Table 2-1
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Plants					
Golden indian-paintbrush *(Castilleja levisecta)*	LT	LE	1-ex	G1, SH	Very unlikely, no suitable habitat, not seen in Oregon for 40 years, not observed.
Howellia (*Howellia aquatilus*)	LT	LT	1	G3, S1	Very unlikely, no suitable habitat, not observed.
Howell's daisy *(Erigeron howellii)*	SoC	C	1	G2, S2	Very unlikely, known from higher elevations in the Gorge, potentially suitable habitat on Bradford Island in forested areas, not project site, not observed.
Oregon daisy *(Erigeron oreganus)*	SoC	C	1	G3, S3	Very unlikely, last seen in early 1900s in Bonneville Dam area, unlikely to occur, not observed.
Tall bugbane *(Cimicifuga elata)*		C	1	G3, S3	Very unlikely, not observed, no suitable habitat.
Barrett's penstemon *(Penstemon barrettiae)*	SoC	C	1	G2, S2	Very unlikely, not observed in potentially suitable habitat, and would be identifiable if it had been present.
Howell's bentgrass *(Agrostis howellii)*	SoC	C	1	G2, S2	Very unlikely, not observed, should have been identifiable if present.
Cold-water corydalis *(Corydalis aquae-gelidae)*	SoC	C	1	G5T3, S3	Very unlikely, not observed, no habitat present.
Liverwort *(Scapania gymnostomophila)*			2	G4, S1	Very unlikely, not observed, potentially suitable habitat present on side of island north of project area.
Strickland's tauschia *(Tauschia stricklandii)*			2	G4, S1	Very unlikely, no suitable habitat, not observed.
Long-bearded hawkweed *(Hieracium longiberbe)*			4	G4G5, S3	Very unlikely, not observed, potential cliff habitat not within project area.
Sicklepod rockcress *(Arabis sparsiflora* var. *atrorubens)*			2	G5T3, S2	Very unlikely, not observed, probably no suitable habitat present.
Columbia lewisia (Lewisia columbiana var. columbiana)			2	G4T4, S2	Very unlikely, not observed, rocky slope habitat present outside of project area.
Oregon bolandra (Bolandra oregana)		SC	4	G3, S3	Very unlikely, not observed, no wet cliff/talus habitat present on Bradford Island.
Invertebrates					
Pristine springsnail (Pristinicola hempilli)			3	G3, S2	Very unlikely, no suitable habitat (springs) present in project area.

Table 2-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Fish					
Sockeye salmon *(Oncorhynchus nerka)* Salmon River tributary to Snake River, Idaho ESU	LE		1-ex	G5T1Q, SXB, S1M	Any surviving fish of this extremely rare species would pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migration. No spawning or rearing.
Chum salmon *(Oncorhynchus keta)* Lower Columbia River ESU	LT	SC	1	G5T2Q, S2	Unlikely, current range restricted to below Bonneville Dam. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Lower Columbia ESU	LT	SC	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Snake River Basin ESU	LT	SV	1	G5T2T3Q, S2S3	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Middle Columbia ESU	LT	SV	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Snake River ESU	LT	LT	1	G5T1Q, S1	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Lower Columbia ESU	LT	SC	1	G5T2Q, S2	Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Coastal cutthroat trout *(Oncorhynchus clarki clarki)*	SoC	SC	1	G4T3Q, S2	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Coho salmon *(Oncorhynchus kisutch)* Lower Columbia ESU	LT	LE	1	G4T2Q, S2	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Pacific lamprey *(Lampropelta tridentata)*	SoC	SV	4	G5, S3	Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Bull Trout *(Salvelinus confluentus)*	LT				Adults and juveniles pass thorugh Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.

Table 2-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status				Probability of Occurrence
	Federal	State	ONHP List	TNC	
Amphibians					
Larch mountain salamander *(Plethodon larselli)*	SoC	SV	2	G3, S2	Very unlikely, suitable small-sized talus slope habitat not present.
Oregon spotted frog *(Rana pretiosa)*	C	SC	1	G2, S2	Very unlikely, no suitable warm, shallow marsh habitat present.
Reptiles					
Western painted turtle *(Chrysemys picta)*		SC	2	G5, S2	Very unlikely, observed in ponds near Cascade Locks, no suitable habitat in project area.
Birds					
Northern spotted owl *(Strix occidentalis caurina)*	LT	LT	1	G3T3, S3	Very unlikely to occur, only as transients passing through, area too small and disturbed to provide habitat.
Bald eagle *(Haliaeetus leucocephalus)*		LT	4	G5,S4B, S4N	Summer breeding and wintering resident of the vicinity.
Mammals					
Columbia white-tailed deer *(Odocoileus virginianus lecurus)*	PS:LE	SV	1	G5T2Q, S2	Very unlikely, no suitable habitat, current range below RM 50.
Northern (Stellar) Sea Lion *(Eumetopias jubatus)*	LT	SV	2	G3, S2	Sea lions have been observed foraging in the Bonneville pool, but they are not known to occur in the Bonneville forebay (above the dam).

State and Federal Status Definitions

LE – Listed Endangered. Taxa listed by the U.S. Fish and Wildlife Service or National Marine Fisheries Service as Endangered under the Endangered Species Act, or by the Oregon Departments of Agriculture (ODA) and Fish and Wildlife (ODFW) under the Oregon Endangered Species Act of 1987. Endangered taxa are those that are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

LT – Listed Threatened. Taxa listed by the above agencies as Threatened; defined as those taxa likely to become endangered within the foreseeable future.

PS – Partial Status. Taxa listed by the above agencies in part of its range.

C – Candidate. Candidate taxa for which National Marine Fisheries Service or U.S. Fish and Wildlife Service have sufficient information to support a proposal to list under the Endangered Species Act, or which is a candidate for listing by the ODA under the Oregon Endangered Species Act.

SoC – Species of Concern. Former Category 2 candidates for which additional information is needed to propose as threatened or endangered under the Endangered Species Act; these species are under review for consideration as Candidates for listing under the Endangered Species Act.

SC – State Critical. Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation activities are not taken. Also considered critical are some peripheral species that are at risk throughout their range, and some disjunct populations.

SV – State Vulnerable. Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.

Oregon Natural Heritage Program (ONHP) Definitions

List 1 - taxa that are threatened with extinction or presumed to be extinct (-ex) throughout their entire range.

Table 2-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

List 2 – taxa threatened with extirpation or presumed extirpated from Oregon; often peripheral or disjunct species that are of concern considering species diversity within Oregon; can be very significant in protecting the genetic diversity of the taxon; ONHP regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.

List 3 – taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

List 4 – taxa that are of conservation concern but not currently threatened or endangered, including taxa that are very rare but considered secure as well as those declining in numbers or habitat but still too common to be proposed as threatened or endangered; these taxa require continued monitoring.

The Nature Conservancy's (TNC) Natural Heritage Network Ranks

The Natural Heritage Network ranks are part of a national system of ranking species throughout the world and is used throughout the U.S., Canada, and 13 Latin American countries. Both global and state ranks are provided in ONHP (2007), abbreviated as "G" and "S", respectively.

1 – Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.

2 – Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.

3 – Rare, uncommon, or threatened, but not immediately imperiled, typically with 21-100 occurrences.

4 – Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences.

5 – Demonstrably widespread, abundant, and secure.

B – Breeding. Conservation status refers to the breeding population of the species in the nation or state/province.

H – Possibly extirpated or extinct. Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty.

M – Migrant. Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

N – Nonbreeding. Conservation status refers to the non-breeding population of the species in the nation or state/province.

T – Infraspecific Taxon (trinomial). The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. A vertebrate animal population, (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

Q – Questionable taxonomy that may reduce conservation priority. Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

X – Presumed extirpated or extinct.

Table 2-2
State and Federally Listed Anadromous Salmonid Species

Evolutionarily Significant Unit (ESU)	State Status	Federal Status	Life History Type	Federal Register (FR) Citation
Chinook Salmon (*Oncorhynchus tshawytscha*)				
Snake River	Threatened	Threatened	Ocean	57 FR 14653; April 22, 1992
Lower Columbia River		Threatened	Stream	64 FR 14308; March 24, 1999
Upper Columbia River		Endangered	Stream	64 FR 14308; March 24, 1999
Upper Willamette River		Threatened	Ocean	64 FR 14308; March 24, 1999
Chum Salmon (*Oncorhynchus keta*)				
Columbia River		Threatened	Ocean	64 FR 14508; March 25, 1999
Sockeye Salmon (*Oncorhynchus nerka*)				
Snake River		Endangered	Stream	56 FR 58619; November 20, 1991
Steelhead Trout (*Oncorhynchus mykiss*)				
Snake River Basin		Threatened	Stream	62 FR 43937; August 18, 1997
Lower Columbia River		Threatened	Stream	63 FR 13347; March 19, 1998
Middle Columbia River		Threatened	Stream	64 FR 14517; March 25, 1999
Upper Columbia River		Endangered	Stream	62 FR 43937; August 18, 1997
Upper Willamette River		Threatened	Stream	64 FR 14517; March 25, 1999
Coho Salmon *(Oncorhynchus kisutch)*				
Lower Columbia River	Endangered	Threatened	Stream	60 FR 38011; July 25, 1995

Table 2-3
Designated Beneficial Uses – Mainstem Columbia River

Beneficial Uses	Columbia River Mouth to RM 86	Columbia River RM 86 to 309
Public Domestic Water Supply[1]	X	X
Private Domestic Water Supply[1]	X	X
Industrial Water Supply	X	X
Irrigation	X	X
Livestock Watering	X	X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	X

Source: OAR 340-41-0101, November 2003

[1] With adequate pretreatment and natural quality that meets drinking water standards.

[2] See also Table 3-3 for fish use designations for this river.

Table 2-4
Beneficial Use Designations – Fish Uses, Mainstem Columbia River

Geographic Extent of Use	Salmon and Steelhead Migration Corridors (20°C)	Salmon and Steelhead Spawning through Fry Emergence	Shad and Sturgeon Spawning and Rearing
Mainstem Columbia River			
Beacon Rock to Upstream of Ives Island (RM 141.5 to RM 143.5)		October 15 – March 31	
Columbia River, mouth to Washington border (RM309)	X		
Columbia River (RM 147 to RM 203)			X

Source: OAR 340-41-0101, November 2003
RM = River mile

Table 3-1
Hazard Quotients for Benthic Community – Direct Toxicity via Exposure to Sediment

CPEC	EPC in Sediment (mg/kg dw)[a]	Benchmarks[b]		Hazard Quotients	
		Sediment NOAEC (mg/kg dw)	Sediment LOAEC (mg/kg dw)	Sediment NOAEC HQ	Sediment LOAEC HQ
Inorganics					
Arsenic	32	6.0	33	**5.3E+00**	9.7E-01
Cadmium[d]	4.1	0.67	5.0	**6.1E+00**	8.2E-01
Chromium	620	37	111	**1.7E+01**	**5.6E+00**
Cobalt[c]	23	NA	NA	No SLV	No SLV
Copper[d]	284	56	149	**5.1E+00**	**1.9E+00**
Lead	121	35	128	**3.5E+00**	9.5E-01
Mercury[d]	0.54	0.21	1.1	**2.5E+00**	5.1E-01
Nickel[d]	520	21	48.6	**2.5E+01**	**1.1E+01**
Thallium[c]	0.60	NA	NA	No SLV	No SLV
Vanadium[c]	90	NA	NA	No SLV	No SLV
Zinc	226	123	459	**1.8E+00**	4.9E-01
Total Metals HI	--	--	--	**6.6E+01**	**2.2E+01**
PCBs as Aroclors					
Total PCBs as Aroclors	22	0.034	0.676	**6.5E+02**	**3.3E+01**
PCBs as Congeners					
Total PCBs as Congeners	4.3	0.034	0.676	**1.3E+02**	**6.4E+00**
Butyltins					
Dibutyltin dichloride	0.0046	3.0	15	1.5E-03	3.1E-04
Tributyltin chloride	0.013	3.0	15	4.3E-03	8.7E-04
Pesticides					
4,4'-DDT	0.14	0.0040	0.063	**3.5E+01**	**2.2E+00**
Chlordane (gamma)	0.044	0.0045	0.018	**9.8E+00**	**2.5E+00**
Endrin	0.0074	0.0030	0.207	**2.5E+00**	3.6E-02
Endrin Aldehyde	0.0082	0.0030	0.207	**2.7E+00**	4.0E-02
Total Pesticides HI	--	--	--	**5.0E+01**	**4.8E+00**
PAHs					
Benzo(a)anthracene	0.89	0.032	1.05	**2.8E+01**	8.5E-01
Benzo(a)pyrene	1.3	0.032	1.45	**4.1E+01**	9.0E-01
Benzo(b)fluoranthene	0.75	0.027	0.14	**2.8E+01**	**5.6E+00**
Benzo(g,h,i)perylene	0.87	0.30	1.5	**2.9E+00**	5.8E-01
Benzo(k)fluoranthene	0.72	0.027	0.14	**2.6E+01**	**5.3E+00**
Chrysene	1.2	0.057	1.29	**2.1E+01**	9.3E-01
Dibenz(a,h)anthracene	0.32	0.033	0.17	**9.7E+00**	**1.9E+00**
Fluoranthene	1.7	0.11	2.23	**1.5E+01**	7.6E-01
Indeno(1,2,3-cd)pyrene	0.96	0.017	0.085	**5.6E+01**	**1.1E+01**
Pyrene	2.0	0.053	1.52	**3.8E+01**	**1.3E+00**
Total HPAHs	8.2	0.19	0.97	**4.2E+01**	**8.5E+00**
Acenaphthene	0.053	0.29	1.5	1.8E-01	3.7E-02
Anthracene	0.14	0.057	0.85	**2.5E+00**	1.7E-01
Fluorene	0.029	0.077	0.54	3.8E-01	5.4E-02
Phenanthrene	0.51	0.042	1.17	**1.2E+01**	4.4E-01
Total LPAHs	0.69	0.076	0.38	**9.1E+00**	**1.8E+00**
SVOCs					
Benzoic Acid	0.30	NA	NA	No SLV	No SLV
Benzyl Alcohol	0.022	NA	NA	No SLV	No SLV
Bis(2-ethylhexyl) Phthalate	3.8	0.75	3.8	**5.1E+00**	**1.0E+00**
p-Cresol (4-methylphenol)	0.18	0.048	0.24	**3.8E+00**	7.5E-01

Table 3-1
Hazard Quotients for Benthic Community – Direct Toxicity via Exposure to Sediment

Notes:
a) The sediment EPCs are the maximum detected concentrations.
b) Selected benthic NOAEC/LOAEC values and sources can be found in the Baseline ERA.
c) Those chemicals that do not have established SLVs will be evaluated qualitatively.
d) The background sediment concentration (95% UPL) is higher than the risk-based SLV and replaced the NOAEC in this table.
Bold indicates hazard quotient greater than 1.0.

-- = not applicable
CPEC = chemical of potential ecological concern
dw = dry weight
EPC = exposure point concentration
HI = (cumulative) hazard index
HPAH = high molecular weight polycyclic aromatic hydrocarbons
HQ = hazard quotient
LOAEC = lowest observed adverse effect concentration
LPAH = low molecular weight polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
NA = not available
NOAEC = no observed adverse effect concentration
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
UCL = upper confidence limit
UPL = upper prediction limit

Table 3-2
Hazard Quotients for Clam Tissue – Dietary Exposure

CPEC	EPC in Clam Tissue (mg/kg ww)[a]	Benchmarks[b]		Hazard Quotients	
		Shellfish NOAEC (mg/kg ww)	Shellfish LOAEC (mg/kg ww)	Clam NOAEC HQ	Clam LOAEC HQ
Inorganics					
Aluminum[d]	262	69	218	**3.8E+00**	**1.2E+00**
Barium[d]	3.2	2.4	NA	**1.3E+00**	N/A
Beryllium	0.0072	0.53	2.7	1.4E-02	2.7E-03
Cadmium[d]	0.46	0.41	0.75	**1.1E+00**	6.1E-01
Chromium	1.2	15	74	8.1E-02	1.6E-02
Lead	0.18	0.12	0.60	**1.5E+00**	3.1E-01
Thallium	0.019	400	2,000	4.8E-05	9.7E-06
Vanadium[c]	0.61	NA	NA	No SLV	No SLV
Zinc	28	120	600	2.4E-01	4.7E-02
Total Metals HI	--	--	--	**8.1E+00**	**2.2E+00**
PCBs as Aroclors					
Total PCBs as Aroclors	1.2	0.43	2.2	**2.8E+00**	5.6E-01
PCBs as Aroclors					
Total PCBs as Congeners	2.0	0.43	2.2	**4.7E+00**	9.4E-01
Pesticides					
4,4'-DDD	0.0027	0.054	0.27	5.0E-02	1.0E-02
4,4'-DDE	0.010	0.054	0.27	1.9E-01	3.7E-02
4,4'-DDT	0.11	0.054	0.27	**2.0E+00**	4.1E-01
BHC (alpha)	0.00081	0.82	4.1	9.9E-04	2.0E-04
BHC (beta)	0.0015	0.82	4.1	1.8E-03	3.7E-04
BHC (delta)	0.00061	0.82	4.1	7.5E-04	1.5E-04
BHC (gamma) Lindane	0.00036	0.030	0.15	1.2E-02	2.4E-03
Chlordane (gamma)	0.018	0.0600	0.300	3.0E-01	6.0E-02
Endosulfan I	0.0027	0.0087	0.044	3.1E-01	6.2E-02
Endrin	0.0041	0.27	1.3	1.5E-02	3.0E-03
Endrin Aldehyde	0.0029	0.27	1.3	1.1E-02	2.2E-03
Total DDx HI	--	--	--	**2.3E+00**	4.5E-01
Total Pesticides HI	--	--	--	**2.9E+00**	5.8E-01
SVOCs					
Dibenzofuran[e]	0.0011	5.6	28	1.9E-04	3.8E-05
p-Cresol (4-methylphenol)	0.031	0.12	0.58	2.7E-01	5.4E-02

Notes:
a) The tissue EPCs are the maximum detected concentrations, with exception of dibenzofuran.
b) Selected fish/shellfish NOAEC/LOAEC values and sources can be found in the Baseline ERA.
c) Those chemicals that do not have established CTLs will be evaluated qualitatively.
d) The background tissue concentration (95% UPL) is higher than the risk-based CTL and replaced the NOAEC in this table. If UPL also higher than LOAEC, then LOAEC changed to 'NA.'
e) Not analyzed in tissue; therefore, the tissue is estimated.
Bold indicates hazard quotient greater than 1.0.

-- = not applicable
CPEC = chemical of potential ecological concern
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
LOAEC = lowest observed adverse effect concentration
mg/kg = milligrams per kilogram
NA = not available or not applicable
NOAEC = no observed adverse effect concentration
PCB = polychlorinated biphenyl
SLV = screening level value
TEQ = toxicity equivalence
UCL = upper confidence limit
UPL = upper prediction limit
ww = wet weight

Table 3-3
Hazard Quotients for Crayfish Tissue – Dietary Exposure

CPEC	EPC in Crayfish Tissue (mg/kg ww)[a]	Benchmarks[b]		Hazard Quotients	
		Shellfish NOAEC (mg/kg ww)	Shellfish LOAEC (mg/kg ww)	Crayfish NOAEC HQ	Crayfish LOAEC HQ
Inorganics					
Lead[c]	2.7	1.1	NA	**2.3E+00**	N/A
Zinc	23	120	600	1.9E-01	3.9E-02
Total Metals HI	--	--	--	**2.5E+00**	3.9E-02
SVOCs					
Dibenzofuran[d]	0.0017	5.6	28	3.1E-04	6.1E-05

Notes:
a) The tissue EPCs are the maximum detected concentrations, with exception of dibenzofuran.
b) Selected benthic NOAEC/LOAEC values and sources can be found in the Baseline ERA.
c) The background tissue concentration (95% UPL) is higher than the risk-based CTL and replaced the NOAEC in this table. If UPL also higher than LOAEC, then LOAEC changed to 'NA.'
d) Not analyzed in tissue; therefore, the tissue is estimated.
Bold indicates hazard quotient greater than 1.0.

-- = not applicable
CPEC = chemical of potential ecological concern
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
LOAEC = lowest observed adverse effect concentration
mg/kg = milligrams per kilogram
NA = not available or not applicable
NOAEC = no observed adverse effect concentration
PCB = polychlorinated biphenyl
TRV = toxicity reference value
UCL = upper confidence limit
UPL = upper prediction limit
ww = wet weight

Table 3-4
Hazard Quotients for Sculpin Tissue – Dietary Exposure

CPEC	EPC in Sculpin Tissue[a] (mg/kg ww)	Benchmarks[b]		Hazard Quotients	
		Fish NOAEC (mg/kg ww)	Fish LOAEC (mg/kg ww)	Sculpin NOAEC HQ	Sculpin LOAEC HQ
EU-02					
Inorganics					
Cadmium	0.018	0.15	0.75	1.2E-01	2.4E-02
Lead	0.075	0.12	0.60	6.3E-01	1.3E-01
Mercury[c]	0.24	0.13	0.44	**1.8E+00**	5.5E-01
Total Metals HI	--	--	--	**2.5E+00**	6.9E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000086	0.0000064	0.000032	1.4E-02	2.7E-03
Total PCBs as Congeners	0.049	0.43	2.2	1.1E-01	2.3E-02
SVOCs					
Dibenzofuran[d]	0.0017	5.6	28	3.1E-04	6.1E-05
EU-04					
Inorganics					
Cadmium	0.045	0.15	0.75	3.0E-01	6.0E-02
Lead	0.31	0.12	0.60	**2.6E+00**	5.1E-01
Mercury[c]	0.31	0.13	0.44	**2.3E+00**	7.0E-01
Total Metals HI	--	--	--	**5.2E+00**	**1.3E+00**
PCBs as Aroclors					
Total PCBs as Aroclors	1.7	0.43	2.2	**4.0E+00**	7.9E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.0000082	0.0000064	0.000032	**1.3E+00**	2.6E-01
Total PCBs as Congeners	4.8	0.43	2.2	**1.1E+01**	**2.2E+00**
EU-05					
Inorganics					
Cadmium	0.033	0.15	0.75	2.2E-01	4.3E-02
Lead	0.032	0.12	0.60	2.6E-01	5.3E-02
Mercury[c]	0.22	0.13	0.44	**1.6E+00**	5.0E-01
Total Metals HI	--	--	--	**2.1E+00**	6.0E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000061	0.0000064	0.000032	9.6E-03	1.9E-03
Total PCBs as Congeners	0.035	0.43	2.2	8.2E-02	1.6E-02
EU-06					
Inorganics					
Cadmium	0.021	0.15	0.75	1.4E-01	2.9E-02
Lead	0.092	0.12	0.60	7.7E-01	1.5E-01
Mercury[c]	0.30	0.13	0.44	**2.2E+00**	6.8E-01
Total Metals HI	--	--	--	**3.1E+00**	8.6E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000091	0.0000064	0.000032	1.4E-02	2.9E-03
Total PCBs as Congeners	0.036	0.43	2.2	8.3E-02	1.7E-02
EU-07					
Inorganics					
Cadmium	0.027	0.15	0.75	1.8E-01	3.6E-02
Lead	0.038	0.12	0.60	3.2E-01	6.4E-02
Mercury[c]	0.11	0.13	0.44	8.2E-01	2.5E-01
Total Metals HI	--	--	--	**1.3E+00**	3.5E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000069	0.0000064	0.000032	1.1E-02	2.2E-03
Total PCBs as Congeners	0.041	0.43	2.2	9.5E-02	1.9E-02

Table 3-4
Hazard Quotients for Sculpin Tissue – Dietary Exposure

CPEC	EPC in Sculpin Tissue[a] (mg/kg ww)	Benchmarks[b]		Hazard Quotients	
		Fish NOAEC (mg/kg ww)	Fish LOAEC (mg/kg ww)	Sculpin NOAEC HQ	Sculpin LOAEC HQ
EU-10					
Inorganics					
Cadmium	0.019	0.15	0.75	1.3E-01	2.6E-02
Lead	0.081	0.12	0.60	6.8E-01	1.4E-01
Mercury[c]	0.19	0.13	0.44	**1.4E+00**	4.3E-01
Total Metals HI	--	--	--	**2.2E+00**	5.9E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000056	0.0000064	0.000032	8.7E-03	1.7E-03
Total PCBs as Congeners	0.026	0.43	2.2	6.1E-02	1.2E-02
EU-11					
Inorganics					
Cadmium	0.017	0.15	0.75	1.1E-01	2.2E-02
Lead	0.083	0.12	0.60	6.9E-01	1.4E-01
Mercury[c]	0.16	0.13	0.44	**1.2E+00**	3.7E-01
Total Metals HI	--	--	--	**2.0E+00**	5.3E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.00000020	0.0000064	0.000032	3.2E-02	6.4E-03
Total PCBs as Congeners	0.141	0.43	2.2	3.3E-01	6.6E-02
EU-12					
Inorganics					
Cadmium	0.012	0.15	0.75	8.1E-02	1.6E-02
Lead	0.033	0.12	0.60	2.8E-01	5.6E-02
Mercury[c]	0.21	0.13	0.44	**1.6E+00**	4.8E-01
Total Metals HI	--	--	--	**1.9E+00**	5.5E-01
PCBs as Congeners					
PCBs as Fish TEQ	0.000000050	0.0000064	0.000032	7.8E-03	1.6E-03
Total PCBs as Congeners	0.024	0.43	2.2	5.6E-02	1.1E-02

Notes:
a) The tissue EPCs can be found in the Baseline ERA, with exception of dibenzofuran.
b) Selected fish/shellfish NOAEC/LOAEC values can be found in the Baseilne ERA.

c) The background tissue concentration (95% UPL) is higher than the risk-based CTL and replaced the NOAEC in this table
d) Not analyzed in tissue; therefore, the tissue is estimated.
Bold indicates hazard quotient greater than 1.0.

-- = not applicable
CPEC = chemical of potential ecological concern
EPC = exposure point concentration
EU = exposure unit
HI = (cumulative) hazard index
HQ = hazard quotient
LOAEC = lowest observed adverse effect concentration
mg/kg = milligrams per kilogram
NOAEC = no observed adverse effect concentration
PCB = polychlorinated biphenyl
TEQ = toxicity equivalence
TRV = toxicity reference value
UCL = upper confidence limit
UPL = upper prediction limit
ww = wet weight

Table 3-5
Hazard Quotients for Smallmouth Bass Tissue – Dietary Exposure

CPEC	EPC in Smallmouth Bass Tissue[a] (mg/kg ww)	Benchmarks[b]		Hazard Quotients	
		Fish NOEAC (mg/kg ww)	Fish LOAEC (mg/kg ww)	Smallmouth Bass NOAEC HQ	Smallmouth Bass LOAEC HQ
Inorganics					
Aluminum	5.4	44	218	1.2E-01	2.5E-02
Antimony	0.010	160	800	6.5E-05	1.3E-05
Barium[c]	2.6	3.1	N/A	8.5E-01	N/A
Chromium	0.19	15	74	1.3E-02	2.6E-03
Copper	0.93	1.8	9.0	5.2E-01	1.0E-01
Mercury[c]	0.25	0.36	0.44	6.9E-01	5.6E-01
Zinc	14	120	600	1.2E-01	2.4E-02
Total Metals HI	--	--	--	**2.3E+00**	7.1E-01
PCBs as Aroclors					
Total PCBs as Aroclors	25	0.43	2.2	**5.8E+01**	**1.2E+01**
PCBs as Congeners					
PCBs as Fish TEQ	0.000055	0.0000064	0.000032	**8.6E+00**	**1.7E+00**
Total PCBs as Congeners	47	0.43	2.2	**1.1E+02**	**2.2E+01**
Pesticides					
4,4'-DDD	0.0045	0.054	0.27	8.4E-02	1.7E-02
4,4'-DDE	0.039	0.054	0.27	7.2E-01	1.4E-01
4,4'-DDT	0.0052	0.054	0.27	9.6E-02	1.9E-02
BHC (beta)	0.00079	0.82	4.1	9.6E-04	1.9E-04
BHC (gamma) Lindane	0.00067	0.030	0.15	2.2E-02	4.5E-03
Chlordane (alpha)	0.00030	0.060	0.30	5.0E-03	1.0E-03
Chlordane (gamma)	3.2	0.060	0.30	**5.3E+01**	**1.1E+01**
Dieldrin	0.55	0.26	1.3	**2.1E+00**	4.2E-01
Endosulfan I	0.054	0.0087	0.044	**6.2E+00**	**1.2E+00**
Endrin	0.83	0.27	1.3	**3.1E+00**	6.1E-01
Endrin Aldehyde	0.26	0.27	1.3	9.7E-01	1.9E-01
Methoxychlor	0.00061	0.0095	0.047	6.5E-02	1.3E-02
Total DDx HI	--	--	--	9.0E-01	1.8E-01
Total Pesticides HI	--	--	--	**6.7E+01**	**1.3E+01**
SVOCs					
Butyl benzyl phthalate	0.12	0.31	1.5	3.8E-01	7.7E-02
Dibenzofuran[d]	0.0012	5.6	28	2.2E-04	4.4E-05
p-Cresol (4-methylphenol)	0.037	0.12	0.58	3.2E-01	6.4E-02

Notes:
a) The tissue EPCs can be found in the Baseline ERA, with exception of dibenzofuran.
b) Sources listed on Table 3-7.
c) The background tissue concentration (95% UPL) is higher than the risk-based CTL and replaced the NOAEC in this table.
d) Not analyzed in tissue; therefore, the tissue is estimated.
Bold indicates hazard quotient greater than 1.0.

-- = not applicable
CPEC = chemical of potential ecological concern
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
LOAEC = lowest observed adverse effect concentration
mg/kg = milligrams per kilogram
NOAEC = no observed adverse effect concentration
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TEQ = toxicity equivalence
TRV = toxicity reference value
UCL = upper confidence limit
UPL = upper prediction limit
ww = wet weight

Table 3-6
Calculation of Dose and Hazard Quotient for the Osprey

CPEC	EPCs		Exposure Factors					Dose	TRVs[e]		Hazard Quotients	
	Smallmouth Bass Tissue (mg/kg ww)[a]	Concen-tration in Water (mg/L)[b]	Food Ingestion Rate (kg/day ww)	Water Ingestion Rate (L/day)	PF Bass	AUF	BW (kg)	(mg/kg-bw/day)	NOAEL TRV (mg/kg-bw/day)	LOAEL TRV (mg/kg-bw/day)	NOAEL HQ	LOAEL HQ
Inorganics												
Aluminum	5.4	1.4E-01	0.37	0.090	1	0.71	1.88	0.8	157	785	4.8E-03	9.6E-04
Antimony[c]	0.010	5.0E-02	0.37	0.090	1	0.71	1.88	0.0031	No TRV	No TRV	No TRV	No TRV
Barium	2.6	2.7E-02	0.37	0.090	1	0.71	1.88	0.37	21	42	1.8E-02	8.8E-03
Chromium	0.19	2.0E-03	0.37	0.090	1	0.71	1.88	0.027	2.7	16	1.0E-02	1.7E-03
Copper	0.93	7.9E-04	0.37	0.090	1	0.71	1.88	0.13	4.1	12	3.2E-02	1.1E-02
Mercury	0.25	3.0E-05	0.37	0.090	1	0.71	1.88	0.034	0.013	0.026	**2.6E+00**	**1.3E+00**
Zinc	14	7.0E-03	0.37	0.090	1	0.71	1.88	2.0	66	171	3.0E-02	1.2E-02
PCBs as Aroclors												
Total PCBs as Aroclors	25	3.3E-03	0.37	0.090	1	0.71	1.88	3.5	0.20	0.60	**1.7E+01**	**5.8E+00**
PCBs as Congeners												
PCBs as Bird TEQ	0.00096	6.8E-12	0.37	0.090	1	0.71	1.88	0.00013	1.4E-06	7.0E-06	**9.6E+01**	**1.9E+01**
Total PCBs as Congeners	47	2.1E-07	0.37	0.090	1	0.71	1.88	6.58964	2.0E-01	6.0E-01	**3.3E+01**	**1.1E+01**
Pesticides												
4,4'-DDD	0.0045	1.5E-07	0.37	0.090	1	0.71	1.88	0.00063	0.032	0.32	2.0E-02	2.0E-03
4,4'-DDE	0.039	3.7E-07	0.37	0.090	1	0.71	1.88	0.0055	0.032	0.32	1.7E-01	1.7E-02
4,4'-DDT	0.0052	1.6E-05	0.37	0.090	1	0.71	1.88	0.0007	0.0090	0.027	8.1E-02	2.7E-02
BHC (beta)	0.00079	1.2E-03	0.37	0.090	1	0.71	1.88	0.00015	2.0	20	7.6E-05	7.6E-06
BHC (gamma) Lindane	0.00067	3.2E-06	0.37	0.090	1	0.71	1.88	0.00009	2.0	20	4.7E-05	4.7E-06
Chlordane (alpha)	0.00030	1.3E-03	0.37	0.090	1	0.71	1.88	0.00009	2.0	20	4.3E-05	4.3E-06
Chlordane (gamma)	3.2	1.2E-05	0.37	0.090	1	0.71	1.88	0.45	0.21	1.1	**2.1E+00**	4.2E-01
Dieldrin	0.55	3.4E-02	0.37	0.090	1	0.71	1.88	0.08	0.0077	0.039	**1.0E+01**	**2.0E+00**
Endosulfan I	0.054	4.6E-04	0.37	0.090	1	0.71	1.88	0.008	10	50	7.6E-04	1.5E-04
Endrin	0.83	8.8E-06	0.37	0.090	1	0.71	1.88	0.12	0.010	0.10	**1.2E+01**	**1.2E+00**
Endrin Aldehyde	0.26	6.7E-05	0.37	0.090	1	0.71	1.88	0.036	0.010	0.10	**3.6E+00**	3.6E-01
Methoxychlor	0.00061	8.4E-04	0.37	0.090	1	0.71	1.88	0.00011	20	100	5.7E-06	1.1E-06
SVOCs												
Dibenzofuran[d]	0.0012	1.4E-04	0.37	0.090	1	0.71	1.88	0.000179	1.0	5.1	1.8E-04	3.5E-05
p-Cresol (4-methylphenol)	0.037	5.6E-03	0.37	0.090	1	0.71	1.88	0.0053	0.96	4.8	5.6E-03	1.1E-03

Metals HI	**2.7E+00**	**1.4E+00**
DDx HI	2.7E-01	4.6E-02
Pesticides HI	**2.8E+01**	**4.0E+00**

Notes:
a) The tissue EPCs can be found in the Baseline ERA, with exception of dibenzofuran.
b) Maximum detected concentrations in River OU surface water were used if available, otherwise concentrations were estimated.
c) Antimony does not have TRVs, but will be evaluated qualitatively.
d) Not analyzed in tissue; therefore, the tissue is estimated.
e) Selected TRVs and sources can be found in the Baseline ERA.
Bold indicates hazard quotient greater than 1.0.

Table 3-6
Calculation of Dose and Hazard Quotient for the Osprey

AUF = Area Use Factor
BW = body weight
CPEC = chemical of potential ecological concern
Dose = average daily dose (mg/kg-bw/day)
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
kg = kilogram
kg/day = kilograms per day
L/day = liters per day
LOAEL = lowest observed adverse effect level
mg/kg = milligrams per kilogram
mg/kg-bw/day = milligrams per kilogram body weight per day
mg/L = milligrams per liter
NOAEL = no observed adverse effect level
PCB = polychlorinated biphenyl
PF = portion of food item
SVOC = semivolatile organic compound
TEQ = toxicity equivalence
TRV = toxicity reference value
UCL = upper confidence limit
ww = wet weight

Table 3-7
Calculation of Hazard Quotient for the Osprey/Eagle Eggs

CPEC	Estimated Concentrations[a]		TRVs[b]		Hazard Quotients			
	Estimated Osprey C_{egg} (mg/kg ww)	Estimated Eagle C_{egg} (mg/kg ww)	Bird-egg NOAEL TRV (mg/kg ww)	Bird-egg LOAEL TRV (mg/kg ww)	Osprey Egg NOAEL HQ	Osprey Egg LOAEL HQ	Eagle Egg NOAEL HQ	Eagle Egg LOAEL HQ
Mercury	0.69	0.69	0.50	2.5	**1.4**	0.28	**1.4**	0.28
Total PCBs as Aroclors	273	2804	4.0	20	**68**	**14**	**701**	**140**
Total PCBs as Congeners	519	5328	4.0	20	**130**	**26**	**1,332**	**266**
PCBs as Bird TEQ	0.0096	0.015	0.00030	0.00040	**32**	**24**	**51**	**38**
Sum DDx	4.2	3.7	1.0	4.2	**4.2**	**1.0**	**3.7**	0.9

Notes:
a) Egg concentrations were estimated.
b) Selected TRVs and sources can be found in the Baseline ERA.
Bold indicates hazard quotient greater than 1.0.

C_{egg} = concentration in egg
CPEC = chemical of potential ecological concern
HQ = hazard quotient
LOAEL = lowest observed adverse effect level
mg/kg = milligrams per kilogram
NOAEL = no observed adverse effect level
PCB = polychlorinated biphenyl
TEQ = toxicity equivalence
TRV = toxicity reference value
ww = wet weight

Table 3-8
Calculation of Dose and Hazard Quotient for the Bald Eagle

CPEC	EPCs		Exposure Factors					Dose	TRVs[e]		Hazard Quotients	
	Smallmouth Bass Tissue (mg/kg ww)[a]	Concen-tration in Water (mg/L)[b]	Food Ingestion Rate (kg/day ww)	Water Ingestion Rate (L/day)	PF Bass	AUF	BW (kg)	(mg/kg-bw/day)	NOAEL TRV (mg/kg-bw/day)	LOAEL TRV (mg/kg-bw/day)	NOAEL HQ	LOAEL HQ
Inorganics												
Aluminum	5.4	1.4E-01	0.68	0.16	1	0.86	4.50	0.70	157	785	4.4E-03	8.9E-04
Antimony[c]	0.010	5.0E-02	0.68	0.16	1	0.86	4.50	0.0029	No TRV	No TRV	No TRV	No TRV
Barium	2.6	2.7E-02	0.68	0.16	1	0.86	4.50	0.34	21	42	1.6E-02	8.2E-03
Chromium	0.19	2.0E-03	0.68	0.16	1	0.86	4.50	0.025	2.7	16	9.4E-03	1.6E-03
Copper	0.93	7.9E-04	0.68	0.16	1	0.86	4.50	0.12	4.1	12	3.0E-02	1.0E-02
Mercury	0.25	3.0E-05	0.68	0.16	1	0.86	4.50	0.032	0.013	0.026	**2.4E+00**	**1.2E+00**
Zinc	14	7.0E-03	0.68	0.16	1	0.86	4.50	1.8	66	171	2.8E-02	1.1E-02
PCBs as Aroclors												
Total PCBs as Aroclors	25	3.3E-03	0.68	0.16	1	0.86	4.50	3.2	0.20	0.60	**1.6E+01**	**5.4E+00**
PCBs as Congeners												
PCBs as Bird TEQ	0.00096	6.8E-12	0.68	0.16	1	0.86	4.50	0.00012	1.4E-06	7.0E-06	**8.9E+01**	**1.8E+01**
Total PCBs as Congeners	47	2.1E-07	0.68	0.16	1	0.86	4.50	6.09953	2.0E-01	6.0E-01	**3.0E+01**	**1.0E+01**
Pesticides												
4,4'-DDD	0.0045	1.5E-07	0.68	0.16	1	0.86	4.50	0.00059	0.032	0.32	1.8E-02	1.8E-03
4,4'-DDE	0.039	3.7E-07	0.68	0.16	1	0.86	4.50	0.0051	0.032	0.32	1.6E-01	1.6E-02
4,4'-DDT	0.0052	1.6E-05	0.68	0.16	1	0.86	4.50	0.00067	0.0090	0.027	7.5E-02	2.5E-02
BHC (beta)	0.00079	1.2E-03	0.68	0.16	1	0.86	4.50	0.00014	2.0	20	7.0E-05	7.0E-06
BHC (gamma) Lindane	0.00067	3.2E-06	0.68	0.16	1	0.86	4.50	0.00009	2.0	20	4.3E-05	4.3E-06
Chlordane (alpha)	0.00030	1.3E-03	0.68	0.16	1	0.86	4.50	0.000079	0.2	1	3.7E-04	7.4E-05
Chlordane (gamma)	3.2	1.2E-05	0.68	0.16	1	0.86	4.50	0.41	0.21	1.1	**1.9E+00**	3.9E-01
Dieldrin	0.55	3.4E-02	0.68	0.16	1	0.86	4.50	0.072	0.0077	0.039	**9.4E+00**	**1.8E+00**
Endosulfan I	0.054	4.6E-04	0.68	0.16	1	0.86	4.50	0.0071	10	50	7.1E-04	1.4E-04
Endrin	0.83	8.8E-06	0.68	0.16	1	0.86	4.50	0.11	0.010	0.10	**1.1E+01**	**1.1E+00**
Endrin Aldehyde	0.26	6.7E-05	0.68	0.16	1	0.86	4.50	0.034	0.010	0.10	**3.4E+00**	3.4E-01
Methoxychlor	0.00061	8.4E-04	0.68	0.16	1	0.86	4.50	0.00011	20	100	5.3E-06	1.1E-06
SVOCs												
Dibenzofuran[d]	0.0012	1.4E-04	0.68	0.16	1	0.86	4.50	0.000166	1.0	5.1	1.6E-04	3.2E-05
p-Cresol (4-methylphenol)	0.037	5.6E-03	0.68	0.16	1	0.86	4.50	0.0049	0.96	4.8	5.1E-03	1.0E-03

Metals HI	**2.5E+00**	**1.3E+00**
DDx HI	2.5E-01	4.3E-02
Pesticides HI	**2.6E+01**	**3.7E+00**

Notes:

a) The tissue EPCs can be found in the Baseline ERA, with exception of dibenzofuran.

b) Maximum detected concentrations in River OU surface water were used if available, otherwise concentrations were estimated.

c) Antimony does not have TRVs, but will be evaluated qualitatively.

d) Not analyzed in tissue; therefore, the tissue concentration is estimated.

e) Selected TRVs and sources can be found in the Baseline ERA.

Bold indicates hazard quotient greater than 1.0.

Table 3-8
Calculation of Dose and Hazard Quotient for the Bald Eagle

AUF = Area Use Factor
BW = body weight
CPEC = chemical of potential ecological concern
Dose = average daily dose (mg/kg-bw/day)
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
kg = kilogram
kg/day = kilograms per day
L/day = liters per day
LOAEL = lowest observed adverse effect level
mg/kg = milligrams per kilogram
mg/kg-bw/day = milligrams per kilogram body weight per day
mg/L = milligrams per liter
NOAEL = no observed adverse effect level
PCB = polychlorinated biphenyl
PF = portion of food item
SVOC = semivolatile organic compound
TEQ = toxicity equivalence
TRV = toxicity reference value
UCL = upper confidence limit
ww = wet weight

Table 3-9
Calculation of Dose and Hazard Quotient for the American Mink

CPEC	EPCs[c]					Exposure Factors								Dose	TRVs[e]		Hazard Quotients	
	Crayfish Tissue (mg/kg ww)[a]	Sculpin Tissue (mg/kg ww)[a]	Smallmouth Bass Tissue (mg/kg ww)[a]	Concen-tration in Sediment (mg/kg dw)[b]	Concen-tration in Water (mg/L)[c]	Food Ingestion Rate (kg/day ww)	Sediment Incidental Ingestion Rate (kg/day dw)	Water Ingestion Rate (L/day)	PF Crayfish	PF Sculpin	PF Bass	AUF	BW (kg)	(mg/kg-bw/day)	NOAEL TRV (mg/kg-bw/day)	LOAEL TRV (mg/kg-bw/day)	NOAEL HQ	LOAEL HQ
Inorganics																		
Aluminum[f]	116	--	5.4	15,767	1.4E-01	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	167	34	76	**4.8E+00**	**2.2E+00**
Antimony[f]	0.042	--	0.010	0.32	5.0E-02	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	0.009	0.059	0.59	1.6E-01	1.6E-02
Barium[f]	69	--	2.6	138	2.7E-02	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	5.3	52	83	1.0E-01	6.4E-02
Chromium[f]	0.76	--	0.19	37	2.0E-03	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	0.43	2.4	37	1.8E-01	1.2E-02
Copper[f]	22	--	0.93	38	7.9E-04	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	1.6	5.6	9.3	2.9E-01	1.7E-01
Mercury	0.024	0.19	0.25	0.14	3.0E-05	0.162	0.0152	0.097	0.33	0.33	0.33	0.65	0.974	0.018	0.016	0.027	**1.1E+00**	6.5E-01
Zinc[f]	21	--	14	110	7.0E-03	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	3.0	20	101	1.5E-01	3.0E-02
PCBs as Aroclors																		
Total PCBs as Aroclors	0.019	0.44	25	2.2	3.3E-03	0.162	0.0152	0.097	0.33	0.33	0.33	0.65	0.974	0.9	0.12	0.23	**7.7E+00**	**4.0E+00**
PCBs as Congeners																		
PCBs as Mammal TEQ	0.0000011	0.000025	0.00046	0.0000054	1.1E-13	0.162	0.0152	0.097	0.33	0.33	0.33	0.65	0.974	0.000017	8.0E-08	2.2E-06	**2.2E+02**	**7.9E+00**
Total PCBs as Congeners	0.019	3.0	47	1.7	2.1E-07	0.162	0.0152	0.097	0.33	0.33	0.33	0.65	0.974	1.8	1.2E-01	2.3E-01	**1.5E+01**	**7.9E+00**
Pesticides [f]																		
4,4'-DDD	--	--	0.0045	0.00015	1.5E-07	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.00049	0.080	0.40	6.2E-03	1.2E-03
4,4'-DDE	--	--	0.039	0.00037	3.7E-07	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.0042	0.080	0.40	5.3E-02	1.1E-02
4,4'-DDT	--	--	0.0052	0.022	1.6E-05	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.0008	0.080	0.40	9.8E-03	2.0E-03
BHC (beta)	--	--	0.00079	0.029	1.2E-03	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.00046	0.014	0.14	3.3E-02	3.3E-03
BHC (gamma) Lindane	--	--	0.00067	0.000075	3.2E-06	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.00007	0.014	0.14	5.2E-03	5.2E-04
Chlordane (alpha)	--	--	0.00030	0.74	1.3E-03	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.008	0.46	0.92	1.7E-02	8.3E-03
Chlordane (gamma)	--	--	3.2	0.0069	1.2E-05	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.34	0.46	0.92	7.5E-01	3.8E-01
Dieldrin	--	--	0.55	5.8	3.4E-02	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.12	0.020	0.10	**6.0E+00**	**1.2E+00**
Endosulfan I	--	--	0.054	0.026	4.6E-04	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.0062	0.15	0.75	4.1E-02	8.2E-03
Endrin	--	--	0.83	0.0015	8.8E-06	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.09	0.092	0.92	9.7E-01	9.7E-02
Endrin Aldehyde	--	--	0.26	0.0018	6.7E-05	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.028	0.092	0.92	3.1E-01	3.1E-02
Methoxychlor	--	--	0.00061	0.29	8.4E-04	0.162	0.0152	0.097	0	0	1	0.65	0.974	0.0031	4.0	8.0	7.7E-04	3.8E-04
SVOCs																		
Dibenzofuran[b]	0.00030	0.0017	0.0012	0.011	1.4E-04	0.162	0.0152	0.097	0.33	0.33	0.33	0.65	0.974	0.00024	3.0	30.0	7.9E-05	7.9E-06
p-Cresol (4-methylphenol)[f]	0.011	--	0.037	0.014	5.6E-03	0.162	0.0152	0.097	0.5	0	0.5	0.65	0.974	0.0031	219	1096	1.4E-05	2.8E-06

Metals HI	**6.8E+00**	**3.1E+00**
DDx HI	6.9E-02	1.4E-02
Pesticides HI	**8.2E+00**	**1.7E+00**

Notes:
a)The tissue EPCs can be found in the Baseline ERA, with exception of dibenzofuran. The EPC of non-detects is the maximum method detection limit of the non-detects.
b)The sediment EPCs can be found in the Baseline ERA. The EPC of non-detects is the maximum method detection limit of the non-detects.
c)Maximum detected concentrations in River OU surface water were used if available, otherwise concentrations were estimated.
d)Not analyzed in tissue; therefore, the tissue concentration is estimated.
e)Selected TRVs and sources can be found in the Baseline ERA.
f) In cases where a CPEC was not analyzed in one or two tissues, the dietary fraction was divided between the tissues for which the CPEC was analyzed (PF changes are noted above).
Bold indicates hazard quotient greater than 1.0.
Non-detect; EPC = maximum method detection limit of non-detects

Table 3-9
Calculation of Dose and Hazard Quotient for the American Mink

-- = not analyzed
AUF = Area Use Factor
BW = body weight
CPEC = chemical of potential ecological concern
Dose = average daily dose (mg/kg-bw/day)
dw = dry weight
EPC = exposure point concentration
HI = (cumulative) hazard index
HQ = hazard quotient
kg = kilogram
kg/day = kilograms per day
L/day = liters per day
LOAEL = lowest observed adverse effect level
mg/kg = milligrams per kilogram
mg/kg-bw/day = milligrams per kilogram body weight per day
mg/L = milligrams per liter
NOAEL = no observed adverse effect level
PCB = polychlorinated biphenyl
PF = portion of food item
SVOC = semivolatile organic compound
TRV = toxicity reference value
TEQ = toxicity equivalence
UCL = upper confidence limit
ww = wet weight

Table 3-10.1
Non-Tribal Recreational Smallmouth Bass Fisher (Child and Adult): RME Summary

Analyte	C_{fish} (mg/kg)	SF_o $(mg/kg\text{-}day)^{-1}$	Cancer Risk (dimensionless)	RfD_o (mg/kg-day)	Adult Noncancer Hazard (dimensionless)	Child Noncancer Hazard (dimensionless)
Metals						
Aluminum	5.4E+00	No Toxicity Value	--	1.0E+00	1.5E-03	2.5E-03
Antimony	1.0E-02	No Toxicity Value	--	4.0E-04	7.3E-03	1.2E-02
Barium	2.6E+00	No Toxicity Value	--	2.0E-01	3.7E-03	6.2E-03
Chromium (III)	1.9E-01	No Toxicity Value	--	1.5E+00	3.6E-05	6.1E-05
Copper	9.3E-01	No Toxicity Value	--	4.0E-02	6.5E-03	1.1E-02
Mercury	2.5E-01	No Toxicity Value	--	1.0E-04	6.9E-01	1.2E+00
PCB Aroclors						
Total PCBs as Aroclors (MDL-based)	2.5E+01	2.0E+00	**6.0E-03**	2.0E-05	**3.5E+02**	**5.9E+02**
PCB Congeners						
PCBs as Mammal TEQ (KM-capped, RDL-based)	4.6E-04	1.3E+05	**7.2E-03**	7.0E-10	**1.8E+02**	**3.1E+02**
Total PCBs as Congeners (KM-based, capped)	4.7E+01	2.0E+00	**1.1E-02**	2.0E-05	**6.6E+02**	**1.1E+03**
Pesticides						
4,4'-DDD	4.5E-03	2.4E-01	1.3E-07	No Toxicity Value	--	--
4,4'-DDE	3.9E-02	3.4E-01	**1.6E-06**	No Toxicity Value	--	--
4,4'-DDT	5.2E-03	3.4E-01	2.1E-07	5.0E-04	2.9E-03	4.9E-03
BHC (beta)	7.9E-04	1.8E+00	1.7E-07	No Toxicity Value	--	--
BHC (gamma) Lindane	6.7E-04	1.1E+00	8.8E-08	3.0E-04	6.2E-04	1.0E-03
Chlordane (alpha)	3.0E-04	3.5E-01	1.3E-08	5.0E-04	1.7E-04	2.8E-04
Chlordane (gamma)	3.2E+00	3.5E-01	**1.3E-04**	5.0E-04	**1.8E+00**	**3.0E+00**
Dieldrin	5.5E-01	1.6E+01	**1.1E-03**	5.0E-05	**3.1E+00**	**5.2E+00**
Endosulfan I	5.4E-02	No Toxicity Value	--	6.0E-03	2.5E-03	4.3E-03
Endrin	8.3E-01	No Toxicity Value	--	3.0E-04	7.7E-01	1.3E+00
Endrin Aldehyde	2.6E-01	No Toxicity Value	--	No Toxicity Value	--	--
Methoxychlor	6.1E-04	No Toxicity Value	--	5.0E-03	3.4E-05	5.8E-05
SVOCs and PAHs						
cPAHs as BaPEQ (KM-capped, MDL-based)	2.8E-03	7.3E+00	**7.8E-06**	No Toxicity Value	--	--
p-cresol (4-Methylphenol)	3.7E-02	No Toxicity Value	--	1.0E-01	1.0E-04	1.7E-04

	Cancer Risk	Adult Hazard Index	Child Hazard Index
Pathway Sum Excluding PCBs:	**1E-03**	**6.3**	**11**
Pathway Sum with Total PCBs as Aroclors:	**7E-03**	**353**	**598**
Pathway Sum with PCBs as TEQ:	**8E-03**	**191**	**324**
Pathway Sum with Total PCBs as Congeners:	**1E-02**	**665**	**1126**

Notes:

Cancer risks are presented for time-integrated adult+child exposure. Noncancer hazards are presented separately for exposure during adulthood and exposure during childhood.

Table 3-10.1
Non-Tribal Recreational Smallmouth Bass Fisher (Child and Adult): RME Summary

"--" = data not available or not calculated
BaPEQ = benzo(a)pyrene equivalents
BHC = benzene hexachloride
C_{fish} = concentration in fish
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram per day
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
RDL = reported detection limit
RfD_o = oral reference dose
RME = reasonable maximum exposure
Sf_o = oral slope factor
SVOC = semivolatile organic compound
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Table 3-10.2
Non-Tribal Recreational Smallmouth Bass Fisher (Nursing Infant): RME Summary

Definition	Variable	Value	Source	Equations
Infant Risk Adjustment Factor	IRAF	Chemical Specific	ODEQ 2010	
Carcinogenic IRAFc				
DDT/DDE/DDD	IRAFc_ddx	0.007	ODEQ 2010	Infant Cancer Risk = Mother Risk x IRAFc
Total PCB	IRAFc_pcb	1	ODEQ 2010	
PCB TEQ	IRAFc_teq	1	ODEQ 2010	
Noncancer IRAFnc				
DDT/DDE/DDD	IRAFnc_ddx	2	ODEQ 2010	Infant Noncancer Hazard = Mother HQ x IRAFnc
Total PCB	IRAFnc_pcb	25	ODEQ 2010	
PCB TEQ	IRAFnc_teq	2	ODEQ 2010	

Analyte	C_{fish} (mg/kg)	Mother		Infant	
		Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
PCB Aroclors					
Total PCBs as Aroclors (MDL-based)	2.5E+01	4.0E-03	3.5E+02	**4.0E-03**	**8.7E+03**
PCB Congeners					
PCBs as Mammal TEQ (KM-capped, RDL-based)	4.6E-04	4.8E-03	1.8E+02	**4.8E-03**	**3.7E+02**
Total PCBs as Congeners (KM-based, capped)	4.7E+01	7.5E-03	6.6E+02	**7.5E-03**	**1.6E+04**
Pesticides					
4,4'-DDD	4.5E-03	8.7E-08	--	6.1E-10	--
4,4'-DDE	3.9E-02	1.1E-06	--	7.4E-09	--
4,4'-DDT	5.2E-03	1.4E-07	2.9E-03	9.9E-10	5.8E-03
Pathway Sum Excluding PCBs:				9E-09	6E-03
Pathway Sum with Total PCBs as Aroclors:				**4E-03**	**8,664**
Pathway Sum with PCBs as TEQ:				**5E-03**	**369**
Pathway Sum with Total PCBs as Congeners:				**8E-03**	**16,460**

Notes:
Nursing infant's risks and hazards are presented as a function of Mother's risks and hazards, assuming an infant exposure duration of 1 year.

Table 3-10.2
Non-Tribal Recreational Smallmouth Bass Fisher (Nursing Infant): RME Summary

"--" = data not available or not calculated
C_{fish} = concentration in fish
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
IRAF = Infant Risk Adjustment Factor
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
MDL = method detection limit
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
RDL = reported detection limit
RfD_o = oral reference dose
RME = reasonable maximum exposure
Sf_o = oral slope factor
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Source:
ODEQ. 2010. Oregon DEQ Human Health Risk Assessment Guidance. October.

Table 3-11.1
Non-Tribal Recreational Crayfish Fisher (Child and Adult): RME Summary

Analyte	C_{fish} (mg/kg)	SF_o $(mg/kg\text{-}day)^{-1}$	Cancer Risk (dimensionless)	RfD_o (mg/kg-day)	Adult Noncancer Hazard (dimensionless)	Child Noncancer Hazard (dimensionless)
Metals						
Arsenic	5.2E-01	1.5E+00	**7.2E-05**	3.0E-04	3.7E-01	6.3E-01
PCB Congeners						
PCBs as Mammal TEQ (KM-capped, RDL-based	1.1E-06	1.3E+05	**1.3E-05**	7.0E-10	3.4E-01	5.7E-01
Total PCBs as Congeners (KM-based, capped)	1.9E-02	2.0E+00	**3.5E-06**	2.0E-05	2.0E-01	3.4E-01

	Cancer Risk	Adult Hazard Index	Child Hazard Index
Pathway Sum Excluding PCBs:	**7E-05**	0.37	0.63
Pathway Sum with PCBs as TEQ:	**9E-05**	0.71	1.2
Pathway Sum with Total PCBs as Congeners:	**8E-05**	0.57	0.97

Notes:
Cancer risks are presented for time-integrated adult+child exposure. Noncancer hazards are presented separately for exposure during adulthood and exposure during childhood.

"--" = data not available or not calculated
C_{fish} = concentration in fish
EPC = exposure point concentration
HQ = hazard quotient
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram per day
PCB = polychlorinated biphenyl
RDL = reported detection limit
RfD_o = oral reference dose
RME = reasonable maximum exposure
Sf_o = oral slope factor
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Table 3-11.2
Non-Tribal Recreational Crayfish Fisher (Nursing Infant): RME Summary

Definition	Variable	Value	Source	Equations
Infant Risk Adjustment Factor	IRAF	Chemical Specific	ODEQ 2010	
Carcinogenic IRAFc				
DDT/DDE/DDD	IRAFc_ddx	0.007	ODEQ 2010	Infant Cancer Risk = Mother Risk x IRAFc
Total PCB	IRAFc_pcb	1	ODEQ 2010	
PCB TEQ	IRAFc_teq	1	ODEQ 2010	
Noncancer IRAFnc				
DDT/DDE/DDD	IRAFnc_ddx	2	ODEQ 2010	fant Noncancer Hazard = Mother HQ x IRAFnc
Total PCB	IRAFnc_pcb	25	ODEQ 2010	
PCB TEQ	IRAFnc_teq	2	ODEQ 2010	

		Mother		Infant	
Analyte	**C_{fish}** (mg/kg)	**Cancer Risk**	**Hazard Quotient**	**Cancer Risk**	**Hazard Quotient**
PCB Congeners					
PCBs as Mammal TEQ (KM-capped, RDL-based)	1.1E-06	8.8E-06	3.4E-01	**8.8E-06**	6.7E-01
Total PCBs as Congeners (KM-based, capped)	1.9E-02	2.3E-06	2.0E-01	**2.3E-06**	**5.0E+00**
		Pathway Sum with PCBs as TEQ:		**9E-06**	7E-01
		Pathway Sum with Total PCBs as Congeners:		**2E-06**	**5.0**

Notes:
Nursing infant's risks and hazards are presented as a function of Mother's risks and hazards, assuming an infant exposure duration of 1 year.

C_{fish} = concentration in fish
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
IRAF = Infant Risk Adjustment Factor
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
mg/kg = milligrams per kilogram
PCB = poly
PCB = polychlorinated biphenyl
RDL = reported detection limit
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Source:
ODEQ. 2010. Oregon DEQ Human Health Risk Assessment Guidance. October.

Table 3-12.1
Wader (Child and Adult): RME Summary

Analyte	Soil EPC (mg/kg)	Mutagen?	Cancer-Risk Estimate			Noncancer Hazard Estimate (Child)			Noncancer Hazard Estimate (Adult)		
			Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway
Inorganic Constituents											
Antimony	0.42	0	--	--		5.7E-03	2.6E-03	8.3E-03	5.4E-04	3.9E-04	9.3E-04
Arsenic	7.7	0	**7.1E-06**	**1.7E-06**	**8.8E-06**	1.4E-01	2.9E-02	1.7E-01	1.3E-02	4.3E-03	1.7E-02
Cadmium	0.54	0	--	--		3.0E-03	8.1E-04	3.8E-03	2.8E-04	1.2E-04	4.0E-04
Chromium	145	0	--	--		--	--	--	--	--	--
Cobalt	11	0	--	--		2.0E-01	1.4E-02	2.2E-01	1.9E-02	2.1E-03	2.1E-02
Copper	33	0	--	--		4.5E-03	3.1E-04	4.9E-03	4.3E-04	4.6E-05	4.7E-04
Lead	--	0	--	--		--	--	--	--	--	--
Manganese	511	0	--	--		1.2E-01	2.0E-01	3.2E-01	1.1E-02	3.0E-02	4.1E-02
Mercury	0.11	0	--	--		3.9E-03	2.6E-04	4.1E-03	3.6E-04	4.0E-05	4.0E-04
Nickel	119	0	--	--		3.3E-02	5.6E-02	8.8E-02	3.1E-03	8.3E-03	1.1E-02
Silver	2.0	0	--	--		2.2E-03	3.7E-03	5.9E-03	2.1E-04	5.6E-04	7.7E-04
Thallium	0.24	0	--	--		1.3E-01	9.1E-03	1.4E-01	1.3E-02	1.4E-03	1.4E-02
Vanadium	55	0	--	--		6.1E-02	1.6E-01	2.2E-01	5.7E-03	2.4E-02	3.0E-02
Zinc	124	0	--	--		2.3E-03	1.5E-04	2.4E-03	2.1E-04	2.3E-05	2.4E-04
PCBs											
Total PCBs as Aroclors (MDL-based)	0.17	0	2.1E-07	2.3E-07	4.4E-07	4.7E-02	4.5E-02	9.2E-02	4.4E-03	6.7E-03	1.1E-02
Total PCBs as Congeners (KM-based, capped)	0.81	0	1.0E-06	1.1E-06	**2.1E-06**	2.2E-01	2.1E-01	4.3E-01	2.1E-02	3.2E-02	5.2E-02
PCBs as Mammal TEQ (KM-capped, RDL-based)	0.0000030	0	2.4E-07	5.6E-08	2.9E-07	2.3E-02	4.8E-03	2.8E-02	2.2E-03	7.1E-04	2.9E-03
Butyltins											
Dibutyltin dichloride	0.0046	0	--	--		8.4E-05	5.7E-05	1.4E-04	7.9E-06	8.6E-06	1.6E-05
Tributyltin chloride	0.013	0	--	--		2.4E-04	1.6E-04	4.0E-04	2.2E-05	2.4E-05	4.7E-05
Pesticides											
4,4'-DDE	0.0012	0	2.5E-10	2.0E-10	4.5E-10	--	--	--	--	--	--
4,4'-DDT	0.041	0	8.6E-09	2.0E-09	1.1E-08	4.5E-04	9.2E-05	5.4E-04	4.2E-05	1.4E-05	5.6E-05
BHC (gamma) Lindane	0.000080	0	5.4E-11	1.7E-11	7.1E-11	1.5E-06	4.0E-07	1.9E-06	1.4E-07	6.0E-08	2.0E-07
Chlordane (gamma)	0.010	0	2.2E-09	6.7E-10	2.8E-09	1.1E-04	3.0E-05	1.4E-04	1.0E-05	4.5E-06	1.5E-05
Endrin Aldehyde	0.0032	0	--	--		--	--	--	--	--	--
Endrin	0.0027	0	--	--		4.9E-05	3.4E-05	8.3E-05	4.6E-06	5.0E-06	9.7E-06
TPH											
Diesel Range Organics	26	0	--	--		7.0E-03	0.0E+00	7.0E-03	6.6E-04	0.0E+00	6.6E-04
SVOCs and PAHs											
cPAHs as BaPEQ (KM-capped, MDL-based)	0.17	M	**3.5E-06**	**3.3E-06**	**6.9E-06**	--	--	--	--	--	--
Anthracene	0.017	0	--	--		3.1E-07	2.7E-07	5.8E-07	2.9E-08	4.1E-08	7.0E-08
Fluoranthene	0.65	0	--	--		8.9E-05	7.9E-05	1.7E-04	8.4E-06	1.2E-05	2.0E-05
Phenanthrene	0.075	0	--	--		1.4E-06	1.2E-06	2.6E-06	1.3E-07	1.8E-07	3.1E-07
pyrene	0.76	0	--	--		1.4E-04	1.2E-04	2.6E-04	1.3E-05	1.8E-05	3.1E-05
Acenaphthene	0.0059	0	--	--		5.4E-07	4.8E-07	1.0E-06	5.0E-08	7.2E-08	1.2E-07
Fluorene	0.014	0	--	--		1.9E-06	1.7E-06	3.6E-06	1.8E-07	2.6E-07	4.3E-07
Bis(2-ethylhexyl) Phthalate	2.8	0	2.4E-08	1.9E-08	4.2E-08	7.6E-04	5.2E-04	1.3E-03	7.1E-05	7.8E-05	1.5E-04
Butyl Benzyl Phthalate	0.010	0	1.2E-11	9.1E-12	2.1E-11	2.7E-07	1.9E-07	4.6E-07	2.6E-08	2.8E-08	5.4E-08
Carbazole	0.021	0	2.6E-10	2.0E-10	4.6E-10	--	--	--	--	--	--
Di-n-butyl Phthalate	0.022	0	--	--		1.2E-06	8.3E-07	2.0E-06	1.1E-07	1.2E-07	2.4E-07
p-cresol (4-Methylphenol)	0.036	0	--	--		2.0E-06	1.4E-06	3.3E-06	1.9E-07	2.0E-07	3.9E-07
Phenol	0.024	0	--	--		4.4E-07	3.0E-07	7.4E-07	4.1E-08	4.5E-08	8.6E-08

Table 3-12.1
Wader (Child and Adult): RME Summary

Analyte	Soil EPC (mg/kg)	Mutagen?	Cancer-Risk Estimate			Noncancer Hazard Estimate (Child)			Noncancer Hazard Estimate (Adult)		
			Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway
					Cancer Risk			Hazard Index (Child)			Hazard Index (Adult)
Pathway Sum Excluding PCBs:					**1.6E-05**			1.2			0.14
Pathway Sum with Total PCBs as Aroclors:					**1.6E-05**			1.3			0.15
Pathway Sum with Total PCBs as Congeners:					**1.8E-05**			1.6			0.19
Pathway Sum with PCBs as TEQ:					**1.6E-05**			1.2			0.14

Notes:
Cancer risks are presented for time-integrated adult+child exposure. Noncancer hazards are presented separately for exposure during adulthood and exposure during childhood.

"--" = data not available or not calculated
BaPEQ = benzo(a)pyrene equivalents
BHC = benzene hexachloride
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
MDL = method detection limit
mg/kg = milligrams per kilogram
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
RDL = reported detection limit
RME = reasonable maximum exposure
SVOC = semivolatile organic compound
TEQ = toxicity equivalence
TPH = total petroleum hydrocarbons

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Table 3-12.2
Wader (Nursing Infant): RME Summary

Definition	Variable	Value	Source	Equations
Infant Risk Adjustment Factor	IRAF	Chemical Specific	ODEQ 2010	
Carcinogenic IRAFc				
DDT/DDE/DDD	IRAFc_ddx	0.004	ODEQ 2010	Infant Cancer Risk = Mother Risk x IRAFc
Total PCB	IRAFc_pcb	0.6	ODEQ 2010	
PCB TEQ	IRAFc_teq	0.7	ODEQ 2010	
Noncancer IRAFnc				
DDT/DDE/DDD	IRAFnc_ddx	0.3	ODEQ 2010	Infant Noncancer Hazard = Mother HQ x IRAFnc
Total PCB	IRAFnc_pcb	4	ODEQ 2010	
PCB TEQ	IRAFnc_teq	0.3	ODEQ 2010	

Analyte	$C_{sediment}$ (mg/kg)	Mother		Infant	
		Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
DDx					
4,4'-DDE	1.2E-03	4.5E-10	--	1.8E-12	--
4,4'-DDT	4.1E-02	1.1E-08	5.4E-04	4.2E-11	1.6E-04
PCB Congeners					
PCBs as Mammal TEQ (KM-capped, RDL-based)	3.0E-06	2.9E-07	2.8E-02	2.1E-07	8.4E-03
Total PCBs as Congeners (KM-based, capped)	8.1E-01	2.1E-06	4.3E-01	**1.3E-06**	**1.7E+00**
Total PCBs as Aroclors (MDL-based)	1.7E-01	4.4E-07	9.2E-02	2.7E-07	3.7E-01
		Pathway Sum Excluding PCBs:		4.4E-11	1.6E-04
		Pathway Sum with Total PCBs as Aroclors:		2.7E-07	0.37
		Pathway Sum with Total PCBs as Congeners:		1.3E-06	**1.7**
		Pathway Sum with PCBs as TEQ:		2.1E-07	8.6E-03

Notes
Nursing infant's risks and hazards are presented as a function of Mother's risks and hazards, assuming an infant exposure duration of 1 year.

Table 3-12.2
Wader (Nursing Infant): RME Summary

"--" = data not available or not calculated
$C_{sediment}$ = concentration in sediment
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
IRAF = Infant Risk Adjustment Factor
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
MDL = method detection limit
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
RDL = reported detection limit
RME = reasonable maximum exposure
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Source:
ODEQ. 2010. Oregon DEQ Human Health Risk Assessment Guidance. October.

Table 3-13.1
Swimmer (Child and Adult): RME Summary

Compound	Water EPC (µg/L)	Cancer-Risk Estimate			Noncancer-Hazard Estimate (Child)			Noncancer-Hazard Estimate (Adult)		
		Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway	Ingestion	Dermal	Multi-Pathway
COPCs										
Arsenic	1.0.E+00	2.9.E-07	1.1.E-07	4.0.E-07	4.6.E-03	9.6.E-04	5.6.E-03	8.6.E-04	5.9.E-04	1.5.E-03
Total PCBs as Congeners (KM-based, capped)	2.1.E-04	8.0.E-11	2.0.E-07	2.0.E-07	1.4.E-05	1.9.E-02	1.9.E-02	2.7.E-06	1.2.E-02	1.2.E-02
PCBs as Mammal TEQ (KM-capped, RDL-based)	1.1.E-10	2.7.E-12	3.5.E-09	3.6.E-09	2.1.E-07	1.5.E-04	1.5.E-04	4.0.E-08	9.2.E-05	9.2.E-05

	Cancer Risk	Hazard Index (Child)	Hazard Index (Adult)
Pathway Sum Excluding PCBs:	4.0E-07	5.6E-03	1.5E-03
Pathway Sum with Total PCBs as Congeners:	6.0E-07	0.025	0.013
Pathway Sum with PCBs as TEQ:	4.1E-07	5.7E-03	1.5E-03

Notes:
Cancer risks are presented for time-integrated adult+child exposure. Noncancer hazards are presented separately for exposure during adulthood and exposure during childhood.

"--" = data not available or not calculated
µg/L = microgram per liter
COPC = chemical of potential concern
EPC = exposure point concentration
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
PCB = polychlorinated biphenyl
RDL = reported detection limit
RME = reasonable maximum exposure
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Table 3-13.2
Swimmer (Nursing Infant): RME Summary

Definition	Variable	Value	Source	Equations
Infant Risk Adjustment Factor	IRAF	Chemical Specific	ODEQ 2010	
Carcinogenic IRAFc				
DDT/DDE/DDD	IRAFc_ddx	0.007	ODEQ 2010	Infant Cancer Risk = Mother Risk x IRAFc
Total PCB	IRAFc_pcb	1	ODEQ 2010	
PCB TEQ	IRAFc_teq	1	ODEQ 2010	
Noncancer IRAFnc				
DDT/DDE/DDD	RAFnc_ddx	2	ODEQ 2010	Infant Noncancer Hazard = Mother HQ x IRAFnc
Total PCB	RAFnc_pcb	25	ODEQ 2010	
PCB TEQ	IRAFnc_teq	2	ODEQ 2010	

Analyte	Water EPC (*µg/L*)	SFo	Mother		Infant	
			Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
PCB Congeners						
PCBs as Mammal TEQ (KM-capped, RDL-based)	1.1E-10	1.3E+05	3.6E-09	1.5E-04	3.6E-09	3.0E-04
Total PCBs as Congeners (KM-based, capped)	2.1E-04	2.0E+00	2.0E-07	1.9E-02	2.0E-07	4.8E-01
		Pathway Sum with Total PCBs as Congeners:			2.0E-07	0.48
		Pathway Sum with PCBs as TEQ:			3.6E-09	3.0E-04

Notes:
Nursing infant's risks and hazards are presented as a function of Mother's risks and hazards, assuming an infant exposure duration of 1 year.

Table 3-13.2
Swimmer (Nursing Infant): RME Summary

"--" = data not available or not calculated
µg/L = microgram per liter
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
IRAF = Infant Risk Adjustment Factor
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
PCB = polychlorinated biphenyl
RDL = reported detection limit
RME = reasonable maximum exposure
Sf_o = oral slope factor
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Source:
ODEQ. 2010. Oregon DEQ Human Health Risk Assessment Guidance. October.

Table 3-14.1
Hypothetical Downstream Potable Water User (Child and Adult): RME Summary

Analyte	Water EPC (*µg/L*)	Cancer-Risk Estimate				Noncancer-Hazard Estimate (Child)				Noncancer-Hazard Estimate (Adult)			
		Ingestion	Inhalation	Dermal	Multi-Pathway	Ingestion	Inhalation	Dermal	Multi-Pathway	Ingestion	Inhalation	Dermal	Multi-Pathway
COPCs													
Arsenic	1.0E+00	**1.9E-05**	--	1.1E-07	**2.0E-05**	1.7E-01	--	7.4E-04	1.7E-01	1.0E-01	--	6.0E-04	1.0E-01
Total PCBs as Congeners (KM-based, capped)	2.1E-04	5.4E-09	--	--	5.4E-09	5.2E-04	--	--	5.2E-04	3.1E-04	--	--	3.1E-04
PCBs as Mammal TEQ (KM-capped, RDL-based)	1.1E-10	1.8E-10	--	--	1.8E-10	7.8E-06	--	--	7.8E-06	4.7E-06	--	--	4.7E-06
					Cancer Risk				**Hazard Index**				**Hazard Index**
		Pathway Sum Excluding PCBs:			**2.0E-05**				0.17				0.10
		Pathway Sum with PCBs as TEQ:			**2.0E-05**				0.17				0.10
		Pathway Sum with Total PCBs as Congeners:			**2.0E-05**				0.17				0.10

Notes:
Cancer risks are presented for time-integrated adult+child exposure. Noncancer hazards are presented separately for exposure during adulthood and exposure during childhood.

"--" = data not available or not calculated
µg/L = microgram per liter
COPC = chemical of potential concern
EPC = exposure point concentration
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
PCB = polychlorinated biphenyl
RDL = reported detection limit
RME = reasonable maximum exposure
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Table 3-14.2
Hypothetical Downstream Potable Water User (Nursing Infant): RME Summary

Definition	Variable	Value	Source	Equations
Infant Risk Adjustment Factor	IRAF	Chemical Specific	ODEQ 2010	
Carcinogenic IRAFc				
DDT/DDE/DDD	IRAFc_ddx	0.007	ODEQ 2010	Infant Cancer Risk = Mother Risk x IRAFc
Total PCB	IRAFc_pcb	1	ODEQ 2010	
PCB TEQ	IRAFc_teq	1	ODEQ 2010	
Noncancer IRAFnc				
DDT/DDE/DDD	IRAFnc_ddx	2	ODEQ 2010	Infant Noncancer Hazard = Mother HQ x IRAFnc
Total PCB	IRAFnc_pcb	25	ODEQ 2010	
PCB TEQ	IRAFnc_teq	2	ODEQ 2010	

Analyte	C_{fish} (mg/kg)	SFo	Mother		Infant	
			Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
PCB Congeners						
PCBs as Mammal TEQ (KM-capped, RDL-based)	1.1E-10	1.3E+05	1.8E-10	7.8E-06	1.8E-10	1.6E-05
Total PCBs as Congeners (KM-based, capped)	2.1E-04	2.0E+00	5.4E-09	5.2E-04	5.4E-09	1.3E-02
			Pathway Sum with PCBs as TEQ:		1.8E-10	1.6E-05
			Pathway Sum with Total PCBs as Congeners:		5.4E-09	0.013

Notes:
Nursing infant's risks and hazards are presented as a function of Mother's risks and hazards, assuming an infant exposure duration of 1 year.

RME = reasonable maximum exposure
"--" = data not available or not calculated
C_{fish} = concentration in fish
DDD = dichloro-diphenyl-dichloroethane
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
EPC = exposure point concentration
HQ = hazard quotient
IRAF = Infant Risk Adjustment Factor
KM - capped = Kaplan–Meier-based with Efron's bias correction, capped
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
RDL = reported detection limit
Sf_o = oral slope factor
TEQ = toxicity equivalence

Bolded values indicate a risk estimate > 1E-06 or a hazard estimate >1

Source:
ODEQ. 2010. Oregon DEQ Human Health Risk Assessment Guidance. October.

Table 3-15
Summary of Site-Specific Risk-Based Tissue Concentrations

CEC	Risk-Based Tissue Concentrations (mg/kg ww)						Upstream Reference UPLs (mg/kg ww)			
	Osprey Diet	Eagle Diet	Bird Bird Egg	Mink Diet	Fish Diet	Lowest RBC	Clams	Crayfish	Sculpin	Bass
Inorganics										
Lead	--	--	--	--	0.12	**0.12**	0.073	1.1	0.076	1.7
Total Mercury	0.19	0.20	--	--	0.13	**0.13**	0.016	0.023	0.13	0.36
PCBs as Aroclors										
Total PCBs as Aroclors	4.3	5.6	0.18	2.1	0.43	**0.18**	0.039	0.0052	0.045	0.10
PCBs as Congeners										
PCBs as Fish TEQ	--	--	--	--	6.4E-06	**6.4E-06**	--	--	6.1E-08	3.6E-07
PCBs as Bird TEQ	5.0E-05	6.6E-05	2.5E-05	see mammal TEQ	--	**2.5E-05**	--	--	--	9.5E-06
PCBs as Mammal TEQ	see bird TEQ	see bird TEQ	see bird TEQ	2.0E-05	--	**2.0E-05**	--	6.4E-08	7.9E-07	3.9E-06
Total PCBs as Congeners	4.3	5.6	0.18	2.1	0.43	**0.18**	0.035	0.0014	0.038	0.41
Pesticides										
Chlordane (gamma)	--	--	--	--	0.060	**0.060**	NA	NA	NA	0.0042
Dieldrin	0.28	0.37	--	0.93	0.26	**0.26**	NA	NA	NA	0.00083
Endosulfan I	--	--	--	--	0.0087	**0.0087**	NA	NA	NA	0.002
Endrin	0.72	0.94	--	--	0.27	**0.27**	NA	NA	NA	0.00086

Notes:

Wildlife Risk-Based Tissue Concentration Fish-Diet = LOAEL TRV ÷ ((FIR÷BW)*AUF) (ODEQ 2007; Equation C-3). See Baseline ERA for FIRs, BWs, and AUFs. Fish Risk-Based Tissue Concentration Diet = NOAEC TRV.
Risk-Based Tissue Concentration Fish-Bird Egg = LOAEL Bird Egg ATL ÷ BMF (see LOAEL TRVs and BMFs in Baseline ERA).
Upstream Reference UPLs can be found in the Baseline ERA.

-- = Not a CEC for that receptor/receptor group
AUF = area use factor
BMF = biomagnification factor
BW = body weight
CEC = constituent of ecological concern
FIR = food ingestion rate
LOAEL = lowest observed adverse effect level
mg/kg ww = milligrams per kilogram in wet weight
NA = not available
NOAEC = no observed adverse effect concentration
PCB = polychlorinated biphenyl
RBC = risk based concentration
TEQ = toxicity equivalence
TRV = toxicity reference value
UPL = upper prediction limit

Source:
ODEQ 2007. Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment. Final. April.

Table 3-16
Summary of Site-Specific Risk-Based Sediment Concentrations

CEC	Risk-Based Sediment Concentrations (mg/kg dw)							Upstream Reference UPLs (mg/kg dw)
	Osprey Diet	Eagle Diet	Bird Bird Egg	Mink Diet	Benthic Invertebrate Direct Toxicity	Fish Diet	Lowest RBC	
Inorganics								
Chromium	--	--	--	--	111	--	**111**	28
Copper	--	--	--	--	149	--	**149**	56
Lead [a]	--	--	--	--	--	see UPL	**see UPL**	15
Nickel	--	--	--	--	48.6	--	**48.6**	21
Total Mercury [a]	see UPL	see UPL	--	--	--	see UPL	**see UPL**	0.21
PCBs as Aroclors								
Total PCBs as Aroclors	0.36	0.48	0.015	0.19	0.676	0.042	**0.015**	0.016
PCBs as Congeners								
PCBs as Fish TEQ	--	--	--	--	NA	8.1E-08	**8.1E-08**	2.0E-09
PCBs as Bird TEQ	1.0E-06	1.3E-06	5.0E-07	see mammal TEQ	NA	--	**5.0E-07**	1.2E-07
PCBs as Mammal TEQ	see bird TEQ	see bird TEQ	see bird TEQ	2.0E-07	NA	--	**2.0E-07**	3.1E-08
Total PCBs as Congeners	0.038	0.049	0.0016	0.020	0.676	0.0044	**0.0016**	0.00094
PAHs								
Total HPAHs (KM-capped, MDL-based)	--	--	--	--	0.97	--	**0.97**	0.12
Total LPAHs (KM-capped, MDL-based)	--	--	--	--	0.38	--	**0.38**	0.010
Pesticides								
4,4'-DDT	--	--	--	--	0.0629	--	**0.063**	NA
Chlordane (gamma)	--	--	--	--	0.0176	3.8	**0.018**	NA
Dieldrin[b]	9.5	13	--	34	--	10	**9.5**	NA
Endosulfan I[b]	--	--	--	--	--	0.17	**0.17**	NA
Endrin[b]	19	25	--	--	--	8.2	**8.2**	NA

Notes:
Diet/Egg Risk-Based Sediment Concentration = f_{oc} x (RBC_{tissue} ÷ [BSAF x f_{lipid}]) (ODEQ 2007; Equation D-1). See Appendix D of the Baseline ERA for BSAF development. Direct Toxicity Risk-Based Sediment Concentration = Benthic Invertebrate LOAEC TRV.
Upstream Reference UPLs can be found in the Baseline ERA.

-- = Not a CEC for that receptor/receptor group
BSAF = biota-sediment accumulation factor
CEC = constituent of ecological concern
HPAH = high molecular weight polycyclic aromatic hydrocarbon
KM-capped = Kaplan–Meier-based with Efron's bias correction, capped
LOAEC = lowest observed adverse effect concentration
LPAH = low molecular weight polycyclic aromatic hydrocarbon
MDL = method detection limit

Table 3-16
Summary of Site-Specific Risk-Based Sediment Concentrations

mg/kg dw = milligrams per kilogram in dry weight
NA = not available
PCB = polychlorinated biphenyl
RBC = risk based concentration
TEQ = toxicity equivalence
TRV = toxicity reference value
UPL = upper prediction limit

f_{oc} = fraction of organic carbon (site-specific) =	0.0084	median of all River OU data
f_{lipid} = fraction of lipid (bass) =	0.03	median of all River OU bass data (used for Bird RBCs)
f_{lipid} = fraction of lipid (bass+sculpin+crayfish) =	0.028	median of all River OU bass, sculpin, and crayfish data (used for Mink RBC)
f_{lipid} = fraction of lipid (all four tissue) =	0.026	median of all River OU bass, sculpin, crayfish, and clam data (used for Fish Diet RBC)

NA = Not available

a) For dietary RBCs, due to the potentially high uncertainty associated with establishing correlations between concentrations of metals in sediment versus tissue, default is to Upstream Reference UPLs.

b) Dietary sediment RBCs developed for these CECs because they have demonstrated risk from tissue consumption and have tissue RBCs (see Table 3-19). However, these dietary sediment RBCs are not depicted on the figures due to the following:

Dieldrin and endosulfan I are non-detect in sediment and their maximum MDLs are less than their RBCs.
Endrin RBC is three orders of magnitude greater than the maximum detected concentration in sediment.

Source:
ODEQ 2007. Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment. Final. April.

Table 3-17
River OU CECs Recommended in the Baseline RA for Further Evaluation in the FS

Target Receptor	Medium	Chemical of Ecological Concern	Lowest RBTC[d,e] (mg/kg)	Reference Area UPL(s) (mg/kg)
Benthic Community	Sediment	PCBs[a]	0.68	0.016 & 0.00094
		HPAHs	0.97	0.12
Fish Community	Sculpin Tissue	PCBs[a]	0.43	0.045 & 0.038
	Bass Tissue	PCBs[b]	6.4E-06	3.6E-07
		OCPs[c]	0.0087	0.0020
Osprey	Bass Tissue	PCBs[b]	5.0E-05	9.5E-06
		Dieldrin	0.28	0.00083
Eagle	Bass Tissue	PCBs[b]	6.6E-05	9.5E-06
		Dieldrin	0.37	0.00083
Mink	Sculpin Tissue	PCBs[a]	2.1	0.045 & 0.038
	Bass Tissue	PCBs[b]	2.0E-05	3.9E-06

Notes:

CECs = chemicals of ecological concern

LOAEC = lowest observed adverse effect concentration

LOAEL = lowest observed adverse effect level

mg/kg = milligrams per kilogram

NOAEC = no observed adverse effect concentration

OCP = organochlorine pesticides

PCBs = polychlorinated biphenyls

RBTC = risk based threshold concentration

TEQ = toxicity equivalence

UPL = upper prediction limit

No exceedances of sediment risk-based concentrations protective of fish consumption pathways were observed for OCPs, only for PCBs. Therefore, sediment is also a medium of concern for PCBs.

a) PCBs as total Aroclors and total (209) congeners

b) PCBs as total Aroclors, total (209) congeners, and PCB TEQ

c) OCPs gamma-chlordane, dieldrin, and endosulfan I

d) For PCBs and OCPs, the lowest RBC of applicable CECs is shown, see Tables 3-19 and Table 3-20 for individual RBCs.

e) RBTCs protective of fish based on NOAECs and RBCs for other receptors based on LOAECs/LOAELs.

Table 3-18
River OU COCs Recommended in the Baseline RA for Further Evaluation in the FS

Media	Contaminants of Concern[a] (COCs)	Calculated RBC[b] (At target risk of 1E-06 or HQ of 1)	units	Reference Area UPL
Smallmouth Bass Tissue	PCB-Aro	1.5	ug/kg	102
	PCB-Cong	1.5	ug/kg	408
	PCB TEQ-Mam	2.9E-05	ug/kg	3.9E-03
	Chlordane (gamma)	11	ug/kg	4.2
	Dieldrin	0.24	ug/kg	0.83
Crayfish Tissue	PCB TEQ-Mam (c)	8.3E-05	ug/kg	6.4E-05
Sediment (Direct Contact)	None	--	--	--
Sediment (Bioaccumulation)	PCB-Aro	0.12	ug/kg	16
	PCB-Cong	0.013	ug/kg	0.94
	PCB TEQ-Mam	2.6E-07	ug/kg	3.1E-05

Notes:
COC = contaminant of concern
HQ = hazard quotient
PCB-Aro = total PCBs as Aroclors
PCB-Cong = total PCBs as congeners
PCBs = polychlorinated biphenyls
RBC = risk-based concentration
TEQ = toxicity equivalence
PCB TEQ-Mam = PCBs as Mammal TEQ
ug/kg = micrograms per kilogram
UPL = upper prediction limit
-- = not applicable

Footnotes:
a) Final list of chemicals from the Baseline HHRA recommended for further evaluation in the Feasibility Study.
b) Presented RBC is the lowest among receptors evaluated and corresponds to target cancer risk of 1E-06 or noncancer HQ of 1.
c) Tentatively identified COC.

Table 3-19. CECs and Risk Driver Selection

CECs Recommended for further Evaluation from the baseline ERA	Receptors of Concern	Risk Driver	Rationale for Selection/Exclusion as a Risk Driver
Total PCBs as Aroclors	Benthic community, fish community, osprey, eagle, mink	No	While total PCBs as aroclors does present unacceptable ecological risk, total PCBs will be represented as congeners for identification as a risk driver due to the higher level of accuracy, generally lower detection limits, and higher information content.
Total PCBs as congeners	Benthic community, fish community, osprey, eagle, mink	Yes (except benthic)	Unacceptable risk. Because of the isolated nature of contamination and sessile characteristics of benthos, no population level risk is expected.
Total PCBs as TEQ	Fish community, osprey, eagle, mink	No	Given that TEQs are a derivative of a subset of congener data, PCBs will be represented by total congeners for identification as a risk driver.
Total HPAHs	Benthic community	No	Given the few areas with RBTC exceedances on the north shore of the Bradford Island, there is low potential for population level impacts to the benthic community in these localized areas.
Chlordane	Benthic community, fish community	No	Detection of OCP pesticides is believed to be the result of interference caused by coelution with high concentration PCBs.
Dieldrin	Fish community, osprey, eagle, mink	No	Detection of OCP pesticides is believed to be the result of interference caused by coelution with high concentration PCBs.
Endosulfan	Fish community	No	Detection of OCP pesticides is believed to be the result of interference caused by coelution with high concentration PCBs.

Table 3-20. COCs and Risk Driver Selection

COCs Recommended for further Evaluation from the baseline HHRA	Receptors of Concern	Risk Driver	Rationale for Selection/Exclusion as a Risk Driver
Total PCBs as Aroclors	Tribal Subsistence fisher, non-tribal recreational fisher	No	While total PCBs as aroclors does present unacceptable human health risk, total PCBs will be represented as congeners for identification as a risk driver due to the higher level of accuracy, generally lower detection limits, and higher information content.
Total PCBs as congeners	Tribal Subsistence fisher, non-tribal recreational fisher	Yes	Unacceptable risk
Total PCBs as TEQ	Tribal Subsistence fisher, non-tribal recreational fisher	No	Given that TEQs are a derivative of a subset of congener data, PCBs will be represented by total congeners for identification as a risk driver.
Chlordane	Tribal Subsistence fisher, non-tribal recreational fisher	No	Detection of OCP pesticides is believed to be the result of interference caused by coelution with high concentration PCBs.
Dieldrin	Tribal Subsistence fisher, non-tribal recreational fisher	No	Detection of OCP pesticides is believed to be the result of interference caused by coelution with high concentration PCBs.

Table 4-1. Practical Quantitation Limits and Risk-Based Threshold Concentrations for Sediment COC and CEC Risk Drivers.

Sediment COC and CEC Risk Drivers	Practical Quantitation Limits		Risk Based Threshold Concentrations (ug/kg dw)
	EPA Method	RI Reporting Limits (ug/kg dw)	
Total PCBs as Congeners	EPA 1668	0.002	$1.7x10^{-2}$ for human health (bioaccumulation); 1.6 for ecological (bird egg); background is 0.60

Table 4-2. RAOs and Associated PRGs for Sediment COC and CEC Risk Drivers

Risk Driver COC/CEC	PRG (µg/kg dw)	Basis	Statistical Metric for Application	Spatial Scale of PRG Application
RAO 1 – Human Health				
Total PCBs and Congeners	0.60	Site Background (Reference Area 95% UCL)	Surface weighted average concentration (SWAC)	Surface sediment (top 15cm), River OU
RAO 2 – Ecological Health, Indirect exposure				
Total PCBs and Congeners	1.6	Bird Egg RBTC	SWAC	Surface sediment (top 15cm), River OU

Table 5-1 General Response Actions, Technology Types, and Process Options Considered for Bradford Island River Operable Unit

GRA	Technology Type	Process Option	Description
No action	None	Not applicable	No active remedy or monitoring
Monitored natural recovery (MNR)	Chemical/phsical transport and degradation	Combination	Desorption, dispersion, diffusion, dilution, volatilization, resuspension, and transport.
	Biological degradation	COC metabolism	Chlorine atoms are removed from PCB molecules by bacteria; however, toxicity reduction is not directly correlated to the degree of dechlorination.
	Physical-burial processes		Contaminated sediments are buried (by naturally occurring sediment deposition) to deeper intervals that are less biologically available. (Resuspension and transport are minor components of MNR).
Enhanced monitored natural recovery (EMNR)	Thin-layer placement	Placement of thin layer to augment natural recovery	Application of a thin layer of clean sand and natural resorting, sedimentation, and bioturbation to mix the contaminated and clean sediments, resulting in acceptable contaminant concentrations.
In situ treatment	Physical-immobilization	Activared Carbon Amendment	Activated carbon (powder, granules, or pellets) serves as an amendment to the bioactive surface layer of sediment. Hydrophobic organic contaminants adsorb to activated carbon, reducing porewater contaminant concentrations and bioavailability.
		Organoclay Amendment	Organoclay products for use in sediment remediation consist of mineral clay, polymer additives, and an aggregate core for densification. Organoclays bind contaminants through replacement of metal ions with amines or other functional groups, physically isolate the contaminated sediment from receptors (because of low permeability), and stabilize sediment by preventing resuspension and transport of contaminants.
Removal	Dredging	Mechanical dredging	A barge-mounted floating crane on a derrick barge maneuvers a dredging bucket. The bucket is lowered into the sediment; when the bucket is withdrawn, the jaws of the bucket are closed, retaining the dredged material. Alternatively, a barge-mounted excavator with fixed arm linkages (boom and stick), instead of cables, to position the clamshell bucket at the target elevation for sediment removal.
		Hydraulic dredging	Use of hydraulic dredges (e.g., cutterhead, horizontal auger, plain suction, pneumatic, or specialty dredges) with various cutter and suction heads to remove contaminated sediments from the environment in a slurry. The slurry is transported via pipeline to a sediment handling facility or slurry discharge location. Includes small scale diver assisted or hand-held hydraulic dredging.
	Excavation	Dry excavation	Sediment is removed by upland-based conventional excavation (backhoe) equipment. This removal option may include erecting sheet-pile walls or a cofferdam around the contaminated sediments to dewater.

Ex situ treatment	Chemical/Physical	Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.
	Physical	Solidification	The mobility of constituents in a "solid"medium is reduced through addition of immobilization additivies.
	Chemical/Phsyical	Thermal	Volatilization of organic contaminants (to be collected and combusted later) or direct combustion of the contaminants.
Disposal/Reuse	On-site disposal	Contained Aquatic Disposal (CAD)	Untreated sediment is placed within a lateral containment structure (i.e., bottom depression or subaqueous berm) and capped with clean sediment.
		Confined Disposal Facility (CDF)	Untreated sediment is placed in a nearshore CDF that is separated from the river by an earthen berm or other physical barrier and capped to prevent contact. A CDF may be designed for habitat purposes.
	Off-site disposal	Subtitle D landfill	Off-site disposal at a licensed commercial facility that can accept nonhazardous sediment. Regional landfills can accept dewaterd and wet sediments.
		Subtitle C landfill	Off-site disposal at a licensed commercial facility that can accept hazardous dewatered sediment removed from dredging or excavation. Dewatering required to reduce water content for transportation.
		TSCA-licensed landfill	Off-site disposal at a licensed commercial facility that can accept TSCA sediment. Dewatering required to reduce water content for transportation.
Containment	Capping	Conventional sand cap	Placement of clean sand over existing contaminated bottom to physically isolate contaminants.
		Conventional sediment/clay cap	Use of dredged fine-grained sediments or commercially obtained clay materials to achieve contaminant isolation.
		Armored cap	Coarse granular material such as cobbles, pebbles, or larger material are incorporated into the cap to prevent erosion in high-energy environments or to prevent cap breaching by bioturbators.
		Composite cap	Soil, media, and geotextile cap placed over contaminated material to inhibit migration of contaminated porewater and/or inhibit bioturbators.
		Reactive cap	Incorporation of materials such as granular activated carbon or iron filiings to provide chemical binding or destruction of contaminants migrating in porewater.
		Hard cap	Placement of capping materials (concrete, grout, or mortar) onto a surface and in cracks. Capping materials can be poured or pumped onto surfaces and into cracks.
Institutional Controls	Proprietary controls	Proprietary controls	Mechanism in deeds or other instruments transferring property that restrict or affect the use of property.

	Informational devices	Seafood Consumption Advisories, Education, and Public Outreach	Public Advisories that consumption of resident fish and sediment contact may present health risks.
Monitoring	Physical and chemical assessment	Baseline Monitoring	Establishes a statistical basis for comparing site conditions before, during, and after cleanup action. Baseline monitoring can be used to inform remedial design.
		Construction Monitoring	Short-term monitoring during remediation used to evaluate whether the project is being constructed in accordance with specifications (i.e., water quality monitoring, bathymetric surveys, discharge monitoring, inspection surveys, sediment monitoring).
		Post-construction Performance Monitoring	Evaluates post-removal surface and subsurface sediment conditions in dredging or containment areas to confirm compliance with project specifications.
		Operation and Maintenance Monitoring	Operation and maintenance monitoring of dredging areas, containment, and/or disposal sites (i.e., CAD sites, ENR, and capping areas) required to ensure long-term effectiveness and continued stability of the structure.
		Long-term Monitoring	Evaluates sediment, tissue, and water quality at the site for an extended period following the remedial action.

Table 5-2 Effectiveness and Implementability Considerations

GRA	Technology Type	Process Option	Effectiveness	Implementability			Screening Decision	Cost
			Site COCs	Site Conditions	Available and Demonstrated	Innovative Technology		
No action	None	--	--	Technically implementable for site conditions	--	--	Retained per NCP requirement	Low
Monitored natural recovery (MNR)	Chemical degradation	Natural desorption, diffusion, dilution, volatilization	Potentially effective for immobilizing COCs through total organic carbon (TOC), though TOC content in site sediments is low.	Technically implementable for site conditions	--	--	Retained for further consideration for dispersal areas.	Low
	Biological Degradation	COC metabolism (aerobic and anaerobic)	Effective for PCBs but does not result in complete destruction of PCBs in an acceptable time frame.	Technically implementable for site conditions	--	--	Retained for further consideration for dispersal areas.	Low
	Physical/Burial Processes	Natural sedimentation and burial (resuspension and transport are minor components of MNR)	Potentially effective for site COCs via deposition and reburial. Demonstration of deposition and burial has not been completed.	Technically implementable for site conditions	Preliminary results at some projects show some success.	--	Retained for further consideration.	Low
Enhanced monitored natural recovery (EMNR)	Thin-layer placement	Thin-layer placement	Effective for all Site COCs. Applicable in areas where MNR processes are demonstrated, but faster recovery is required, or as a residual management tool after completion of a removal action.	Technically implementable for site conditions	Thin-layer placements for EMNR and residuals have been applied in multiple locations nationally.	--	Retained for further consideration.	Low to Moderate
In-situ treatment	Physical Immobiilization	Activated Carbon Amendment	Effective at adsorbing organic contaminants in sediment applications. Carbon-amended sediment provides a suitable habitat for benthic communities.	Technically implementable in some areas of the Site. May require armoring.	Demonstrated effective in recent pilot-scale remediation projects.	Yes	Retained for further consideration.	Low to Moderate
		Organoclay amendment	Effective at adsorbing organic contaminants in sediment applications.	Technically implementable in some areas of the Site. May require armoring.		Yes	Retained for further consideration.	Low to Moderate
Removal	Dredging	Mechanical Dredging	Applicable to all site COCs.	Implementable in areas to the northwest and to the south of island; large boulders and rocks dominate the river bottom in other areas.		No	Retained for further consideration.	Moderate
		Hydraulic Dredging	Applicable to all site COCs, though the 2007 diver-assisted hydraulic dredging effort was unsuccessful in source areas.	Diver assisted-dredging is potentially implementable in where contamination is on the surface of the rocks at the river bottom. Unlikely to be effective in source areas. Larger scale hydraulic dredging is implementable in the same area as mechanical dredging.		No	Retained for further consideration.	Moderate
	Excavation	Dry Excavation	Applicable to all site COCs.	Not implementable for site conditions. Steep slope on north shore of island and rocky nature of the bottom limit the applicaion of on-land excavators, backhoes, etc.	--	--	Eliminated.	Moderate
Ex-situ treatment	Chemical	Soil Washing with Air Stripping	Applicable to site COCs. High contaminant concentration, increased percentage of fine grained sediments, and high organic content increases over treatment costs.	Technically implementable for site conditions. Would require upland processing space, storage capacity for dredged sediments, wastewater treatment, and discharge. Treated residuals would still require disposal.	Full-scale mobile equipment is commercially available.	Yes	Retained	Moderate to High

	Physical	Solidification	Applicable to site COCs. Immobilizing reagents used depends on sediment characteristics and water content.	Technically implementable for site conditionsl. Would still require disposal, but disposal facilities accept contaminated wet sediment. May be considered during remedial design if moisture or leachability reduction is needed.	Yes	No	Retained	Moderate
	Chemical/Physical	Thermal	High temperature thermal desorption (HTTD) followed by destruction and incineration are effective for PCBs. Alternatively, Cement-Lock® technology showed effectiveness for destroying and encapsulating PCBs.	Technically implementable for site conditions.	Mobile HTTD units are available. Other thermail treatment facilities are located out of state. Cement-Lock has been demonstrated.	Cement-Lock® is considered innovative	Eliminated.	Moderate to High
Disposal/Reuse	On-site Disposal	Contained Aqautic Disposal (CAD)	Applicable to all site COCs below hazardous waste designations.	Applicable to submerged areas where sediments have sufficient bearing to support cap, and have low erosive potential.	Available and demonstrated	No	Elimintated.	Low to Moderate
		Confined Disposal Facility (CDF)	Applicable to all site COCs below hazardous waste designations.	Requires large suitable near-shore or upland containment site.	Available and demonstrated	No	Eliminated.	Moderate to High
	Off-site Disposoal	Subtitle D Landfill	Applicable to all site COCs below hazardous waste designations.	Applicable for both dewatered and wet sediments.	Available and demonstrated	No	Retained	Moderate
		Subtitle C Landfill	Applicable to all site COCs exceeding hazardous waste designations.	Applicable for dewatered sediments.	Available and demonstrated	No	Retained	High
		Open water disposal	Applicable to all site COCs below hazardous waste designations.	Technically implementable for site conditions	Available and demonstrated	No	Retained	Low
		Beneficial Reuse	Applicable to all site COCs in sediments that are either below or treated to below the reuse standards for uplands or in-water.	Technically implementable for site conditions	Available and demonstrated	No	Retained	None
Containment	Capping	Conventional Sand Cap	Effective for contaminants with low solubility and high sorption where the main concern is resuspension and direct contact. Isolates contaminants from the overlying water column and prevents direct contact between aquatic biota and contaminants.	Applicable to site conditions. Easily applied in situ, though scour must be considered.	Conventional sand caps have been applied in multiple locations nationally.	No	Retained for further consideration for all areas of the Site.	Low to Moderate
		Conventional Sediment Cap	Effective for contaminants with low solubility and high sorption where the main concern is resuspension and direct contact. Sediment with silt and clay is effective in limiting diffusion of contaminants. Sediment caps area generally more effective than sand caps for containment of contaminants with high solubility and low sorption.	Generally applicable to Site conditions, though special engineering controls may be needed to place clay cap.	Conventional sediment caps using river-dredged sediments have been applied in multiple locations nationally. Application of clay caps is relatively new, but demonstrated.	No	Retained for further consideration for all areas of the Site.	Low to Moderate
		Armored Cap	Applicable to Site COCs. Isolates contaminants from the overlying water column and prevents direct contact between aquatic biota and contaminants.	Applicable to Site Areas where increased velocities from river flow might be expected.	Armored caps have been implemented at several sites nationally.	No	Retained for further consideration for all areas of the Site.	Low to moderate

		Composite Cap	Effective for Site COCs. Isolates contaminants from the overlying water column and prevents direct contact between aquatic biota and contaminants. Can be used 1) to limit cap thickness, 2) for low solids underlying sediments where additional floor support is required, 3) as a bioturbation layer, or 4) as a barrier for areas where methane generation may be an issue.	Technically implementable for site conditions	Application of composite capping is relatively new, but demonstrated.	No	Retained for further consideration for all areas of the Site.	Low to Moderate
		Reactive Cap	Effective for Site COCs. Isolates contaminants from the overlying water column and prevents direct contact between aquatic biota and contaminants.	Technically implementable for site conditions	Addition of materials to increase sorptive capacity of cap has been demonstrated.	Yes	Retained for further consideration for all areas of the Site.	Low to Moderate
		Hard Cap	Confines COCs by encapsulating with concrete, grout, or mortar placed over an underlying surface.	Applicable to difficult to access areas (e.g. cracks and crevices between boulders), though may be difficult to install and show success. Hard cap reduces the habitat value.	Shotcrete used at Todd Shipyards effectively encapsulating existing debris mounds under dock structures from the aquatic environment.	Yes	Eliminated.	Low to Moderate
Institutional Controls	Proprietary Controls	Proprietary Controls	--	--	--	--	Retained	Low
	Informational Devices	Seafood Consumption Advisories, Education, and Public Outreach	--	--	--	--	Retained	Low
Monitoring	Physical and chemical assessment	Baseline Monitoring	Can be effective for evaluating changes.	Technically implementable for site conditions	Available and demonstrated	--	Retained	Moderate
		Construction Monitoring	Can be effective for evaluating changes.	Technically implementable for site conditions	Available and demonstrated	--	Retained	Low
		Post-construction Performance Monitoring	Can be effective for evaluating changes.	Technically implementable for site conditions	Available and demonstrated	--	Retained	Low
		Operation and Maintenance Monitoring	Can be effective for evaluation and maintenance of remedy following remedial actions	Technically implementable for site conditions	Available and demonstrated	--	Retained	Moderate
		Long-term Monitoring	Can be effective for evaluating sediment, tissue, and water quality over an extended period of time following remedial actions.	Technically implementable for site conditions	Available and demonstrated	--	Retained	Moderate to High

Table 5-3 Technology Screening Summary (shaded technologies are retained)

GRA	Technology Type	Process Option	Comments Related to Technology Assumptions for the FS
No action	None	Not Applicable	Per NCP requirements
Monitored natural recovery (MNR)	Natural Physical, Chemical, and Biological Recovery	Multiple potential mechanisms: burial (sedimentation), immobilization, desorption, dispersion, diffusion, dilution, volatilization, resuspension, biological degradation	Sediment chemistry is monitored over time to track recovery by multiple physical, chemical, and biological mechanisms that operate naturally in the environment. Burial is assumed to be the principal recovery mechansim, though burial rates would need to be evaluated during remedial design. Areas suitable for MNR must be depoisitional and not subject to significant physical disturbances from high river flows.
Enhanced monitored natural recovery (EMNR)	Thin-layer placement	Thin-layer placement to augment natural recovery	EMNR differs from MNR with respect to modification of initial conditions (i.e., placing clean material onto the contaminated sediment surface). In other respects, siting and monitoring considerations remain the same. The composition of EMNR may include carbon amendments and/or habitat mix.
In situ treatment	Physical Immobiilization	Activated Carbon Amendment	Technology can be considered in various ways from stand-alone applications to enhancements of other technologies (e.g., amending cap materials or incorporating into media used for EMNR).
		Organoclay amendment	Technology can be considered in various ways from stand-alone applications to enhancements of other technologies (e.g., amending cap materials or incorporating into media used for EMNR).
Removal	Dredging	Mechanical Dredging	
		Hydraulic Dredging	
	Excavation	Dry Excavation	Generally applicable only to nearshore areas. Steep slope on north shore of island and rocky nature of the bottom limit the applicaion of on-land excavators, backhoes, etc.
Ex situ treatment	Chemical	Soil Washing with Air Stripping	To-be-considered during remedial design (if ex situ treatment required/economical).

	Physical	Solidification	To-be-considered during remedial design (if ex situ treatment required/economical).
	Chemical/Physical	Thermal	
Disposal/Reuse	On-site Disposal	Contained Aqautic Disposal (CAD)	This FS assumes it would be difficult to obtain agreement from the states of Washington and Oregon to place a CAD in the Columbia River at or near this Site.
		Confined Disposal Facility (CDF)	Numerous hurdles, including: identifying suitable available land/water sites for acquisition, providing compensatory habitat mitigation for lost aquatic habitat, and demonstrating appropriate economic development purposes for the upland facility in accordance with the Clean Water Act Section 404(b)(1) guidelines.
	Off-site Disposoal	Subtitle D Landfill	
		Subtitle C Landfill	
		Open water disposal	To-be-considered during remedial design if material is demonstrated to achieve applicable criteria for open water disposal.
		Beneficial Reuse	Potentially significant administrative issues, including timing, contracting, and administrative approvals).
Containment	Capping	Conventional Sand Cap	Conventional capping is restricted to net deposition areas that are not subject to appreciable sustained or episodic erosion (unless armored). Cap thickness must be sufficient to prevent reintroduction of buried contaminants into biologically active zone.
		Conventional Sediment Cap	Cap thickness must be sufficient to prevent reintroduction of buried contaminants into biologically active zone.
		Armored Cap	If capping is considered in erosion areas, armoring will likely by required to maintain cap integrity.
		Composite Cap	Application would be location-specific where sand capping is not adequate.
		Reactive Cap	Application would be location-specific where sand capping is not adequate.

		Hard Cap	Hard capping is a potential approach for confining or isolating contaminants on steep slopes within cracks and crevices, but uncertainties remain for this technology's use as a sediment remediation strategy.
Institutional Controls	Proprietary Controls	Proprietary Controls	Access to the Bradford Island shoreline from the uplands is already restricted by general security measures by USACE. The Columbia River is a public waterway, but access by boat is restricted immediately upstream of Bonneville Dam; public access to nearshore areas is generally not permitted.
	Informational Devices	Seafood Consumption Advisories, Education, and Public Outreach	Public advisories regarding fish consumption are currently posted for smallmouth bass caught from Bonneville Dam upstream to Ruckel Creek. Revised advisories are a likely element of all remedial alternatives and will remain in place until monitoring data confirms that the advisories can be modified or removed entirely. A robust and effective education and outreach program would seek to better inform potential receptors of the remaining risks.
Monitoring	Physical and chemical assessment	Baseline Monitoring	Establishes a statistical basis for comparing conditions before and after cleanup actions.
		Construction Monitoring	Short-term monitoring during remediation used to evaluate whether the project is being implemented in accordance with project specifications.
		Post-construction Performance Monitoring	Evaluates post-removal surface and subsurface sediment conditions in dredging or containment areas to confirm compliance with project specifications.
		Operation and Maintenance Monitoring	O&M monitoring of dredging, containment, or disposal areas (e.g., CAD sites, ENR and capping areas) required to ensure long-term effectiveness and continued stability of the structure.
		Long-term Monitoring	Evaluates sediment, tissue, and water quality at the site for an extended period following the remedial action.

Table 6-1. Remedial Action Level (RAL) and Alternative Rationale

Alternative	RAL (µg/kg)	RAL/Alternative Rationale	RAO 1 PRG Achieved?	RAO 2 PRG Achieved?
1	--	No Action Alternative	Not after 30 years	Between 20 and 30 years
2	--	LUCs Only Alternative	Not after 30 years	Between 20 and 30 years
3	29	Highest RAL where both PRGs are achieved in 30 years with combination of capping and ENR	Betweeen 20 and 30 years	Immediately following construction
4	15	RAL where both PRGs are achieved in 30 years with combination of capping and ENR	Betweeen 20 and 30 years	Immediately following construction
5	2.1	RAL where both PRGs are achieved in 30 years with combination of capping and ENR	Betweeen 20 and 30 years	Immediately following construction
6	2.1	RAL where both PRGs are achieved within 20 years with combination of capping and ENR	Between 10 and 20 years	Immediately following construction
7	1.3	RAL where both PRGs are achieved within 20 years with mostly capping or dredging	Between 10 and 20 years	Immediately following construction
8	0.97	RAL where both PRGs are achieved immediately following construction	Immediately following construction	Immediately following construction

Table 6-2. TCLP Maximum Values and Maximum Leachable Concentrations

Contaminant	TCLP Maximum (mg/L)[a]	Maximum Theoretical Leachable Concentration (mg/kg)
Chlordane	0.03	0.6
Chromium (Cr)	5	100
Endrin	0.02	0.4
Lead (Pb)	5	100
Mercury (Hg)	0.2	4

[a] Regulatory level defining the toxicity characteristic for these contaminants as identified in 40 CFR 261.24

Table 6-3. Total PCBs as congeners Surface-weighted Average Concentrations (SWACs) for Each Alternative

Remedial Alternative	Human Health SWAC-based PRG - RAO 1 (µg/kg dw)	Ecological Health SWAC-based PRG - RAO 2 (µg/kg dw)	SWAC following Construction (µg/kg dw)	Estimated SWAC after 10 years (µg/kg dw)	Estimated SWAC after 20 years (µg/kg dw)	Estimated SWAC after 30 years (µg/kg dw)
1	0.60	1.6	60	12	2.9	1.1
2			60	12	2.9	1.1
3			0.98	0.68	0.62	0.60
4			0.75	0.63	0.61	0.60
5			0.69	0.62	0.61	0.60
6			0.68	0.62	0.60	0.60
7			0.65	0.61	0.60	0.60
8			0.56	0.59	0.60	0.60

Indicates concentration is less than or equal to Ecological SWAC-based PRG (RAO 2)

Indicates concentration is less than or equal to both SWAC-based PRGs (RAOs 1 and 2)

Table 6-4. Technology Area Summary

Alternative	Capping Area (sq ft)	Dredging Area (sq ft)	ENR Area (sq ft)
1	0	0	0
2	0	0	0
3	179,704	0	292,137
4	224,649	0	247,192
5	245,402	0	226,438
6	245,402	0	387,595
7	245,402	192,404	34,035
8	245,402	643,846	34,035

Table 6-5. Material Volumes Summary

Alternative	Coarse Sand/Fine Gravel Mass (cubic feet)[a]	Activated Carbon Volume (cubic feet)[b]	Dredged Material Volume (cubic feet)
1	--	--	--
2	--	--	--
3	309,339	16,434	--
4	331,811	16,434	--
5	342,187	16,434	--
6	422,766	16,434	--
7	342,188	16,434	192,404
8	567,909	16,434	643,846

[a] Includes material for capping, ENR, and residuals management as appropriate

[b] Assumes 0.12 lbs/ft^2/cm loading rate and 25 lb/ft^3 bulk density

Table 6-6. Total PCBs as Congeners SWACs (µg/kg) after 10 years with Different Replacement Rates

Alternative	Replacement Rate			
	5%	15%[a]	25%	35%
1	36	12	4.0	1.4
2	36	12	4.0	1.4
3	0.83	0.68	0.62	0.61
4	0.69	0.63	0.61	0.60
5	0.66	0.62	0.61	0.60
6	0.65	0.62	0.61	0.60
7	0.63	0.61	0.60	0.60
8	0.57	0.59	0.60	0.60

[a] This value assumed for developing alternatives.

Table 6-7. Material Summary and Estimated Costs

River OU Alternatives	Volume of Dredged Material (cubic yards)	Volume of Residual Management Material (cubic yards)	Volume of Capping Material (cubic yards)	Volume of ENR Material (cubic yards)	Present Value Cost – Best Estimate[a]
Alternative 2	0	0	0	0	$3,395,673
Alternative 3	0	0	6,656	5,410	$7,931,391
Alternative 4	0	0	8,320	4,578	$8,562,054
Alternative 5	0	0	9,089	4,193	$8,880,377
Alternative 6	0	0	9,089	7,178	$9,125,661
Alternative 7	7,126	3,563	9,089	630	$14,874,160
Alternative 8	23,846	11,923	9,089	630	$20,927,961

[a] Net present value costs are calculated assuming a discount rate of 1.4% on both capital and monitoring costs starting at the beginning of construction.

Table 6-8. Estimated Capital and O&M Costs

River OU Alternatives	Present Value Capital Cost	Present Value Operation and Maintenance Cost
Alternative 2	$605,848	$2,145,604
Alternative 3	$4,247,467	$3,683,924
Alternative 4	$4,739,518	$3,822,536
Alternative 5	$4,991,435	$3,888,942
Alternative 6	$5,197,915	$3,927,746
Alternative 7	$11,009,926	$3,864,234
Alternative 8	$17,063,727	$3,864,234

Table 7-1. River OU Criteria Comparison

Evaluation Criteria				Remedial Alternative							
				1	2	3	4	5	6	7	8
Threshold Criteria	Overall Protection of Human Health and the Environment			N - SWAC remains above RAO 1 PRG after 30 years; no additional LUCs instituted to inform potential receptors of remaining risks	Y - SWAC remains above RAO 1 PRG after 30 years but meets the RAO 2 PRG between 20 and 30 years following remedy implementation; additional LUCs instituted to inform potential receptors of remaining risks	Y - SWAC remains above RAO 1 PRG after 10 years, but RAO 2 PRG achieved after 6 years; additional LUCs instituted to inform potential receptors of remaining risks	Y - SWAC remains above RAO 1 PRG after 10 years, but RAO 2 PRG achieved following construction; additional LUCs instituted to inform potential receptors of remaining risks	Y - SWAC remains above RAO 1 PRG after 10 years, but RAO 2 PRG achieved following construction; additional LUCs instituted to inform potential receptors of remaining risks	Y - Achieves RAO 1 PRG after 10 years, and RAO 2 PRG achieved following construction; additional LUCs instituted to inform potential receptors of remaining risks	Y - Achieves RAO 1 PRG after 10 years, but RAO 2 PRG achieved following construction; additional LUCs instituted to inform potential receptors of remaining risks	Y - Both PRGs achieved immediately after construction; additional LUCs instituted to inform potential receptors of remaining risks
	Compliance with ARARs			No chemical-specific ARARs for sediment cleanup.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.	No chemical-specific ARARs for sediment cleanup. Compliance with all identified ARARs is expected.
Balancing Criteria	Long-Term Effectiveness and Permanence	Magnitude and Type of Residual Risk		Does not pass threshold criteria and was not evaluated for comparison.	After 30 years, estimated SWAC exceeds RAO 1 PRG by factor of 1.8. Unacceptable ecological risk remains for 20-30 years after construction.	Estimated SWAC exceeds RAO 1 PRG by factor of 1.6 following construction, but meets the RAO 1 PRG after 20-30 years. No unnacceptable ecological risk remains following construction.	Estimated SWAC exceeds RAO 1 PRG by factor of 1.25 following construction, but meets the RAO 1 PRG after 20-30 years. No unnacceptable ecological risk remains following construction.	Estimated SWAC exceeds RAO 1 PRG by factor of 1.15 following construction, but meets the RAO 1 PRG after 20-30 years. No unnacceptable ecological risk remains following construction.	Estimated SWAC exceeds RAO 1 PRG by factor of 1.13 following construction, but meets the RAO 1 PRG after 10-20 years. No unnacceptable ecological risk remains following construction.	Estimated SWAC exceeds RAO 1 PRG by factor of 1.08 following construction, but meets the RAO 1 PRG after 10-20 years. No unnacceptable ecological risk remains following construction.	Estimated SWAC is less than RAO 1 and RAO 2 PRGs immediately following construction. No unnacceptable ecological risk remains following construction.
		Hot Spots			Hot spots are not addressed under Alternative 2.	All hot spots are addressed by Alternative 3.	All hot spots are addressed by Alternative 4.	All hot spots are addressed by Alternative 5.	All hot spots are addressed by Alternative 6.	All hot spots are addressed by Alternative 7.	All hot spots are addressed by Alternative 8.
		Adequacy and Reliability of Controls	Land Use Controls		Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary	Additional land use controls (education and outreach) are necessary
			Monitoring		Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate	Five-year review required; long-term monitoring necessary and adequate
			Maintenance		No inspections or repairs necessary	Regular inspections; repairs as necessary	Regular inspections; repairs as necessary	Regular inspections; repairs as necessary	Regular inspections; repairs as necessary	Regular inspections; repairs as necessary	Regular inspections; repairs as necessary
	Reduction of Toxicity, Mobility, & Sediment Volume Through Treatment				No treatment is provided.	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8	Capping or ENR with a reactive component over all PTW areas; the amount of reactive component is the same across Alternatives 3-8
	Short-Term Effectiveness		Community and Worker Protection		No impact to workers and community from remedy implementation	Temporary impacts to workers and the community	Temporary impacts to workers and the community	Temporary impacts to workers and the community	Temporary construction impacts, though over a longer duration than Alternatives 3-5	Temporary construction impacts, though over a longer duration than Alternatives 3-5	Temporary construction impacts, though over a longer duration than Alternatives 3-5
			Environmental Impacts		No environmental impacts of remedial efforts	Relatively small scale impacts to water quality, air emissions, noise (based on the area of active remediation)	Relatively small scale impacts to water quality, air emissions, noise (based on the area of active remediation)	Relatively small scale impacts to water quality, air emissions, noise (based on the area of active remediation)	Relatively large scale impacts to water quality, air emissions, noise (based on the area of active remediation)	Relatively large scale impacts to water quality, air emissions, noise (based on the area of active remediation)	Relatively large scale impacts to water quality, air emissions, noise (based on the area of active remediation)
			Estimated Timeframe to Achieve Protection		RAO 1 PRG Achievement: >30 years; RAO 2 PRG Achievement: 20-30 years; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: 20-30 years; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: 20-30 years; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: 20-30 years; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: 10-20 years; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: 10-20 years; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years	RAO 1 PRG Achievement: following construction; RAO 2 PRG Achievement: immediately following construction; Education and outreach program in place: 3 years
	Implementability		Administrative and Technical Feasibility		Challenges related to coordination and collaboration necessary for successful education and outreach program	Challenges related to coordination and collaboration necessary for successful education and outreach program, plus challenges related to placing material on the slopes off the north side of Bradford Island	Challenges related to coordination and collaboration necessary for successful education and outreach program, plus challenges related to placing material on the slopes off the north side of Bradford Island	Challenges related to coordination and collaboration necessary for successful education and outreach program, plus challenges related to placing material on the slopes off the north side of Bradford Island	Same as Alternatives 3-5, plus challenges with placing material on slopes off the south side of Bradford Island or near the powerhouse and navigation channel	Same as Alternatives 3-5, plus challenges with placing material or dredging on the slopes off the south side of Bradford Island	Same as Alternatives 3-5, plus challenges with on the slopes off the south side of Bradford Island or near the powerhouse and navigation channel
	Cost (in millions of dollars)				$3.3	$7.9	$8.6	$8.9	$9.1	$14.9	$20.9

Table 7-2. River OU Relative Rating

Evaluation Criteria				Alternative						
				2	3	4	5	6	7	8
Balancing Criteria	Long-Term Effectiveness and Permanence	Magnitude and Type of Residual Risk		○	◒	◒	◒	◒	◒	●
		Hot Spots		○	●	●	●	●	●	●
		Adequacy and Reliability of Controls	Land Use Controls	◒	◒	◒	◒	◒	◒	◒
			Monitoring	●	●	●	●	●	●	●
			Maintenance	●	◒	◒	◒	◒	◒	◒
	Reduction of Toxicity, Mobility, & Sediment Volume Through Treatment			○	●	●	●	●	●	●
	Short-Term Effectiveness		Community and Worker Protection	●	◒	◒	◒	○	○	○
			Environmental Impacts	●	◒	◒	◒	○	○	○
			Estimated Timeframe to Achieve Protection	○	◒	◒	◒	◒	◒	●
	Implementability		Administrative and Technical Feasibility	●	◒	◒	◒	○	○	○
	Cost (in millions of dollars)			$3.3	$7.9	$8.6	$8.9	$9.1	$14.9	$20.9

● Highest Rating
◒ Moderate Rating
○ Lowest Rating