cores; some new cores collected in 2014 with good coverage at depth.
		17	X			
RM 5 to 6W	Shallow Blobs	18		X	Define vertical extent	Reoccupy C136 which is vertically unbounded, core went down ~15 feet bgs with a PAH concentration of 80,000 µg/kg. No other core in existing dredge footprint.
		19		X	Define vertical extent	Reoccupy C142 which is vertically unbounded, core went down ~10 feet bgs with a PAH concentration of 240,000 µg/kg.
		20		X	Define vertical extent	Reoccupy C147 which is vertically unbounded, core went down ~15 feet bgs with a PAH concentration of 250,000 µg/kg.
		21		X	Define vertical extent	Reoccupy C179 which is vertically unbounded, core went down ~10 feet bgs with a PAH concentration of 90,000 µg/kg. Next to C182, also unbounded vertically with a concentration of ~25,000 µg/kg.
RM 5.5E	Sliver	22	X		No existing cores in dredge footprint	No existing cores in dredge footprint, 1 core nearby vertically bounded at 10 feet below ground surface; Alt I dredge/cap.
		23	X			No existing cores in dredge footprint, 1 core nearby vertically bounded at 10 feet below ground surface; Alt I dredge/cap
		24	X			No existing cores in dredge footprint, 1 core nearby vertically bounded at 10 feet below ground surface; Alt I dredge/cap

Table 7b. Rationale for Sediment Core Locations for Pre-Design Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

Alternative F Mod Active Footprint Area / Description		Core #	New Core Station	Re-Occupy Old Station	Summary Rationale	Additional Rationale
RM 6W	Shallow Long Band / Inlet	25	X		Define vertical extent	Horizontally define navigational channel. CS003 was less than 1 foot bgs, with a concentration of 34,800 µg/kg.
		26	X		Horizontal extent along nav channel, define vertical extent for proximal cores	Horizontally define navigational channel extent. No core currently within proposed dredge footprint.
		27	X			Better define concentration gradient. Closest cores ~250 feet away is DGS-08C (in navigational channel, concentration of 1,800,000 µg/kg). Downriver of LWMC11, unbounded sample with a concentration of 8,400,000 µg/kg, and DGS-19SC with a concentration of 4,500,000 µg/kg.
		28		X	Define vertical extent	Reoccupy LMWC11 which is vertically unbounded, core went down ~10 feet bgs with 8,400,000 µg/kg. Next to GS-B5 also unbounded vertically with concentrations of 1,100,000 µg/kg.
RM 6.5E	Blob	29		X	Define vertical extent	Reoccupy C244 which is vertically unbounded, core went down ~10 feet bgs 250 µg/kg PCB. Southern edge of proposed dredge footprint.
		30	X		Define horizontal extent	No historical cores collected within Alternative F Mod footprint.
		31	X		Define vertical/horizontal extent in the low spot near C291	Better define horizontal gradient. Distance between cores is greater than 300 feet. Two of the four closest cores are unbounded vertically with concentrations of 250 µg/kg and 750 µg/kg PCB.
RM7W	Blob	32	X		Define vertical extent	Define vertical extent in proposed dredge area around C311, DGS-37SC, SD072, and C316; these cores are all unbounded vertically and have PAH concentrations >50,000 µg/kg and as high as 570,000 µg/kg.
		33	X		Define vertical and horizontal extent	Define horizontal extent of proposed dredge area around WB-66, which is unbounded vertically and horizontally and has a 2,3,7,8-TCDD concentrations as high as 0.0015 µg/kg.
		34	X		Define vertical extent	Define vertical extent in proposed dredge area around C679, which is unbounded vertically and has a 2,3,7,8-TCDD concentration 0.003 µg/kg.
		35	X		Define vertical extent	Define vertical extent in proposed dredge area around LWMC14, which is unbounded vertically and has a 2,3,7,8-TCDD concentration 0.002 µg/kg; surrounding unbounded samples are WB-37, WB-41, and SD092 with concentrations as high as 0.007 µg/kg.
		36	X		Define vertical/horizontal extent	Define vertical and horizontal extent of proposed dredge area south of WB-34. WB-34 is unbounded vertically and has a 2,3,7,8-TCDD concentration 0.001 µg/kg.
RM 7.5W		37	X		Define vertical/ horizontal extent	Define vertical and horizontal extent near C688. C688 is unbounded vertically and has a 1,2,3,7,8-PeCDD concentration >0.001 µg/kg.
		38		X	Define vertical extent	Reoccupy C690. C690 had concentrations greater than 0.001 of 2,3,7,8-TCDD and 1,2,3,78-PeCDD is 0.007 µg/kg, and vertical extent was unbounded to 15 ft below mudline surface.
		39	X		No existing core in active footprint	Inside proposed dredge area has no core samples.
Swan Island		40	X		Define vertical extent	Sample near SD133 to define vertical extent in proposed dredge area. SD133 was unbounded vertically and had a PCB concentration of 2,400 µg/kg .
		41		X	Define vertical extent	
		42	X		Define vertical extent	Help determine vertical extent and better cover horizontal area which is over 250 feet from next sample location.
		43	X		Define vertical extent / horizontal gradient	Define vertical extent between C702 and C703 (cores are over 400 feet apart) and C702 is unbounded with a max concentrations of 250 µg/kg of PCB.
		44	X		Define horizontal extent	Define horizontal and vertical extent between C364 and PSY20C (cores are over 600 feet apart) and have max PCB concentration of >250 µg/kg and 2,300 µg/kg respectively.
		45	X		Define vertical extent	Define vertical extent between C372 and PSY18C (cores are over 400 feet apart) and have PCB concentrations of ~200 µg/kg and >500 µg/kg respectively. C372 is also unbounded vertically.

Table 7b. Rationale for Sediment Core Locations for Pre-Design Studies
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR

Alternative F Mod Active Footprint Area / Description		Core #	New Core Station	Re-Occupy Old Station	Summary Rationale	Additional Rationale
		46	X		Define vertical extent	Better define vertical gradient between C379 and PSY11C (cores are over 600 feet apart) and have max PCB concentration of >750 µg/kg and >7.5 µg/kg respectively.
		47	X		Define vertical/horizontal extent	Better define vertical gradient near C397. C397 is vertically unbounded and had a max PCB concentration of >500 µg/kg.
		48	X		Refine horizontal gradient	Better define vertical gradient between C405 and SD141 (cores are over 300 feet apart) and both are vertically unbounded. The max concentration between the two cores was >500 µg/kg of PCB.
RM 8 to 8.75W	long band	49		X	Unbounded to 10 ft below ground surface	Define vertical extent in proposed dredge area around C450, which is unbounded vertically and has a PCB concentration 2,200 µg/kg.
		50	X		collect bank sample near C431	Define vertical and horizontal extent of proposed dredge area north east of C431, edge of dredge area over 300 feet from C431 core.
		51	X		Define vertical extent	Define shallow horizontal extent west of C455. C455 has a max PCB concentration of 6,000 µg/kg.
		52	X		Define vertical extent	Define vertical extent in proposed dredge area around LWMC19, which is unbounded vertically and has a PCB concentration 2,200µg/kg. No proposed cores in this area or vertically bounded cores in this dredge area.
RM 9.8W		53	X		Cores are vertically unbounded, but there is 10 ft of clean overburden; horizontal extent	Define vertical and horizontal extents in proposed dredge area north east of C738 and C739; both cores are vertically and horizontally unbounded with max concentrations >500 µg/kg of PCB.
		54	X			Better define vertical gradient between C739 and LWMC24. Both cores are unbounded, with max concentrations greater than 500 µg/kg of PCB.
		55	X		Define extent	Define vertical and horizontal extents in proposed dredge area west of LMWC24. LWMC24 is vertically unbounded with max concentration >750 µg/kg of PCB.
		56		X	Define vertical/ horizontal extent	Define horizontal extent south of LMWC24 which is approximately 400 feet from the shoreline and is unbounded vertically with a max concentration >750 µg/kg of PCB.
RM11E		57	X		Define horizontal extent	Define vertical and horizontal extent within new dredge footprint. Nearby core samples C007 or UC01 were shallow cores (less than a couple feet) and UC01 was unbounded with a PCB concentration close to 500 µg/kg.
		58		X	Define vertical extent	Reoccupy C003. C003 had a max PCB concentration close to 1,000 µg/kg and was vertically unbounded.
		59		X	Define vertical extent	Reoccupy C023. C023 had a max PCB concentration of 4,300 µg/kg and was vertically unbounded.
		60	X		Define horizontal/vertical extent	Define horizontal and vertical extents between WR-CD-40 and C778. Cores are over 300 feet apart and WR-CD-40 is unbounded vertically with a PCB concentration >7.5 µg/kg.
Shallow Area Cores		30	X		Define areas	No existing cores in these areas

Abbreviations:
bgs - below ground surface; bml - below mudline; COC - contaminant of concern; PAH - polycyclic aromatic hydrocarbons

Table 8. Data Interpretation and Analysis Plan
Portland Harbor Pre-Remedial Design Investigation Work Plan
Portland, OR