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OFFICE OF
ENVIRONMENTAL CLEANUP

April 3, 2018

MEMORANDUM

SUBJECT: Errata for Portland Harbor Superfund Site Record of Decision, Version 1.0

FROM: Sean Sheldrake, Remedial Project Manager
Office of Environmental Cleanup

TO: Portland Harbor site file

This memorandum documents minor errors identified in the Portland Harbor Superfund Site Record of Decision, dated January 2017. Redlined corrections for the items below are attached:

1. List of Acronyms, page xii. The acronym for HxCDF should be hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran. The acronym for polybrominated diphenyl ether (PDBE) was also added to the list of acronyms.

2. Section 6.5.1, Contaminants of Concern, page 20. The last bullet under "Highly Toxic" listed as 1,2,3,4,6,7,8-hexachlorodibenzofuran (HxCDF) should be 1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF).

3. Section 6.6.6, River Banks, pages 24-26. As shown in the attachment, the ECSI site IDs for Willamette Cove, Hampton Lumber and Glacier NW were corrected, and descriptions for Premier Edible Oils and US Navy Reserve were added.

4. Appendix I, ROD Figure 7. In a label on this figure, the Upriver Reach should be defined as River Mile 16.6 to 28.4, instead of River Mile 16.7 to 28.4 that was shown.

5. Appendix II, ROD Table 1. Four abbreviations in this table should be updated to include the correct congener for each abbreviation:

    a. HxCDF should be 1,2,3,4,7,8-hexachlorodibenzofuran

    b. PeCDD should be 1,2,3,7,8-pentachlorodibenzo-p-dioxin

    c. PeCDF should be 2,3,4,7,8-pentachlorodibenzofuran

    d. TCDF should be 2,3,7,8-tetrachlorodibenzofuran

6. Appendix II, ROD Table 2 and Table 3. Two abbreviations in each table should be updated to include the correct congener for each abbreviation:
    a. PeCDD should be 1,2,3,7,8-pentachlorodibenzo-p-dioxin
    b. PeCDF should be 2,3,4,7,8-pentachlorodibenzofuran
7. Appendix II, ROD Table 4. In the abbreviations list, the abbreviation for HxCDF should be 1,2,3,4,7,8-hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.
8. Appendix II, ROD Table 6. The contaminant listed as 1,2,3,4,6,7,8- HxCDF should be 1,2,3,4,7,8-HxCDF.
9. Appendix II, ROD Table 17. Revisions to this table include:
    a. The groundwater cleanup level of 9.9 µg/L listed for cis-1,2-Dichloroethene should be 70 µg/L.
    b. The fish tissue target concentration of 0.031 mg/kg listed for mercury should be 0.03 mg/kg.
    c. The river bank soil/sediment PAH cleanup level of 23000 µg/kg is a risk-based value so an "R" should be added to the basis column for this contaminant.
    d. The contaminant listed as TPH-Diesel (C10-C12 Aliphatic) should be Aliphatic Hydrocarbons C10-C12.
    e. The contaminant listed as 2,4,5-Trichlorophenol in the table should be 2,4,5-TP (Silvex). The full name for this contaminant, 2-(2,4,5-Trichlorophenoxy)propionic acid, should be added to the abbreviations.
    f. The abbreviation for HxCDF should be hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.
10. Appendix II, ROD Table 21. Revisions to this table include:
    a. This table does not have footnote 4 so the "(4)" in first column by Total PAHs should be deleted.
    b. The table should include µg/kg as the units for the values listed in this table.
    c. The additional contaminant listed as 1,2,3,4,6,7,8-HxCDF should be 1,2,3,4,7,8-HxCDF.
11. Appendix II, ROD Table 22. The reference to Oregon Health Authority (OHA) fish advisory regarding allowable fish meals under the no action Alternative A on pages

1, 3, 5 and 6 should be revised. The calculations are based on the HHRA assumptions and not a OHA advisory. The acronym for OHA should also be removed from page 9.

12. Appendix IV, Appendix J, Section J2.3, page J-4. The last paragraph on this page should state that Tables J2.3-4a-j and Tables J2.3-5a-g show noncancer HQ values instead of HI values.

13. Appendix IV, Appendix J, Table J2.3-5f. The values in this table show cancer risk estimates but should show HQ values. Corrected values are provided in Table J2.3-5f are included as an attachment to this memo.

14. Appendix IV, Appendix J, Tables J2.3-4a through J2.3-4j. In the title of each table, "HI" should be replaced with "HQ" because the values pertain to a single contaminant.

15. Appendix IV, Appendix J, Tables J2.3-5a through J2.3-5g. In the title of each table, "Risk" should be replaced with "HQ" because the values shown are HQs and not risk values.

The attachment shows redlined corrections for each of the items above except for items 13 and 14. Due to the number of pages, redlined corrections showing the title changes to Tables J2.3-4a through J2.3-4j and J2.3-5a through J2.3-5g are not attached. The errors listed above do not affect the remedy. As such, they do not require an Explanation of Significant Differences or other amendment. This memorandum will be added to the site file.

Attachment

EFH	Essential Fish Habitat
ENR	enhanced natural recovery
E.O.	Executive Order
eq	equivalent
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ESA	Endangered Species Act
ESD	Explanation of Significant Differences
FEMA	Federal Emergency Management Agency
FFA	Fill, Fine-grained Facies of Flood Deposits, and Recent Alluvium
FMD	future maintenance dredge
F Mod	Alternative F (Modified)
FS	feasibility study
ft	feet
g/day	grams per day
HEA	Habitat Equivalency Analysis
HEC-RAS	Hydrologic Engineering Center River Analysis System
HI	hazard index
HQ	hazard quotient
HST	hydrodynamic and sediment transport
HxCDF	~~1,2,3,7,8,9-~~hexachlorodibenzofuran
IC	institutional control
ICIAP	Institutional Controls Implementation and Assurance Plan
ISA	initial study area
LDR	land disposal restriction
LOE	line of evidence
LWG	Lower Willamette Group
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPP	2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg-day	milligrams per kilogram per day
MGP	manufactured gas production
MNR	monitored natural recovery
MOU	memorandum of understanding
NAPL	non-aqueous-phase liquid
NCP	National Contingency Plan
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
OAR	Oregon State Administrative Rules
ODFW	Oregon Department of Fish and Wildlife

OHA	Oregon Health Authority
OHSRA	Oregon Hazardous Substance Remedial Action
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon
PA/SI	preliminary assessment/site investigation
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PCDD/F	polychlorinated dibenzo-p-dioxin/furan
PCDF	polychlorinated dibenzofuran
PCP	pentachlorophenol
PDBE	polybrominated diphenyl ether
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
pg/L	pictogram per liter
ppm	parts per million
PRP	potentially responsible party
PTW	principal threat waste
RAL	remedial action level
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RHV	Relative Habitat Value
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RM	river mile
RME	reasonable maximum exposure
RNA	regulated navigation area
ROD	Record of Decision
RSL	regional screening level
SDU	sediment decision unit
SDWA	Safe Drinking Water Act
SF	slope factor
Site	Portland Harbor Superfund Site
SLERA	screening-level ecological risk assessment
SMA	sediment management area
SPCC	Spill Prevention, Containment and Countermeasure Plan
SQV	sediment quality value
SVOC	semivolatile organic compound
SWAC	surface area weighted average concentration
TAG	technical assistance grant
TBC	to be considered

shellfish, and mammals, and can cause adverse reproductive effects such as eggshell thinning in birds.

Principal Threat Waste

Principal threat waste (PTW) is defined as source material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or that acts as a source for direct exposure. Further, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

PTW was identified based on a 10^{-3} cancer risk (highly toxic) or NAPL within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment. "Reliably contained" was not used in identifying PTW but rather was used to determine how to address it through cleanup and whether there are concentrations of PTW that could be reliably contained. The following criteria were utilized to identify PTW:

- **Source Material:** NAPL has been identified in subsurface sediment offshore of the Arkema and Gasco facilities (RM 6 through RM 7.5) as globules or blebs of product in surface and subsurface sediment. However, areas of NAPL have not been fully delineated. Figure 8 in Appendix I identifies the general locations where NAPL was observed. NAPL observed offshore of the Arkema facility contained chlorobenzene with dissolved DDT. NAPL observed at the Gasco facility contained PAHs and other aromatic hydrocarbons.
- **Highly Toxic:** The following COCs were found at concentrations exceeding a 10^{-3} risk level at the Site based on consumption of fish, using the assumptions and methodology presented in the baseline human health risk assessment (BHHRA) summarized in Section 8.1 and on Table 6 in Appendix II:
    - PCBs
    - Carcinogenic PAHs (cPAHs)
    - DDx
    - 2,3,7,8-TCDD
    - 2,3,7,8-tetrachlorodibenzofuran (TCDF)
    - 1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD)
    - 2,3,4,7,8-pentachlorodibenzofuran (PeCDF)
    - 1,2,3,4~~,6~~,7,8-hexachlorodibenzofuran (HxCDF)
- **PTW That Cannot be Reliably Contained:** A capping model was utilized in the FS (Appendix D) to identify PTW that cannot be reliably contained by a cap. Representative Site conditions and capping options were modeled to determine the maximum concentration of COCs in PTW material that would not exceed ambient water quality criteria (AWQC) in the sediment cap pore water after a period of 100 years. This assumption was used in developing the remedial alternative cost estimates in the FS

Contaminants were detected in a majority of fish and invertebrate species sampled throughout the Site. Contaminant concentrations varied within and between different species, and concentrations in fish tissue were generally greater than in invertebrates. Concentrations of bioaccumulative compounds, such as PCBs and DDx, were often found at greater concentrations in organisms higher up the food chain and correlated with areas of elevated concentrations in sediment. Biota samples from within the Site exhibited greater concentrations for most contaminants than background biota samples that were collected from the upriver reaches and above Willamette Falls. Areas of elevated concentrations of some contaminants were found in resident species, reflecting high concentrations in nearby surface sediment and biological uptake by species with small home ranges.

Selected PCB and DDx results for resident fish species (smallmouth bass, brown bullhead, black crappie, and carp), adult Chinook salmon, and sturgeon are briefly summarized in Table 8 in Appendix II. These contaminants were selected because they commonly bioaccumulate and these species were evaluated in the BHHRA. Full results for all contaminants are included in RI Table 5.6-1.

6.6.6. River Banks

River banks are defined as the area from the top of bank down to the river. River bank data were collected under DEQ-led investigations. Contaminants detected in river bank material at levels that pose a risk to human health, the environment, or for recontamination to any implemented remedy, are summarized below by RM on the east and west sides of the river. Properties with known contaminated river banks are shown in Figure 9 in Appendix I and river bank contaminants are summarized on Table 5 in Appendix II).

East Side of Willamette River

RM 2: Evraz Oregon Steel Mill (Environmental Cleanup Site Information [ECSI] Site ID 141[5]) – Contaminants present in the river bank include PCBs and metals (arsenic, cadmium, chromium, copper, lead, manganese, and zinc).

RM 3.5: Premier Edible Oils (ECSI Site ID 2013) – Contaminants may include mercury, cobalt, antimony, barium, PAHs, zinc, copper, manganese, arsenic, carbazole, dibenzofuran, methylnaphthalene, petroleum hydrocarbons, BTEX, chlorinated solvents, and bis(2-ethylhexyl)phthalate.

Schnitzer Steel Industries (ECSI Site ID 2355) – Results of soil samples collected under the docks along the south shore of the International Slip indicate that contaminants are PCBs and dioxins.

RM 5.5: MarCom South (ECSI Site ID 2350) – Further investigation of the nature and extent of contamination in the bank was conducted in 2012. Contaminants are PAHs and metals (arsenic, cadmium, chromium, copper, zinc).

[5] Site ID number is from DEQ's ECSI database.

RM 7: Willamette Cove (ECSI Site ID 2066~~2363~~) – River bank contaminants are PCBs, dioxins/furans, metals (lead, mercury, nickel, and copper), and PAHs.

RM 8.5: Swan Island Shipyard (ECSI Site ID 271) – Recent sampling results for indicate that contaminants include metals (arsenic, cadmium, chromium, copper, lead, mercury, and zinc), PAHs, PCBs, and tributyltin. Contaminants in river bank soils in OU5 include metals (arsenic, copper, lead, and zinc), PAHs, and PCBs.

US Navy Reserve (ECSI Site ID 5109) – Tank was removed from this property in 1993. DEQ identified this site as needing further investigation.

West Side of Willamette River

RM 4: Kinder Morgan Linnton Bulk Terminal (ECSI Site ID 1096) – Contaminants are petroleum constituents (benzene, toluene, ethylbenzene, xylenes, and PAHs) and metals (arsenic and lead).

RM 6: NW Natural/Gasco (ECSI Site ID 84) – Contamination associated with historical MGP waste are known to be located in the river bank. Contaminants include PAHs, gasolinerange hydrocarbons, diesel-range hydrocarbons, residual-range hydrocarbons, cyanide, and metals (zinc).

RM 6 to RM 7: Siltronic (ECSI Site ID 183) – Contamination associated with historical MGP waste is known to be present in the northern portion of the Siltronic river bank. River bank contaminants include PAHs, gasoline-range hydrocarbons, diesel-range hydrocarbons, residual-range hydrocarbon and cyanide and metals (zinc).

Burlington Northern Santa Fe Railway Company (BNSF) Railroad Bridge – Contamination associated with pesticide and herbicide releases from Rhone Poulenc and Arkema are known to be present in the river bank below and adjacent to the BNSF railroad bridge. River bank contaminants include dioxin/furans, metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, insecticides (DDD, DDE, DDT, aldrin, alpha-hexachlorocyclohexane, alpha-chlordane, beta-BHC, cis-nonachlor, delta-BHC, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-BHC, gamma-chlordane heptachlor, heptachlor epoxide, hexachlorobutadiene, methoxychlor, mirex, oxychlordane, and transnonachlor), PCBs, semi-volatile organic compounds (SVOCs) (acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzoic acid, benzyl alcohol, BEHP, butylbenzylphthalate, chrysene, bibenzo(a,h)anthracene, dimethylphthalate, di-n-butylphthalate, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene) (AMEC 2011).

RM 7 to RM 8: Arkema (ECSI Site ID 398) – River bank contaminants include DDT, dioxin/furans, PCBs, and metals (chromium and lead).

GS Roofing (ECSI Site ID 117) – River bank contaminants include total petroleum hydrocarbons and metals (arsenic, chromium, mercury, nickel, selenium).

RM 8: Hampton Lumber (ECSI Site ID 5761) and Glacier NW (ECSI Site ID 2378~~1239~~) – River bank contaminants include steel mill slag fill.

RM 9: Gunderson (ECSI Site ID 1155) – River bank contaminants include metals (lead, nickel, and zinc), and PCBs.

RM 10: Sulzer Bingham Pumps (ECSI Site ID 1235) – River bank contaminants include PCBs and metals (arsenic, copper, lead, manganese, and zinc).

6.6.7. RCRA Hazardous Waste in Media

RCRA characteristic hazardous waste criteria and disposal requirements are discussed in Section 3.4.9.1 in the FS (EPA 2016b) and in Sections 14 and 15 below. Based on current information, two areas of the Site have listed hazardous waste commingled in the sediment, either under RCRA hazardous waste listings or under Oregon's hazardous waste law, offshore of the Arkema and Siltronic/Gasco facilities.

6.7. Computer Models Used For Fate and Transport

6.7.1. Hydrodynamic and Sediment Transport Models

Numerical hydrodynamic and sediment transport (HST) models were conducted to complement the empirical observations and gain a further understanding of physical system dynamics. The models were used to predict the potential impact of extreme (flood) events on Site sediment stability, particularly the potential for buried contaminated sediments to be re-exposed, and to better understand the complex hydrodynamics (i.e., the movement of surface water) of the lower Willamette River system. The models were also used to predict the bed elevation changes (i.e., the areas and magnitude of erosion and deposition in the Site) that would result from five different high-flow scenarios. A range of high-flow simulations were run because bed response can be a function of long-term hydrographic conditions that exist leading up to a flood event. The development and results of the HST model are discussed in the RI report (EPA 2016a).

6.7.2. Mass Transfer Model

The RI also evaluated contaminant mass inputs from external sources and internal mass transfer mechanisms for a subset of contaminants within the Site on a Site-wide basis. Mass transfer models for these contaminants are presented on RI Figures 10.2-2, 10.2-5, 10.2-8, 10.2-11a, 10.2-14, 10.2-17, 10.2-20, 10.2-29, 10.2-32, 10.2-35, and 10.2-38. With all surface water, sediment, and sediment trap sample results taken together, there is evidence that contaminants from the Site are migrating downstream, especially from erosional areas, to either the Columbia River or Multnomah Channel and that the mass flux of contaminants exiting the downstream end of the Site in surface water is greater than the flux entering the Site.

External sources include upstream loading (via surface water and sediment bedload), "lateral" external loading such as stormwater runoff permitted discharges (point-source, non-stormwater),

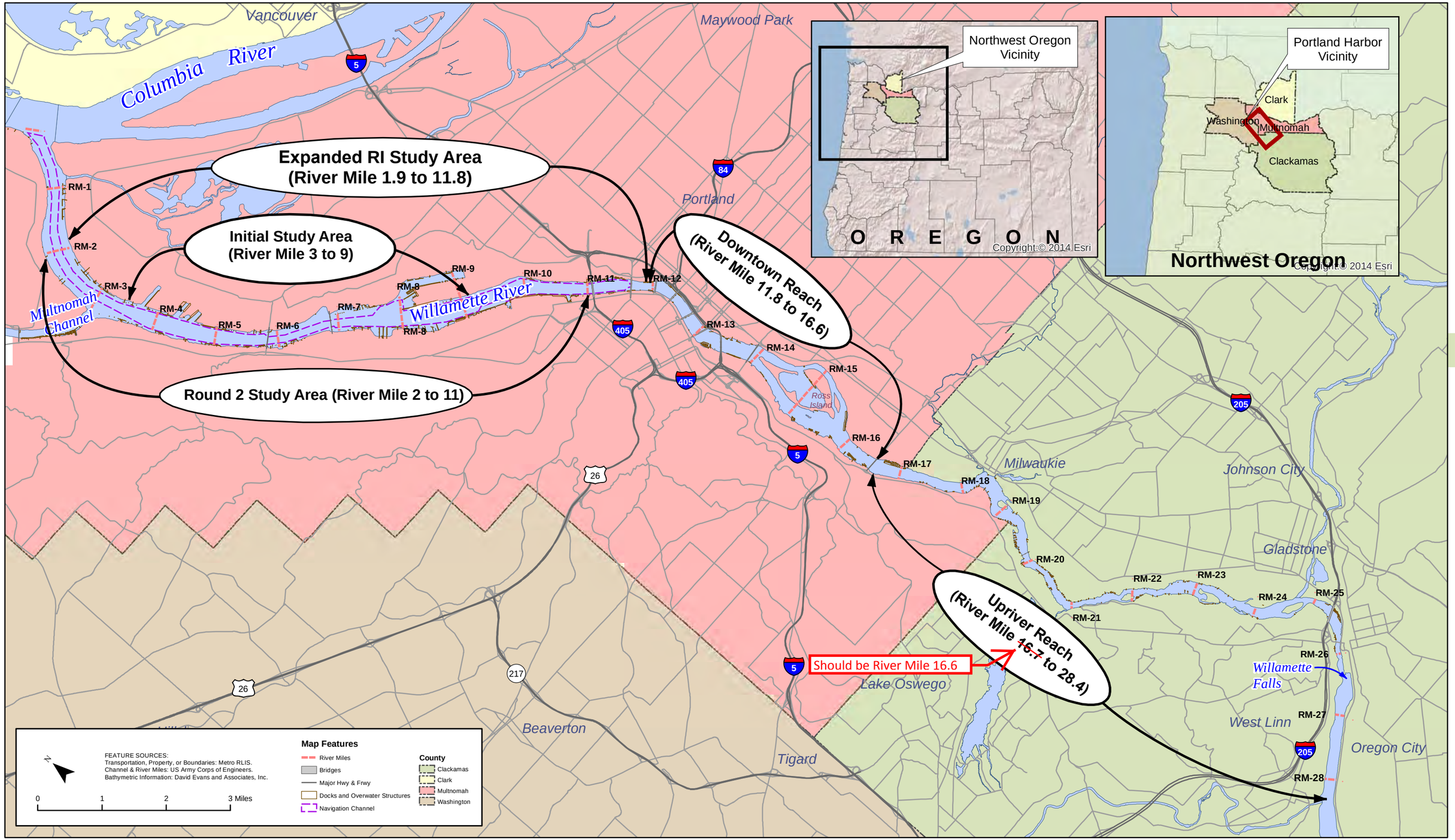

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Figure 7. Portland Harbor Study Area and Vicinity

Portland Harbor Superfund Site

Table 1. Summary of Contaminants of Concern in Sediment

		Surface				Subsurface			
Contaminant	**Units**	**Frequency of Detection**	**Min-Max**	**Mean**	**Median**	**Frequency of Detection**	**Min-Max**	**Mean**	**Median**
Aldrin	µg/kg	254/1081	0.00333 - 691	5	0.5	127/1102	0.11 - 1,340	24	0.85
Arsenic	mg/kg	1348/1473	0.7 - 132	5	3.7	1429/1492	0.5 - 51	4	3.6
BEHP	µg/kg	884/1438	7 - 440,000	1,061	150	595/1496	2.4 - 18,000	355	95
Cadmium	mg/kg	1332/1460	0.0156 - 10	0.41	0.25	1377/1469	0.011 - 44	0.42	0.27
Chlordanes	µg/kg	723/1103	0.063 - 669	6	1.2	607/1103	0.11 - 2300	21	2.1
Copper	mg/kg	1457/1461	6.19 - 2,830	58	38.7	1481/1481	9.42 - 3,290	56	36
DDD	µg/kg	982/1179	0.051 - 11,000	43	2.3	969/1298	0.087 - 690,000	2483	4.5
DDE	µg/kg	964/1176	0.052 - 2,240	16	15.97	846/1298	0.054 - 24,000	81	3.9
DDT	µg/kg	801/1165	0.0613 - 81,000	259	2.19	755/1275	0.069 - 3,500,000	5,201	3.5
DDx	µg/kg	1072/1179	0.13 - 85,000	267	8.3	1065/1294	0.18 - 3,600,000	4,756	14
Dieldrin	µg/kg	238/1121	0.00834 - 356	3	0.28	72/1134	0.038 - 100	4	0.43
gamma-BHC	µg/kg	198/1126	0.0031 - 430	4	1.2	114/1145	0.052 - 172	5	1.29
Hexachlorobenzene	µg/kg	7/50	0.28 - 3	1	0.66	210/1270	0.066 - 14,000	78	0.94
HxCDF	µg/kg	201/222	0.000043 - 66	0.347	0.00127	183/250	0.000014 - 41	0.374	0.0023
Lead	mg/kg	1469/1484	1.1 - 13,400	49	15.8	1528/1536	1.54 - 3330	47	20
Mercury	mg/kg	1331/1452	0.005 - 65	0.144	0.068	1316/1395	0.004 - 17	0.192	0.089
PAHs, total	µg/kg	1559/1580	6.3 - 7,300,000	26,006	1,200	1553/1620	3.3 - 53,000,000	234,036	1,400
cPAHs (BaP eq)	µg/kg	1533/1580	0.42 - 450,000	2,477	130	1485/1620	0.26 - 1,300,000	9,163	140
PeCDD	µg/kg	131/222	0.00002 - 0.021	0.001	0.000219	128/251	0.000018 - 0.058	0.002	0.00035
PeCDF	µg/kg	175/222	0.000026 - 9	0.058	0.000551	168/251	0.000024 - 11	0.125	0.00069
TCDD	µg/kg	46/222	0.00004 - 0.111	0.003	0.00035	74/251	0.000045 - 0.084	0.003	0.00048
TCDF	µg/kg	139/222	0.000058 - 14	0.11	0.00088	125/250	0.000095 - 15	0.207	0.00164

Table 1. Summary of Contaminants of Concern in Sediment

Contaminant	Units	Surface				Subsurface			
		Frequency of Detection	Min-Max	Mean	Median	Frequency of Detection	Min-Max	Mean	Median
PCBs (Aroclors)	µg/kg	725/984	6.2 - 6,000	162	40	744/1294	3.8 - 26,000	311	83
PCBs (congeners)	µg/kg	244/244	1.7 - 35,000	467	36	149/153	0.4 - 37,000	705	100
Tributyltin	µg/kg	321/342	0.45 - 47,000	480	22	213/397	0.32 - 90,000	1,469	29
Zinc	mg/kg	1490/1490	3.68 - 4,220	153	106	1521/1521	24 - 9,000	148	105

Focused contaminants of concern are shown in **bold**.

Abbreviations:
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - 1,2,3,4,7,8,9-hexachlorodibenzofuran
max - maximum
mg/kg - milligram per kilogram
min - minimum
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PeCDD - 1,2,3,7,8-pentachlorodibenzo-p-dioxin
PeCDF - 2,3,4,7,8-pentachlorodibenzofuran
TCDD - 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF - 2,3,7,8-tetrachlorodibenzofurans
µg/kg - microgram per kilogram

Table 2. Summary of Contaminants of Concern in Surface Water

Contaminant	Units	Frequency of Detection	Minimum	Maximum	Mean	Median
Aldrin	µg/L	124/268	0.0000001	0.005	0.00004	0.000001
Arsenic	µg/L	295/346	0.18	0.75	0.39	0.39
BEHP	µg/L	37/226	0.004	64	4.09	1.00
Benzo(a)anthracene	µg/L	132/335	0.00003	0.27	0.006	0.0005
Benzo(a)pyrene	µg/L	107/335	0.00002	0.19	0.005	0.0005
Benzo(b)fluoranthene	µg/L	128/335	0.00002	0.13	0.004	0.0004
Benzo(k)fluoranthene	µg/L	13/179	0.0017	0.13	0.032	0.007
Chlordanes	µg/L	166/268	0.0000001	0.002	0.0001	0.00002
Chromium	µg/L	164/346	0.1	1.92	0.53	0.38
Copper	µg/L	344/346	0.37	3.68	1.02	0.87
DDD	µg/L	177/268	0.000001	0.003	0.0002	0.00004
DDE	µg/L	180/268	0.000003	0.001	0.00007	0.00004
DDT	µg/L	183/268	0.000001	0.02	0.0004	0.00003
DDx	µg/L	200/268	0.000008	0.02	0.0006	0.0001
Dioxin/Furan (TCDD eq)	µg/L	147/149	0.0000000003	0.0000009	0.00000006	0.00000002
Ethylbenzene	µg/L	8/23	0.55	11.4	3.09	1.65
Hexachlorobenzene	µg/L	165/353	0.000001	0.007	0.0001	0.00002
MCPP	µg/L	7/164	7.3	34	15	13
Naphthalene	µg/L	55/358	0.001	605	44	0.02
PAHs	µg/L	262/335	0.0001	7.4	0.07	0.01
PAHs (BaP eq)	µg/L	193/335	0.0000001	0.27	0.005	0.0002
PCBs	µg/L	735/876	0.000007	0.02	0.001	0.0002
Pentachlorophenol	µg/L	0/178	ND	ND	ND	ND
PeCDD	µg/L	65/149	0.000000002	0.0000005	0.00000002	0.00000001
PeCDF	µg/L	51/149	0.000000002	0.0000003	0.00000003	0.00000001
TCDD	µg/L	7/149	0.000000005	0.0000003	0.00000004	0.00000001
TCDD TEQ	µg/L	237/240	0.00000000004	0.0000009	0.00000004	0.000000006
Tributyltin	µg/L	11/167	0.001	0.004	0.002	0.001
Zinc	µg/L	208/346	0.9	58	3.68	2.74

Focused contaminants of concern are shown in **bold**.

Abbreviations:
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane

Table 2. Summary of Contaminants of Concern in Surface Water

Abbreviations (continued)
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PeCDD - 1,2,3,7,8-pentachlorodibenzo-p-dioxin
PeCDF - 2,3,4,7,8-pentachlorodibenzofuran
TCDD - 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalent concentration
µg/L - microgram per liter

Table 3. Summary of Contaminants of Concern in Pore Water and Transition Zone Water

Contaminant	Units	Frequency of Detection	Minimum	Maximum	Mean	Median
Acenaphthene	µg/L	160/170	0.0031	680	41	3.1
Anthracene	µg/L	129/170	0.0027	257	7.2	0.14
Arsenic	µg/L	202/237	0.30	77	12	8
Benzene	µg/L	166/316	0.14	8,200	537	4.6
Benzo(a)anthracene	µg/L	80/170	0.0035	147	5.6	0.14
Benzo(a)pyrene	µg/L	70/170	0.0025	144	7.1	0.14
Benzo(b)fluoranthene	µg/L	59/170	0.0042	126	7.3	0.21
Benzo(g,h,i)perylene	µg/L	69/170	0.0041	54	4.5	0.13
Benzo(k)fluoranthene	µg/L	50/170	0.004	30	2.6	0.25
Cadmium	µg/L	119/188	0.004	36	0.48	0.099
Chlorobenzene	µg/L	66/312	0.15	30,000	856	2.1
Chromium	µg/L	147/228	0.2	147	13	4.1
Chrysene	µg/L	82/170	0.0033	174	6.3	0.11
Copper	µg/L	88/210	0.03	182	19	8.3
Cyanide	mg/L	52/61	0.004	23	1.03	0.18
1,1-DCE	µg/L	38/312	0.18	283	29	3.2
cis-1,2-DCE	µg/L	109/275	0.12	574,000	7,185	8.5
2,4-Dichlorophenoxyacetic acid	µg/L	10/18	0.12	0.97	0.32	0.18
DDD	µg/L	18/31	0.029	2.5	0.64	0.18
DDE	µg/L	10/31	0.0039	0.24	0.09	0.07
DDT	µg/L	14/31	0.0075	3.2	0.79	0.75
DDx	µg/L	22/31	0.0075	5.7	1.1	0.17
Dibenzo(a,h)anthracene	µg/L	50/170	0.0024	11.7	0.89	0.07
Ethylbenzene	µg/L	116/316	0.09	905	104	5.3
Fluoranthene	µg/L	116/170	0.0055	407	16.1	0.87
Fluorene	µg/L	135/170	0.0075	304	15.3	1.90
Indeno(1,2,3-cd)pyrene	µg/L	68/170	0.0037	53	4.0	0.11
Lead	µg/L	116/237	0.01	166	13.8	4.7
Manganese	µg/L	279/279	23	66,200	4,503	2,710
2-Methylnaphthalene	µg/L	49/157	0.0078	1,260	138	0.94
Naphthalene	µg/L	183/369	0.048	19,700	2,342	15
PAHs	µg/L	165/170	0.0025	21,000	1,470	8.1
cPAHs (BaP eq)	µg/L	104/170	0.0000033	188	6.3	0.06
PCE	µg/L	23/312	0.14	12,000	596	1.7
Pentachlorophenol	µg/L	0/11	ND	ND	ND	ND
PeCDD	µg/L	0/6	ND	ND	ND	ND
PeCDF	µg/L	1/6	0.0000013	0.0000013	0.0000013	0.0000013
Perchlorate	µg/L	21/42	105	210,000	61,002	49,900
Phenanthrene	µg/L	125/170	0.012	1,510	50	3.1

Table 3. Summary of Contaminants of Concern in Pore Water and Transition Zone Water

Contaminant	Units	Frequency of Detection	Minimum	Maximum	Mean	Median
Pyrene	µg/L	121/170	0.012	409	17	0.87
Silvex	µg/L	4/18	0.76	22	7.0	2.6
TCDD	µg/L	0/6	ND	ND	ND	ND
TCE	µg/L	73/312	0.14	585,000	9,788	1.9
Toluene	µg/L	168/316	0.2	821	26	1.7
TPH-Diesel	µg/L	93/135	26	28,800	1,522	600
Vanadium	µg/L	9/24	11.6	379	91	40
Vinyl chloride	µg/L	130/312	0.06	28,900	421	2.5
Xylene	µg/L	144/316	0.11	1,430	86	2.6
Zinc	µg/L	144/237	0.95	983	64	17

Focused contaminants of concern are shown in **bold**.

Abbreviations:
BaP eq - benzo(a)pyrene equivalent
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DCE - dichloroethene
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PCE - tetrachloroethene
PeCDD - 1,2,3,7,8-pentachlorodibenzo-p-dioxin
PeCDF - 2,3,4,7,8-pentachlorodibenzofuran
TCDD - 2,3,7,8-tetrachlorodibenzo-p-dioxin
TPH - total petroleum hydrocarbon
µg/L - microgram per liter

Table 4. Summary of Contaminants of Concern in Fish Tissue

Contaminant	Units	Fillet						Whole Body			
		Frequency of Detection	Minimum	Maximum	Min - Max	Mean	Median	Frequency of Detection	Min - Max	Mean	Median
Aldrin	µg/kg	15/53	0.005	0.119	0.005 - 0.119	0.05335	0.0541	47/141	0.00532 - 0.163	2.19	0.5
Arsenic	mg/kg	53/53	0.02	0.538	0.02 - 0.538	0.156962264	0.16	141/141	0.034 - 1.06	0.254618897	0.22
BEHP	µg/kg	4/33	69	130	69 - 130	96.5	98	20/124	44 - 87,000	8487	220
Cadmium	mg/kg	21/53	0.001	0.009	0.001 - 0.009	0.002952381	0.002	116/141	0.002 - 0.108	0.015750889	0.0093
Chlordanes	µg/kg	40/53	0.915	11.8	0.915 - 11.8	3.787125	1.765	97/141	0.59 - 67	9.42	9.13
Copper	mg/kg	53/53	0.127	1.12	0.127 - 1.12	0.360792453	0.335	141/141	0.365 - 7.16	1.09	0.9525
DDE	µg/kg	53/53	4.98	253	4.98 - 253	38.89641509	15	134/141	7 - 657	93	75
DDx	µg/kg	53/53	6.41	494	6.4 - 494	64.51132075	26	141/141	12.7 - 3,060	166.1120567	99.6
Dieldrin	µg/kg	33/53	0.183	3.3	0.183 - 3.3	0.936909091	0.436	78/141	0.23 - 24	3.106544304	2.11
Hexachlorobenzene	µg/kg	32/53	0.24	140	0.240 - 140	5.5	0.49	68/141	0.62 - 8.1	2.15	1.8
1,2,3,4,7,8-HxCDF	µg/kg	30/32	0.000013	0.00588	0.000013 - 0.00588	0.00062	0.00008	98/102	0.000051 - 0.0771	0.00187	0.00029
Mercury	mg/kg	53/53	0.035	0.349	0.035 - 0.349	0.13	0.096	141/141	0.01014 - 0.494	0.065	0.047
cPAHs (BaP eq)	µg/kg	10/38	0.00799	3.38	0.00799 - 3.38	0.79	0.04	24/127	0.0020 - 1.64	0.36	0.11895
PBDEs	µg/kg	26/32	8.28	82.3	8.28 - 82.3	27.5	11.2	No whole body results			
PCBs	µg/kg	53/53	19.6	19700	19.6 - 19700	650.9283019	96.2	141/141	30 - 25,100	842	301
1,2,3,7,8-PeCDD	µg/kg	31/32	0.0000615	0.00186	0.0000615 - 0.00186	0.00043	0.00017	96/102	0.000091 - 0.0128	0.00093	0.00069
2,3,4,7,8-PeCDF	µg/kg	30/32	0.000079	0.0188	0.000079 - 0.0188	0.00111	0.00029	100/102	0.000169 - 0.108	0.00273	0.00077
Pentachlorophenol	µg/kg	0/33	NA	NA	ND	ND	ND	1/123	400	NA	NA
2,3,7,8-TCDD	µg/kg	32/32	0.000055	0.000877	0.000055 - 0.000877	0.00023	0.00011	92/102	0.000119 - 0.00172	0.00048	0.00042
2,3,7,8-TCDF	µg/kg	32/32	0.000055	0.0174	0.000055 - 0.0174	0.00023	0.00011	102/102	0.000312 - 0.123	0.00517	0.00197
Tributyltin	µg/kg	12/27	0.48	11	0.48 - 7	3.84	3.75	29/62	0.61 - 8.6	3.1	2.5

Focused contaminants of concern are shown in **bold**.

Abbreviations:
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDE - dichlorodiphenyldichloroethene
DDx - DDD + DDE + DDT
HxCDF - 1,2,3,4,7,8,9-hexachlorodibenzofuran
max - maximum
mg/kg - milligram per kilogram
min - minimum
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
TCDD - 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
µg/kg - microgram per kilogram

Table 6. Concentrations of PTW Defined as "Highly Toxic"

Contaminant	Highly Toxic PTW Threshold (µg/kg) (10^{-3} risk)
PCBs	200
2,3,7,8-TCDD	0.01
2,3,7,8-TCDF	0.6
1,2,3,7,8-PeCDD	0.01
2,3,4,7,8-PeCDF	0.2
1,2,3,4, ~~6,~~7,8-HxCDF	0.04
DDx	7,050
cPAHs (BaP eq)	106,000

Abbreviations:
cPAH (BaP eq) – carcinogenic PAHs (benzo(a)pyrene equivalent)
DDx – dichlorodiphenyldichloroethane + dichlorodiphenyldichloroethene + dichlorodiphenyltrichloroethane
HxCDF – hexachlorodibenzofuran
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PeCDD – pentachlorodibenzo-p-dioxin
PeCDF – pentachlorodibenzofuran
PTW – principal threat waste
TCDD – tetrachlorodibenzo-p-dioxin
TCDF – tetrachlorodibenzofuran
µg/kg – microgram per kilogram

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~~ 70	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	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	0.03~~1~~	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	R			
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			
Aliphatic Hydrocarbons C10-C12 ~~TPH-Diesel (C10-12 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-TP (Silvex) ~~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:

2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex

ARAR - applicable or relevant and appropriate requirement

B - Background-based number

BEHP - bis(2-ethylhexyl)phthalate

BaP eq - benzo(a)pyrene equivalent

C - carbon

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations (continued):
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 - tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

Table 21. Sediment RALs and PTW Thresholds for Selected Remedy

Contaminants	Site Wide RALs[1] (µg/kg)	PTW Thresholds [2] (µg/kg)	Navigation Channel RALs (µg/kg)
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^{-3} 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 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Overall Protectiveness								
Risk at Construction Completion (Interim Target [IT]) **Site Wide Human Health (HH):** **Remedial Action Objective (RAO) 1[1]: IT: $1x10^{-5}$** **RAO 2: IT for cancer risk: $1x10^{-4}$** **RAO 2: IT for non-cancer risk in child: Hazard Index (HI) = 10** **RAO 2: IT for non-cancer risk in infant: Hazard Index (HI) = 1,320** **RAO 3: IT: 10 times cleanup level** **RAO 4: IT: not calculated** **Site Wide Ecological (Eco):** **RAO 5[2]: IT: address 50 percent (%) of benthic risk area** **RAO 6: IT: Hazard Quotient (HQ) 10** **RAO 7: IT: not calculated** **RAO8: IT: not calculated** **Source Control** **RAO 9: IT: not calculated**	No risk reduction	May Not Be Protective Site Wide HH: RAO 1: $4.8x10^{-5}$ RAO 2: $2.3x10^{-4}$ RAO 2: (Child HI): 25 RAO 2: (Infant HI): 417 RAO 3: Does not achieve ITs RAO 4: 16% addressed Site Wide Eco: RAO 5[2]: 48% addressed RAO 6: Maximum HQ (BEHP) = 19 RAO 7: Not calculated RAO 8: 16% addressed RAO 9: 32% addressed	May Not Be Protective Site Wide HH: RAO 1: $2.2x10^{-5}$ RAO 2: $2.0x10^{-4}$ RAO 2: (Child HI): 21 RAO 2: (Infant HI): 358 RAO 3: Does not achieve ITs RAO 4: 23% addressed Site Wide Eco: RAO 5[2]: 64% addressed RAO 6: Maximum HQ (BEHP) = 17 RAO 7: Not calculated RAO 8: 23% addressed RAO 9: 46% addressed	Protective Site Wide HH: RAO 1: $1.5x10^{-5}$ RAO 2: $1.7x10^{-4}$ RAO 2: (Child HI): 18 RAO 2: (Infant HI): 305 RAO 3: Does not achieve ITs RAO 4: 32% addressed Site Wide Eco: RAO 5[2]: 73% addressed RAO 6: Maximum HQ (BEHP) = 15 RAO 7: Not calculated RAO 8: 32% addressed RAO 9: 61% addressed	Protective Site Wide HH: RAO 1: $1.0x10^{-5}$ RAO 2: $1.5x10^{-4}$ RAO 2: (Child HI): 15 RAO 2: (Infant HI): 259 RAO 3: Achieves ITs RAO 4: 39% addressed Site-Wide Eco: RAO 5[2]: 72% addressed RAO 6: Maximum HQ (BEHP) = 5 RAO 7: Not calculated RAO 8: 39% addressed RAO 9: 78% addressed	Protective Site Wide HH: RAO 1: $1.0x10^{-5}$ RAO 2: $1.2x10^{-4}$ RAO 2: (Child HI): 13 RAO 2: (Infant HI): 213 RAO 3: Achieves ITs RAO 4: 46% addressed Site Wide Eco: RAO 5[2]: 87% addressed RAO 6: Maximum HQ (BEHP) = 5 RAO 7: Not calculated RAO 8: 46% addressed RAO 9: 78% addressed	Protective Site Wide HH: RAO 1: $7.2x10^{-6}$ RAO 2: $8.9x10^{-5}$ RAO 2: (Child HI): 9 RAO 2: (Infant HI): 157 RAO 3: Achieves ITs RAO 4: 62% addressed Site Wide Eco: RAO 5[2]: 93% addressed RAO 6: Maximum HQ (BEHP) = 53 RAO 7: Not calculated RAO 8: 62% addressed RAO 9: 88% addressed	Protective Site Wide HH: RAO 1: $1.8x10^{-5}$ RAO 2: $1.7x10^{-4}$ RAO 2: (Child HI): 18 RAO 2: (Infant HI): 307 RAO 3: Does not achieve ITs RAO 4: 33% addressed Site Wide Eco: RAO 5[2]: 64% addressed RAO 6: Maximum HQ (BEHP) = 19 RAO 7: Not calculated RAO 8: 33% addressed RAO 9: 65% addressed
Allowable Fish Meals/Year (yr) at Construction Completion[3] (RAO 2)	Current allowance based on ~~Oregon Health Authority (OHA) advisories~~ human health risk assessment assumptions (4 fish meals/yr [1×10^{-5}]; 3 fish meals [child HI 71]; 0.2 fish meal [breastfeeding infant HI of 1,123])	10 fish meals/yr (1×10^{-5} risk) 9 fish meals/yr (child) 0.5 fish meal/yr (breastfeeding infant)	11 fish meals/yr (1×10^{-5} risk) 10 fish meals/yr (child) 0.6 fish meal/yr (breastfeeding infant)	13 fish meals/yr (1×10^{-5} risk) 12 fish meals/yr (child) 0.7 fish meal/yr (breastfeeding infant)	16 fish meals/yr (1×10^{-5} risk) 14 fish meals/yr (child) 1 fish meal/yr (breastfeeding infant)	19 fish meals/yr (1×10^{-5} risk) 18 fish meals/yr (child) 1 fish meal/yr (breastfeeding infant)	26 fish meals/yr (1×10^{-5} risk) 24 fish meals/yr (child) 2 fish meal/yr (breastfeeding infant)	13 fish meals/yr (1×10^{-5} risk) 12 fish meals/yr (child) 0.7 fish meal/yr (breastfeeding infant)
Direct Contact Surface Water (RAO 3) (IT: 10 times cleanup level)	Exceedances of surface water cleanup levels continue	ITs are not achieved for polychlorinated biphenyls (PCBs) and tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalent concentration (TEQ)	ITs are not achieved for PCBs and TCDD TEQ	ITs are not achieved for PCBs	ITs achieved	ITs achieved	ITs achieved	ITs are not achieved for PCBs
Groundwater Plumes Addressed (%) (RAO 4)	0% - continued migration to sediment and surface water	16% addressed	23% addressed	32% addressed	39% addressed	46% addressed	62% addressed	33% addressed

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River Banks Addressed (%) (RAO 9)	0% - continued migration from river banks to sediment/ surface water.	32% of river banks addressed	46% of river banks addressed	61% river banks addressed	78% river banks addressed	78% river banks addressed	88% river banks addressed	65% river banks addressed
Benthic Areas Addressed (%) (RAO 5)[2] (IT: 50 % addressed)	0% - No reduction in benthic risk	48% of benthic areas addressed	64% of benthic areas addressed	73% of benthic areas addressed	72% of benthic areas addressed	87% of benthic areas addressed	93% of benthic areas addressed	64% of benthic areas addressed
Consumption of Prey (RAO 6) (IT: Eco HQ=10)	No reduction in HQ.	Does not achieve IT River mile (RM) scale: Maximum HQ = 19 (BEHP) Sediment decision unit (SDU) scale: Maximum HQ=7 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 17 (BEHP) SDU scale: Maximum HQ=5 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 15 (BEHP) SDU scale: Maximum HQ=4 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 3 (BEHP) SDU Scale: Maximum HQ = 1 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 19 (BEHP) SDU scale: Maximum HQ=3 (BEHP)
Direct Contact Surface Water (RAO 7)	Exceedances of surface water cleanup levels would continue.	Not quantifiable. Time to achieve cleanup levels through monitored natural recovery (MNR) uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)								
Chemical-specific ARARs	Would not meet water quality criteria (WQCs) and maximum contaminant levels (MCLs).	Would not be achieved	Complies	Complies	Complies	Complies	Complies	Complies
Location-specific ARARs	No location-specific ARARs	Complies. Addressed during design and implementation	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Action-specific ARARs	No action-specific ARARs	Complies. Addressed during design and implementation. 15 acres of mitigation	Same as Alternative B. 25 acres of mitigation	Same as Alternative B. 35 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 86 acres of mitigation	Same as Alternative B. 34 acres of mitigation
LONG-TERM EFFECTIVENESS AND PERMANENCE								

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Magnitude of Residual Risk (Post Construction [PC] Risk) **RAO 1**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Sediment: Post Construction risk: $4.8x10^{-5}$	Sediment: Post Construction risk: $2.2x10^{-5}$	Sediment: Post Construction risk: $1.5x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $7.2x10^{-6}$	Sediment: Post Construction risk: $1.8x10^{-5}$
RAO 2 (Allowable Fish Meals at Construction Completion)	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain. ~~OHA fF~~ish advisories would continue.	(see fish meal information under Overall Protectiveness)						
RAO 3 - Direct Contact Surface Water (Risk at Construction Completion vs. Risk at Cleanup Level for each Contaminant of Concern [COC])	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	PCBs – 16 times > cleanup levels TCDD TEQ – 13 times > cleanup level Carcinogenic polycyclic aromatic hydrocarbon (cPAH) – 2 times cleanup level	PCBs – 13 times > cleanup levels TCDD TEQ – 11 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 8 times > cleanup levels	PCBs – 10 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 8 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 6 times > cleanup levels TCDD TEQ – 5 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 9 times > cleanup level cPAH – 2 times cleanup level
RAO 4 **Migration Groundwater to Sediment/Surface Water** **(Contaminated Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed. The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed. Same as Alternative B	68% not addressed. Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed. Same as Alternative B	38% not addressed. Same as Alternative B	67% not addressed. Same as Alternative B
RAO 5[2] **Benthic Organisms** **(Benthic Areas not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	52% not addressed. Degree of recovery is uncertain because it is likely that an insufficient amount of the benthic risk areas will be addressed.	36% not addressed. Same as Alternative B	27% not addressed. Same as Alternative B	28 % not addressed Same as Alternative B	13% not addressed. Same as Alternative B	7% not addressed. Same as Alternative B	36% not addressed. Same as Alternative B

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RAO 6 **Consumption of Prey**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 5 times TCDF – 6 times PeCDF – 4 times HxCDF – 3 times SDU scale: BEHP – 7 times PCBs – 4 times TCDF – 3 times PeCDF – 2 times HxCDF – 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 17 times PCBs – 3 times TCDF – 4 times PeCDF – 3 times HxCDF – 2 times SDU scale: BEHP – 5 times PCBs – 2 times TCDF – 3 times PeCDF– 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 15 times PCBs – 2 times TCDF – 1.4 times SDU scale: BEHP – 4 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 2 times SDU scale: BEHP – 4 times
RAO 7 **Direct Contact Surface Water**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Not quantifiable. Time to achieve protectiveness through MNR uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
RAO 8 **Migration Groundwater to Sediment/Surface Water** **(Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed Same as Alternative B	68% not addressed Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed Same as Alternative B	38% not addressed Same as Alternative B	67% not addressed Same as alternative B
RAO 9 **Migration River Banks** **(Contaminated River Banks not Addressed)**	Existing risk remains.	68% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated river banks will be addressed with this alternative.	54% not addressed Same as Alternative B	39% not addressed Same as Alternative B	22% not addressed Same as Alternative B	22% not addressed Same as Alternative B	12% not addressed Same as Alternative B	35% not addressed Same as Alternative B

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Adequacy and Reliability of Controls	No engineering controls ~~OHA f~~Fish advisories may not prevent human exposure.	Technologies are proven and reliable Operation and maintenance (O&M) of caps Long-term monitoring Periodic inspections and sampling of media and fish Institutional Controls (ICs): - Fish advisories - Land-use restrictions - regulated navigation areas (RNAs) to protect caps RNA Areas Capped: 28.3 acres MNR Area: 1,966 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 55.8 acres MNR Area: 1,900 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,838 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,774 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,634 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 231.4 acres MNR Area: 1,391 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,876 acres
REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT								
Treatment Process Used	None	Activated carbon Organophilic clay Solidification/stabilization Thermal desorption	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Amount Destroyed or Treated *In-situ treatment includes areas within and outside of sediment management areas (SMAs).	None	In-situ treatment*: 70 acres Ex-situ treatment: 191,573 cubic yards (cy)	In-situ treatment*: 108 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 109 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 133 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 145 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 184 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 113 acres Ex-situ treatment: 191,573 cy
Reduction in Toxicity, Mobility, or Volume	None	• Broadcast activated carbon (AC): 6.7 acres • Reactive Caps: 23 acres • Reactive residual layer: 36 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 3.2 acres • Reactive Caps: 40 acres • Reactive residual layer: 61 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 60 acres • Reactive residual layer: 45 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 58 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive caps: 101 acres • Reactive residual layer: 80 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 64 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres

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Irreversible Treatment	None	Permanent and Irreversible Treatment Activated carbon Low-temperature thermal desorption Solidification/stabilization forms stable solids that are non-hazardous or less-hazardous than the original materials	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B
Type and Quantity of Residuals Remaining after Treatment	Contaminated sediment and soil remains.	Principal threat waste (PTW) addressed: 37 % PTW remaining: 63%	PTW addressed: 57 % PTW remaining: 43 %	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%
SHORT-TERM EFFECTIVENESS								
Community Protection	Continued risks to community from no action. ~~OHA fF~~ish advisories would continue.	Community Impacts: 4 months per year for 4 years. • Temporary noise, light, odors, air quality impacts. • Disruptions to river use • potential for waterborne accidents during construction Addressed with health and safety (H&S) plans and use of best management practices (BMPs). Fish consumption advisories would continue until RAO achieved.	Community Impacts: 4 months per year for 6 years. Same as Alternative B	Community Impacts: 4 months per year for 7 years. Same as Alternative B	Community Impacts: 4 month per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 19 years. Same as Alternative B	Community Impacts for 4 months per year for 7 years. Same as Alternative E

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Worker Protection	No risk to workers	Risks to workers for 4-5 months per year for 4 years. • Physical hazards during construction. • Increased accident risks from heavy equipment, transport of materials, and increased vessel traffic. Addressed with H&S Plans and BMPs.	Risks to worker for 4-5 months per year for 6 years. Same as Alternative B	Risks to workers for 4-5 months per year for 7 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Environmental Impacts (Impacts of Construction Activities)	Continued impact from existing conditions.	Impact time frame: 4 months per year for 4 years. • Temporary loss of benthos and habitat, increased emissions from construction and transportation equipment. • Exposure to contamination greater than PRGs during MNR period Addressed with BMPs, engineering control measures, emissions control strategies.	Impact time frame: 4 months per year for 6 years. Same as Alternative B	Impact time frame: 4 months per year for 7 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Time Until Action is Complete	Not applicable.	Construction time: 4 years Estimated time to achieve RAOs is uncertain, but unlikely to occur in a reasonable timeframe.	Construction time: 6 years Same as Alternative B	Construction time: 7 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 19 years Same as Alternative B	Construction time: 7 years Same as Alternative B
IMPLEMENTABILITY								

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Ability to Construct and Operate	No construction or operation	Technologies successfully implemented at other Superfund sites. Material handling: 627,652 cy of sediment/soil 495,931 cy of fill	Same as Alternative B, except: Material handling: 1,181,238 cy of sediment/soil 727,154 cy of fill	Same as Alternative B, except: Material handling: 2,024,222 cy of sediment/soil 957,630 cy of fill	Same as Alternative B, except: Material handling: 3,017,189 cy of sediment/soil 1,339,587 cy of fill	Same as Alternative B, except: Material handling: 4,585,401 cy of sediment/soil 1,565,247 cy of fill	Same as Alternative B, except: Material handling: 7,396,598 cy of sediment/soil 2,257,357 cy of fill	Same as Alternative B, except: Material handling: 1,752,374 cy of sediment/soil 900,271 cy of fill,000 cy of fill
Ease of Doing More Action, if Needed	May require ROD amendment in the future.	Easy	Easy	Easy	Easy	Easy	Easy	Easy
Ability to Monitor Effectiveness	No monitoring required. Ongoing exposure and risks would continue	Monitoring of: RNAs: 28 acres of caps Capped areas (includes river banks): 39 acres MNR: 1,966 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 56 acres of caps Capped areas (includes river banks): 71 acres MNR: 1,900 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 101 acres MNR: 1,838 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,774 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,634 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 231 acres of caps Capped areas (includes river banks): 260 acres MNR: 1,391 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 102 acres MNR: 1,876 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals necessary.	Approvals and coordination with other agencies possible. Waste left in 2,088 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,032 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,964 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,920 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,780 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,596 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,000 acres of the Site.
COST								
Capital Cost	$0	$352,097,000	$556,004,000	$827,465,000	$1,184,607,000	$1,629,407,000	$2,500,545,000	$751,359,000
Periodic Cost	$0	$290,324,000	$397,028,000	$412,332,000	$524,028,000	$549,512,000	$708,114,000	$421,940,000
Present Value Cost	$0	$451,460,000	$653,700,000	$869,530,000	$1,054,200,000	$1,371,170,000	$1,777,320,000	$811,290,000

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Acronyms:

AC – activated carbon
ARAR – applicable or relevant and appropriate
BEHP – bis(2-ethyl-hexyl)phthalate
BMP – best management practice
COC – contaminant of concern
cPAH – carcinogenic polycyclic aromatic hydrocarbon
cy – cubic yard
DDD – Dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethane
DDT – dichlorodiphenyltrichloroethane
DMM - disposed material management
eco – ecological
ENR – enhanced natural recovery
HQ – Hazard Quotient
H&S – health and safety
HxCDF - hexachlorodibenzofuran
HH – human health
IC- institutional control
IT – interim target
lf – lineal feet
MCL – maximum contaminant limit
MNR – monitored natural recovery
O&M – operation and maintenance
~~OHA – Oregon Health Authority~~
PeCDF – pentachlorodibenzofuran
PCB – polychlorinated biphenyl
PC – post construction
PTW – principal threat waste
RNA – regulated navigation area
RAO – remedial action objective
RM – river mile
SDU – sediment decision unit
SMA – sediment management area
TCDD – tetrachlorodibenzo-p-dioxin
TCDF – tetrachlorodibenzofuran
TEQ – toxic equivalent concentration
yr – year
% – percent

Notes:

1 – Residual risk estimates are based on direct contact exposure to shallow sediments. There is insufficient data to estimate post construction risks based on exposure to beach sediments.

2 – Percentage is based on percentage of the Site that exceeds 10 times the benthic cleanup level.

3 – Allowable fish meals at completion represents the number of fish meals associated with a post-construction carcinogenic risk of $1x10^{-5}$ and an adult consumption rate based on a 142 g/day fish consumption rate and an 8 ounce fish meal. The child consumption rate based on a 60 g/day fish consumption rate and a 3.5 ounce fish meal.

cancer risks for RAO 1 are presented in **Tables J2.2-2a-e**. Residual non-cancer hazard for RAO 1 was not evaluated, as there are no PRGs for RAO 1 COCs based on non-cancer effects.

J2.3 POST-CONSTRUCTION RISK ESTIMATES FOR RAO 2

Post-construction risks for RAO 2 were estimated on a on a site-wide basis, a rolling river mile scale (1-mile average concentration), and by SDU. Site-wide post-construction risks were calculated using the site-wide weighted average sediment concentrations calculated for each COC (see Section J2). These sediment concentrations were input into the FWM (Appendix B1) to calculate COC concentrations in tissue. Surface water concentrations in this analysis was set to zero in order to directly assess the contribution from post-construction sediment concentrations on the post-construction risk estimate. COC concentrations in fillet tissue were calculated using the fillet-whole body concentration ratios presented in Appendix B3 (Table B3-3), and a mean exposure concentration was calculated as the average of fillet concentration in sculpin, largescale sucker, carp, and smallmouth bass (with largescale sucker as a surrogate for brown bullhead and sculpin as a surrogate for black crappie). Post-construction cancer risks and noncancer HIs were calculated using the same equations used for residual risk (equations J1-2 and J1-3, respectively). The risk-based tissue PRGs presented in Table B3-5 assuming a consumption rate of 142 g/day were used for this evaluation. Post-construction risk and hazard estimates are presented in **Tables J2.3-1a-g**.

Post-construction risks on a rolling river mile and SDU scale were calculated using the sediment PRGs based on a consumption rate of 49 g/day (Table B3-5), using the following equation:

$$Cancer\ risk = \left(\frac{Conc_a}{PRG_a} + \frac{Conc_b}{PRG_b} + \frac{Conc_c}{PRG_c} + \ldots + \frac{Conc_i}{PRG_i} \right) \times 10^{-6} \qquad \text{Equation J2-2}$$

Noncancer hazard was calculated using the sediment PRGs presented in Table 2.2-5 for the child or infant the following equation:

$$Hazard\ Index = \left(\frac{Conc_a}{PRG_a} + \frac{Conc_b}{PRG_b} + \frac{Conc_c}{PRG_c} + \ldots + \frac{Conc_i}{PRG_i} \right) \qquad \text{Equation J2-3}$$

Post construction risks were calculated for 0.1 mile incremental average surface concentration for each COC. Concentrations averaged on a 1 river mile scale are presented in **Tables J2.3-2a-m.** Site-wide post-construction risk estimates for individual COCs are presented in **Tables J2.3-3a-k** (cancer risk), **Tables J2.3-4a-j** (noncancer ~~HI~~ HQ), and **Tables J2.3-5a-g** (noncancer ~~HI~~ HQ-infant). Cumulative post-construction risk and HI estimates are presented in **Tables J2.3-6a-c**.

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
1.8	East	4.85	4.70	4.64	4.56	4.47	4.47	4.43	4.56
1.9	East	5.06	4.70	4.62	4.41	4.25	4.25	4.20	4.41
2	East	5.59	4.90	4.77	4.52	4.09	4.09	3.94	4.52
2.1	East	5.88	5.19	5.06	4.80	3.98	3.98	3.77	4.80
2.2	East	5.52	4.85	4.72	4.47	3.59	3.59	3.30	4.47
2.3	East	5.22	4.52	4.38	4.11	3.16	3.16	2.81	4.11
2.4	East	5.00	4.30	4.13	3.83	2.86	2.86	2.48	3.84
2.5	East	4.89	4.17	4.00	3.72	2.76	2.76	2.38	3.73
2.6	East	4.84	4.10	3.94	3.68	2.70	2.70	2.32	3.69
2.7	East	4.92	4.18	4.02	3.76	2.73	2.73	2.34	3.77
2.8	East	4.96	4.28	4.14	3.88	2.80	2.80	2.38	3.89
2.9	East	4.55	4.11	4.00	3.88	2.87	2.87	2.46	3.89
3	East	4.27	4.27	3.98	3.94	3.21	3.21	2.90	3.95
3.1	East	4.26	4.26	3.95	3.90	3.71	3.71	3.42	3.91
3.2	East	4.51	4.50	4.17	4.12	4.03	4.03	3.79	4.13
3.3	East	6.53	5.73	4.30	4.15	3.78	3.78	3.40	4.16
3.4	East	8.11	6.30	4.42	4.30	3.87	3.87	3.42	4.30
3.5	East	8.55	6.61	4.61	4.43	3.91	3.91	3.37	4.43
3.6	East	9.21	7.15	4.96	4.47	3.89	3.89	3.29	4.47
3.7	East	10.11	7.99	5.72	4.67	3.87	3.87	3.19	4.67
3.8	East	10.39	8.22	5.91	4.83	3.98	3.98	3.22	4.83
3.9	East	10.04	8.08	5.91	4.79	3.53	3.53	2.68	4.79
4	East	9.18	7.34	5.53	4.45	2.90	2.90	1.95	4.45
4.1	East	8.46	6.69	4.90	3.83	2.29	2.29	1.35	3.83
4.2	East	7.93	6.26	4.35	3.22	1.71	1.71	0.82	3.22
4.3	East	6.55	5.36	4.32	3.01	1.46	1.46	0.59	3.01
4.4	East	5.11	5.05	4.43	3.02	1.45	1.45	0.62	3.02
4.5	East	5.13	5.08	4.44	3.07	1.53	1.53	0.74	3.07
4.6	East	4.98	4.95	4.41	3.38	1.89	1.89	1.11	3.38
4.7	East	4.57	4.55	4.03	3.58	2.31	2.31	1.59	3.58
4.8	East	5.00	4.97	4.44	3.99	2.72	2.72	2.03	3.99
4.9	East	5.33	5.30	4.77	4.45	3.64	3.64	2.70	4.45
5	East	6.15	6.12	5.50	5.17	4.88	4.88	3.84	5.15
5.1	East	7.41	7.37	6.79	6.48	6.05	6.05	4.58	6.24
5.2	East	8.65	8.65	8.63	8.57	7.57	7.57	5.62	7.59
5.3	East	8.42	8.42	8.42	8.29	7.14	7.14	5.34	7.14
5.4	East	7.19	7.19	7.19	7.08	6.06	6.06	4.39	6.06
5.5	East	6.39	6.39	6.39	6.29	5.33	5.33	3.77	5.35
5.6	East	5.54	5.54	5.54	5.44	4.48	4.48	3.07	4.59
5.7	East	4.78	4.77	4.77	4.68	3.71	3.71	2.40	3.92
5.8	East	4.21	4.20	4.12	4.04	3.15	3.15	1.97	3.43
5.9	East	3.70	3.70	3.52	3.42	2.54	2.54	1.64	2.98
6	East	3.18	3.18	2.90	2.80	1.99	1.99	1.26	2.53
6.1	East	2.89	2.89	2.39	2.31	1.63	1.63	1.16	2.35
6.2	East	3.88	3.15	2.19	2.14	1.73	1.73	1.31	2.69
6.3	East	10.55	4.92	2.13	2.10	1.76	1.76	1.26	4.55

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
6.4	East	13.99	6.02	2.44	2.40	2.07	2.07	1.58	5.69
6.5	East	13.57	5.91	2.49	2.45	2.16	2.16	1.73	5.61
6.6	East	13.10	5.87	2.64	2.61	2.37	2.37	1.96	5.59
6.7	East	16.55	6.62	2.96	2.93	2.75	2.75	2.39	9.49
6.8	East	18.85	7.65	3.24	3.22	3.05	3.05	2.72	12.08
6.9	East	18.79	7.98	3.43	3.42	3.21	3.21	2.91	12.19
7	East	18.28	7.95	3.66	3.64	3.44	3.44	3.15	11.98
7.1	East	18.13	7.86	3.72	3.70	3.52	3.52	3.24	11.89
7.2	East	18.34	7.92	3.85	3.84	3.66	3.66	3.42	12.33
7.3	East	14.77	7.14	4.17	4.16	4.00	4.00	3.79	12.12
7.4	East	12.56	6.66	4.29	4.29	4.17	4.17	3.94	12.42
7.5	East	13.50	7.28	4.76	4.76	4.64	4.64	4.31	13.39
7.6	East	14.71	7.67	5.00	5.00	4.86	4.86	4.23	14.15
7.7	East	10.65	6.64	4.61	4.61	4.46	4.46	3.77	9.15
7.8	East	7.06	4.94	4.27	4.27	4.07	4.07	3.27	4.85
7.9	East	6.56	4.17	4.15	4.14	4.08	4.08	3.18	4.16
8	East	6.81	3.90	3.90	3.90	3.84	3.84	2.79	3.90
8.1	East	7.49	4.11	4.11	4.11	4.04	4.04	2.83	4.11
8.2	East	7.39	4.06	4.06	4.05	3.99	3.99	2.79	4.05
8.3	East	7.10	3.97	3.97	3.97	3.91	3.91	2.93	3.97
8.4	East	6.85	3.82	3.82	3.82	3.76	3.76	3.00	3.82
8.5	East	6.44	3.29	3.29	3.28	3.21	3.21	2.50	3.28
8.6	East	5.70	3.08	3.08	3.08	2.93	2.93	2.53	3.08
8.7	East	4.68	3.72	3.72	3.72	3.48	3.48	2.82	3.72
8.8	East	3.92	3.92	3.92	3.92	3.74	3.74	3.10	3.92
8.9	East	3.97	3.97	3.97	3.97	3.80	3.80	3.18	3.97
9	East	4.10	4.10	4.10	4.10	3.92	3.92	3.29	4.10
9.1	East	4.24	4.24	4.24	4.24	3.82	3.82	3.04	4.24
9.2	East	4.46	4.46	4.46	4.46	3.77	3.77	2.74	4.46
9.3	East	4.88	4.88	4.88	4.88	4.20	4.20	2.98	4.88
9.4	East	5.46	5.46	5.46	5.46	4.81	4.81	3.63	5.46
9.5	East	6.07	6.07	6.07	6.07	5.43	5.43	4.40	6.07
9.6	East	6.48	6.48	6.47	6.40	5.69	5.69	4.76	6.40
9.7	East	6.92	6.91	6.91	6.83	6.08	6.08	5.22	6.83
9.8	East	7.54	7.53	7.53	7.44	6.66	6.66	5.67	7.45
9.9	East	8.24	8.23	8.23	8.14	7.29	7.29	6.20	8.14
10	East	8.96	8.96	8.95	8.85	7.90	7.90	6.66	8.86
10.1	East	9.61	9.61	9.60	9.50	8.64	8.64	7.40	9.50
10.2	East	10.37	10.37	10.36	10.23	9.25	9.25	8.16	10.24
10.3	East	11.40	11.39	11.39	10.79	9.23	9.23	8.28	10.80
10.4	East	12.37	12.36	12.35	11.33	9.16	9.16	7.84	11.33
10.5	East	12.98	12.97	12.96	11.83	8.70	8.70	6.68	11.84
10.6	East	14.09	14.09	14.02	12.80	9.42	9.42	6.67	12.81
10.7	East	15.50	14.97	14.30	12.75	9.12	9.12	6.41	12.75
10.8	East	17.73	16.87	15.34	13.10	8.87	8.87	5.39	13.10
10.9	East	20.47	17.76	14.57	11.62	7.40	7.40	4.18	11.62

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
11	East	22.43	17.54	13.88	10.46	6.21	6.21	3.29	10.46
11.1	East	22.12	17.19	13.46	9.93	5.71	5.71	2.90	9.93
11.2	East	21.38	16.64	13.05	9.54	5.76	5.76	2.51	9.54
11.3	East	22.09	16.77	12.74	9.37	5.71	5.71	2.17	9.37
11.4	East	22.84	16.84	12.29	8.93	5.32	5.32	1.64	8.93
11.5	East	23.41	16.84	11.86	8.17	5.12	5.12	1.75	8.17
11.6	East	24.24	16.70	11.08	7.10	4.10	4.10	1.43	7.10
11.7	East	24.66	16.65	10.98	6.79	3.85	3.85	0.92	6.79
1.8	Nav Channel	2.10	2.10	2.10	2.10	2.10	2.10	2.02	2.10
1.9	Nav Channel	2.12	2.12	2.12	2.12	2.12	2.12	1.92	2.12
2	Nav Channel	2.18	2.18	2.18	2.18	2.18	2.18	1.96	2.18
2.1	Nav Channel	2.28	2.28	2.28	2.28	2.28	2.28	2.05	2.28
2.2	Nav Channel	2.37	2.37	2.37	2.37	2.37	2.37	2.15	2.37
2.3	Nav Channel	2.45	2.45	2.45	2.45	2.45	2.45	2.23	2.45
2.4	Nav Channel	2.52	2.52	2.52	2.52	2.52	2.52	2.30	2.52
2.5	Nav Channel	2.62	2.62	2.62	2.62	2.62	2.62	2.39	2.62
2.6	Nav Channel	2.73	2.73	2.73	2.73	2.73	2.73	2.50	2.73
2.7	Nav Channel	2.84	2.84	2.84	2.84	2.84	2.84	2.62	2.84
2.8	Nav Channel	2.96	2.96	2.96	2.96	2.96	2.96	2.81	2.96
2.9	Nav Channel	3.08	3.08	3.08	3.08	3.08	3.08	2.99	3.08
3	Nav Channel	3.20	3.20	3.20	3.20	3.20	3.13	2.93	3.20
3.1	Nav Channel	3.32	3.32	3.32	3.31	3.31	3.11	2.69	3.31
3.2	Nav Channel	3.43	3.43	3.43	3.42	3.42	3.11	2.44	3.42
3.3	Nav Channel	3.51	3.51	3.51	3.50	3.50	3.18	2.46	3.50
3.4	Nav Channel	3.57	3.57	3.57	3.56	3.56	3.26	2.59	3.56
3.5	Nav Channel	3.61	3.61	3.61	3.60	3.60	3.32	2.64	3.60
3.6	Nav Channel	3.61	3.61	3.61	3.61	3.61	3.34	2.64	3.61
3.7	Nav Channel	3.57	3.57	3.57	3.57	3.57	3.32	2.66	3.57
3.8	Nav Channel	3.51	3.51	3.51	3.51	3.51	3.27	2.66	3.51
3.9	Nav Channel	3.45	3.45	3.45	3.45	3.45	3.23	2.67	3.45
4	Nav Channel	3.38	3.38	3.38	3.38	3.38	3.19	2.70	3.38
4.1	Nav Channel	3.29	3.29	3.29	3.29	3.29	3.18	2.77	3.29
4.2	Nav Channel	3.18	3.18	3.18	3.18	3.18	3.13	2.89	3.18
4.3	Nav Channel	3.06	3.06	3.06	3.06	3.06	3.04	2.85	3.06
4.4	Nav Channel	2.95	2.95	2.95	2.95	2.95	2.93	2.73	2.95
4.5	Nav Channel	2.86	2.86	2.86	2.86	2.86	2.83	2.67	2.86
4.6	Nav Channel	2.79	2.79	2.73	2.69	2.79	2.63	2.49	2.79
4.7	Nav Channel	2.77	2.68	2.54	2.47	2.68	2.37	2.20	2.68
4.8	Nav Channel	2.77	2.67	2.44	2.31	2.67	2.16	1.96	2.67
4.9	Nav Channel	2.79	2.58	2.27	2.11	2.58	1.92	1.71	2.58
5	Nav Channel	2.82	2.54	2.16	1.96	2.54	1.70	1.51	2.54
5.1	Nav Channel	2.90	2.59	2.19	1.96	2.59	1.59	1.35	2.59
5.2	Nav Channel	3.06	2.57	2.11	1.86	2.57	1.45	1.19	2.57
5.3	Nav Channel	3.34	2.57	2.07	1.81	2.57	1.37	1.08	2.57
5.4	Nav Channel	3.61	2.79	2.25	1.95	2.79	1.29	0.95	2.79
5.5	Nav Channel	3.93	3.06	2.49	2.15	3.06	1.40	0.89	3.06

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
5.6	Nav Channel	4.42	3.49	2.97	2.61	3.49	1.80	1.20	3.49
5.7	Nav Channel	5.07	4.16	3.59	3.16	4.16	2.18	1.40	4.12
5.8	Nav Channel	6.09	4.94	4.40	3.97	4.94	2.87	1.97	4.88
5.9	Nav Channel	7.59	6.41	5.94	5.50	6.41	4.35	3.24	6.35
6	Nav Channel	9.85	8.44	8.02	7.60	8.44	6.29	4.76	8.37
6.1	Nav Channel	12.98	11.42	10.01	9.24	11.22	6.94	5.34	11.15
6.2	Nav Channel	16.70	15.36	12.90	11.51	14.47	7.26	5.44	14.39
6.3	Nav Channel	20.53	19.57	17.03	15.60	18.64	8.60	5.71	18.56
6.4	Nav Channel	23.87	22.91	20.34	18.90	21.95	11.45	7.30	21.87
6.5	Nav Channel	26.17	25.16	22.60	21.22	24.21	13.89	9.97	24.18
6.6	Nav Channel	27.65	26.56	24.05	22.70	25.63	15.58	11.86	25.63
6.7	Nav Channel	28.18	27.18	24.88	23.69	26.26	16.90	13.41	26.32
6.8	Nav Channel	27.84	27.10	24.95	23.86	26.20	17.42	13.80	26.28
6.9	Nav Channel	26.60	26.05	24.00	22.98	25.17	16.71	12.96	25.25
7	Nav Channel	24.42	24.18	22.23	21.27	23.34	15.05	11.43	23.42
7.1	Nav Channel	21.33	21.19	20.28	19.70	20.58	14.34	10.69	20.66
7.2	Nav Channel	17.77	17.64	17.64	17.60	17.64	14.20	10.64	17.70
7.3	Nav Channel	14.66	14.55	14.55	14.52	14.55	13.22	10.68	14.60
7.4	Nav Channel	12.24	12.15	12.15	12.12	12.15	11.34	9.85	12.20
7.5	Nav Channel	10.56	10.51	10.51	10.48	10.50	9.79	8.50	10.52
7.6	Nav Channel	9.35	9.35	9.35	9.34	9.34	8.70	7.44	9.34
7.7	Nav Channel	8.56	8.55	8.55	8.55	8.55	7.94	6.74	8.55
7.8	Nav Channel	7.94	7.94	7.94	7.93	7.94	7.34	6.34	7.94
7.9	Nav Channel	7.45	7.45	7.45	7.42	7.45	6.91	6.14	7.45
8	Nav Channel	7.09	7.09	7.09	7.05	7.09	6.74	6.20	7.09
8.1	Nav Channel	6.83	6.83	6.83	6.75	6.83	6.69	6.34	6.83
8.2	Nav Channel	6.51	6.51	6.51	6.39	6.51	6.38	6.26	6.51
8.3	Nav Channel	6.30	6.26	6.25	6.11	6.24	6.11	6.02	6.24
8.4	Nav Channel	6.21	6.07	6.06	5.92	6.05	5.88	5.76	6.05
8.5	Nav Channel	6.12	5.89	5.89	5.73	5.87	5.52	5.31	5.87
8.6	Nav Channel	6.26	6.02	5.99	5.81	6.00	5.48	5.28	6.00
8.7	Nav Channel	6.52	6.29	6.24	6.04	6.24	5.51	5.27	6.24
8.8	Nav Channel	6.83	6.59	6.53	6.32	6.53	5.49	5.14	6.53
8.9	Nav Channel	7.19	6.94	6.89	6.69	6.88	5.78	5.28	6.88
9	Nav Channel	7.63	7.38	7.32	7.14	7.31	6.19	5.65	7.31
9.1	Nav Channel	8.10	7.84	7.78	7.65	7.77	6.66	6.07	7.77
9.2	Nav Channel	8.56	8.29	8.22	8.14	8.22	7.08	6.42	8.22
9.3	Nav Channel	8.87	8.65	8.59	8.52	8.60	7.41	6.74	8.60
9.4	Nav Channel	9.12	9.02	8.96	8.89	8.97	7.79	7.01	8.97
9.5	Nav Channel	9.49	9.48	9.42	9.35	9.44	8.16	7.26	9.44
9.6	Nav Channel	9.94	9.94	9.91	9.87	9.90	8.82	7.91	9.90
9.7	Nav Channel	10.28	10.28	10.27	10.25	10.26	9.44	8.44	10.26
9.8	Nav Channel	10.46	10.46	10.46	10.46	10.46	9.61	8.34	10.46
9.9	Nav Channel	10.51	10.51	10.51	10.51	10.51	9.13	7.83	10.51
10	Nav Channel	10.50	10.50	10.50	10.50	10.50	8.97	7.41	10.50
10.1	Nav Channel	10.47	10.47	10.47	10.47	10.47	8.89	7.30	10.47

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
10.2	Nav Channel	10.55	10.55	10.55	10.55	10.55	8.91	7.29	10.55
10.3	Nav Channel	10.75	10.75	10.75	10.75	10.75	9.01	7.29	10.75
10.4	Nav Channel	11.05	11.05	11.05	11.05	11.05	9.12	6.83	11.05
10.5	Nav Channel	11.33	11.33	11.33	11.33	11.33	9.36	6.67	11.33
10.6	Nav Channel	11.66	11.66	11.66	11.66	11.66	9.57	6.69	11.66
10.7	Nav Channel	12.32	12.23	12.16	12.12	12.12	9.95	7.11	12.12
10.8	Nav Channel	13.35	12.80	12.67	12.52	12.52	10.61	8.14	12.52
10.9	Nav Channel	14.86	14.10	13.75	13.24	13.24	11.75	9.26	13.24
11	Nav Channel	16.03	15.27	14.93	14.41	14.41	12.91	10.64	14.41
11.1	Nav Channel	16.60	15.83	15.48	14.96	14.96	13.51	11.27	14.96
11.2	Nav Channel	17.10	16.26	15.89	15.33	15.33	13.88	11.54	15.33
11.3	Nav Channel	17.74	16.81	16.39	15.76	15.76	14.26	11.77	15.76
11.4	Nav Channel	18.33	17.28	16.81	16.09	16.09	14.62	12.85	16.09
11.5	Nav Channel	18.94	17.73	17.20	16.38	16.38	15.18	14.10	16.38
11.6	Nav Channel	19.48	18.07	17.45	16.49	16.49	15.09	14.01	16.49
11.7	Nav Channel	19.79	18.28	17.66	16.58	16.58	14.92	13.71	16.58
1.8	West	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
1.9	West	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
2	West	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
2.1	West	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29
2.2	West	2.25	2.25	2.25	2.25	2.25	2.25	2.24	2.25
2.3	West	2.33	2.33	2.33	2.33	2.33	2.33	2.30	2.33
2.4	West	2.50	2.50	2.50	2.50	2.50	2.50	2.38	2.50
2.5	West	2.72	2.72	2.72	2.72	2.72	2.72	2.45	2.72
2.6	West	2.95	2.95	2.95	2.95	2.95	2.95	2.59	2.95
2.7	West	3.17	3.17	3.17	3.17	3.17	3.17	2.78	3.17
2.8	West	3.38	3.38	3.38	3.38	3.38	3.38	2.84	3.38
2.9	West	3.70	3.70	3.70	3.70	3.70	3.70	3.07	3.70
3	West	4.08	4.08	4.08	4.08	4.07	4.07	3.39	4.08
3.1	West	4.55	4.55	4.55	4.55	4.55	4.55	3.84	4.55
3.2	West	5.05	5.05	5.05	5.05	5.04	5.04	4.33	5.05
3.3	West	5.62	5.62	5.62	5.62	5.61	5.61	4.83	5.62
3.4	West	6.18	6.18	6.18	6.18	6.09	6.09	5.17	6.18
3.5	West	6.96	6.96	6.96	6.94	6.72	6.72	5.73	6.94
3.6	West	7.89	7.89	7.89	7.86	7.54	7.54	6.38	7.86
3.7	West	9.19	9.19	9.19	9.16	8.69	8.69	7.15	9.16
3.8	West	10.85	10.85	10.85	10.81	10.00	10.00	7.75	10.81
3.9	West	13.69	13.69	13.69	13.64	12.55	12.55	8.25	13.64
4	West	16.72	16.72	16.72	16.65	15.43	15.43	9.02	16.65
4.1	West	20.12	20.12	20.12	20.05	18.23	18.23	9.80	20.05
4.2	West	23.87	23.87	23.87	23.79	19.88	19.88	9.93	23.79
4.3	West	25.61	25.61	25.61	25.53	21.23	21.23	10.70	25.53
4.4	West	25.70	25.70	25.70	25.61	21.41	21.41	11.08	25.61
4.5	West	25.66	25.66	25.66	25.61	21.41	21.41	10.92	25.61
4.6	West	25.49	25.49	25.49	25.44	21.26	21.26	10.71	25.44
4.7	West	25.11	25.11	25.08	24.91	20.60	20.60	10.29	24.91

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
4.8	West	24.72	24.72	24.63	24.36	20.30	20.30	10.79	24.36
4.9	West	22.85	22.82	22.49	22.15	18.00	18.00	10.82	22.15
5	West	19.90	19.81	19.22	18.77	14.38	14.38	9.53	18.77
5.1	West	16.60	16.51	15.83	15.34	11.35	11.35	7.80	15.34
5.2	West	12.00	11.90	11.17	10.64	9.25	9.25	6.59	10.64
5.3	West	9.04	8.94	8.17	7.60	6.50	6.50	4.21	7.60
5.4	West	8.49	8.38	7.63	6.96	5.58	5.58	3.16	7.10
5.5	West	8.78	8.69	7.93	7.28	5.84	5.84	3.31	7.51
5.6	West	8.84	8.59	7.82	7.16	5.35	5.35	2.66	7.44
5.7	West	8.63	7.88	7.01	6.48	4.92	4.92	2.33	6.76
5.8	West	8.28	6.92	6.13	5.72	4.28	4.28	2.08	5.99
5.9	West	8.13	6.11	5.53	5.17	3.80	3.80	1.97	5.43
6	West	8.37	5.64	5.25	4.96	3.66	3.66	1.96	5.22
6.1	West	8.91	5.65	5.29	4.96	3.52	3.52	1.91	4.97
6.2	West	9.63	6.42	6.05	5.68	3.64	3.64	1.69	5.06
6.3	West	12.09	8.45	8.03	6.39	3.17	3.17	1.40	4.52
6.4	West	59.62	12.02	8.20	6.20	2.75	2.75	1.14	3.65
6.5	West	245.44	12.88	8.02	5.08	1.66	1.66	0.44	2.21
6.6	West	260.49	14.11	8.64	4.86	1.27	1.27	0.38	1.28
6.7	West	248.62	13.74	8.25	4.56	1.18	1.18	0.35	1.18
6.8	West	261.77	13.52	8.07	4.47	1.17	1.17	0.36	1.18
6.9	West	279.09	13.69	8.21	4.55	1.20	1.20	0.38	1.20
7	West	274.08	14.13	8.59	4.73	1.36	1.36	0.38	1.36
7.1	West	228.98	14.67	10.01	6.39	3.37	3.37	1.07	3.37
7.2	West	193.17	13.80	9.90	6.75	4.23	4.23	2.14	4.23
7.3	West	166.38	11.97	8.63	6.58	4.81	4.81	2.13	4.81
7.4	West	139.89	9.83	8.41	6.64	5.23	5.23	2.17	5.23
7.5	West	42.77	9.79	8.86	7.55	5.97	5.97	2.27	6.09
7.6	West	36.56	10.03	9.46	8.63	7.03	7.03	2.33	7.51
7.7	West	36.24	11.75	11.47	10.66	8.50	8.50	2.38	9.51
7.8	West	26.62	14.44	14.20	12.98	9.26	9.26	2.39	11.83
7.9	West	17.70	16.97	16.76	13.56	9.08	9.08	2.22	12.52
8	West	19.82	19.78	19.69	14.07	9.84	9.84	3.34	13.15
8.1	West	27.91	27.76	27.75	17.08	10.56	10.56	4.20	16.45
8.2	West	37.22	37.06	37.05	19.05	10.14	10.14	3.51	18.69
8.3	West	53.86	51.11	49.57	20.71	10.10	10.10	3.65	20.61
8.4	West	78.34	54.13	52.01	21.18	9.93	9.93	3.71	21.09
8.5	West	93.34	56.92	52.07	20.67	9.44	9.44	3.76	20.67
8.6	West	105.53	63.09	52.66	19.44	8.47	8.47	3.82	19.44
8.7	West	112.25	65.42	53.07	17.96	7.19	7.19	3.97	17.96
8.8	West	113.97	67.75	54.78	18.26	8.12	8.12	5.36	18.26
8.9	West	118.75	71.09	57.73	22.87	13.02	13.02	10.00	22.87
9	West	122.80	72.23	58.04	25.47	13.84	13.84	10.58	25.47
9.1	West	120.17	64.80	49.22	22.26	12.84	12.84	10.40	22.26
9.2	West	107.14	52.85	36.65	19.05	12.74	12.74	10.33	19.05
9.3	West	95.25	42.56	25.26	18.60	13.15	13.15	10.66	18.60

Table J2.3-5f
RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
9.4	West	71.16	44.24	26.56	19.70	13.90	13.90	11.26	19.70
9.5	West	53.88	42.32	27.71	20.59	14.55	14.55	11.80	20.59
9.6	West	39.72	35.29	27.71	22.07	15.63	15.63	12.69	22.07
9.7	West	34.58	33.89	28.19	23.17	16.43	16.43	13.27	23.17
9.8	West	28.08	27.35	22.33	20.57	15.03	15.03	12.31	20.57
9.9	West	22.82	21.93	15.81	13.69	8.40	8.40	6.42	13.70
10	West	20.59	19.46	11.67	8.97	5.59	5.59	4.29	8.97
10.1	West	21.27	19.96	9.40	6.21	4.44	4.44	3.31	6.21
10.2	West	22.02	21.48	11.21	10.19	8.57	8.57	6.18	10.20
10.3	West	15.31	15.31	15.30	14.96	13.86	13.86	9.35	14.97
10.4	West	15.20	15.20	15.19	14.91	13.99	13.99	10.21	14.91
10.5	West	15.16	15.16	15.15	14.90	14.08	14.08	10.73	14.90
10.6	West	15.00	15.00	14.99	14.76	14.01	14.01	10.97	14.76
10.7	West	14.85	14.85	14.84	14.62	13.95	13.95	11.24	14.63
10.8	West	14.56	14.56	14.56	14.56	14.44	14.44	11.84	14.56
10.9	West	14.20	14.20	14.20	14.20	14.20	14.20	11.89	14.20
11	West	13.58	13.58	13.58	13.58	13.58	13.58	11.44	13.58
11.1	West	12.92	12.92	12.92	12.92	12.92	12.92	10.86	12.92
11.2	West	11.46	11.46	11.46	11.46	11.46	11.46	10.08	11.46
11.3	West	9.93	9.93	9.93	9.93	9.93	9.93	9.91	9.93
11.4	West	9.12	9.12	9.12	9.12	9.12	9.12	9.11	9.12
11.5	West	8.22	8.22	8.22	8.22	8.22	8.22	8.21	8.22
11.6	West	7.33	7.33	7.33	7.33	7.33	7.33	7.31	7.33
11.7	West	6.68	6.68	6.68	6.68	6.68	6.68	6.66	6.68
7.6	Swan Isl	10.47	0.70	0.70	0.43	0.09	0.09	0.04	0.43
7.7	Swan Isl	11.52	0.68	0.67	0.43	0.10	0.10	0.04	0.43
7.8	Swan Isl	11.47	0.78	0.71	0.44	0.12	0.12	0.04	0.44
7.9	Swan Isl	10.79	0.71	0.64	0.40	0.12	0.12	0.05	0.40
8	Swan Isl	10.32	0.66	0.60	0.38	0.13	0.13	0.06	0.38
8.1	Swan Isl	10.25	0.65	0.59	0.38	0.14	0.14	0.06	0.38
8.2	Swan Isl	10.32	0.68	0.62	0.42	0.20	0.20	0.13	0.42
8.3	Swan Isl	10.67	0.77	0.65	0.44	0.23	0.23	0.16	0.44
8.4	Swan Isl	11.15	0.86	0.64	0.44	0.24	0.24	0.17	0.44
8.5	Swan Isl	11.69	0.92	0.64	0.45	0.24	0.24	0.18	0.45
8.6	Swan Isl	12.29	1.42	0.87	0.71	0.30	0.30	0.22	0.93
8.7	Swan Isl	12.50	2.54	1.60	1.39	0.59	0.59	0.48	1.99
8.8	Swan Isl	12.74	2.83	1.76	1.59	0.68	0.68	0.57	2.30
8.9	Swan Isl	13.68	3.21	1.98	1.79	0.75	0.75	0.64	2.61
9	Swan Isl	14.82	3.67	2.25	2.04	0.84	0.84	0.71	2.99
9.1	Swan Isl	15.27	3.92	2.40	2.17	0.88	0.88	0.75	3.19
9.2	Swan Isl	16.27	4.61	2.74	2.49	0.92	0.92	0.78	3.74
9.3	Swan Isl	17.05	5.57	3.33	3.10	1.06	1.06	0.87	4.76
9.4	Swan Isl	17.69	7.54	4.76	4.47	1.44	1.44	1.16	6.97
9.5	Swan Isl	16.87	11.53	7.52	7.07	2.17	2.17	1.76	11.28
9.6	Swan Isl	15.20	15.20	11.20	10.19	3.98	3.98	3.36	15.20