Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 3/20/2018 10:51:17 PM
To: Bill Ross [bross@rossstrategic.com]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'Richard Whitman' [richard.whitman@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'SEIDEL Paul' [paul.seidel@state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]

Subject: Portland Harbor Sr Leadership
Location: Call-in number Ex. 6 Personal Privacy (PP) 2, pass code Ex. 6 Personal Privacy (PP)

Start: 4/13/2018 10:30:00 PM
End: 4/13/2018 11:30:00 PM
Show Time As: Tentative

Recurrence: (none)

Here is the agenda for Friday's senior leaders call on the Portland Harbor Cleanup. The agenda has been organized to focus time on the issues needing the most discussion and interaction. Thanks, Bill

Agenda:

- Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation. Discuss potential SMAs/AOCs that ODEQ might provide lead technical oversight and how and when to consult with TCT/tribes on the purpose of the protocol.
- Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
- 4 (Port project) - Port is revising their original proposal for T4 and is now not requesting a potential ROD amendment. They are proposing a standard application of the RALs as per the ROD. Senior Port leadership meeting with EPA on April 17 to discuss.
- Willamette Cove - results of US Department of Justice meeting on March 20 to discuss federal participation. 60 day notice letter recently sent out. Will state and federal participation be sufficient to begin RD?

- ESD for PAHs - EPA is preparing an ESD in response to NW Natural's request that the RALs for PAHs be reconsidered in light of the updated cancer potency for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation (and can/should consultation occur prior to seeking public comment?). As this commences, how and when should DEQ indicate its concurrence?
- Nature of the response to the PCI letter to all PRP's and implications for EPA's stated desire that allocation be completed by 2020.
- Gasco - ExxonMobil has communicated with both EPA and DEQ that it believes the Gasco AOC needs to be substantially expanded to include downriver PAH contamination. DEQ has sent a response letter to EM focusing on EM's assertion of inadequate source control. EM also requested an opportunity to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. How should EPA and DEQ respond to EM's requests for agency interaction/decisions?
- OHA Fish Advisory. The Oregon Health Authority issued this week an updated fish consumption advisory for the Lower Willamette River based on information provided in EPA's 2017 ROD. The updated advisory follows OHA's consultation with Oregon Tribes and EPA's engagement with the Yakama Nation.
- Timing of next meeting and determination of the value and frequency of these more focused strategic discussions.

Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 2/15/2018 12:17:07 AM
To: Bill Ross [bross@rossstrategic.com]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'Richard Whitman' [richard.whitman@state.or.us]; 'SEIDEL Paul' [paul.seidel@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]
CC: Tyson, Linda [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d7ad12af04f64468b18e3960f2a77781-Tyson, Lind]

Subject: Canceled: Portland Harbor Sr Leadership call
Location: Call-in number Personal Privacy / Ex. 6

Start: 3/13/2018 9:00:00 PM
End: 3/13/2018 9:30:00 PM
Show Time As: Free

Importance: High

Recurrence: (none)

As per a separate email you will have received, this meeting is being postponed. We will send out a new meeting request as soon as we narrow in on a new time. Thanks!

Here is the agenda for the March 13 Senior Leaders call. Working with the EPA and DEQ managers of the cleanup, the agenda has been developed to focus on issues in which senior leaders' direction, decision-making and connectivity are essential and hence the call will not be an overall project update briefing. Attendance at the call has been determined by the managers to include those staff essential to the strategic discussion that will ensue at the call.

1. Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
   - **T4 (Port project)** - EPA response to Port request for potential ROD amendments by applying Nav Channel RALs in Slip 3. Deliberative Process / Ex. 5
   - **Gasco** - ExxonMobil has communicated with both EPA and DEQ that it believes the AOC needs to be substantially expanded to include downriver PAH contamination. DEQ is drafting a response letter to EM's

assertion of inadequate source control. EM also wants to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. *How should EPA and DEQ respond to EM's requests for agency decisions?*

- **ESD for PAHs** - EPA is preparing an ESD in response to NW Natural's request that the RAL for PAHs be reconsidered in light of the updated risk numbers for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation. *When this commences, how should DEQ indicate its concurrence?*

2. Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation.
3. Timing of next meeting and determination of the value (and frequency) of all hands briefings as well as these more focused strategic discussions.

Appointment

From: DeMaria, Eva [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=0C04D60F20714B4BB58B49524BFE83D7-DEMARIA, EVA]

Sent: 10/19/2017 10:44:55 PM

To: DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Alex Liverman [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; bob@ridolfi.com; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson [courtney@crag.org]; Dan Hafley [HAFLEY.Dan@deq.state.or.us]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Gail Fricano [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio [rdelvecchio@indecon.com]; Rita Cabral [rcabral@indecon.com]; Robert Brunoe [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield [Greenfield.Sarah@deq.state.or.us]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]

CC: GREENFIELD Sarah [sarah.greenfield@state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; PARRETT Kevin [kevin.parrett@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group

(FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Rose Longoria [lonr@yakamafish-nsn.gov]

Subject: Portland Harbor TCT - via telecon only, not in-person
Location: Conference line only: Personal Privacy / Ex. 6

Start: 10/25/2017 5:00:00 PM
End: 10/25/2017 7:00:00 PM
Show Time As: Busy

Recurrence: Monthly
the fourth Wednesday of every 1 month(s) from 10:00 AM to 12:00 PM

Hi all- This is a reminder that the monthly Portland Harbor TCT meeting is on for this Wednesday, October 25, 2017. This will be a call-in meeting only. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

October 25, 2017

Call-In only

10am to Noon Pacific Time

Personal Privacy / Ex. 6

Project Updates

10:00 to 10:30
Sampling Update
IRIS Update
T4, 11E, Gasco Updates

10:30-11:00
Community Involvement Update

- Recap of activities conducted in prior month
- Schedule of activities next month
- Questions

11:00 to 11:15
CERCLA Coordination Permitting

- Recap of activities conducted in prior month
- Schedule of activities in upcoming month
- Questions

11:15-11:30
DEQ Upland Source Control

- Recap of activities conducted in prior month
- Schedule of activities in upcoming month
- Questions

11:30-11:45
Willamette Watershed Issues

- Recap of activities conducted in prior month
- Schedule of activities in upcoming month
- Questions

11:45 to Noon
Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
Office of Environmental Cleanup | Superfund Site Cleanup Unit #2
U.S. EPA Region 10 | 1200 Sixth Avenue, Ste. 900, ECL-122 | Seattle, WA 98101
P: 206-553-1970 | demaria.eva@epa.gov

Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 3/13/2018 6:10:54 PM
To: Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'Richard Whitman' [richard.whitman@state.or.us]; 'SEIDEL Paul' [paul.seidel@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]
CC: Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Tyson, Linda [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d7ad12af04f64468b18e3960f2a77781-Tyson, Lind]

Subject: Canceled: Portland Harbor Sr Leadership call
Location: Call-in number Personal Privacy / Ex. 6

Start: 3/13/2018 9:00:00 PM
End: 3/13/2018 9:30:00 PM
Show Time As: Free

Importance: High

Recurrence: (none)

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3. Timing of next meeting and determination of the value (and frequency) of all hands briefings as well as these more focused strategic discussions.

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 3/13/2018 5:20:55 PM
To: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
CC: Bill Ross [bross@rossstrategic.com]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; OGRODNIK Katie [katie.ogrodnik@state.or.us]; PARRETT Kevin [kevin.parrett@state.or.us]; Richard Whitman [richard.whitman@state.or.us]; SEIDEL Paul [paul.seidel@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]
Subject: Re: POSTPONED: Portland Harbor Sr Leadership call

Thanks

Sent from my iPhone, please excuse spelling errors.

Thanks, Jim.

On Mar 13, 2018, at 1:05 PM, Zhen, Davis <Zhen.Davis@epa.gov> wrote:

> Hi Everyone,
>
> Cami just confirmed with Chris earlier today to postpone this meeting to a later date. I will work with Bill and Kevin to reschedule this meeting. Have a nice day everyone.
>
> Thanks,
>
> **********
> Davis Zhen
> Environmental Cleanup Unit 2
> Office of Environmental Cleanup
> 1200 Sixth Avenue Suite 900
> M/S ECL – 122, Seattle, WA 98101
> Tel: (206) 553-7660
> Cell: (206) 437-5826
> **********

-----Original Appointment-----
From: Bill Ross [mailto:bross@rossstrategic.com]
Sent: Wednesday, February 14, 2018 4:17 PM
To: Bill Ross; Cora, Lori; Mackey, Cyndy; Zhen, Davis; Hladick, Christopher; Woolford, James; Pirzadeh, Michelle; 'OGRODNIK Katie'; 'PARRETT Kevin'; 'Richard Whitman'; 'SEIDEL Paul'; Sheldrake, Sean; Bilbrey, Sheryl; Ingemansen, Dean; Mairs, Stephanie; Chu, Rebecca
Subject: Portland Harbor Sr Leadership call
When: Tuesday, March 13, 2018 2:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Call-in number Personal Privacy / Ex. 6

Here is the agenda for the March 13 Senior Leaders call. Working with the EPA and DEQ managers of the cleanup, the agenda has been developed to focus on issues in which senior leaders' direction, decision-making and connectivity are essential and hence the call will not be an overall project update briefing. Attendance at the call has been determined by the managers to include those staff essential to the strategic discussion that will ensue at the call.

1. <!--[if !supportLists]--><!--[endif]-->Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
   - **T4 (Port project)** - EPA response to Port request for potential ROD amendments by applying Nav Channel RALs in Slip 3. Deliberative Process / Ex. 5
   - **Gasco** - ExxonMobil has communicated with both EPA and DEQ that it believes the AOC needs to be substantially expanded to include downriver PAH contamination. DEQ is drafting a response letter to EM's assertion of inadequate source control. EM also wants to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. *How should EPA and DEQ respond to EM's requests for agency decisions?*
   - **ESD for PAHs** - EPA is preparing an ESD in response to NW Natural's request that the RAL for PAHs be reconsidered in light of the updated risk numbers for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation. *When this commences, how should DEQ indicate its concurrence?*
2. <!--[if !supportLists]--><!--[endif]-->Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation.
3. <!--[if !supportLists]--><!--[endif]-->Timing of next meeting and determination of the value (and frequency) of all hands briefings as well as these more focused strategic discussions.

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January 28, 2019

Davis Zhen
United State Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 155
Seattle, WA 98101-3123

RE: EPA Request for Remedial Design Proposals
Portland Harbor Superfund Site

Dear Mr. Zhen:

Please accept this as NW Natural's response to EPA's March 16, 2018 and December 17, 2018 letters inviting remedial design proposals for the Portland Harbor Superfund Site. As you know, NW Natural is already performing remedial design at the Gasco Sediments Site under an Administrative Settlement Agreement and Order on Consent dated September 28, 2009. Our work at Gasco is well underway. We anticipate completing remedial design investigations during the spring and summer of 2019, and we currently expect to submit final design documents to EPA in 2021.

NW Natural appreciates EPA's willingness to break the site into manageable work areas, and we understand EPA's interest in accelerating the pace of remedial design work throughout Portland Harbor. We believe, however, that, instead of requiring harborwide remedial design immediately, EPA should prioritize those areas that contribute the most to human health or environmental risk, and where remedial work can be commenced in the reasonable future. Focusing on areas presenting the highest potential risks will allow those areas to proceed quickly to construction following entry of consent decrees while allowing space for the ongoing Portland Harbor allocation to work out performance and responsibility in lower priority areas.[1] We encourage EPA to reschedule its meeting with the allocation group as soon as possible to explore how the allocation schedule aligns with the completion of remedial design work both planned and in progress.

NW Natural's strong preference remains to implement the Gasco cleanup as part of a harborwide settlement with EPA, and so we need the allocation to be successful. We are extremely concerned that broad enforcement action by EPA has the potential to undermine

[1] We also note that EPA has proposed to update cleanup levels and remedial action levels for cPAHs. Several parties submitted comments on EPA's proposed Explanation of Significant Differences, and EPA should consider those comments and finalize the ESD before requiring additional remedial design commitments in areas defined primarily by PAH concentrations.

the allocation and result in litigation that will delay, rather than expedite, the cleanup. We believe that providing incentives (including forbearance from enforcement action) to parties who are willing to or are already performing remedial design work is EPA's best path to move the site as a whole toward cleanup as quickly as possible. If EPA needs to use its enforcement authority to start remedial design in certain high priority areas, it should target that enforcement specifically to those areas and associated responsible parties and should not take action against parties who are cooperating with EPA and already performing design work in priority areas.

EPA and NW Natural have worked collaboratively during the last two years to develop site-specific technical approaches for a successful cleanup at Gasco. We have experienced firsthand EPA's willingness to implement flexibilities built into the Portland Harbor Record of Decision. We have shared our experience working with EPA with other responsible parties and will continue to do so. We are also committed to communicating with EPA and other responsible parties to ensure efficiency and consistency in Portland Harbor remedial design work where appropriate.

In summary, we appreciate EPA's ongoing work with us on the design for the Gasco site, and we hope that EPA will consider the relative risks associated with different areas of the site as it establishes schedules and deadlines for remedial design throughout the Portland Harbor. EPA should not require parties, such as NW Natural, who have already stepped forward to address priority areas, to risk enforcement or litigation that will only serve to delay the initiation of cleanup.

We would be happy to discuss this request with EPA, and we look forward to continued progress on the remedial design for Gasco.

Sincerely,

Bob Wyatt

cc: Steven Cook, EPA
Chris Hladick, EPA
Jim Woolford, EPA
Cyndy Mackey, EPA
Sheryl Bilbrey, EPA
Cami Grandinetti, EPA
Lori Cora, EPA
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Via email: HarborComments@epa.gov

Attn: Portland Harbor Superfund Comments
U.S. Environmental Protection Agency
805 SW Broadway, Suite 500
Portland, OR 97205

Re: NW Natural Comments on Proposed Explanation of Significant Differences
Portland Harbor Superfund Site

Dear Environmental Protection Agency:

NW Natural appreciates the opportunity to submit these comments on EPA's *Proposed Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon* (October 2018). We are pleased that EPA has moved quickly to incorporate its updated *Toxicological Review of Benzo(a)pyrene* (January 19, 2017) into the Portland Harbor Record of Decision before significant resources were spent implementing outdated cleanup values. We do, however, have some concerns about the proposed ESD, and we request that EPA modify the proposed ESD to be consistent with the remedy selected in the Record of Decision for the Portland Harbor Site.

A brief summary of our comments, together with our requested revisions to the proposed ESD, follows:

- *Nearshore PAH Remedial Action Levels should be revised proportionally to the updated cleanup level for direct contact with cPAHs (RAO 1).* The ROD establishes an interim target for human health direct contact risk of 1×10^{-5} from all chemicals at the completion of construction of active remedies and then selects monitored natural recovery as the response action through which final cleanup levels will be achieved.[1] The proposed ESD eliminates MNR as a component of RAO 1 cPAH remedies by establishing nearshore PAH RALs that achieve final RAO1 cPAH cleanup levels in every area of the site immediately upon the conclusion of construction. Because the nearshore RAL is set to achieve final cleanup levels at construction completion at 100% of nearshore rolling half river mile segments, large areas of the site will be subjected to active remedies based on PAH RALs where the RAO 1 interim target is already met, including some areas where EPA's calculations show that no actual cPAH risk is present at the updated cleanup level. This is a fundamental change from the remedy selection criteria employed in the FS and the ROD.

[1] ROD, Table 22. *See also, Portland Harbor Feasibility Study* (EPA, June 2016), p. 4-6

Requested revision: EPA should revise the PAH RALs proportionally to the updated cleanup levels. EPA's June 2016 FS evaluations demonstrate that nearshore PAH RALS as high as 170,000 ppb would meet the cPAH interim target for RAO 1 of 1 x 10^{-5} throughout the site. [2] *Proportional revision of the PAH RALs would maintain MNR as a component of the RAO 1 remedy and be consistent with the FS and the ROD.*

- *The Site meets the shellfish consumption interim target at the "no action" level, and no PAH cleanup in the navigation channel is necessary to reduce risk from shellfish consumption (RAO 2).* EPA's baseline human health risk assessment identified no human health risk from clams harvested within the navigation channel, based upon the assumption that clam harvesting would occur only in nearshore areas with accessible water depths.[3] Neither the ROD nor the ESD explain why EPA diverged from the risk assessment by finding that clams were likely to be harvested and consumed from the bottom of the navigation channel.

  Regardless, the ROD establishes an interim target for RAO 2 of 1 x 10^{-4} on a sitewide basis.[4] EPA's FS and ROD evaluations calculate sitewide cPAH concentrations at the "no action" level at 1,489.1 µg/kg, just above the updated 1076 µg/kg cPAH final cleanup level for RAO 2.[5] The contribution of PAH RALs in the navigation channel to attainment of EPA's interim target for RAO 2 is therefore essentially nonexistent, except to the extent that a cleanup area established using a PAH RAL may sweep up co-located non-petroleum chemicals contributing to fish consumption risk. If other chemicals are posing unacceptable risk from fish consumption, EPA should select remedies on that basis explicitly instead of using the PAH RAL to address them.

  Requested revision: Any concern about limited interim risk based on shellfish consumption could be addressed in the ESD through EPA's clarification that institutional controls prohibiting clam harvesting are an appropriate alternative to dredging in in the navigation channel. EPA should not require extensive dredging in the navigation channel to address chemicals that are irrelevant to attaining EPA's RAO 2 protectiveness criteria.

- *The Site surface water meets Oregon water quality standards applicable to cPAHs at the "no action" level, and no PAH cleanup is necessary to protect surface water (RAO 3).* The proposed ESD states, "The BaP [cancer slope factor] change is not expected to result in a change to Oregon water quality standards in the foreseeable future. As a result, the ARAR based surface water CULs specified in Table 17 of the ROD have not been modified." The most stringent benzo(a)pyrene Oregon water quality standard (human health water + organism consumption) is .0013 µg/l. EPA's ROD shows maximum

[2] ROD, Appendix IV Table J2.2-1c (Alternative B)
[3] EPA Comments on Comprehensive Round 2 Site Summary and Data Gaps Analysis Report (January 15, 2008), p. 26.
[4] ROD, Table 22.
[5] ROD, Appendix IV, Table J2.3-7

predicted cPAH surface water concentrations at the "no action" level at just over .0012 µg/l.[6]

ROD Table 17 sets the cPAH surface water cleanup level at .00012 µg/l based not on the Oregon water quality standard but on the National Recommended Water Quality Criteria for benzo(a)pyrene. NRWQC are not applicable to CERCLA cleanups but may be relevant and appropriate at some sites. The .00012 µg/l benzo(a)pyrene NRWQC, which is based on outdated cancer slope factors, no longer represents good science and is no longer relevant or appropriate to RAO 3 (reduce cancer and non-cancer risks to people from surface water at the site).[7]

Requested revision: EPA should update the cPAH cleanup level in ROD Table 17 to the applicable Oregon water quality standard. Because EPA's analysis shows this standard is met at the no action level, no PAH cleanup is necessary to meet RAO 3.

- *Consistent with the ROD, PAH RALs should not be used to define active remediation to address benthic risk (RAO 5).* In the ROD, EPA set an interim target for RAO 5 of addressing 50% of the area of the site exceeding 10 times the cleanup level at the end of construction.[8] The remaining 50% of benthic risk areas are allowed to naturally recover.[9] The ESD explicitly rejects any PAH RAL above 170,000 µg/kg because it "may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community."[10] Simple math shows that any PAH RAL below 230,000 µg/kg will address all areas exceeding 10 times the PAH cleanup level at construction completion, eliminating any MNR component from the remedy. This is a fundamentally different remedy for RAO 5 than selected in the ROD.

  The PAH RALs developed to define active remedies based on RAOs 1 and 2 were never intended to target RAO 5 risks. There is no rational connection between the RALs and EPA's interim target for RAO 5, and EPA should not apply PAH RALs in the navigation channel.

  Requested revision: At a minimum, EPA should clarify that during remedial design, areas of benthic toxicity for which active remediation is required will be further defined through the multiple lines of evidence, such as benthic toxicity testing, used in the Baseline Ecological Risk Assessment.[11]

The revisions we are requesting to the proposed ESD would have minimal effect on the Gasco Sediments project area, and we want to be absolutely clear that we are proceeding

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[6] ROD Appendix IV, Figure 4.2-8b.
[7] *ARARs Q's & A's: Compliance with Federal Water Quality Criteria* (EPA, June 1990) ("Prior to using an FWQC for a particular constituent, RPMs should consult the IRIS data base ... to ensure consideration of the latest available scientific information.")
[8] ROD, Table 22.
[9] ROD Responsiveness Summary, page 2-217.
[10] Proposed ESD, p. 26
[11] See, ROD Responsiveness Summary, p. 2-218

expeditiously with remedial design under the existing ROD on the schedule set out in the 2009 Administrative Settlement Agreement and Order on Consent between EPA and NW Natural. The requested revisions could, however, limit litigation among responsible parties over the sources of relatively low level petroleum contamination in other areas of Portland Harbor that present little or no risk based on the best available science, thereby focusing the parties' resources on cleanup and avoiding delay while remaining consistent with the basic features of the ROD, including the use of interim targets to evaluate protectiveness and the reliance on MNR to attain final cleanup levels.

Our detailed comments are provided below.

COMMENTS ON THE PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES

Under the National Contingency Plan, an ESD is appropriate where EPA adjusts the remedial action in ways that "significantly change but do not fundamentally alter the remedy selected in the ROD with respect to scope, performance, or cost."[12] An ESD is the correct administrative procedure to conform cleanup levels and criteria to updated Integrated Risk Information System (IRIS) toxicity values, because the updated values maintain the same measure of protectiveness as the original ROD.

IRIS "represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review."[13] When selecting remedial goals, EPA site managers should "[u]se the most current toxicity values provided by the Integrated Risk Information System (IRIS) or the Health Effects Assessment Summary Tables (HEAST)."[14] After a remedy is selected, EPA guidance directs site managers to review existing cleanup levels against updated IRIS values. "It is EPA's policy to encourage appropriate remedy changes in response to advances in remediation science and technology."[15] EPA "recognizes that some remedy decisions made at Superfund sites in the past should be modified to bring those decisions up to date with the current state of the science."[16] EPA has used ESDs at many other sites to recalculate cleanup levels based on updated IRIS values.[17]

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[12] 40 C.F.R. § 300.435(c)(2)(i).
[13] *Id.*
[14] *Rules of Thumb for Superfund Remedy Selection*, OSWER 9355.0-69 (August 1997), p. 6.
[15] *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents,* EPA 540-R-98-031 (July 1991), p. 7-1.
[16] *Superfund Reforms: Updating Remedy Decisions*, EPA 540-F-96-026 (September 1996), p. 2.
[17] *See, e.g.* Salem Acres (Salem, MA) January 1998 ESD (revising cPAH cleanup levels based upon updated B(a)P IRIS values ("benzo(a)pyrene less potent than it was believed when the ROD was written"); Burlington Northern Somers Plant (Somers, Montana) July 1998 ESD (revising soil remediation level for cPAHs from 36 to 57 ppm B(a)Peq based upon revised B(a)P cancer slope factor); Petrochem Recycling Corp (Salt Lake City, Utah) March 1999 ESD (updating soil performance standard for PCBs from 0.15 ppm to 2.7 ppm based upon updated IRIS slope factors); Commencement Bay November 1997 ESD (updating PCB cleanup levels for multiple reasons, including new toxicity information and updated exposure assumptions).

Where EPA seeks to "fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost," however, EPA must do so by amending the ROD.[18] Here, the proposed ESD goes beyond merely updating the cPAH cleanup level and associated RALs to make wholesale changes in the manner in which EPA's ROD combines active remedies and natural recovery to achieve protectiveness. And EPA is making these fundamental changes in the scope of its selected remedy for cPAHs and PAHs alone among the dozens of chemicals found to present unacceptable risk at Portland Harbor.

1. Selection of active remediation areas to achieve final cleanup levels at construction completion is a fundamental change to the selected remedy.

The NCP requires EPA to evaluate and compare remedial alternatives against nine criteria. 40 CFR 300.430(e)(9). Two of these criteria, overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs), are "threshold" criteria that must be met for an alternative to be carried forward for further comparison. In the Portland Harbor FS and ROD, EPA evaluated overall protectiveness and ARARs by reference to "interim targets" to be met at completion of construction of active remedies. EPA expected final cleanup levels to be achieved through monitored natural recovery.

> As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions. These interim targets are higher than residual risks once PRGs are achieved, and assume that further reductions with [sic] be achieved through MNR. Because the primary mechanism for MNR is through deposition, MNR is likely to be effective in the shortest amount of time in depositional environments after source control actions and active remediation of any sediment posing the highest risks have been completed (USEPA 2005). However, the majority of the Site is transitional; depositional during low flows and erosional in higher flows, which the exception of RM 11E and in the navigation channel at RM 6 that are erosional under all flow conditions. Further, the establishment of interim targets is consistent with EPA's Contaminated Sediment Guidance. Therefore, the protection of human health and the environment is assessed for each RAO by evaluating achievement of interim targets at the end of construction, as well as any additional benefit provided by measures that further reduce exposure risks such as ICs.[19]

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[18] 40 C.F.R. § 300.435(c)(2)(ii). *See also, United States v. NCR Corp.*, 911 F. Supp. 2d 767, 774 (E.D. Wis. 2012), *aff'd sub nom. United States v. P.H. Glatfelter Co.*, 768 F.3d 662 (7th Cir. 2014) (amendment required for change to "basics" of the remedy).

[19] *Portland Harbor Feasibility Study* (EPA, June 2016) ("EPA FS"), p. 4-6.

For RAO 1 (human health direct contact), EPA chose to evaluate protectiveness against an interim target of 1 x 10^{-5} cumulative post-construction risk.[20] EPA then selected active remedies, delineated through the application of PAH and other RALs, that met this interim target and selected MNR to attain final cleanup levels.[21]

The proposed ESD instead selects areas for active remediation of nearshore petroleum contamination by "achieving the updated direct contact cPAH CUL of 774 µg/kg as measured on one-half rolling river mile [surface area weighted average concentrations (SWACs)] throughout the Site" at "100% of the nearshore half-river miles" at the completion of construction.[22] This is a fundamentally different remedy than selected in the ROD, because it entirely eliminates MNR as a component of RAO 1 cPAH remedies (and only cPAH remedies).

The proposed ESD did not evaluate any alternative PAH RALs against the interim target of 1 x 10^{-5} post-construction cumulative risk. If EPA intended merely to update its selected remedy consistent with the IRIS update, EPA, at a minimum, should have compared cumulative risks using PAH SWACS calculated for all alternatives evaluated in the FS against the interim targets adopted in the ROD. Instead, EPA simply compared post-construction cPAH SWACs to the updated cPAH cleanup level. ROD Appendix IV Table J2.2-1c readily shows that a PAH RAL as high as 170,000 µg/kg (FS Alternative B) would reduce cPAH concentrations below 1 x 10^{-5} (7,740 µg/kg) in all nearshore half-river miles. The figures below, modeled after proposed ESD Figures 4a and 4b, show this graphically.[23]

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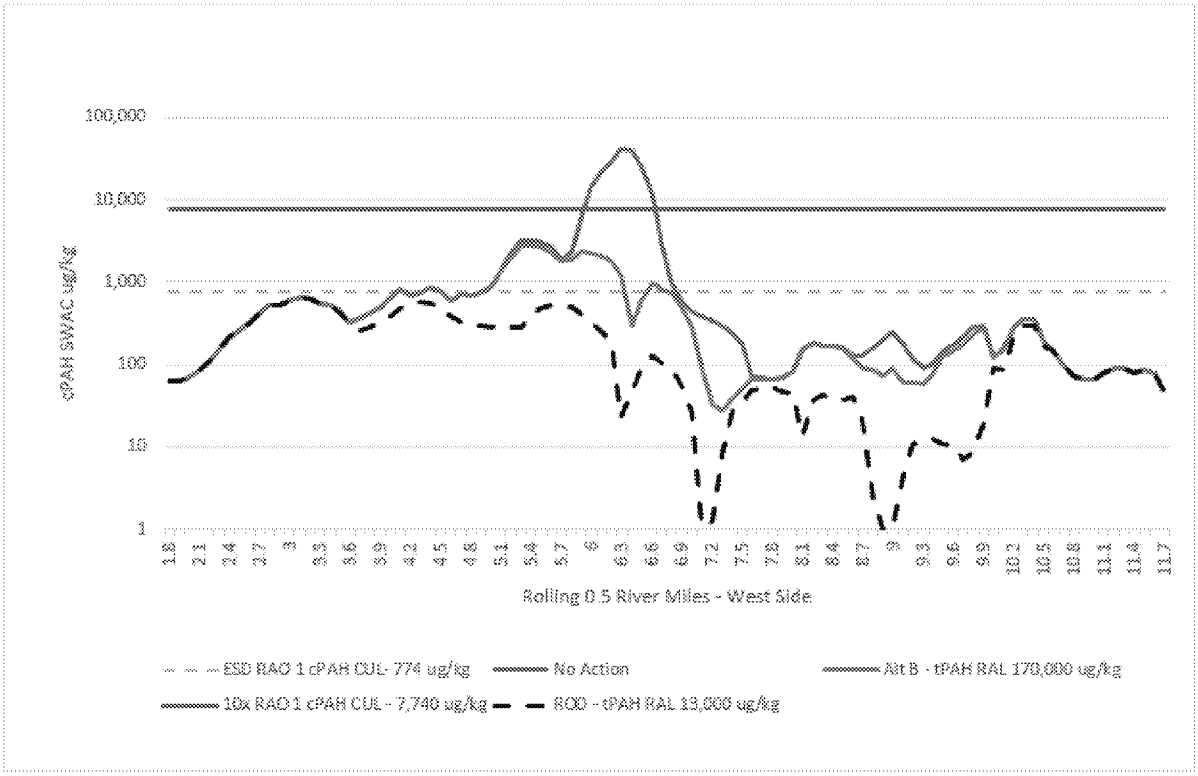
[20] ROD, Table 22

[21] *See*, Proposed ESD, p. 16 ("The Selected Remedy addresses all areas where contaminant concentrations exceed the CULs through a combination of dredging, capping, enhanced natural recovery (ENR), monitored natural recovery (MNR), and institutional controls.")

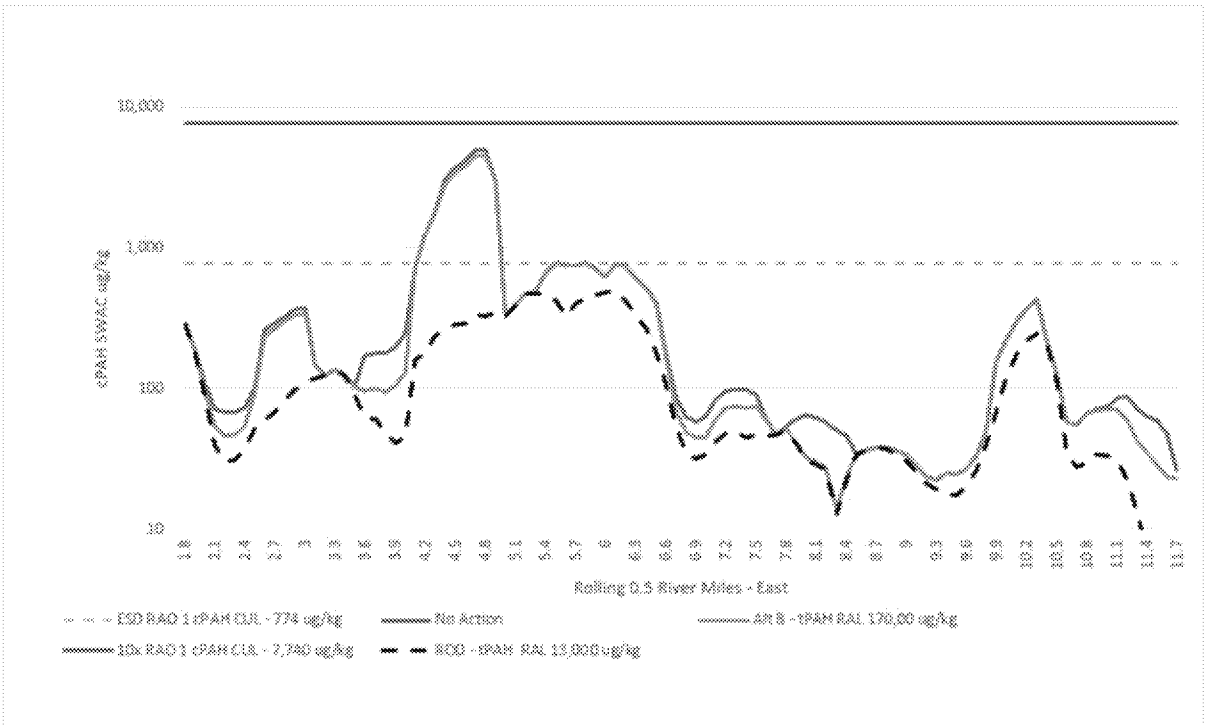
[22] Proposed ESD, p. 24.

[23] Our figures were plotted using data from ROD Appendix IV Table J2.2-1c. We do not know the source of the data plotted on proposed ESD Figures 4a and 4b, but the 13,000 µg/kg (F-Mod) lines on those figures do not match the post-construction SWACs presented in the ROD.

Post Construction SWACs RAO 1 – EPA App J 0.5 RM - West Side



Post Construction SWACs RAO 1 – EPA App J 0.5 RM - East Side



Indeed, as ROD Appendix IV Table J2.2-1c shows, only seven half-river miles exceed 7,740 µg/kg at the "no action" (Alternative A) condition, and many areas identified for active remedies based on PAH RALs in the ESD would meet or approach the final cPAH cleanup level at PAH RALs significantly higher than the RAL selected in the proposed ESD.[24] Proposed ESD Figure 8, for example, shows an area of active remedy defined by the proposed 30,000 g/kg PAH RAL at approximately RM 3.8W; according to ROD Appendix IV Table J2.2-1c, all west bank half-river miles downstream of RM 4W already meet the final cleanup level at the "no action condition."[25]

If the proposed ESD were a ROD amendment, the divergence, without explanation, from EPA's previous selection of a remedial approach that combined active remedies with MNR, and without comparison of a range of alternatives against the full nine criteria would have been inconsistent with the NCP and arbitrary and capricious.[26] EPA has not explained why it is proposing response actions for petroleum contamination that are far more aggressive than for any other hazardous substance present at the Site and has not provided any analysis of whether those actions are cost-effective or even necessary.[27] This is an absurd outcome at a site where EPA has concluded that "health risks from consumption of fish are 100 times or more greater than any other risks evaluated at Portland Harbor. The majority of these risks are due to PCBs...."[28] And it is a very odd conclusion given that PAHs degrade more quickly in the environment than any of the other primary risk drivers (PCBs, pesticides and dioxins).[29]

It may be that EPA has concluded that low nearshore PAH RALs remain necessary to capture risk associated with other chemicals and other RAOs. For example, EPA identified an RAO 2 risk-based PRG of 0 µg/kg for PCBs.[30] EPA's site wide PCB RAL is 75 µg/kg.[31] Areas of the site that do not exceed cPAH interim target concentrations, or even present unacceptable risk from cPAHs, based upon the updated IRIS cancer slope factor might nonetheless contribute to RAO 2 risks because of PCB concentrations between 0 and 75 µg/kg, and smaller areas of active remedy defined by PAH RALs might therefore affect the ability of EPA's ROD as a whole to meet the RAO 2 interim target due to PCB risk. If this is the basis for EPA not proportionally adjusting the PAH RALs to reflect the updated IRIS cancer slope factor, EPA should say so explicitly, and should show its analyses to reach this conclusion. A fair allocation of response costs among

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[24] We do not understand how EPA generated Figure 5 in the proposed ESD or the conclusion that a "total PAH RAL of 95 mg/kg protects 22% of the nearshore areas." Proposed ESD, p. 24. ROD Appendix IV Table J2.2-1c shows that rolling river mile average concentrations of cPAHs (0.5 mile increments) are below the 774 µg/kg updated cleanup level in approximately 86% of nearshore segments at the "no action" condition. Please review this figure and conclusion and either correct it or explain it.

[25] EPA has no legal basis for requiring remediation in the absence of unacceptable risk. 42 U.S.C §9606(a).

[26] *See, Puerto Rico Sun Oil Co. v. U.S. E.P.A.*, 8 F.3d 73, 78 (1st Cir. 1993), citing *Atchison, T & S.F. Ry. Co. v. Wichita Bd. of Trade*, 412 U.S. 800, 808, 93 S.Ct. 2367, 2375, 37 L.Ed.2d 350 (1973) (EPA departure from past practice or precedent must be explained).

[27] *Puerto Rico Sun Oil Co*. 8 F.3rd at 77 ("Unexplained discrimination" by an agency is arbitrary and capricious).

[28] *Portland Harbor Human Health Risk Assessment Summary* (EPA, August 2013)

[29] *See, e.g., Portland Harbor Draft Feasibility Study* (LWG, March 30, 2012), Appendix HA, Table 3.2-9 (Summary of of Biodegradation Rates Applied in the Final Calibrated Fate Model)

[30] EPA FS, Table 2.2-5. The ROD PCB cleanup level of 9 µg/kg is based on background. ROD, Table 17.

[31] ROD, Table 21.

potentially responsible parties requires transparency into EPA's basis for selecting remedial areas and technologies; the absence of such transparency will further complicate the already extraordinarily difficult task of reaching such an allocation at this site without litigation and further delay in the cleanup.

Requested revision: EPA's June 2016 FS evaluations demonstrate that nearshore PAH RALS as high as 170,000 µg/kg would meet the ROD interim target for RAO 1 of 1 x 10^{-5} throughout the site.[32] *Revising the PAH RALs proportionally to the updated cleanup levels would be consistent with the FS and the ROD, which explicitly incorporate MNR as a component of RAO 1 remedies.*

2. EPA's updated cPAH cleanup level based upon risks from consumption of clams harvested in the navigation channel is not a basis for retaining the 170,000 µg/kg PAH RAL

As we have previously commented to EPA, EPA's BHHRA found no risk to humans from clams harvested in the navigation channel.[33] EPA explicitly assumed in the BHHRA that clam harvesting occurred only in nearshore areas: "EPA acknowledges that an appropriate exposure area should be determined in consideration of water depth (i.e., nearshore areas) and the area over which a sustainable shellfish harvest consistent with the clam consumption is possible."[34] EPA has never explained why it abandoned this finding in the ROD, and EPA's application of a cPAH sediment cleanup level for clam consumption in areas of the river in which the BHHRA found no clam consumption risk is inconsistent with the NCP and arbitrary and capricious.[35]

In the ROD, EPA chose to evaluate protectiveness for RAO 2 (fish and shellfish consumption) against an interim target (post-construction) of 1 x 10^{-4} site wide cancer risk.[36] The selected remedy, Alternative F-MOD, was determined protective of RAO 2 at a post-

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[32] ROD, Appendix IV Table J2.2-1c (Alternative B). We also calculated cumulative risk using the updated RAO 1 cPAH cleanup level based upon a 170,000 µg/kg nearshore PAH RAL. Maximum cumulative RAO 1 risk at construction completion was 7.E – 06 at RM 5.3W.

[33] See *Portland Harbor Baseline Human Health Risk Assessment* (EPA April 2013) ("BHHRA"), Appendix F, Map 5-4.1 (Risks from Clam Consumption, RME).

[34] EPA Comments on Comprehensive Round 2 Site Summary and Data Gaps Analysis Report (January 15, 2008), p. 26.

[35] EPA must "explain the key assumptions that underpin its remedy." *Emhart Industries, Inc. v. New England Container Company, Inc.*, 274 F. Supp.3d 30, 48 (D.R.I. 2017) (citations omitted) (finding EPA assumptions concerning use of groundwater and risks from fish consumption on which remedy selection was based arbitrary and capricious). An agency "must offer a 'reasoned explanation' when its current course 'rests upon factual findings that contradict those which underlay' a previous course." *Humane Society of U.S. v. Locke,* 626 F.3d 1040, 1049 (9th Cir. 2010) (NMFS finding that sea lion predation rate of 1 percent had a significant negative impact on recovery of listed salmonid populations arbitrary and capricious without explanation of prior findings that fishery takes of up to 17 percent had no significant adverse effect on salmonid populations). EPA's shifting positions on the clam consumption pathway are discussed in detail in Proposed ESD Appendices A4 and A16.

[36] ROD Table 22 ("Overall Protectiveness … Risk at Construction Completion (Interim Target) [IT]) … Site Wide Human Heath (HH) … RAO 2: IT for cancer risk: 1x10^{-4}")

construction risk of 1.5 x 10^{-4}.[37] As described above, EPA explicitly determined that "further reductions [will] be achieved through MNR." [38]

In the proposed ESD, EPA determined that the RAO 2 cPAH cleanup level should be updated to 1,076 µg/kg but did not provide any evaluation of whether the 170,000 µg/kg PAH RAL applicable to the navigation channel was necessary or appropriate to achieve the interim target for RAO 2. The proposed ESD simply notes that the 170,000 µg/kg PAH RAL results in a "maximum post construction risk to human health based on the shellfish consumption exposure pathway of 3 x 10^{-6} as measured on a rolling river mile basis. Based on this post-construction risk level, EPA has determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised."[39] EPA does not appear to have evaluated various alternative PAH RALs against the interim target in consideration of the updated cleanup value; it simply concluded that its existing RALs would be adequately protective.

In fact, EPA's calculation of sitewide cPAH concentrations at the "no action" condition (1489.1 µg/kg)[40] would yield risks calculated using the updated cleanup level (1,076 µg/kg) of 1 x 10^{-6}, using the same rounding conventions as the ROD . Certainly, cPAH risks, if any,[41] are so far below the interim target of 1 x 10^{-4} that they contribute little, if anything, to attainment of the interim target. As shown in the figure below, cleanup in nearshore areas to even the least conservative PAH RAL considered in EPA's FS (170,000 µg/kg) would result in potential risks from clam consumption well below the interim target as calculated on the whole river mile scale evaluated in the BHHRA without any active PAH cleanup in the navigation channel.[42]

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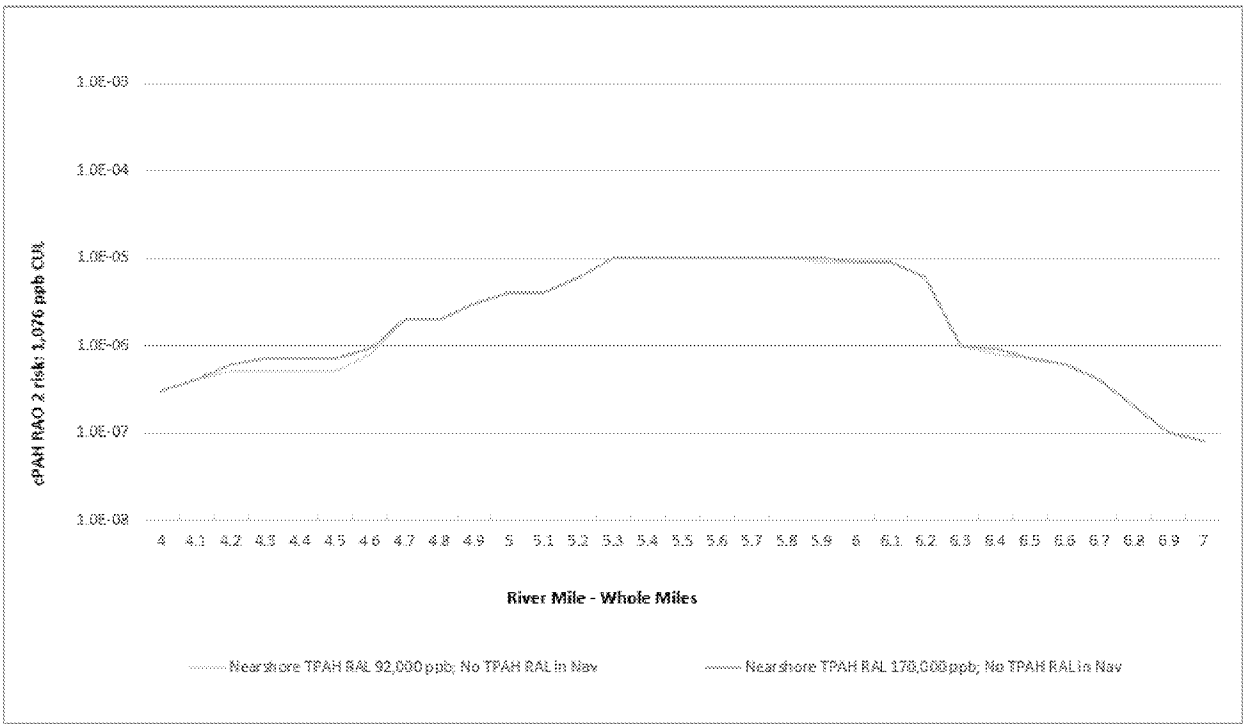
[37] ROD Table 22
[38] EPA FS, p. 4-6.
[39] Proposed ESD, p. 26.
[40] ROD, Appendix IV, Table J2.3-7
[41] Biota-sediment accumulation regression analysis showed only a weak relationship between benzo(a)pyrene in sediment and clam tissue. *Portland Harbor RI/FS Bioaccumulation Modeling Report*, Revised Draft (LWG, June 19, 2015), p. 15, Table 4-1.
[42] Figure shows residual risk calculated on a whole river mile basis, the smallest scale evaluated in the BHRRA for consumption scenarios not limited by water depth. See BHHRA §3.4.5.

Post Construction Clam Consumption Risk
RM 4-7 Whole River Miles
Log Scale



Again, EPA appears to have determined that natural recovery has no role in addressing cPAH risks associated with shellfish consumption, but only for cPAHs and for no other chemical presenting unacceptable risk at Portland Harbor.[43] Such a decision would amount to a fundamental change to a basic feature of the ROD and must be made by a ROD amendment, subjected to evaluation of the nine remedy selection criteria, and adequately explained.

As discussed above, it may be that EPA has concluded that navigation channel PAH RALs remain necessary to capture risk associated with other chemicals and other RAOs. If this is the case, EPA should explicitly state this rationale for the PAH RALs and show its work.

Requested revision: EPA's ROD is flexible enough to support the use of institutional controls in place of dredging or capping based upon land use.[44] The ESD could confirm the findings of the EPA risk assessment that clam harvesting is unlikely to occur in deep water areas and state explicitly that institutional controls could be used to prohibit harvesting of any clams that may be present within the navigation channel, obviating the need for expensive and disruptive dredging on the basis of this hypothetical and undocumented exposure pathway.[45]

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[43] "Unexplained discrimination" by an agency is arbitrary and capricious. *Puerto Rico Sun Oil Co*. 8 F.3rd at 77.

[44] ROD, page 106.

[45] The Asian clam, the predominant species found in Portland Harbor, is an invasive, non-native species that is already illegal to harvest or possess in Oregon. *See,* BHHRA p. 29; OAR 635-056-0050(f)(A)(i).

3. Oregon Water Quality Standards do not justify the PAH RALs identified in the proposed ESD.

The proposed ESD states, "The BaP [cancer slope factor] change is not expected to result in a change to Oregon water quality standards in the foreseeable future. As a result, the ARAR based surface water CULs specified in Table 17 of the ROD have not been modified."[46] The most stringent benzo(a)pyrene Oregon water quality standard (human health water + organism consumption) is .0013 µg/l.

In the ROD, EPA evaluated protection of human health risk related to surface water (RAO 3) against an interim target of 10 times the cleanup level.[47] EPA calculated maximum predicted cPAH surface water concentrations at the "no action" level at just over .0012 µg/l.[48] EPA has calculated the average Site cPAH concentration at "no action" at 0.0008 µg/l.[49]

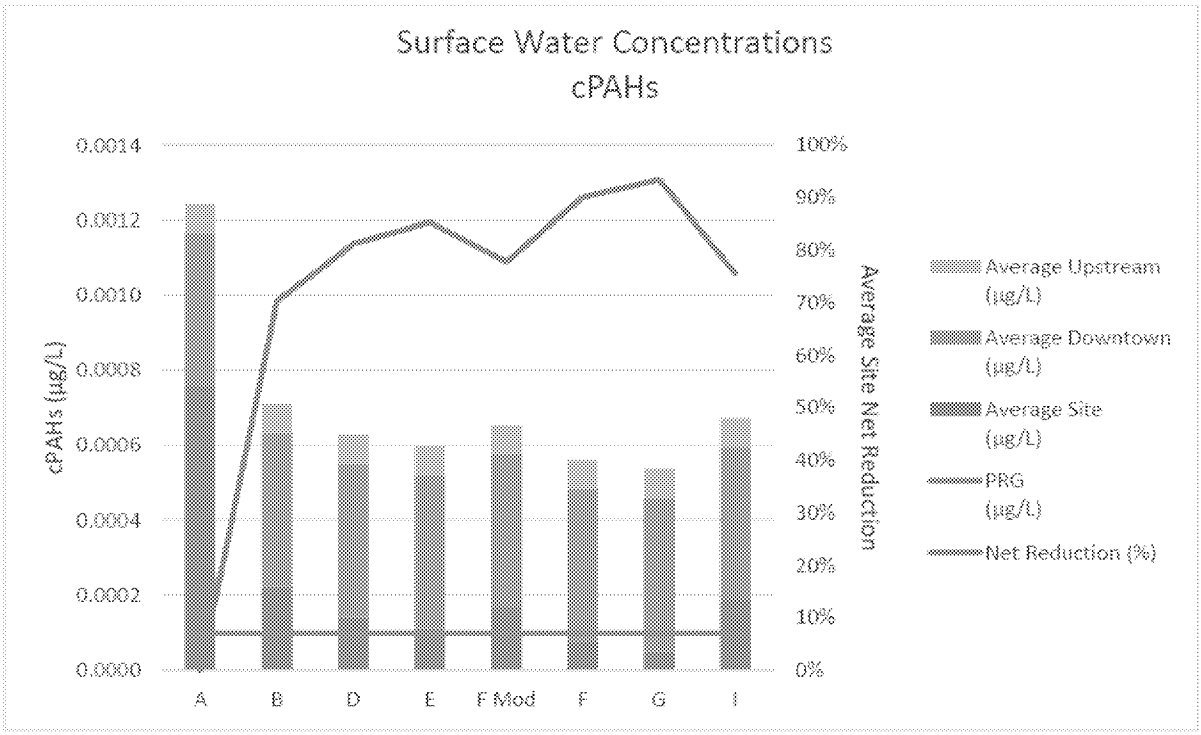

Figure 4.2-8b. Predicted surface water cPAH concentration reductions.

This is below the Oregon water quality standard.

ROD Table 17 sets the cPAH surface water cleanup level at .00012 µg/l based not on the Oregon water quality standard but on the National Recommended Water Quality Criteria for benzo(a)pyrene. NRWQC are not applicable to CERCLA cleanups but may be relevant and

[46] Proposed ESD, page 25.
[47] ROD, Table 10.
[48] ROD Appendix IV, Figure 4.2-8b.
[49] EPA FS, Table K3-4a.

appropriate at some sites. EPA guidance provides, "Prior to using an FWQC for a particular constituent, RPMs should consult the IRIS data base ... to ensure consideration of the latest available scientific information."[50] The .00012 µg/l benzo(a)pyrene NRWQC, which is based on outdated cancer slope factors, no longer represents good science and is no longer relevant or appropriate to RAO 3 (reduce cancer and non-cancer risks to people from surface water at the site).[51]

Requested revision: EPA should update the cPAH cleanup level in ROD Table 17 to the applicable Oregon water quality standard. Because EPA's analysis shows this standard is met at the no action level, no PAH cleanup is necessary to meet RAO 3.

4. The proposed ESD's definition of areas of active remedy specifically to address potential benthic risk is a fundamental change from the ROD

The ROD did not use RALs to define areas of active remedy based on benthic risk. Instead, EPA evaluated benthic risk against an interim target of 50% of the areas of the Site exceeding 10 times the RAO 5 cleanup levels.[52] EPA determined that "if 50 percent was addressed through active remediation, the other 50 percent would be addressed through MNR."[53]

The PAH cleanup level for RAO 5 is 23,000 µg/kg; 10 times the RAO 5 PAH cleanup level is 230,000 µg/kg. In the proposed ESD, EPA "determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5)."[54] A January 11, 2018 EPA presentation titled "Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a) Pyrene" states that "increasing the total PAH RAL to 230,000 µg/kg (10x the total PAH Benthic CUL) ... may not achieve the ROD specified protectiveness standards" for RAO 5.[55] This is patently incorrect as a matter of simple math. PAH RALs of 230,000 µg/kg or less will remove 100% of areas exceeding 10 times the RAO 5 cleanup levels, surpassing the ROD interim target by a factor of at least two and eliminating any role for MNR in the cleanup.

The proposed ESD justifies this far more aggressive petroleum cleanup than selected in the ROD based on "the lack of natural recovery processes within the navigation channel

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[50] *ARARs Q's & A's: Compliance with Federal Water Quality Criteria* (EPA, June 1990)
[51] We note that ROD Figure 4.2-8b suggests that the EPA's interim target of 10 times the cleanup level could also be met through less conservative cPAH RALs even based upon the outdated NWRQC. Maximum surface water concentrations at the "no action" condition just exceed the .0012 µg/l cPAH interim target. We do not see that EPA undertook any evaluation of the effect of less aggressive active remedies on attainment of the cPAH interim target. Again, EPA appears to have eliminated any role for natural recovery in reducing surface water risks from cPAHs.
[52] ROD, Table 22.
[53] ROD Responsiveness Summary, page 2-217.
[54] Proposed, ESD, page 27
[55] Proposed ESD, Appendix A5, Slide 5.

between RM5 and RM 7 where the total PAH RAL is exceeded."[56] In reaching this conclusion, EPA reviewed bathymetric surveys between 2002 and 2009 as well as "sediment grain size, the potential for propeller wash induced erosion, the ratio of subsurface to surface sediment concentrations, and the erosion potential associated wind and vessel wake generated waves."[57] It is unclear what, if any, information EPA reviewed that was not available to EPA prior to the January 2017 ROD and that drove it to reverse its finding in the ROD that "natural recovery would be effective over most of the Site, except it was less certain in RMs 6-8, and may not occur in RM 11.8-11 and Swan Island Lagoon."[58] We do know that an additional site-wide bathymetry survey was performed in 2018, and the results[59] show large areas of variable thickness of deposition in RM 5-7 based on comparison to the 2004 surveys. In addition, significant additional surface sediment data was recently collected between RM 5-7, which would impact the subsurface to surface sediment concentration line of evidence results. At a minimum, EPA should review this available existing information and update the multiple lines of evidence evaluation results regarding natural recovery throughout RM 5-7 before making such a fundamental change to the remedy selected in the ROD.

EPA also does not explain why it abandoned its decision in the ROD to evaluate protection of the benthic community using an order of magnitude greater than the 23,000 µg/kg PRG "based on the conservativeness of the sediment quality values used in the [baseline ecological risk assessment] models" and its decision to set the interim target at 50 percent reduction of the area posing benthic risk "because protection of the benthic community is based on a population rather than individual effects, and is considered a target to which the benthic population as a whole can be stressed and still recover."[60] Nor does EPA address its apparent rejection of its "further risk management decisions that the entire area above the RAO 5 PRGs did not need to be addressed through capping and dredging .... Since benthic effects from contaminated sediment are due to reproduction and growth, not just survival, this approach would also ensure that the entire population was not diminished through active remediation (capping and dredging is assumed to kill benthic organisms where it occurs)."[61]

This is a fundamental change in the ROD in that it eliminates monitored natural recovery as a component of RAO 5 remedies, at least in areas where PAH RALs can be applied, and should have been undertaken through an amendment to the ROD. If it had done so, EPA's failure to provide any of its reasons for abandoning the protectiveness criteria on which it based its original selection of a remedy and to explain the complete reversal of its previous position on the effectiveness of natural recovery in this area of the river would have been arbitrary and capricious.

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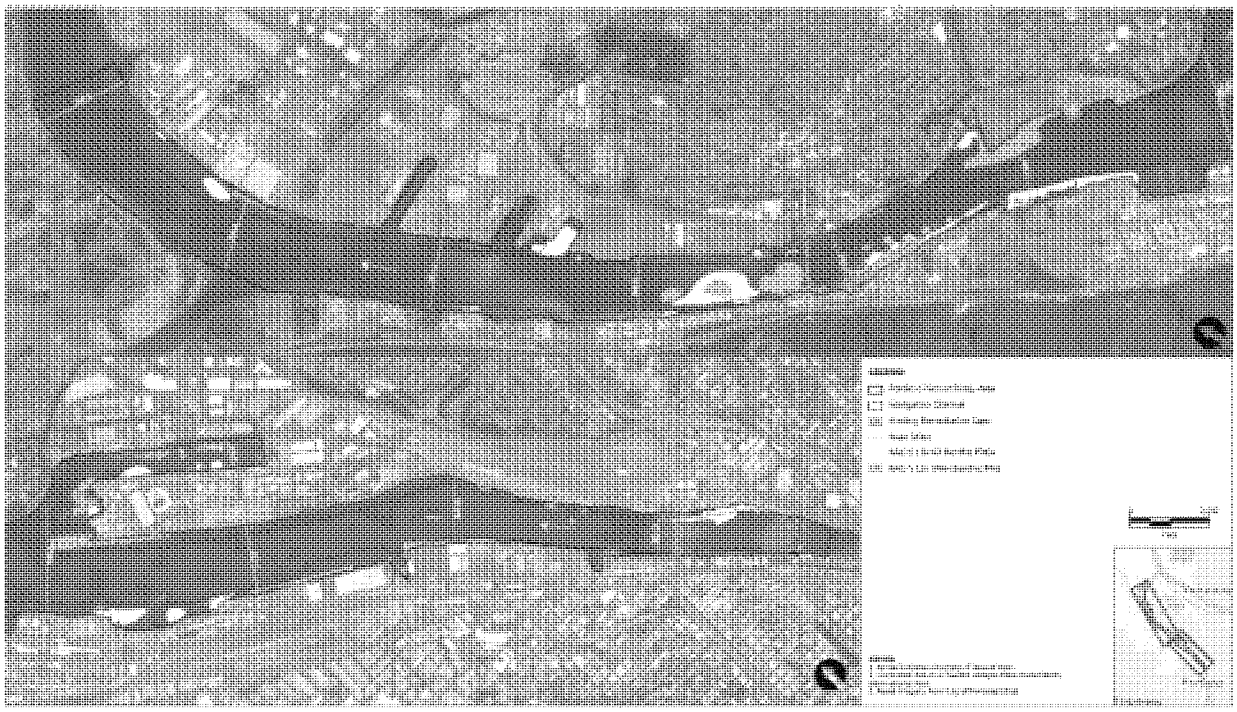
[56] Proposed ESD, page 27
[57] *Id.*
[58] ROD, page 67
[59] David Evans and Associates, Willamette River, Oregon. River Mile 1.9 to 11.8 Hydrographic Survey Report. Prepared for the Pre-RD AOC Group (July 2018), p. 19.
[60] ROD Responsiveness Summary, page 2-217.
[61] *Id.*

The effect of this fundamental change is to require petroleum cleanups to assume a grossly disproportionate share of the burden of addressing RAO 5 among the 87 chemicals determined to present potentially unacceptable risk to benthic invertebrates. Using surfaces generated consistent with EPA ROD methodology, we calculate a total of 117 acres exceed 10 times the RAO 5 cleanup levels for all chemicals. Our mapping shows that approximately 30 acres of the site exceed the 10x RAO 5 PAH cleanup level (approximately 26% of the 117 total acres).

RAO 5 10x areas



Under the proposed ESD, which would apply PAH RALs ranging from 30,000 µg/kg to 170,000 µg/kg, active remedies will address 69% of the 117 acres exceeding 10 times benthic cleanup levels, or about 81 acres.[62] PAH RALs would therefore remove 37% (30 of the 81 acres) of the benthic risk area addressed by active remedies, even though PAHs are responsible for only 26% of the total area exceeding 10 times the RAO 5 PRGs. Put another way, using the RALs in the proposed ESD, active petroleum remedies would remove approximately 124% of the PAH share of the RAO 5 interim target. This may be EPA's strategy for mitigating benthic risk presented by chemicals other than PAHs, but if so EPA should state so explicitly and explain its decision that the burden of this remedy should fall on petroleum sources.

The PAH RALs developed to define active remedies based on RAOs 1 and 2 were never intended to target RAO 5 risks.[63] As EPA's proposed ESD demonstrates, increasing the

[62] Proposed ESD, p. 29.

[63] EPA's PAH RALs for requiring active remediation are not based on benthic risk PRGs (ROD Responsiveness Summary, page 2-216), but this is clearly the reason the proposed ESD now seeks to

nearshore PAH RAL from 13,000 µg/kg to 30,000 µg/kg reduces the area of the site meeting the 50% of 10 times the cleanup level interim target from 72% to 69%, while still removing more than 100% of the area exceeding 10 times the PAH RAO 5 cleanup level (because both nearshore and navigation channel RALS are less than 230,000 µg/kg). The more the PAH RAL is adjusted proportionate to the RAO 1 cleanup level on which it was based, the wider this gap becomes, because smaller PAH SMAs fail to capture areas that exceed 10 times the cleanup level for other chemicals. This disconnect is also apparent in the difference between the finding of the BERA that 4% to 8% of the Site presents potential benthic invertebrate risk and the conclusion of the FS that such risks are present across approximately 59% of the site.[64] Plainly, there is no rational connection between the RALs and RAO 5.[65]

Requested revision: EPA should not apply PAH RALs in the navigation channel on the basis of RAO 5. The existing ROD contains the flexibility to allow for delineation during remedial design of areas where RAO 5 is driving cleanup based on the multiple lines of evidence, including toxicity testing, used in the BERA.[66] For all of the reasons discussed above, protection of benthic invertebrates is the only potential basis consistent with the baseline risk assessment for active PAH remedies in the navigation channel. At a minimum, the proposed ESD should clarify that, during remedial design, active remediation of benthic toxicity areas in the navigation channel may be defined using the multiple lines of evidence approach rather than through strict application of PAH RALs.

5. Please clarify or correct a few apparent errors in the proposed ESD

    a. Proposed ESD Figure 3 does not appear to have been updated with the new PAH PTW-Highly Toxic contours. Please update this figure.

    b. Proposed ESD Figure 8 correctly labels the Gasco site in large bolded type, but also includes a small label to the north that incorrectly identifies the Corps of Engineers US Moorings facility as "Gasco." Please remove this small label.

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retain them in the navigation channel. EPA's ROD originally established the RAO 2 cleanup at 3,950 µg/kg. Based upon the IRIS cancer slope factor, that cleanup level would have increased to 107,600 µg/kg. At this cleanup value, EPA concluded that "remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2)." EPA, *Evaluation of Potential Modifications to Total PAH Navigation Channel RAL,* Proposed ESD at .pdf page 274. Still, EPA decided to retain the PAH RALs because of its concern about the ability of MNR in the channel to achieve RAO 5. *Id.* at page 275. EPA later discovered an error in calculation of the original clam consumption PRG and reinserted RAO 2 as a justification for the navigation channel RAL. As discussed above, however, RAO 2 simply does not support navigation channel PAH RALs.

[64] ROD, p. 49; ROD Appendix IV, Table 4.2-7 (1289 acres benthic risk area) and p. 1 (Site is 2190 acres).

[65] An agency decision is arbitrary and capricious unless it is "founded on a rational connection between the facts found and the choices made." *Arizona Cattle Growers' Ass'n v. U.S. Fish & Wildlife, Bureau of Land Mgmt*, 273 F.3d 1120, 1243 (9th Cir. 2001) (finding incidental take statement arbitrary and capricious based on speculation that razorback sucker may be present on property when it had no evidence that the sucker "even exists anywhere in the area.").

[66] See, ROD Responsiveness Summary, p. 2-218

c. Proposed ESD Figure 6 showing the TPAH RAL curve should be updated to reflect the updated direct contact cleanup level.

d. Proposed ESD Appendix A1 "ROD Table 17 Updated for ESD" shows the incorrect basis for cPAH sediment CUL; it shows "B" indicating background based, but it should be "R" indicating risk-based.

e. Proposed ESD page 24 indicates there is a recreational beach at RM 5.9W when there is not. Please correct this reference.

CONCLUSION

NW Natural thanks you for your consideration of these comments. We hope that EPA will (1) increase nearshore PAH RALs proportionally to the updated cPAH RAO 1 cleanup level; (2) eliminate navigation channel PAH RALs or clarify that institutional controls may be used in lieu of active remedies to prevent shellfish consumption from the navigation channel while the Site naturally recovers; (3) update Table 17 to reflect the Oregon water quality standard for benzo(a)pyrene as the RAO 3 cleanup level; and (4) confirm that areas of potential benthic risk from PAHs in the navigation channel may be defined using multiple lines of evidence, including benthic toxicity testing.

If you have any questions concerning these comments, please do not hesitate to contact me.

Sincerely,

Robert J. Wyatt

cc: Jim Woolford, EPA Headquarters
Sheryl Bilbrey, EPA Region 10
Sean Sheldrake, EPA Region 10
Lori Cora, EPA Region 10

Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 4/12/2018 1:23:36 AM
To: Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'Richard Whitman' [richard.whitman@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'SEIDEL Paul' [paul.seidel@state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]

Subject: Portland Harbor Sr Leadership
Location: Call-in number Personal Privacy / Ex. 6

Start: 4/13/2018 10:30:00 PM
End: 4/13/2018 11:30:00 PM
Show Time As: Tentative

Recurrence: (none)

Here is the agenda for Friday's senior leaders call on the Portland Harbor Cleanup. The agenda has been organized to focus time on the issues needing the most discussion and interaction. Thanks, Bill

Agenda:

- Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation. Discuss potential SMAs/AOCs that ODEQ might provide lead technical oversight and how and when to consult with TCT/tribes on the purpose of the protocol.
- Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
- 4 (Port project) - Port is revising their original proposal for T4 and is now not requesting a potential ROD amendment. They are proposing a standard application of the RALs as per the ROD. Senior Port leadership meeting with EPA on April 17 to discuss.
- Willamette Cove - results of US Department of Justice meeting on March 20 to discuss federal participation. 60 day notice letter recently sent out. Will state and federal participation be sufficient to begin RD?

- ESD for PAHs - EPA is preparing an ESD in response to NW Natural's request that the RALs for PAHs be reconsidered in light of the updated cancer potency for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation (and can/should consultation occur prior to seeking public comment?). As this commences, how and when should DEQ indicate its concurrence?
- Nature of the response to the PCI letter to all PRP's and implications for EPA's stated desire that allocation be completed by 2020.
- Gasco - ExxonMobil has communicated with both EPA and DEQ that it believes the Gasco AOC needs to be substantially expanded to include downriver PAH contamination. DEQ has sent a response letter to EM focusing on EM's assertion of inadequate source control. EM also requested an opportunity to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. How should EPA and DEQ respond to EM's requests for agency interaction/decisions?
- OHA Fish Advisory. The Oregon Health Authority issued this week an updated fish consumption advisory for the Lower Willamette River based on information provided in EPA's 2017 ROD. The updated advisory follows OHA's consultation with Oregon Tribes and EPA's engagement with the Yakama Nation.
- Timing of next meeting and determination of the value and frequency of these more focused strategic discussions.

Message

From: Bill Ross [bross@rossstrategic.com]
Sent: 9/5/2017 9:26:01 PM
To: Bill Ross [bross@rossstrategic.com]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'Richard Whitman' [richard.whitman@state.or.us]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; 'Katie Ogrodnik' [ogrodnik.katie@deq.state.or.us]; Opalski, Dan [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b5ed6410d934bf699a008a252791a55-Opalski, Dan]; Barber, Anthony [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5e1b829ad1824045b9b91334160bd8b3-Barber, Anthony]; 'Bruce Gilles' [bruce.a.gilles@state.or.us]; 'Tyson.Linda@epa.gov'; Patterson, Kenneth [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8124081dc0f5490d983dbd6764b0a3f1-KPATTERS]; Nearhood, Jennifer [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=20b4526e6bad4a3fa51ed3c14ca51a04-Nearhood, J]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'JOHNSON Keith' [keith.johnson@state.or.us]; 'DECONCINI Nina' [nina.deconcini@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; 'GREENFIELD Sarah' [sarah.greenfield@state.or.us]; Stern, Allyn [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2e2d6f5df08d4e9abbff2c0880407775-Stern, Allyn]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Soscia, Marylou [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0849f6bc30264a53b883725e58333224-Soscia, Mary L.]; seidel.paul@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7425335f49334052b6ec6c5ba02f2ee7-seidel.paul@deq.state.or.us]; SEIDEL Paul [paul.seidel@state.or.us]
Subject: Portland Harbor Sr Leadership call 9/7 - Agenda

The agenda for the call is as follows:

1. Status of the negotiations with the private PRPs and next steps to get additional data sampling
2. Status of getting RD/RA action efforts going in 2017
3. Analysis of the implications for the new risk number for PAH
4. Review of the Port's request for slip T4
5. Status of DEQ's identification of potential 'reuse' sites
6. Updating communication and consultation protocols for DEQ and the TCT
7. Connecting with Jim and Cyndy when they are in Seattle on September 18?
8. Other items as requested

-----Original Appointment-----
From: Bill Ross
Sent: Friday, August 25, 2017 8:43 AM
To: Bill Ross; Cami Grandinetti (grandinetti.cami@epa.gov); 'Cyndy Mackey'; 'Davis Zhen'; 'Dean Ingemansen'; 'Jim Woolford'; 'Michelle Pirzadeh'; 'Richard Whitman'; 'Sheryl Bilbrey'; 'Katie Ogrodnik'; 'Dan Opalski'; 'Tony Barber'; 'Bruce Gilles'; 'Tyson.Linda@epa.gov'; 'Patterson, Kenneth'; 'Nearhood, Jennifer'; 'PARRETT Kevin'; 'JOHNSON Keith'; 'DECONCINI Nina'; 'Sheldrake, Sean'; 'Cora, Lori'; 'GREENFIELD Sarah'; 'Stern, Allyn'; 'OGRODNIK Katie'; 'Knudsen, Laura'; 'Soscia, Marylou'; 'seidel.paul@deq.state.or.us'; SEIDEL Paul
Subject: Portland Harbor Sr Leadership call
When: Thursday, September 7, 2017 12:00 PM-1:00 PM Customized Time Zone.
Where: Call-in number Personal Privacy / Ex. 6

The next meeting/call of the Portland harbor cleanup senior leaders will be on September 7 at noon PDT/3:00 EDT. An agenda will follow closer to the date.

Thanks, Bill.

To: tosm@yakamafish-nsn.gov; Zhen, Davis [Zhen.Davis@epa.gov]; tomd@ctsi.nsn.us; Buerger, Ted [ted_buerger@fws.gov]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Sheldrake, Sean [sheldrake.sean@epa.gov]; rose@yakamafish-nsn.gov; Robert.Neely@noaa.gov; NaomiStacy@ctuir.org; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; Peterson, Lance [PetersonLE@cdmsmith.com]; Knudsen, Laura [Knudsen.Laura@epa.gov]; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Clark, Josie [clark.josie@epa.gov]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Cora, Lori [cora.lori@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; Chu, Rebecca [Chu.Rebecca@epa.gov]; callie@ridolfi.com; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; bayuk.dana@deq.state.or.us; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; Bob Dexter [dexb@yakamafish-nsn.gov]; bob@ridolfi.com; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Deirdre F. 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Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 4/11/2018 5:00:00 PM
End: 4/11/2018 7:00:00 PM

Recurrence: (none)

Hi all – Just sending a reminder that we have a TCT meeting this Wednesday, April 11. This meeting is via teleconference only. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, April, 11, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

Our agenda:

- DEQ Upland Source Control
- IRIS update
- AOC updates (Pre-RD, 11E, NWN/Gasco, T4, ICIAP/DMP, Willamette Cove, Gunderson/FMC)
- Community Involvement Update
- CERCLA Coordination Permitting
- Willamette Watershed Issues
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria

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Subject: Portland Harbor TCT meeting (2nd Wednesdays) - in person

Location: Fox Tower, 20th floor conference room; call-in Personal Privacy / Ex. 6

Start: 6/13/2018 5:00:00 PM

End: 6/13/2018 7:00:00 PM

Recurrence: (none)

Hi all – Just a reminder that our next TCT meeting on June 13 will be in-person on the 20th floor conference room. Laura and Sean will be there in-person. I've mixed up the agenda a little as some of us will be on our way to the airport as we take the conference call before our 11 am flight. Sean will be leading the call. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, June 13, 2018

In-person and via teleconference

Call-In Personal Privacy / Ex. 6

805 SW Broadway, Portland, Oregon

Fox Tower, 20th floor conference room

10am to Noon Pacific Time

Our regular agenda:

- DEQ Oversight Protocol
- AOC updates (T4, ICIAP/SOW, Willamette Cove, Gunderson/FMC, pre-RD, 11E, Gasco/NWN)
- Community Involvement Update (Fish Advisory, Public Forum)
- IRIS update
- Upland Source Control
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

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Appointment

To: DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; Bob Dexter [dexb@yakamafish-nsn.gov]; bob@ridolfi.com; callie@ridolfi.com; Chu, Rebecca [Chu.Rebecca@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; Cora, Lori [cora.lori@epa.gov]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham (Jennifer.graham@ctwsbnr.org) [Jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [clark.josie@epa.gov]; jweis@hk-law.com; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [Knudsen.Laura@epa.gov]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak [madi.novak@state.or.us]; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [sheldrake.sean@epa.gov]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Buerger, Ted [ted_buerger@fws.gov]; tomd@ctsi.nsn.us; Zhen, Davis [Zhen.Davis@epa.gov]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; tosm@yakamafish-nsn.gov; NaomiStacy@ctuir.org; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]

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Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 7/11/2018 5:00:00 PM
End: 7/11/2018 7:00:00 PM

Recurrence: (none)

Hi all – Just a reminder that our next TCT call is this Wednesday. Please see below for the agenda. Let me know if you have other agenda items to add. Thanks.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, July 11, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New agenda items:

- IRIS/ESD update
- Ash Grove Company 404 permit (Yakama questions, see attached)

Our regular agenda:

- DEQ Upland Source Control

- AOC updates (baseline sampling, NWN/Gasco, 11E, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

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Subject: Portland Harbor TCT meeting in-person and via telecon

Location: OOO and via teleconference; call-in Personal Privacy / Ex. 6

Start: 9/12/2018 5:00:00 PM

End: 9/12/2018 7:00:00 PM

Recurrence: (none)

Hi all ? We are holding the next TCT meeting in-person and via teleconference as it coincides with our second Portland Harbor Public Forum. Laura Knudsen, Josie Clark, and Davis Zhen will be there. I?ll be calling-in from the airport. Sean is in training. I think the T5 question by the Yakama has been addressed. Let me know if there are other topics to add to the agenda. Thanks.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, September 12, 2018

OOO and teleconference

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

Our regular agenda:

- DEQ Upland Source Control
- ESD update
- AOC updates (baseline sampling, 11E, Gasco/NWN, Arkema, T4, ICIAP/DMP, FMC, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

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Subject: Canceled: Portland Harbor TCT Meeting via telecon and in Portland for 2018!
Location: EPA's Oregon Operations Office; call-in Personal Privacy / Ex. 6

Start: 4/25/2018 5:00:00 PM
End: 4/25/2018 7:00:00 PM
Show Time As: Free

Importance: High

Recurrence: (none)

Hi all – Our next TCT meeting is around the corner. Josie Clark (our newest RPM), Laura Knudsen, and Sean Sheldrake will be there in-person. I've attached the agenda. Let me know if you have questions or other agenda items. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

Wednesdays, April 25, 2018
Call-In 1 Personal Privacy / Ex. 6
805 SW Broadway, Portland, Oregon
10am to Noon Pacific Time

Our regular agenda:

- DEQ Upland Source Control
- IRIS Update
- AOC negotiations (pre-RD, 11E, Gasco/NWN, T4, ICIAP/DMP, Willamette Cove, Gunderson/FMC)
- Community Involvement Update
- CERCLA Coordination Permitting
- Willamette Watershed Issues
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

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CC: GREENFIELD Sarah [Sarah.GREENFIELD@state.or.us]

Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 10/10/2018 5:00:00 PM
End: 10/10/2018 7:00:00 PM
Show Time As: Busy

Recurrence: (none)

Hi all - We'll have lots of updates for next week's TCT meeting even though Sean won't be able to attend. See below for latest agenda. If you have anything else you want to discuss, please forward to me. Thank you!

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, October 10, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New stuff:

- 10/4 Acting Administrator Wheeler briefing update (ESD, baseline sampling/data usage)
- 10/18 PCI meeting (small group/private?) - FAQ followup
- 12/5 PRP meeting

Our regular agenda:

- DEQ Upland Source Control
- AOC updates (baseline sampling, 11E, NWN/Gasco, RM7W, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

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Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 11/14/2018 6:00:00 PM
End: 11/14/2018 8:00:00 PM
Show Time As: Busy

Recurrence: (none)

Hi all – Just a reminder that our next TCT meeting is Wednesday, November 14 via teleconference only! Let me know if you have additional agenda items. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, November 14, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New agenda items:

- ESD update
- Dec. 3rd week of activities/meetings

Our regular agenda:

- DEQ Upland Source Control
- AOC updates (Baseline sampling, 11E, NWN/Gasco, RM7W, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria

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Appointment

To: DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; liverman.alex@deq.state.or.us; dexb@yakamafish-nsn.gov; bob@ridolfi.com; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; callie@ridolfi.com; Chu, Rebecca [Chu.Rebecca@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; Cora, Lori [cora.lori@epa.gov]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; holly.partridge@grandronde.org [Holly.Partridge@grandronde.org]; jennifer.graham@ctwsbnr.org [Jennifer.graham@ctwsbnr.org]; Jennifer Hart [jhart@indecon.com]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [clark.josie@epa.gov]; jweis@hk-law.com; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [Knudsen.Laura@epa.gov]; kristin@ridolfi.com; Peterson, Lance [PetersonLE@cdmsmith.com]; shil@yakamafish-nsn.gov; madi.novak@state.or.us; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org; Paul Seidel [paul.seidel@state.or.us]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; rcabral@indecon.com; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; greenfield.sarah@deq.state.or.us [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [sheldrake.sean@epa.gov]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Buerger, Ted [ted_buerger@fws.gov]; tomd@ctsi.nsn.us; Zhen, Davis [Zhen.Davis@epa.gov]

Subject: Portland Harbor TCT Meeting via telecon only
Location: Call-in only Personal Privacy / Ex. 6

Start: 7/25/2018 5:00:00 PM
End: 7/25/2018 7:00:00 PM

Recurrence: (none)

Hi all – Sorry for all the confusion. Note that next week's TCT meeting is call-in only. Let me know if you have other agenda items or questions. Thanks.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, July 25, 2018
Call-In Personal Privacy / Ex. 6
805 SW Broadway, Portland, Oregon
10am to Noon Pacific Time

Our agenda:

- IRIS/ESD Update
- DEQ Upland Source Control
- ASAOC/SOW updates (baseline sampling, NWN/Gasco, 11E, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
Office of Environmental Cleanup | Superfund Site Cleanup Unit #2
U.S. EPA Region 10 | 1200 Sixth Avenue, Ste. 900, ECL-122 | Seattle, WA 98101
P: 206-553-1970 | demaria.eva@epa.gov

Appointment

To: DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; Bob Dexter [dexb@yakamafish-nsn.gov]; bob@ridolfi.com; callie@ridolfi.com; Chu, Rebecca [Chu.Rebecca@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; Cora, Lori [cora.lori@epa.gov]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham (Jennifer.graham@ctwsbnr.org) [Jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [clark.josie@epa.gov]; jweis@hk-law.com; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [Knudsen.Laura@epa.gov]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak [madi.novak@state.or.us]; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [sheldrake.sean@epa.gov]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Buerger, Ted [ted_buerger@fws.gov]; tomd@ctsi.nsn.us; Zhen, Davis [Zhen.Davis@epa.gov]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; tosm@yakamafish-nsn.gov; NaomiStacy@ctuir.org; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]

CC: lonr@yakamafish-nsn.gov; PARRETT Kevin [Kevin.Parrett@state.or.us]; GREENFIELD Sarah [Sarah.GREENFIELD@state.or.us]; lonr@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c2400bf6fdb84e1fa8003e57f7ba217d-lonr@yakama]

Attachments: FW: Public Notice - NWP-1997-114-2, Ash Grove Cement Company, Portland, Multnomah, OR 404 SF

Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 7/11/2018 5:00:00 PM

End: 7/11/2018 7:00:00 PM

Recurrence: (none)

Hi all – Just a reminder that our next TCT call is this Wednesday. Please see below for the agenda. Let me know if you have other agenda items to add. Thanks.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, July 11, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New agenda items:

- IRIS/ESD update
- Ash Grove Company 404 permit (Yakama questions, see attached)

Our regular agenda:

- DEQ Upland Source Control
- AOC updates (baseline sampling, NWN/Gasco, 11E, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
Office of Environmental Cleanup | Superfund Site Cleanup Unit #2
U.S. EPA Region 10 | 1200 Sixth Avenue, Ste. 900, ECL-122 | Seattle, WA 98101
P: 206-553-1970 | demaria.eva@epa.gov

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/16/2018 7:28:42 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; Robert.Neely@noaa.gov; Knudsen, Laura [Knudsen.Laura@epa.gov]; jweis@hk-law.com; brandy.humphreys@grandronde.org; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Kristin Callahan [kristin@ridolfi.com]; tosm@yakamafish-nsn.gov; rose@yakamafish-nsn.gov; NaomiStacy@ctuir.org; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Cora, Lori [Cora.Lori@epa.gov]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; DeMaria, Eva [DeMaria.Eva@epa.gov]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; bayuk.dana@deq.state.or.us; callie@ridolfi.com; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; tomd@ctsi.nsn.us; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Michael.karnosh@grandronde.org; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Zhen, Davis [Zhen.Davis@epa.gov]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Buerger, Ted [ted_buerger@fws.gov]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Jeremy_Buck@fws.gov; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; dexb@yakamafish-nsn.gov; Jen Graham [jennifer.graham@ctwsbnr.org]; mcclincy.matt@deq.state.or.us; Scott Coffey [coffeyse@cdmsmith.com]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; BAYUK Dana [Dana.BAYUK@state.or.us]; Blischke, Eric [blischkee@cdmsmith.com]

Subject: TCT ad-hoc Gasco dredging pre-meeting Personal Privacy / Ex. 6
Attachments: Map_5-1-1_App F_Final BHHRA_Complete Report.pdf; CPAH_Recreational_Beach_Risk_Estimates.xlsx
Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/23/2018 5:30:00 PM
End: 1/23/2018 7:00:00 PM
Show Time As: Busy

(Scott, let me know if this isn't a good line to use).

All, I want to go over some preliminary Gasco dredge design thoughts, and a likely presentation to the TCT by NWN tentatively planned for February 27 in seattle and via web conference. We can address other questions as time allows.

~~As requested, this is another availability session for EPA to go over what the cancer slope factor change may or may not mean, and answer any questions. The goal is to inform the TCT and get input that we can include in internal briefings such that we may come to an informed decision including partner input. Again, no decisions have been made by EPA as of yet.~~

-

~~As it gets closer, I'll include background materials along with a web meeting link in case it's needed.~~

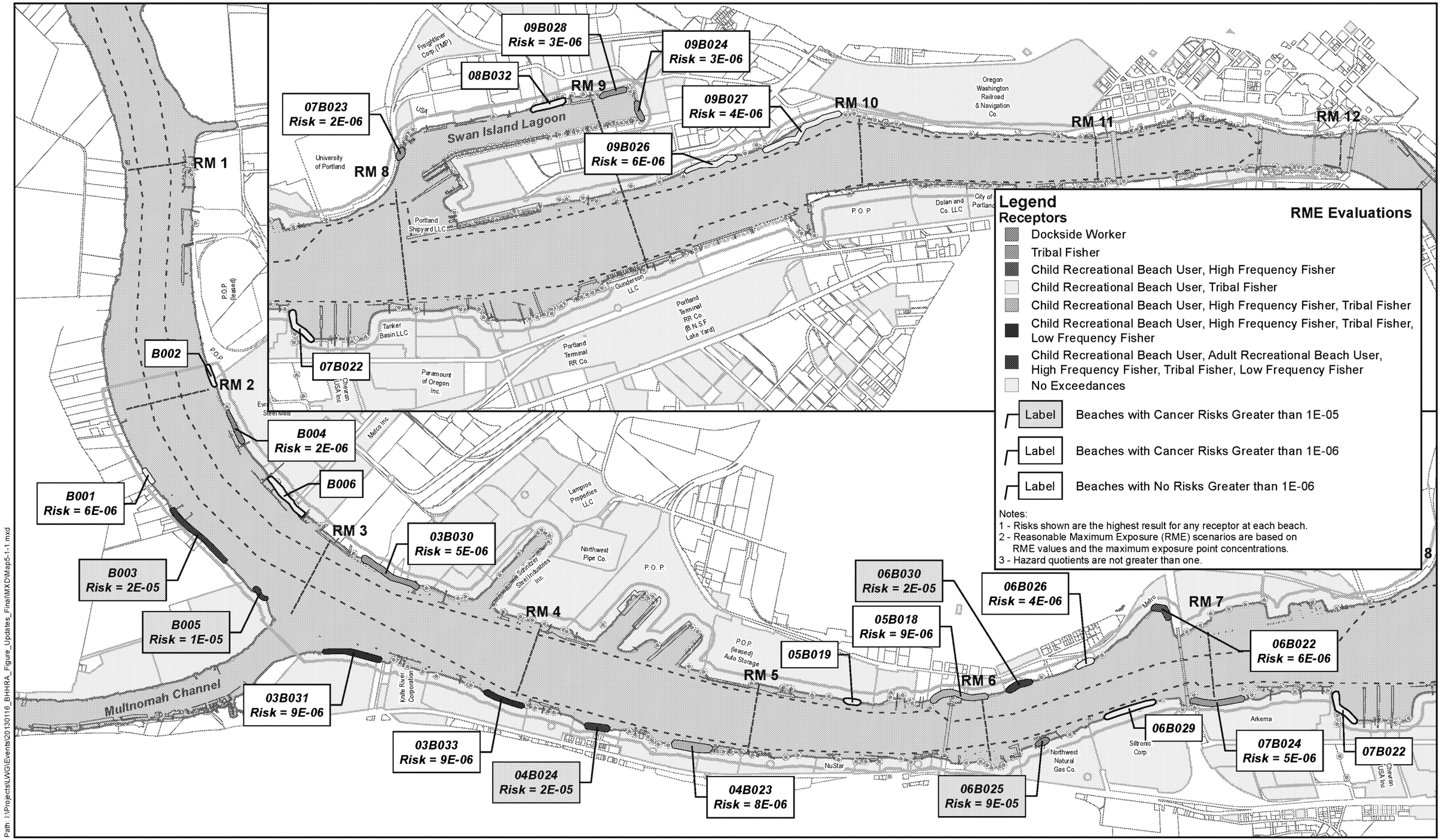
Thank you.

S

PAH Direct Contact Recreational Beach EPC and Risk Estimates (RME)							
Sample	Chemical	EPC	Units	Adult Risk	Child Risk	Total Risk	Revised Total Risk
03B031	Benzo(a)anthracene	3.80E+01	ug/kg	1.00E-08	3.00E-07	3.E-07	4.E-08
03B031	Benzo(a)pyrene	5.30E+01	ug/kg	2.00E-07	4.00E-06	5.E-06	7.E-07
03B031	Benzo(b)fluoranthene	3.50E+01	ug/kg	1.00E-08	3.00E-07	3.E-07	4.E-08
03B031	Dibenzo(a,h)anthracene	1.20E+01	ug/kg	4.00E-08	1.00E-06	1.E-06	1.E-07
03B031	Indeno(1,2,3-cd)pyrene	4.70E+01	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
03B031	Total cPAH (BaPEq)					**7.E-06**	**1.E-06**
03B033	Benzo(a)anthracene	5.20E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
03B033	Benzo(a)pyrene	5.20E+00	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
03B033	Benzo(b)fluoranthene	5.20E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
03B033	Indeno(1,2,3-cd)pyrene	6.40E+00	ug/kg	2.00E-09	5.00E-08	5.E-08	7.E-09
03B033	Total cPAH (BaPEq)					5.E-07	7.E-08
04B023	Benzo(a)anthracene	2.60E+01	ug/kg	1.00E-08	2.00E-07	2.E-07	3.E-08
04B023	Benzo(a)pyrene	4.20E+01	ug/kg	2.00E-07	3.00E-06	4.E-06	5.E-07
04B023	Benzo(b)fluoranthene	3.30E+01	ug/kg	1.00E-08	3.00E-07	3.E-07	4.E-08
04B023	Dibenzo(a,h)anthracene	1.40E+01	ug/kg	5.00E-08	1.00E-06	1.E-06	1.E-07
04B023	Indeno(1,2,3-cd)pyrene	3.80E+01	ug/kg	1.00E-08	3.00E-07	3.E-07	4.E-08
04B023	Total cPAH (BaPEq)					**6.E-06**	8.E-07
04B024	Benzo(a)anthracene	1.80E+02	ug/kg	7.00E-08	1.00E-06	2.E-06	3.E-07
04B024	Benzo(a)pyrene	3.60E+02	ug/kg	1.00E-06	3.00E-05	3.E-05	4.E-06
04B024	Benzo(b)fluoranthene	3.00E+02	ug/kg	1.00E-07	2.00E-06	3.E-06	4.E-07
04B024	Dibenzo(a,h)anthracene	2.30E+01	ug/kg	9.00E-08	2.00E-06	2.E-06	3.E-07
04B024	Indeno(1,2,3-cd)pyrene	2.20E+02	ug/kg	8.00E-08	2.00E-06	2.E-06	3.E-07
04B024	Total cPAH (BaPEq)					**4.E-05**	**5.E-06**
05B018	Benzo(a)anthracene	7.20E+01	ug/kg	3.00E-08	6.00E-07	6.E-07	8.E-08
05B018	Benzo(a)pyrene	8.60E+01	ug/kg	3.00E-07	7.00E-06	7.E-06	1.E-06
05B018	Benzo(b)fluoranthene	1.00E+02	ug/kg	4.00E-08	8.00E-07	9.E-07	1.E-07
05B018	Dibenzo(a,h)anthracene	2.60E+01	ug/kg	1.00E-07	2.00E-06	2.E-06	3.E-07
05B018	Indeno(1,2,3-cd)pyrene	3.90E+01	ug/kg	1.00E-08	3.00E-07	3.E-07	4.E-08
05B018	Total cPAH (BaPEq)					**1.E-05**	**1.E-06**
06B022	Benzo(a)anthracene	4.80E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
06B022	Benzo(a)pyrene	4.40E+00	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
06B022	Benzo(b)fluoranthene	5.60E+00	ug/kg	2.00E-09	4.00E-08	5.E-08	7.E-09
06B022	Indeno(1,2,3-cd)pyrene	4.80E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
06B022	Total cPAH (BaPEq)					5.E-07	7.E-08
06B026	Benzo(a)anthracene	7.90E+00	ug/kg	3.00E-09	6.00E-08	7.E-08	1.E-08
06B026	Benzo(a)pyrene	6.40E+00	ug/kg	2.00E-08	5.00E-07	5.E-07	7.E-08
06B026	Benzo(b)fluoranthene	1.00E+01	ug/kg	4.00E-09	8.00E-08	9.E-08	1.E-08

06B026	Indeno(1,2,3-cd)pyrene	1.10E+01	ug/kg	4.00E-09	9.00E-08	9.E-08	1.E-08
06B026	Total cPAH (BaPEq)					8.E-07	1.E-07
06B030	Benzo(a)anthracene	4.50E+01	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
06B030	Benzo(a)pyrene	6.60E+01	ug/kg	2.00E-07	5.00E-06	6.E-06	8.E-07
06B030	Benzo(b)fluoranthene	8.10E+01	ug/kg	3.00E-08	7.00E-07	7.E-07	1.E-07
06B030	Dibenzo(a,h)anthracene	5.00E+00	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
06B030	Indeno(1,2,3-cd)pyrene	4.70E+01	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
06B030	Total cPAH (BaPEq)					**8.E-06**	**1.E-06**
09B024	Benzo(a)anthracene	1.80E+01	ug/kg	7.00E-09	1.00E-07	2.E-07	3.E-08
09B024	Benzo(a)pyrene	1.40E+01	ug/kg	5.00E-08	1.00E-06	1.E-06	1.E-07
09B024	Benzo(b)fluoranthene	9.70E+00	ug/kg	4.00E-09	8.00E-08	8.E-08	1.E-08
09B024	Dibenzo(a,h)anthracene	2.50E+00	ug/kg	9.00E-09	2.00E-07	2.E-07	3.E-08
09B024	Indeno(1,2,3-cd)pyrene	8.70E+00	ug/kg	3.00E-09	7.00E-08	7.E-08	1.E-08
09B024	Total cPAH (BaPEq)					**2.E-06**	2.E-07
09B026	Benzo(b)fluoranthene	2.10E+00	ug/kg	8.00E-10	2.00E-08	2.E-08	3.E-09
09B026	Total cPAH (BaPEq)					2.E-08	3.E-09
09B027	Benzo(a)anthracene	9.80E+00	ug/kg	4.00E-09	8.00E-08	8.E-08	1.E-08
09B027	Benzo(a)pyrene	9.00E+00	ug/kg	3.00E-08	7.00E-07	8.E-07	1.E-07
09B027	Benzo(b)fluoranthene	1.00E+01	ug/kg	4.00E-09	8.00E-08	9.E-08	1.E-08
09B027	Indeno(1,2,3-cd)pyrene	6.60E+00	ug/kg	2.00E-09	5.00E-08	6.E-08	8.E-09
09B027	Total cPAH (BaPEq)					**1.E-06**	1.E-07
09B028	Benzo(a)anthracene	5.30E+00	ug/kg	2.00E-09	4.00E-08	5.E-08	7.E-09
09B028	Benzo(a)pyrene	4.60E+00	ug/kg	2.00E-08	4.00E-07	4.E-07	5.E-08
09B028	Benzo(b)fluoranthene	5.00E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
09B028	Indeno(1,2,3-cd)pyrene	4.60E+00	ug/kg	2.00E-09	4.00E-08	4.E-08	5.E-09
09B028	Total cPAH (BaPEq)					5.E-07	7.E-08
B001	Benzo(a)anthracene	6.50E+00	ug/kg	2.00E-09	5.00E-08	6.E-08	8.E-09
B001	Benzo(a)pyrene	1.40E+01	ug/kg	5.00E-08	1.00E-06	1.E-06	1.E-07
B001	Benzo(b)fluoranthene	1.20E+01	ug/kg	4.00E-09	1.00E-07	1.E-07	1.E-08
B001	Dibenzo(a,h)anthracene	2.20E+00	ug/kg	8.00E-09	2.00E-07	2.E-07	3.E-08
B001	Indeno(1,2,3-cd)pyrene	9.70E+00	ug/kg	4.00E-09	8.00E-08	8.E-08	1.E-08
B001	Total cPAH (BaPEq)					**1.E-06**	2.E-07
B003	Benzo(a)anthracene	2.10E+02	ug/kg	8.00E-08	2.00E-06	2.E-06	3.E-07
B003	Benzo(a)pyrene	3.60E+02	ug/kg	1.00E-06	3.00E-05	3.E-05	4.E-06
B003	Benzo(b)fluoranthene	3.10E+02	ug/kg	1.00E-07	2.00E-06	3.E-06	4.E-07
B003	Dibenzo(a,h)anthracene	3.30E+01	ug/kg	1.00E-07	3.00E-06	3.E-06	4.E-07
B003	Indeno(1,2,3-cd)pyrene	2.80E+02	ug/kg	1.00E-07	2.00E-06	2.E-06	3.E-07
B003	Total cPAH (BaPEq)					**4.E-05**	**5.E-06**
B005	Benzo(a)anthracene	7.70E+01	ug/kg	3.00E-08	6.00E-07	7.E-07	1.E-07

B005	Benzo(a)pyrene	1.50E+02	ug/kg	6.00E-07	1.00E-05	1.E-05	1.E-06
B005	Benzo(b)fluoranthene	1.20E+02	ug/kg	4.00E-08	1.00E-06	1.E-06	1.E-07
B005	Dibenzo(a,h)anthracene	1.50E+01	ug/kg	6.00E-08	1.00E-06	1.E-06	1.E-07
B005	Indeno(1,2,3-cd)pyrene	1.30E+02	ug/kg	5.00E-08	1.00E-06	1.E-06	1.E-07
B005	Total cPAH (BaPEq)					**1.E-05**	**2.E-06**



Path: I:\Projects\LWG\Events\20130116_BHHRA_Figure_Updates_Final\MXD\Map5-1-1.mxd

Kennedy/Jenks Consultants
Engineers & Scientists

LWG
Lower Willamette Group

FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS.
Channel & River Miles: US Army Corps of Engineers.
Bathymetric Information: David Evans and Associates, Inc.

0 1,000 2,000 Feet

Map Features

- River Miles
- Navigation Channel
- River Edge +13 ft NAVD
- Study Area

Outfalls

- Outfall
- Dock Drain
- Roof Drain

- Bridges
- Docks and Structures
- Waterfront Taxlots
- Upland ECSI Sites (2008)

Map 5-1-1
Portland Harbor RI/FS
Final Remedial Investigation Report
Appendix F: BHHRA
March 28, 2013

Risks from Direct Contact with Beach Sediment, RME Evaluations

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/4/2018 12:18:05 AM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; callie@ridolfi.com; Chu, Rebecca [Chu.Rebecca@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; Cora, Lori [cora.lori@epa.gov]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [Zhen.Davis@epa.gov]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; DeMaria, Eva [DeMaria.Eva@epa.gov]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [Knudsen.Laura@epa.gov]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Buerger, Ted [ted_buerger@fws.gov]; tomd@ctsi.nsn.us
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]; Blischke, Eric [blischkee@cdmsmith.com]

Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx
Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/11/2018 10:00:00 PM
End: 1/12/2018
Show Time As: Tentative

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to

maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018

2pm to 4pm Pacific Time

Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: Personal Privacy / Ex. 6

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
    - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 11, 2018

CONFIDENTIAL WORKING DRAFT --
FOR DELIBERATIVE PURPOSES

Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- RAL change may be necessary based on change in CULs
  - Would current RAL require remediation of sediments that do not pose a risk to human health or the environment?

Proposed cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 12 µg/kg to 85 µg/kg
  - Updated in-water sediment CUL: 106 µg/kg to 774 µg/kg
  - Updated clam consumption CUL: 3950 µg/kg to 107,600 µg/kg
  - Updated highly toxic PTW threshold: 106,000 µg/kg to 774,000 µg/kg
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

Proposed Nearshore* Total PAH RAL Change

- EPA proposes that the current total PAH nearshore * RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - EPA conducted an analysis that that evaluated what RAL would achieve the revised cPAH CUL of 774 ug/kg on a rolling river mile SWAC basis throughout the site
  - The analysis showed that a total PAH RAL of 30,000 µg/kg achieves the cPAH CUL within ½ mile increments.
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon)

*Outside the Navigation Channel

Proposed Navigation Channel Total PAH RAL

- EPA proposes that the current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading to surface water has been observed downstream of RM 6.3
  - Increasing RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data

CUL, PTW and RAL Change Summary

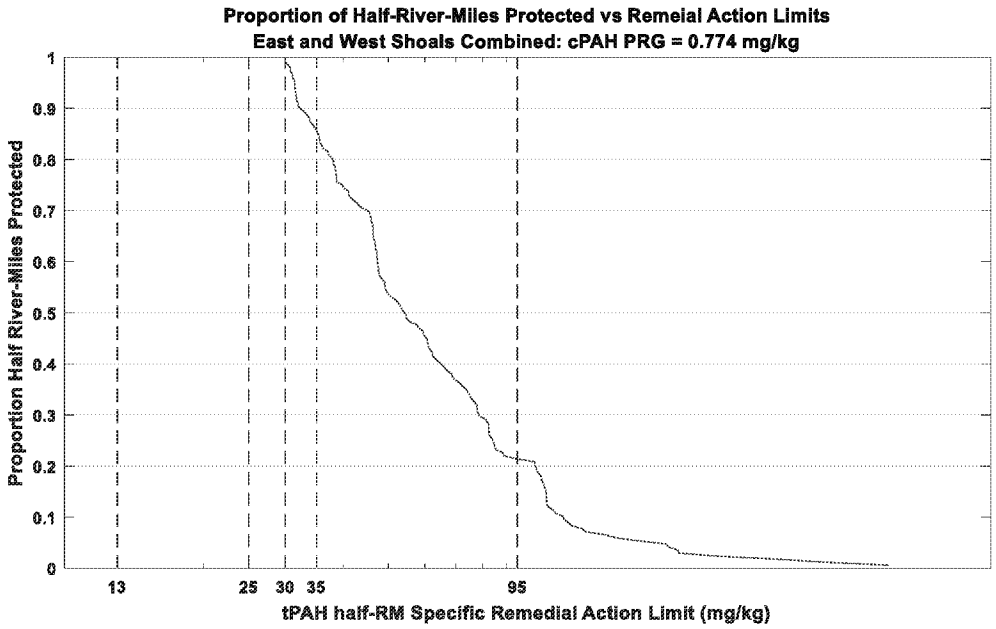
Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL	Site-Wide	3,950 µg/kg	107,600 µg/kg
Benthic Risk total PAH Sediment CUL	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

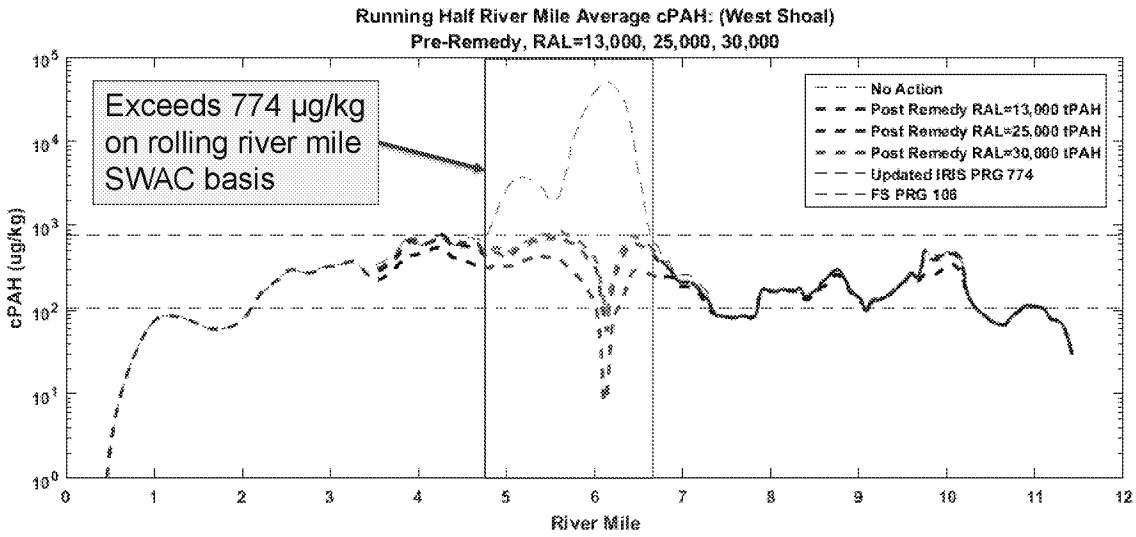
* No Change Proposed

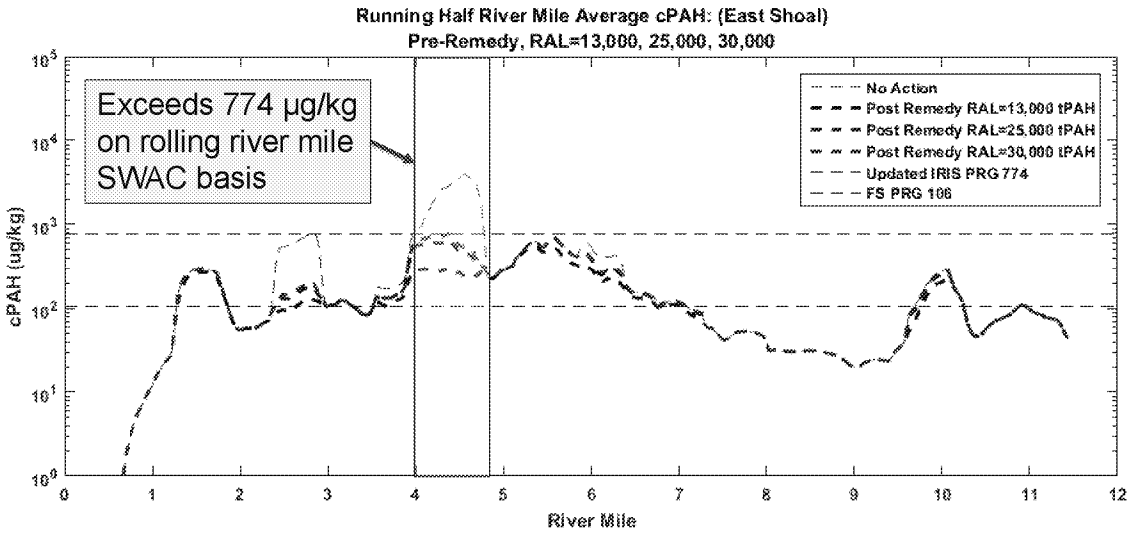
RAL Change Evaluation Summary

Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (230,000 µg/kg)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
State Acceptance	No	Yes	Yes	No

Backup Slides for Discussion


Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)


Running Half River Mile Average cPAH: (West Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
Exceeds 774 µg/kg on rolling river mile SWAC basis
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile


Running Half River Mile Average cPAH: (East Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
Exceeds 774 µg/kg on rolling river mile SWAC basis
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

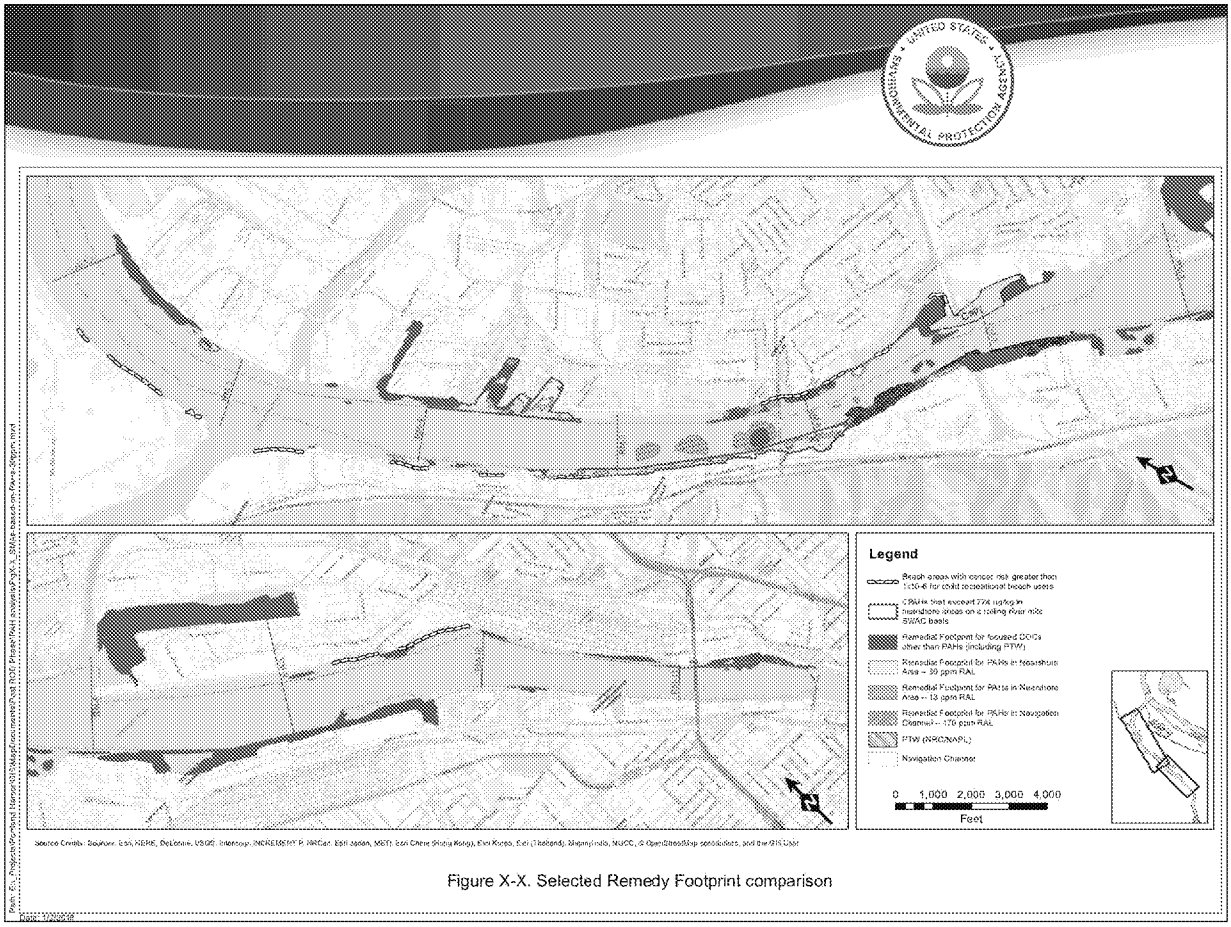


Figure X-X. Selected Remedy Footprint comparison

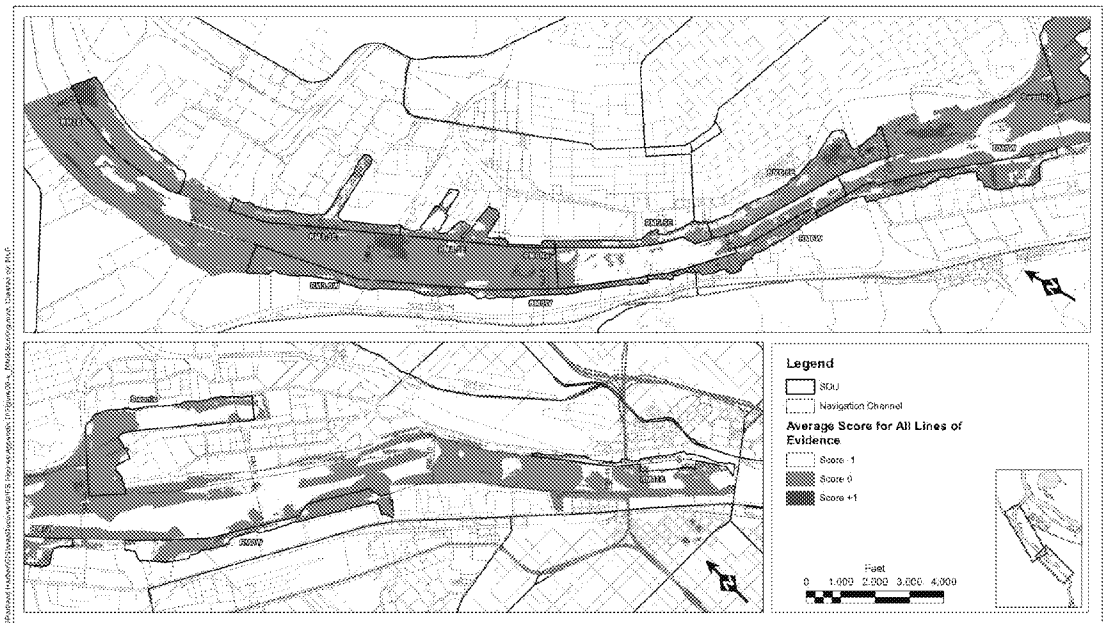


Figure D8-7. Average Score for Six Lines of Evidence

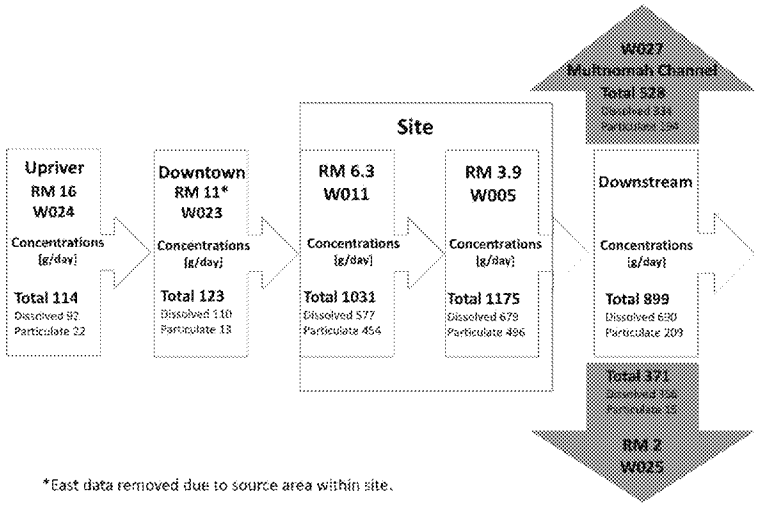
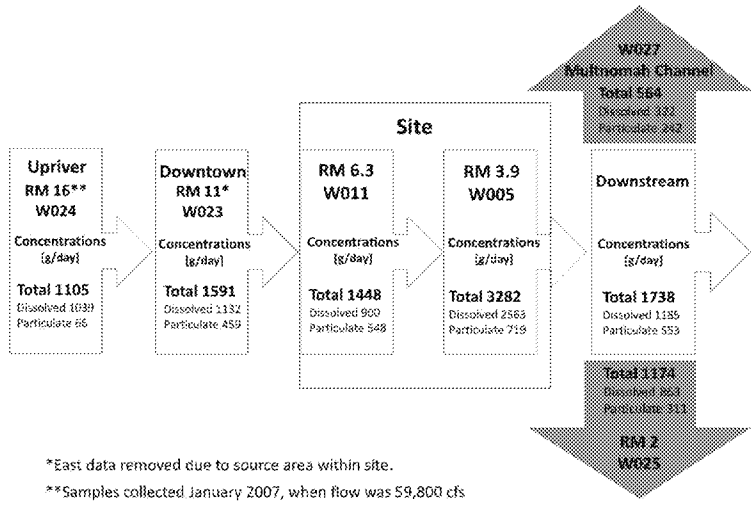


Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs

Remedial Footprint Area Summary

Scenario	Remedial Footprint (Acres)			Notes
	Current Remedy	Nearshore Total PAH RAL Change from 13 to 30 ppm	Remedial Footprint Change	
Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint

Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* ([HYPERLINK "https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136"]).

Human Health Risk:

Within the navigation channel, the current cleanup level is 3,950 ppb CPAHs and is based on the clam consumption exposure pathway. Direct contact with contaminated sediment is not considered a complete exposure pathway in the navigation channel. Surface water exposure pathways (ingestion, inhalation and dermal contact) are complete within the navigation channel. Although it is known that contaminated sediments contribute to surface water COCs, there is not a sediment cleanup levels associated with the protection of drinking water. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling ½ river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

PAH contaminated sediments within the Navigation Channel also pose risks to ecological receptors. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg, a value which is already 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." The areas that exceed the Navigation Channel RAL within the for PAHs are isolated to areas between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may further limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. Sediments within the navigation channel are significantly elevated in cPAH concentration and are likely contribute to cPAH exceedances of the human health and ecological AWQCs. As shown in Figures 3 and 4, taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that the high levels of PAH contamination within the Navigation Channel between RM 5 and 6.6are contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, RAOs 3, 5, and 7 are not affected by the IRIS change. Due to the exceedances of the benthic cleanup levels in the navigation channel between RM 5 and 7, the limited effectiveness of MNR in that area, and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor is not warranted in the navigation channel area.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

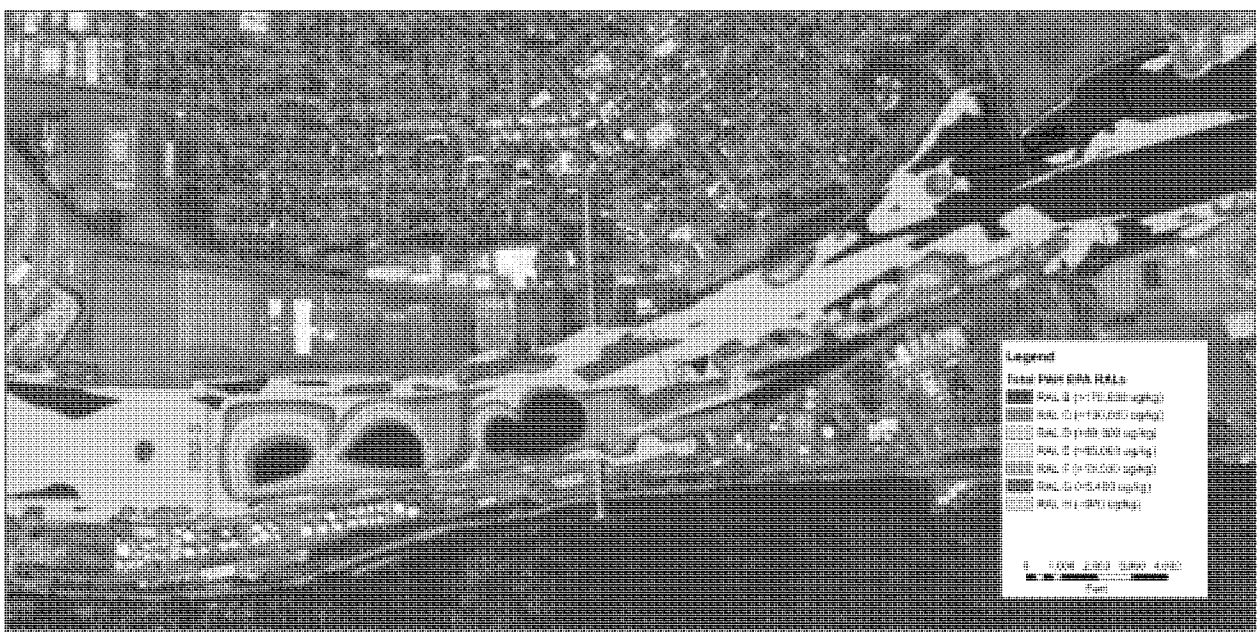


Figure 2 – MNR Average Score for Six Lines of Evidence

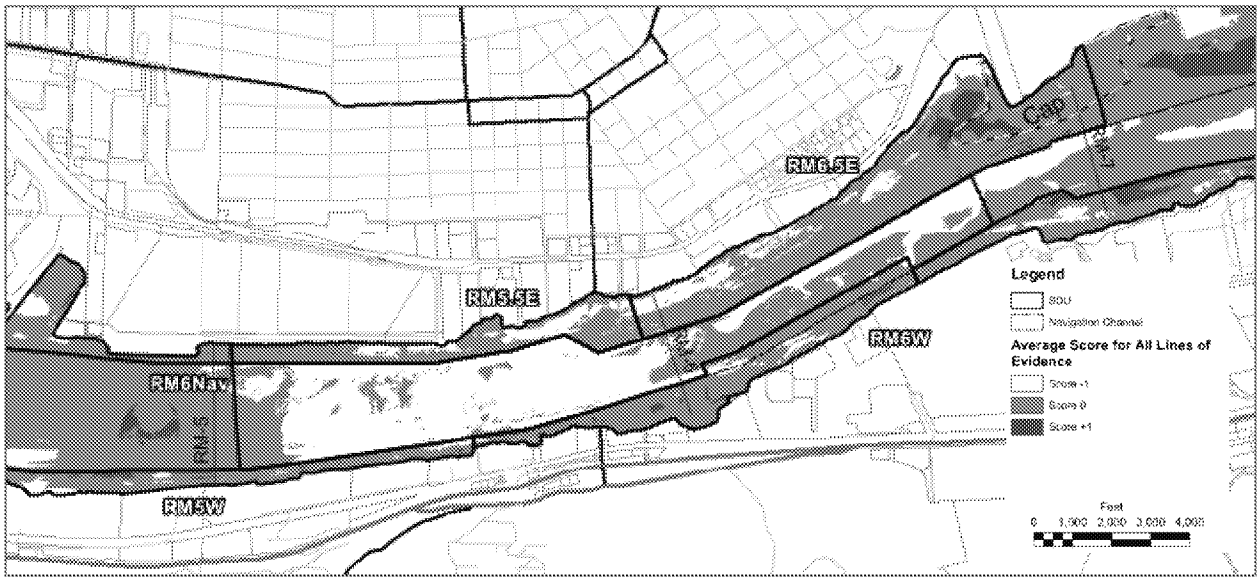


Figure 3 – PAH Loading under Low Flow Conditions

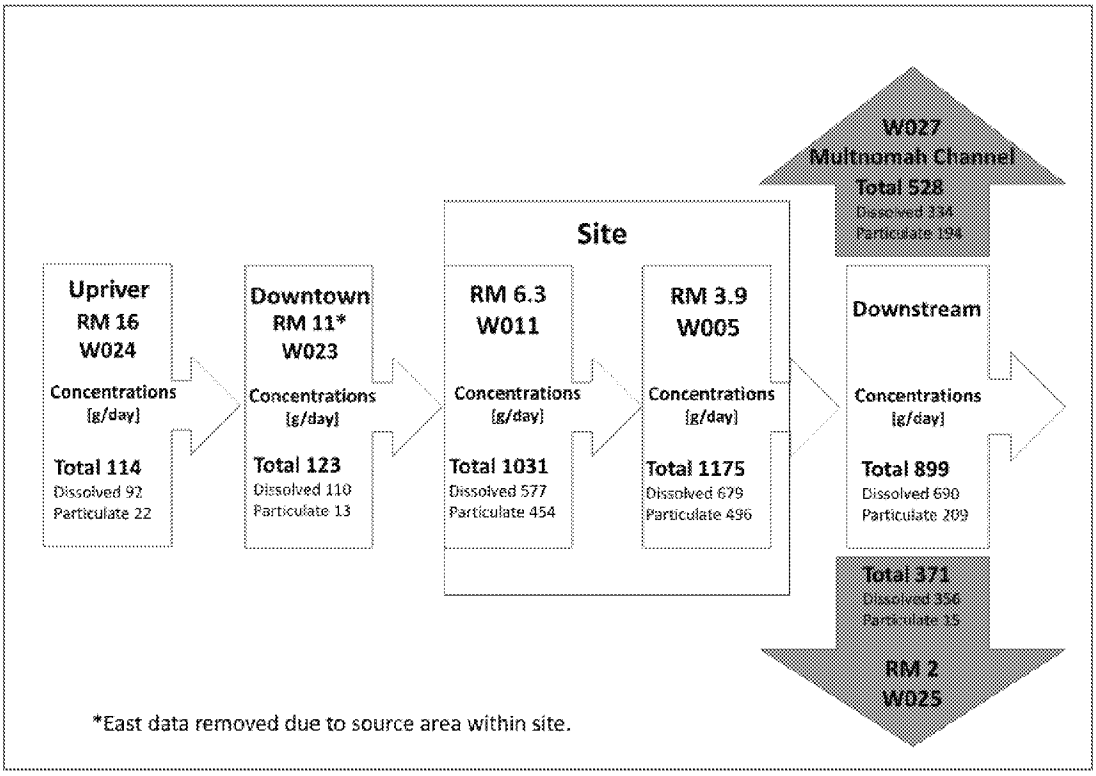
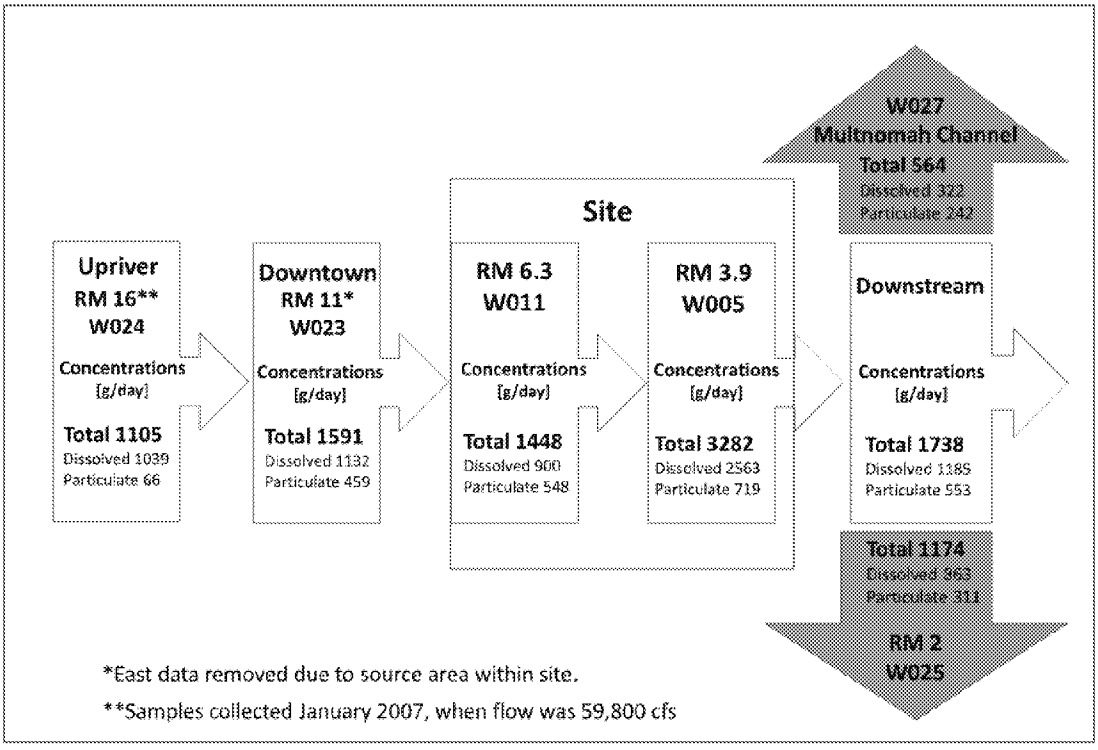


Figure 4 – PAH Loading under High Flow Conditions



Appointment

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 12/15/2017 5:54:13 PM
To: Coffey, Scott [CoffeySE@cdmsmith.com]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Blischke, Eric [blischkee@cdmsmith.com]; John Kern [kernstat@gmail.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]

Subject: Parallel meeting invite to provide materials for PAH discussion on January 4th
Attachments: 12-7-17_Portland Harbor cPAH Cleanup Levels Memo.docx; PAH_RAL_CUL_Evaluation.docx; Beach_Sediment_Risk_Summary.pdf; Attachment_1_CPAH_RRM_greater CUL.XLSX; Figure_2_cPAH_RRM_774 CUL_Comp.pdf; Figure_1_SMA-Selected-Remedy-minus-PAHs.pdf; RollingRiverMileStratifiedNaturalNeighborGrid (RAL 13000 25000 30000) Revised 2017_12_12.pptx; FigX-X_SMAs-based-on-PAHs-30ppm_20180102.pdf; PercentProtective_HalfRM_106_prg.pptx; Total_PAH_Navigation_Channel_RAL_Text_12-21-17.docx; CPAH_Slope_Factor_Change_1-3-17.pptx
Location: Personal Privacy / Ex. 6

Start: 1/4/2018 5:30:00 PM
End: 1/4/2018 7:30:00 PM
Show Time As: Tentative

Importance: High

Recurrence: (none)

Technical materials for PAH discussion/decision making meeting – Updated 1/3/18.

Eric's review summary and response on the three main points presented in the 11/28/2017 memo from Patty Dost to Elliott Laws (**MS Word file titled – 12-7-17_Portland Harbor cPAH Cleanup Levels Memo**)

Eric's rolling river mile evaluation which looks at where active remediation is designated (footprint) against the cPAH cleanup levels, including IRIS adjusted values. Eric presents a summary (MS Word file) of the cPAH questions that have been raised during relevant CUL and RAL adjustment discussions and provides answers gleaned from this analysis (**5 files immediately below**)

John Kern's analysis per Karl's direction to develop a statistically based Adjusted RAL for the nearshore (**Powerpoint slide titled: RollingRiverMileStratifiedNaturalNeighborGrid……)**

A supplemental John Kern analysis per Karl's request to show proportion of half RM protected at the 106 PRG as a function of selected RALs. (**Powerpoint slide titled: PercentProtective_HalfRM_106_prg.pptx**)

Updated GIS PAH coverage map showing footprint of SMA related to Total PAHs, the differences if nearshore TPAH RAL is revised to E-RAL and Stat based RAL of 30ppm

Slide summary of PAH decisions – those agreed upon, ongoing considerations/factors, Options with ranking summary table

Rationale Summary for retaining B-RAL in Nav Channel

Portland Harbor cPAH Cleanup Levels Memo Evaluation

The summary presented below evaluates arguments made in the November 28, 2017 memo to Elliott Laws from Patti Dost of the Pearl Legal Group. The memo addresses EPA's application of the cPAH direct contact and clam consumption sediment cleanup levels and the January 2017 change in the cancer slope factor for benzo(a)pyrene.

EPA has previously considered application of the direct contact sediment cleanup level and the change in the benzo(a)pyrene cancer slope factor. EPA has not previously considered application of the cPAH clam consumption sediment cleanup level previously. However, if EPA revises cPAH cleanup levels based on the change in the benzo(a)pyrene cancer slope factor, the updated cPAH clam consumption cleanup level will not be exceeded on a 1 mile rolling river mile average SWAC basis at the Portland Harbor Site.

The following presents a summary of the key supporting statements is provided along with a preliminary response.

I. **EPA's cPAH cleanup levels are inconstant with the baseline risk assessment and therefore legally indefensible.**

A. EPA's ROD applies an upland beach cleanup level to in-water sediments that the baseline risk assessment found posed no direct contact risk.

<u>Statements made in memo to support</u>:

- EPA provided no explanation for its application of a beach exposure PRG to in-water sediments other than the statement that its selected cleanup levels "represent the lowest value in each medium (beach or in-river sediment) to be protective of all receptors."
- EPA did not explain why it abandoned the finding of the BHHRA that the tribal fisher was the most sensitive receptor for in-water sediment and assumed that children would be playing in underwater sediments offshore of industrial facilities.
- RALs used to define action areas in the ROD were based on the 106 ug/kg PRG for in-water sediment exposure.
- Highly toxic principal threat waste concentrations in the FS and ROD are based on the 106 ug/kg PRG.
- The FS evaluated the performance of all alternatives (including the preferred alternative) for EPA's RAO 1 against the 106 ug/kg tribal fisher PRG.

<u>Preliminary Response</u>:

- EPA stated in its responsiveness summary (Section 2.3.5) that it disagrees it is inappropriate to set a site-wide cleanup for the recreational beach users because much of the site is designated for industrial use and public access is limited. EPA noted that there are several beach areas accessible by people beyond designated public beaches, and land and waterway use is dynamic and may change in the future.

- EPA acknowledged in the responsiveness summary (Section 2.19.3) that direct contact with sediment in the navigation channel segment was not evaluated for RAO 1 and that the evaluation of direct contact human health risk presented in Appendix J only considered direct contact with sediment and did not consider beach exposures.

B. EPA's ROD applies a clam consumption cleanup level to areas of the river in which the baseline risk assessment correctly assumed that clams would not be harvested.

Statements made in memo to support:

- EPA explicitly assumed that clam harvesting occurred only in nearshore areas: "EPA acknowledges that an appropriate exposure area should be determined in consideration of water depth (i.e., nearshore areas) and the area over which a sustainable shellfish harvest consistent with the clam consumption is possible.
- The responsiveness summary states that "EPA.... Disagrees that the shellfish consumption pathway is not complete for the navigation channel. The commenter has not provided any information to support this statement.

Preliminary Response:

- The human health risk assessment evaluated the consumption of clams based on the Linnton Community Center project which reported that some transients reported eating clams and crayfish. This pathway was evaluated only for subsistence fishers, as they were considered the most likely population to regularly harvest and consume shellfish.
- The risk assessment noted in the uncertainty section that evidence of current consumption of freshwater clams from Portland Harbor is limited.
- Clam tissue exposure point concentrations (EPCs) were calculated per river mile on each side of the river as well as for the entire Study Area.
- EPA acknowledges that Map 5.4-1 of the HHRA indicates that the evaluation of clam consumption on a river mile basis is limited to nearshore areas. However, footnote 1 on the figure states: "Exposure areas for clam are per river mile and per side of the river as well as Study Area-wide."
- Study Area-wide risks associated with benzo(a)pyrene for the clam consumption exposure were estimated as 1 x 10-4 assuming a clam consumption rate of 18 g/day. Site-wide risks do not explicitly exclude the navigation channel.
- The risk assessment summary identified 17 chemicals that potentially pose unacceptable risk due to the consumption of shellfish. The summary does not state that these risks only apply to nearshore areas.

II. EPA should recalculate cPAH cleanup levels based upon current IRIS toxicity values before requiring PRPs to design remedies that present no unacceptable risk.

Statements made in memo to support:

EPA guidance is clear that risk estimates and the cleanup levels that follow from those estimates should be based upon the most current IRIS values available.

EPA's comprehensive Five-Year Review Guidance instructs site managers to check for updated toxicity values.

At other sites, EPA has recalculated cleanup levels based on updated IRIS values by issuing ESD documents. Sites include: Salem Acres, Burlington Northern Somers Plant, Petrochem Recycling Corp and Commencement Bay.

Preliminary Response:

- EPA acknowledges the change in the IRIS slope factor, but acting on this adjustment is not an immediate requirement and according to the five-year guidance flow chart for changes in toxicity, (Exhibit G-4) a reduction of risk (the specific outcome of this IRIS change) does not require recalculating risk, or the cleanup values[1].

[1] Five-Year Guidance Flow Chart Exhibit G-4: Evaluating Changes in Toxicity and Other Contaminant Characteristics points out that risks and cleanup levels are recalculated only if the IRIS update results in "the estimated risk has potentially increased". Since the IRIS update results in a reduction of risk, the flow chart directs EPA that no further analysis, or change is necessary (analysis complete).

River Mile	Segment
1.8	East
1.9	East
2	East
2.1	East
2.2	East
2.3	East
2.4	East
2.5	East
2.6	East
2.7	East
2.8	East
2.9	East
3	East
3.1	East
3.2	East
3.3	East
3.4	East
3.5	East
3.6	East
3.7	East
3.8	East
3.9	East
4	East
4.1	East
4.2	East
4.3	East
4.4	East
4.5	East
4.6	East
4.7	East
4.8	East
4.9	East
5	East
5.1	East
5.2	East
5.3	East
5.4	East
5.5	East
5.6	East
5.7	East
5.8	East
5.9	East
6	East
6.1	East

6.2	East
6.3	East
6.4	East
6.5	East
6.6	East
6.7	East
6.8	East
6.9	East
7	East
7.1	East
7.2	East
7.3	East
7.4	East
7.5	East
7.6	East
7.7	East
7.8	East
7.9	East
8	East
8.1	East
8.2	East
8.3	East
8.4	East
8.5	East
8.6	East
8.7	East
8.8	East
8.9	East
9	East
9.1	East
9.2	East
9.3	East
9.4	East
9.5	East
9.6	East
9.7	East
9.8	East
9.9	East
10	East
10.1	East
10.2	East
10.3	East
10.4	East
10.5	East
10.6	East
10.7	East
10.8	East

10.9	East
11	East
11.1	East
11.2	East
11.3	East
11.4	East
11.5	East
11.6	East
11.7	East
1.8	West
1.9	West
2	West
2.1	West
2.2	West
2.3	West
2.4	West
2.5	West
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9	West
9.1	West
9.2	West
9.3	West
9.4	West
9.5	West
9.6	West
9.7	West
9.8	West
9.9	West
10	West
10.1	West
10.2	West

10.3	West
10.4	West
10.5	West
10.6	West
10.7	West
10.8	West
10.9	West
11	West
11.1	West
11.2	West
11.3	West
11.4	West
11.5	West
11.6	West
11.7	West
7.8	Swan Isl
7.9	Swan Isl
8	Swan Isl
8.1	Swan Isl
8.2	Swan Isl
8.3	Swan Isl
8.4	Swan Isl
8.5	Swan Isl
8.6	Swan Isl
8.7	Swan Isl
8.8	Swan Isl
8.9	Swan Isl
9	Swan Isl
9.1	Swan Isl
9.2	Swan Isl
9.3	Swan Isl
9.4	Swan Isl

Notes:
Green Cells indicate that direct contact CUL of 774 ug/kg is exceeded under no action alternative.
Gold Cells indicate that Alternative has reduced Rolling River mile SWAC concentration below CUL

Alternative							
A	B	D	E	F Mod	F	G	I
285.27	285.27	285.22	283.78	282.50	282.50	281.82	283.78
186.86	183.32	182.29	179.84	176.96	176.96	175.82	179.84
109.20	96.92	94.10	91.09	87.40	87.40	85.85	91.09
70.52	53.34	48.21	43.79	39.56	39.56	37.86	43.79
68.53	46.11	40.46	35.65	30.23	30.23	27.86	35.65
68.30	47.58	42.36	38.13	31.09	31.09	28.41	38.13
72.13	53.50	48.88	45.39	37.72	37.72	34.39	45.39
100.32	90.32	83.48	69.85	51.04	51.04	39.92	69.85
260.05	230.35	127.55	89.82	58.76	58.76	42.40	89.82
291.09	265.35	155.32	106.32	67.62	67.62	49.07	118.83
330.61	302.02	178.48	123.59	83.63	83.63	63.97	137.65
366.76	335.38	199.80	139.56	98.14	98.14	77.89	154.99
378.99	342.93	193.30	140.72	111.59	111.59	100.92	158.45
147.28	147.28	144.53	129.07	117.79	117.79	114.39	147.28
123.17	123.17	122.85	122.85	122.69	122.69	122.47	122.85
136.32	136.32	133.30	133.30	132.93	132.93	128.12	133.30
127.61	127.61	124.55	124.55	124.09	124.09	118.04	124.55
103.45	103.45	100.97	100.52	91.46	91.46	80.28	100.52
172.84	97.27	84.23	78.46	61.95	61.95	50.44	78.46
179.17	100.32	86.96	79.70	61.10	61.10	45.42	79.70
178.68	93.22	80.33	70.51	47.73	47.73	31.63	70.51
195.24	106.54	91.25	69.90	40.86	40.86	19.42	69.90
248.27	129.99	109.63	81.01	46.48	46.48	19.35	81.01
728.16	726.84	721.31	477.94	159.25	159.25	56.39	477.94
1246.57	1245.78	1198.34	929.37	181.08	181.08	43.96	929.37
1782.86	1773.03	1345.04	975.23	235.15	235.15	60.41	975.23
3074.92	2823.89	1741.18	1095.22	257.00	257.00	65.42	1095.22
3710.28	3478.82	1862.81	1093.30	281.79	281.79	61.57	1093.30
4185.69	3902.69	1927.87	1114.36	293.82	293.82	61.92	1114.36
4957.91	4571.35	1919.87	905.11	337.01	337.01	91.48	905.11
4953.33	4494.46	1855.23	841.19	324.02	324.02	100.17	841.19
3027.23	3027.23	1047.80	489.04	353.49	353.49	151.99	489.04
327.32	327.32	327.32	327.32	326.85	326.85	258.05	327.32
396.32	396.32	396.32	396.32	396.32	396.32	261.20	396.32
472.15	472.15	472.15	472.15	472.15	472.15	253.14	472.15
487.34	487.34	487.34	487.34	470.21	470.21	257.25	470.21
648.39	648.39	648.39	648.39	473.76	473.76	201.41	473.76
791.48	791.48	791.48	705.73	425.67	425.67	146.70	425.67
756.13	754.13	754.13	662.10	327.38	327.38	96.74	327.38
753.01	751.51	751.51	682.34	400.16	400.16	101.62	400.16
783.51	782.16	782.16	719.82	444.98	444.98	122.94	475.43
708.01	706.78	706.78	646.17	462.45	462.45	210.21	511.54
619.79	618.74	618.64	607.09	486.73	486.73	267.41	542.06
767.76	767.76	716.22	622.10	489.94	489.94	294.15	744.48

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746.34	746.34	685.98	575.15	425.84	425.84	315.52	742.84
622.76	622.76	565.35	461.89	343.59	343.59	285.64	619.62
514.43	513.47	457.38	362.84	266.85	266.85	215.13	512.61
411.54	401.88	341.10	255.14	177.55	177.55	134.57	400.61
175.43	159.12	140.00	130.70	105.92	105.92	78.44	157.40
85.51	70.14	56.22	55.99	53.65	53.65	45.73	68.53
63.97	49.64	37.28	37.07	34.93	34.93	30.21	48.14
58.10	44.76	34.06	33.86	31.91	31.91	28.18	44.38
63.19	44.64	35.46	35.27	33.73	33.73	31.64	56.05
83.64	60.65	42.47	42.46	41.88	41.88	40.58	83.25
95.25	72.49	50.52	50.52	47.62	47.62	45.94	93.68
97.98	74.98	52.76	52.76	49.83	49.83	48.32	96.40
98.34	73.13	48.63	48.63	45.35	45.35	44.13	96.57
88.78	74.07	50.80	50.80	46.58	46.58	44.95	86.51
60.06	58.83	50.07	50.07	45.79	45.79	42.16	57.54
47.33	47.33	47.33	47.33	47.29	47.29	42.92	47.33
53.59	51.37	51.37	50.95	50.59	50.59	32.93	50.95
60.86	41.71	41.71	41.29	40.91	40.91	22.79	41.29
64.55	32.80	32.80	32.44	31.19	31.19	15.85	32.44
61.58	30.57	30.57	30.22	29.04	29.04	17.10	30.22
58.26	27.88	27.88	27.54	26.38	26.38	15.42	27.54
50.11	13.97	13.97	13.97	12.84	12.84	12.45	13.97
45.83	24.04	24.04	24.04	22.74	22.74	22.30	24.04
34.24	34.24	34.24	34.24	34.24	34.24	34.20	34.24
36.89	36.89	36.89	36.89	36.79	36.79	36.69	36.89
38.29	38.29	38.29	38.29	38.00	38.00	37.70	38.29
38.44	38.44	38.44	38.44	37.77	37.77	33.74	38.44
36.13	36.13	36.13	36.13	33.72	33.72	26.51	36.13
34.04	34.04	34.04	34.04	31.13	31.13	22.15	34.04
28.84	28.84	28.84	28.84	26.01	26.01	17.38	28.84
23.29	23.29	23.29	23.29	20.75	20.75	12.61	23.29
22.38	22.38	22.38	22.38	19.02	19.02	13.09	22.38
25.39	25.39	25.39	25.39	17.81	17.81	12.92	25.39
24.85	24.85	24.85	24.85	17.40	17.40	11.87	24.85
27.04	27.04	27.04	27.04	19.92	19.92	14.41	27.04
33.15	33.15	33.15	33.15	26.13	26.13	20.71	33.15
50.35	50.25	50.16	48.52	39.91	39.91	28.13	48.52
157.81	157.70	157.60	149.77	67.36	67.36	38.05	154.95
218.90	218.78	218.67	210.07	118.10	118.10	78.51	215.75
303.54	303.39	303.26	292.62	178.88	178.88	121.87	299.65
378.63	378.44	378.28	364.85	221.32	221.32	148.55	373.72
435.76	435.76	435.76	422.58	247.08	247.08	171.42	433.75
216.49	216.49	216.49	216.49	206.99	206.99	167.83	216.49
127.54	127.54	127.54	125.13	113.66	113.66	92.83	125.13
58.37	58.37	58.37	49.33	35.81	35.81	29.97	49.33
55.75	55.75	55.75	46.54	27.37	27.37	17.73	46.54
66.50	66.50	66.50	57.49	29.84	29.84	13.99	57.49

71.11	70.31	69.04	58.82	34.29	34.29	15.51	58.82
74.55	71.13	65.00	54.79	33.29	33.29	12.65	54.79
86.31	71.05	60.46	52.10	31.40	31.40	10.07	52.10
88.58	59.17	46.90	37.41	22.56	22.56	7.26	37.41
72.01	42.92	30.43	20.47	13.20	13.20	5.28	20.47
63.35	34.72	23.18	13.76	7.00	7.00	1.38	13.76
59.21	29.21	20.91	12.40	6.58	6.58	1.78	12.40
47.93	23.63	18.33	12.13	6.79	6.79	1.90	12.13
26.65	23.05	20.74	16.24	10.33	10.33	2.89	16.24
62.11	62.11	62.11	62.11	62.11	62.11	62.11	62.11
62.46	62.46	62.46	62.46	62.46	62.46	62.46	62.46
69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
86.86	86.86	86.86	86.86	86.86	86.86	86.86	86.86
109.69	109.69	109.69	109.69	109.69	109.69	109.69	109.69
160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70
216.19	216.19	216.19	216.19	216.19	216.19	215.28	216.19
256.95	256.95	256.95	256.95	256.95	256.95	246.87	256.95
320.09	320.09	320.09	320.09	320.09	320.09	285.84	320.09
427.95	427.95	427.95	427.95	427.95	427.95	321.95	427.95
513.27	513.27	513.27	513.27	513.27	513.27	352.94	513.27
526.51	526.51	526.51	526.51	526.51	526.51	371.27	526.51
586.96	586.96	586.96	586.96	586.96	586.96	394.01	586.96
647.53	647.53	647.53	647.53	647.53	647.53	407.71	647.53
617.29	617.29	617.29	617.29	617.29	617.29	404.33	617.29
546.32	546.32	546.32	546.32	545.47	545.47	365.34	546.32
516.01	516.01	516.01	516.01	515.01	515.01	319.22	516.01
431.10	431.10	431.10	431.10	429.87	429.87	282.44	431.10
320.54	320.54	320.54	320.54	318.90	318.90	251.50	320.54
373.99	373.99	373.99	352.46	258.36	258.36	194.92	352.46
426.48	426.48	426.48	400.88	287.29	287.29	192.64	400.88
503.13	503.13	503.13	472.48	330.22	330.22	212.62	472.48
644.46	644.46	644.46	605.28	390.05	390.05	176.66	605.28
821.69	821.69	821.69	782.88	489.17	489.17	144.37	782.88
682.16	682.16	682.16	677.65	533.94	533.94	145.20	677.65
732.10	732.10	732.10	727.05	571.97	571.97	135.33	727.05
840.73	840.73	840.73	835.63	557.96	557.96	94.96	835.63
772.50	772.50	772.50	772.50	499.14	499.14	119.79	772.50
593.79	593.79	593.79	592.04	376.81	376.81	136.58	592.04
718.99	718.99	711.00	652.47	325.64	325.64	160.79	652.47
696.78	696.78	688.77	630.08	296.69	296.69	182.46	630.08
756.67	756.67	706.02	604.99	298.34	298.34	201.23	604.99
904.84	904.84	845.85	597.11	283.58	283.58	187.08	597.11
1352.60	1352.60	980.81	638.54	300.18	300.18	167.35	638.54
2277.41	1934.17	906.25	545.19	286.52	286.52	127.53	545.19
3143.22	2757.01	1149.48	648.54	279.96	279.96	65.85	648.54
3233.89	2819.33	1154.25	673.79	396.69	396.69	59.08	673.79
3059.56	2650.05	1008.27	707.00	475.85	475.85	75.97	707.00

2640.67	2264.25	1070.46	836.59	518.55	518.55	127.89	859.25
1869.14	1836.29	1266.85	917.04	504.08	504.08	171.97	1158.39
2391.43	1841.79	1354.01	1098.30	510.74	510.74	165.33	1354.01
6066.89	2386.42	1320.10	1019.74	404.12	404.12	140.70	1320.10
14260.55	2215.14	1193.81	906.11	328.49	328.49	116.58	1193.81
21991.86	2044.06	1034.16	760.87	249.80	249.80	81.87	1034.16
29236.75	1824.08	779.40	627.65	183.65	183.65	41.57	779.40
40104.32	1213.09	285.27	177.98	22.86	22.86	0.00	285.27
38796.86	294.52	214.70	165.60	46.48	46.48	10.64	47.78
25684.49	586.63	504.02	402.75	89.43	89.43	13.56	90.77
11444.97	950.62	843.35	662.72	130.46	130.46	15.80	131.76
2747.09	819.26	678.48	511.10	100.81	100.81	12.81	101.80
955.57	730.89	601.93	447.69	88.31	88.31	11.43	88.31
573.49	476.19	403.08	296.09	51.95	51.95	4.36	51.95
431.07	288.39	222.10	150.91	26.41	26.41	2.66	26.41
388.34	93.24	39.15	7.75	1.09	1.09	1.19	1.09
337.05	32.98	18.15	6.13	1.25	1.25	0.00	1.25
301.70	27.00	18.52	12.86	8.11	8.11	4.10	8.11
242.36	38.97	36.32	33.02	28.44	28.44	18.99	28.44
174.70	51.50	49.49	45.92	36.50	36.50	22.23	36.50
72.27	65.47	64.07	61.45	49.58	49.58	27.75	49.58
67.72	65.88	64.55	62.32	51.23	51.23	28.44	51.23
65.82	65.80	65.73	64.95	53.14	53.14	28.90	54.27
69.93	69.92	69.83	66.98	47.04	47.04	21.18	55.04
81.38	81.38	81.38	71.75	44.11	44.11	18.32	64.36
154.22	154.22	152.78	127.27	13.66	13.66	2.77	126.62
182.11	182.11	180.96	158.76	37.60	37.60	8.66	158.76
166.50	165.99	165.12	142.72	43.08	43.08	20.70	142.72
164.84	163.87	163.05	131.35	39.75	39.75	19.52	131.35
157.94	156.98	156.07	122.94	38.06	38.06	19.12	122.94
127.83	119.42	110.27	78.72	40.20	40.20	20.23	78.72
126.22	90.14	77.50	40.06	21.28	21.28	17.73	40.06
157.77	85.13	59.05	15.14	2.29	2.29	0.58	15.14
199.49	73.54	34.76	5.52	0.00	0.00	0.00	5.52
244.30	88.99	22.98	3.73	0.00	0.00	0.00	3.73
177.20	61.01	24.76	13.06	4.58	4.58	2.95	13.06
117.12	60.71	33.93	24.75	10.68	10.68	6.83	24.75
88.48	58.85	42.66	34.62	11.69	11.69	7.59	34.62
102.36	77.62	61.19	36.99	12.35	12.35	8.13	36.99
148.22	125.81	81.07	34.07	10.73	10.73	7.05	34.07
173.60	145.67	90.06	34.97	10.55	10.55	7.00	34.97
212.97	176.37	103.49	31.20	7.10	7.10	5.20	31.20
277.97	226.84	125.00	23.84	8.75	8.75	7.45	23.84
300.06	277.99	132.37	28.88	19.25	19.25	12.56	28.88
122.87	122.87	121.18	110.42	90.67	90.67	38.14	112.11
156.51	156.51	155.27	144.59	87.73	87.73	31.04	145.83
282.49	282.49	281.38	272.30	222.85	222.85	121.80	273.41

354.58	354.58	353.49	344.85	297.10	297.10	199.55	345.93
352.57	352.57	351.48	342.73	295.04	295.04	208.29	343.81
186.72	186.72	186.72	185.45	167.31	167.31	106.71	185.45
146.85	146.85	146.85	146.85	146.85	146.85	100.48	146.85
92.15	92.15	92.15	92.15	92.15	92.15	70.90	92.15
70.85	70.85	70.85	70.85	70.85	70.85	52.63	70.85
66.88	66.88	66.88	66.88	66.88	66.88	50.18	66.88
65.35	65.35	65.35	65.35	65.35	65.35	65.33	65.35
77.48	77.48	77.48	77.48	77.48	77.48	77.48	77.48
91.43	91.43	91.43	91.43	91.43	91.43	90.27	91.43
89.88	89.88	89.88	89.88	89.88	89.88	88.54	89.88
79.16	79.16	79.16	79.16	79.16	79.16	77.95	79.16
84.56	84.56	84.56	84.56	84.56	84.56	83.18	84.56
77.70	77.70	77.70	77.70	77.70	77.70	75.99	77.70
49.64	49.64	49.64	49.64	49.64	49.64	49.64	49.64
274.24	34.87	34.82	3.82	1.90	1.90	0.28	3.82
180.11	14.06	13.93	7.22	1.90	1.90	0.72	7.22
230.60	19.33	18.31	9.87	4.01	4.01	0.98	9.87
270.08	21.30	19.69	11.76	5.88	5.88	1.26	11.76
306.92	20.23	18.69	11.55	6.23	6.23	2.12	11.55
324.18	18.63	17.03	11.80	6.47	6.47	2.34	11.80
385.51	21.35	19.09	13.03	8.70	8.70	3.54	13.03
388.14	18.20	15.29	11.45	9.16	9.16	5.45	11.45
359.27	21.05	10.30	7.14	6.12	6.12	5.51	7.14
288.09	25.06	8.82	5.66	4.49	4.49	3.91	5.66
258.99	26.91	8.34	5.28	3.96	3.96	3.54	5.28
309.88	108.46	63.12	40.65	6.27	6.27	4.28	87.76
339.31	131.60	76.02	49.89	7.15	7.15	4.69	109.02
325.88	167.56	104.18	68.44	8.88	8.88	5.55	151.36
379.46	258.88	169.67	111.36	13.46	13.46	8.08	249.40
431.88	369.29	248.47	162.50	19.22	19.22	11.44	366.47
63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59

POSES ONLY

River Mile	Segment	A	B
1.8	East	170.23	161.66
1.9	East	172.41	162.32
2	East	169.06	157.71
2.1	East	158.63	147.24
2.2	East	110.79	99.65
2.3	East	101.63	90.05
2.4	East	172.25	148.66
2.5	East	178.14	154.01
2.6	East	188.39	163.65
2.7	East	203.00	180.79
2.8	East	215.89	197.37
2.9	East	219.75	202.63
3	East	238.23	221.87
3.1	East	259.12	241.63
3.2	East	271.66	252.84
3.3	East	220.33	191.47
3.4	East	151.80	106.96
3.5	East	158.87	110.93
3.6	East	162.77	112.06
3.7	East	169.27	117.17
3.8	East	180.16	126.87
3.9	East	494.16	446.02
4	East	694.35	649.29
4.1	East	1217.16	1159.29
4.2	East	2184.60	2012.37
4.3	East	2816.17	2609.88
4.4	East	2970.07	2787.37
4.5	East	3036.49	2850.03
4.6	East	3036.03	2850.47
4.7	East	3065.94	2878.32
4.8	East	3124.12	2932.80
4.9	East	3307.20	3078.17
5	East	3509.67	3239.03
5.1	East	2795.42	2525.53
5.2	East	628.53	628.53
5.3	East	611.50	610.59
5.4	East	614.06	613.01
5.5	East	668.16	667.24
5.6	East	686.31	685.47
5.7	East	680.47	679.72
5.8	East	670.21	669.53
5.9	East	770.25	769.62
6	East	721.24	720.66
6.1	East	639.58	639.04
6.2	East	548.26	546.25

6.3	East	459.68	451.93
6.4	East	377.23	367.77
6.5	East	306.61	297.54
6.6	East	253.96	245.39
6.7	East	212.55	203.31
6.8	East	194.66	174.52
6.9	East	99.41	79.66
7	East	84.51	65.63
7.1	East	78.81	60.03
7.2	East	75.96	57.05
7.3	East	73.49	57.41
7.4	East	79.50	63.55
7.5	East	84.90	68.00
7.6	East	87.87	66.76
7.7	East	89.18	62.96
7.8	East	61.90	48.97
7.9	East	54.84	40.62
8	East	50.08	32.80
8.1	East	53.57	33.50
8.2	East	53.31	33.49
8.3	East	51.97	33.36
8.4	East	50.70	32.73
8.5	East	47.99	29.24
8.6	East	41.93	27.63
8.7	East	38.36	32.72
8.8	East	33.70	33.70
8.9	East	31.88	31.88
9	East	30.22	30.22
9.1	East	31.09	31.09
9.2	East	29.93	29.93
9.3	East	28.24	28.24
9.4	East	28.13	28.13
9.5	East	28.91	28.91
9.6	East	62.38	62.32
9.7	East	104.83	104.77
9.8	East	130.98	130.92
9.9	East	148.72	148.66
10	East	162.94	162.87
10.1	East	170.90	170.83
10.2	East	182.19	182.11
10.3	East	200.22	200.13
10.4	East	221.95	221.85
10.5	East	246.52	246.42
10.6	East	196.02	196.02
10.7	East	116.09	114.32
10.8	East	78.41	75.20
10.9	East	75.56	60.91

11	East	71.48	54.92
11.1	East	68.99	52.36
11.2	East	65.87	49.86
11.3	East	67.99	50.03
11.4	East	70.13	49.88
11.5	East	65.73	43.54
11.6	East	61.04	35.61
11.7	East	60.14	33.05
1.8	Nav Channel	94.48	94.48
1.9	Nav Channel	112.50	112.50
2	Nav Channel	131.41	131.41
2.1	Nav Channel	145.46	145.46
2.2	Nav Channel	156.94	156.94
2.3	Nav Channel	173.97	173.97
2.4	Nav Channel	192.46	192.46
2.5	Nav Channel	210.15	210.15
2.6	Nav Channel	231.11	231.11
2.7	Nav Channel	258.78	258.78
2.8	Nav Channel	290.00	290.00
2.9	Nav Channel	322.06	322.06
3	Nav Channel	364.72	364.72
3.1	Nav Channel	417.32	417.32
3.2	Nav Channel	472.55	472.55
3.3	Nav Channel	486.41	486.41
3.4	Nav Channel	489.12	489.12
3.5	Nav Channel	474.63	474.63
3.6	Nav Channel	463.41	463.41
3.7	Nav Channel	434.03	434.03
3.8	Nav Channel	391.64	391.64
3.9	Nav Channel	358.24	358.24
4	Nav Channel	342.93	342.93
4.1	Nav Channel	333.09	333.09
4.2	Nav Channel	289.35	289.35
4.3	Nav Channel	271.09	271.09
4.4	Nav Channel	282.20	282.20
4.5	Nav Channel	287.39	287.39
4.6	Nav Channel	682.48	658.06
4.7	Nav Channel	1997.84	1130.63
4.8	Nav Channel	2572.56	1612.45
4.9	Nav Channel	3654.45	1958.26
5	Nav Channel	4652.32	2270.01
5.1	Nav Channel	4998.01	2480.52
5.2	Nav Channel	8019.66	2685.73
5.3	Nav Channel	16026.23	2796.09
5.4	Nav Channel	17092.79	3074.01
5.5	Nav Channel	18145.66	3305.32
5.6	Nav Channel	18886.15	3052.44

5.7	Nav Channel	18510.04	2776.98
5.8	Nav Channel	19403.38	2306.39
5.9	Nav Channel	18902.95	1947.23
6	Nav Channel	18526.53	1576.87
6.1	Nav Channel	19050.57	1384.77
6.2	Nav Channel	15202.90	1251.99
6.3	Nav Channel	2712.53	1244.25
6.4	Nav Channel	2391.94	972.88
6.5	Nav Channel	2236.51	827.81
6.6	Nav Channel	2029.97	655.04
6.7	Nav Channel	1450.71	289.98
6.8	Nav Channel	684.69	151.77
6.9	Nav Channel	345.53	99.11
7	Nav Channel	99.43	88.94
7.1	Nav Channel	58.82	58.64
7.2	Nav Channel	42.34	42.18
7.3	Nav Channel	36.63	36.49
7.4	Nav Channel	35.16	35.07
7.5	Nav Channel	36.70	36.62
7.6	Nav Channel	37.30	37.24
7.7	Nav Channel	35.66	35.60
7.8	Nav Channel	36.28	36.24
7.9	Nav Channel	42.34	42.31
8	Nav Channel	42.40	42.40
8.1	Nav Channel	41.36	41.36
8.2	Nav Channel	40.36	40.36
8.3	Nav Channel	40.44	40.43
8.4	Nav Channel	40.50	40.47
8.5	Nav Channel	39.26	39.20
8.6	Nav Channel	38.04	37.99
8.7	Nav Channel	40.45	40.40
8.8	Nav Channel	42.72	42.67
8.9	Nav Channel	38.10	38.04
9	Nav Channel	37.08	37.02
9.1	Nav Channel	37.92	37.86
9.2	Nav Channel	39.92	39.86
9.3	Nav Channel	42.69	42.63
9.4	Nav Channel	46.49	46.47
9.5	Nav Channel	53.32	53.32
9.6	Nav Channel	54.88	54.88
9.7	Nav Channel	53.05	53.05
9.8	Nav Channel	49.60	49.60
9.9	Nav Channel	47.97	47.97
10	Nav Channel	51.73	51.73
10.1	Nav Channel	53.10	53.10
10.2	Nav Channel	62.51	62.51
10.3	Nav Channel	62.70	62.70

10.4	Nav Channel	60.82	60.82
10.5	Nav Channel	54.87	54.87
10.6	Nav Channel	54.75	54.75
10.7	Nav Channel	55.12	55.07
10.8	Nav Channel	52.74	52.52
10.9	Nav Channel	51.32	50.89
11	Nav Channel	47.75	47.32
11.1	Nav Channel	47.09	46.66
11.2	Nav Channel	35.67	35.20
11.3	Nav Channel	34.38	33.86
11.4	Nav Channel	33.75	33.16
11.5	Nav Channel	33.20	32.53
11.6	Nav Channel	33.47	32.68
11.7	Nav Channel	35.66	34.82
1.8	West	84.35	84.35
1.9	West	88.66	88.66
2	West	97.01	97.01
2.1	West	121.43	121.43
2.2	West	142.65	142.65
2.3	West	167.05	167.05
2.4	West	218.75	218.75
2.5	West	303.33	303.33
2.6	West	369.79	369.79
2.7	West	419.68	419.68
2.8	West	488.64	488.64
2.9	West	531.15	531.15
3	West	538.15	538.15
3.1	West	525.22	525.22
3.2	West	522.51	522.51
3.3	West	538.98	538.98
3.4	West	543.79	543.79
3.5	West	525.92	525.92
3.6	West	511.00	511.00
3.7	West	503.13	503.13
3.8	West	481.36	481.36
3.9	West	483.38	483.38
4	West	516.74	516.74
4.1	West	586.41	586.41
4.2	West	694.55	694.55
4.3	West	706.23	706.23
4.4	West	702.30	702.30
4.5	West	712.03	712.03
4.6	West	726.69	726.69
4.7	West	833.47	833.47
4.8	West	839.14	839.14
4.9	West	1112.13	1066.07
5	West	1582.87	1436.42

5.1	West	1766.71	1602.05
5.2	West	1795.88	1620.32
5.3	West	1925.91	1739.46
5.4	West	2050.80	1872.79
5.5	West	2278.56	2104.70
5.6	West	3487.52	2341.84
5.7	West	8409.98	2441.84
5.8	West	13479.96	2245.89
5.9	West	17086.82	1968.50
6	West	18580.34	1663.38
6.1	West	18714.22	1572.02
6.2	West	18527.99	1605.75
6.3	West	18272.10	1648.95
6.4	West	17468.68	1498.82
6.5	West	17750.77	1105.63
6.6	West	16532.02	684.54
6.7	West	11153.42	394.57
6.8	West	6241.05	386.20
6.9	West	2577.95	388.41
7	West	936.36	382.17
7.1	West	454.78	282.72
7.2	West	335.21	190.91
7.3	West	234.87	114.52
7.4	West	164.68	59.06
7.5	West	153.69	53.02
7.6	West	152.87	52.07
7.7	West	147.05	59.20
7.8	West	102.37	69.28
7.9	West	110.08	107.81
8	West	108.74	108.50
8.1	West	116.86	116.36
8.2	West	122.14	121.60
8.3	West	132.01	130.59
8.4	West	146.55	132.70
8.5	West	155.92	134.86
8.6	West	172.41	137.26
8.7	West	180.09	137.58
8.8	West	173.97	131.93
8.9	West	123.61	80.18
9	West	122.12	76.03
9.1	West	117.19	65.87
9.2	West	161.20	97.83
9.3	West	177.63	112.34
9.4	West	167.70	115.23
9.5	West	163.19	118.38
9.6	West	149.80	122.07
9.7	West	146.52	126.26

9.8	West	155.61	133.41
9.9	West	195.02	168.02
10	West	259.23	224.97
10.1	West	333.66	291.73
10.2	West	248.95	244.94
10.3	West	158.57	158.57
10.4	West	142.60	142.60
10.5	West	138.48	138.48
10.6	West	132.47	132.47
10.7	West	123.04	123.04
10.8	West	114.53	114.53
10.9	West	104.91	104.91
11	West	82.45	82.45
11.1	West	74.06	74.06
11.2	West	72.24	72.24
11.3	West	75.88	75.88
11.4	West	78.07	78.07
11.5	West	75.05	75.05
11.6	West	74.42	74.42
11.7	West	80.62	80.62
7.6	Swan Isl	178.81	19.25
7.7	Swan Isl	209.75	15.78
7.8	Swan Isl	248.67	21.05
7.9	Swan Isl	284.82	20.78
8	Swan Isl	321.18	19.62
8.1	Swan Isl	318.91	19.10
8.2	Swan Isl	300.52	18.27
8.3	Swan Isl	302.60	19.99
8.4	Swan Isl	304.56	21.83
8.5	Swan Isl	297.70	22.15
8.6	Swan Isl	321.10	31.87
8.7	Swan Isl	361.34	67.44
8.8	Swan Isl	359.68	73.57
8.9	Swan Isl	336.06	81.49
9	Swan Isl	292.09	92.82
9.1	Swan Isl	293.54	99.30
9.2	Swan Isl	328.60	119.38
9.3	Swan Isl	330.90	146.35
9.4	Swan Isl	334.75	201.17
9.5	Swan Isl	423.17	320.11
9.6	Swan Isl	500.60	500.60

Notes:
Clam Consumption CUL of 107,600 ug/kg is not exceeded in the Navigation Channel

Alternative					
D	E	F Mod	F	G	I
159.14	157.04	154.92	154.92	154.06	157.04
159.52	156.67	154.00	154.00	152.97	156.67
154.83	151.85	148.38	148.38	146.82	151.85
144.35	141.36	136.36	136.36	134.43	141.36
96.82	93.89	88.43	88.43	85.27	93.89
78.99	67.53	54.30	54.30	47.11	67.53
93.87	67.78	46.47	46.47	36.39	73.69
97.97	71.91	50.59	50.59	40.53	77.95
105.97	79.45	57.81	57.81	47.63	85.69
119.08	91.02	68.61	68.61	57.87	97.75
133.32	103.92	80.39	80.39	69.07	111.15
137.36	108.16	84.72	84.72	73.27	115.56
150.07	118.66	94.32	94.32	82.67	126.70
164.86	131.29	107.50	107.50	93.56	139.89
170.22	134.09	109.36	109.36	95.82	143.34
128.73	106.58	88.19	88.19	78.44	114.22
99.22	95.79	85.64	85.64	77.82	95.79
102.67	97.89	85.61	85.61	75.40	97.89
102.49	95.08	80.37	80.37	67.33	95.08
106.87	94.00	73.96	73.96	56.67	94.00
116.33	103.17	79.16	79.16	55.25	103.17
417.16	298.48	104.80	104.80	49.36	298.48
623.26	487.80	135.70	135.70	47.34	487.80
794.93	559.68	150.12	150.12	43.89	559.68
1089.33	640.50	165.79	165.79	42.24	640.50
1415.93	840.02	231.40	231.40	54.83	840.02
1513.33	898.06	250.11	250.11	63.32	898.06
1549.21	922.27	262.39	262.39	70.63	922.27
1554.22	931.61	275.67	275.67	81.65	931.61
1568.22	944.39	286.61	286.61	94.74	944.39
1596.87	960.74	293.84	293.84	101.97	960.74
1506.89	900.53	352.36	352.36	125.39	900.53
1382.43	710.43	373.97	373.97	154.20	708.98
1180.10	655.21	396.93	396.93	168.76	619.99
607.69	582.07	426.14	426.14	194.63	438.86
610.59	552.79	357.73	357.73	177.51	357.73
613.01	564.96	388.69	388.69	157.66	388.69
667.24	624.85	441.83	441.83	161.14	451.90
685.47	644.41	462.45	462.45	189.79	487.65
679.72	642.60	462.21	462.21	213.14	501.74
667.07	633.34	463.45	463.45	233.60	507.83
733.57	635.88	425.40	425.40	229.32	620.80
685.73	595.40	401.61	401.61	226.69	583.92
606.12	522.90	361.03	361.03	214.22	529.65
514.40	446.76	334.68	334.68	205.75	490.12

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418.35	371.10	291.61	291.61	179.70	433.48
335.97	293.19	226.96	226.96	155.95	358.08
267.13	226.22	173.97	173.97	138.89	295.31
216.66	179.13	136.54	136.54	113.48	244.39
175.72	140.53	107.91	107.91	88.05	203.66
140.78	107.01	78.50	78.50	62.46	186.12
60.42	60.31	57.72	57.72	51.81	90.35
47.96	47.86	45.29	45.29	41.71	75.85
42.87	42.76	40.24	40.24	37.63	70.27
39.95	39.84	37.19	37.19	35.06	68.28
43.02	42.95	40.80	40.80	38.87	70.24
48.16	48.16	46.12	46.12	43.74	78.39
51.68	51.68	49.52	49.52	46.08	83.74
49.44	49.33	46.95	46.95	41.42	83.35
44.70	44.58	41.95	41.95	35.84	79.51
43.01	42.87	39.53	39.53	32.61	47.96
40.44	40.28	39.47	39.47	32.09	40.46
32.80	32.60	31.92	31.92	23.50	32.60
33.50	33.27	32.48	32.48	22.71	33.27
33.49	33.26	32.48	32.48	22.83	33.26
33.36	33.15	32.44	32.44	24.32	33.15
32.73	32.52	31.75	31.75	25.23	32.52
29.24	29.03	28.14	28.14	22.34	29.03
27.63	27.63	26.21	26.21	23.25	27.63
32.72	32.72	30.67	30.67	26.09	32.72
33.70	33.70	32.22	32.22	27.79	33.70
31.88	31.88	30.46	30.46	26.20	31.88
30.22	30.22	28.83	28.83	24.50	30.22
31.09	31.09	27.24	27.24	21.59	31.09
29.93	29.93	24.58	24.58	17.77	29.93
28.24	28.24	22.98	22.98	15.88	28.24
28.13	28.13	23.14	23.14	16.28	28.13
28.91	28.91	24.04	24.04	18.27	28.91
62.27	60.96	35.43	35.43	22.18	60.96
104.72	100.74	54.27	54.27	33.81	103.37
130.87	126.66	77.67	77.67	52.03	129.44
148.60	144.02	90.73	90.73	62.83	147.05
162.80	157.83	99.75	99.75	68.95	161.12
170.76	165.46	105.93	105.93	74.40	168.96
182.04	176.27	112.82	112.82	80.14	180.03
200.05	191.66	120.46	120.46	85.04	195.79
221.76	210.89	129.81	129.81	89.26	215.53
246.32	234.27	139.03	139.03	90.78	239.41
195.66	184.86	126.79	126.79	89.95	190.31
112.30	105.90	89.24	89.24	68.38	105.90
70.68	62.57	44.70	44.70	30.05	62.57
54.44	45.32	28.15	28.15	14.55	45.32

47.98	38.41	21.95	21.95	10.08	38.41
45.23	35.43	19.74	19.74	8.51	35.43
42.99	33.34	19.57	19.57	7.44	33.34
42.33	34.04	20.36	20.36	6.95	34.04
41.19	33.64	19.76	19.76	5.67	33.64
34.02	25.75	17.18	17.18	5.83	25.75
25.17	16.78	9.92	9.92	3.55	16.78
23.36	14.96	8.64	8.64	1.70	14.96
94.48	94.48	94.48	94.48	92.12	94.48
112.50	112.50	112.50	112.50	103.72	112.50
131.41	131.41	131.41	131.41	121.23	131.41
145.46	145.46	145.46	145.46	135.41	145.46
156.94	156.94	156.94	156.94	147.02	156.94
173.97	173.97	173.97	173.97	164.00	173.97
192.46	192.46	192.46	192.46	182.45	192.46
210.15	210.15	210.15	210.15	200.04	210.15
231.11	231.11	231.11	231.11	220.92	231.11
258.78	258.78	258.78	258.78	248.60	258.78
290.00	290.00	290.00	290.00	281.65	290.00
322.06	322.06	322.06	321.87	309.26	322.06
364.72	364.72	364.72	356.78	312.24	364.72
417.32	417.13	417.13	398.68	300.28	417.13
472.55	472.36	472.36	450.06	285.53	472.36
486.41	486.23	486.23	464.12	293.92	486.23
489.12	488.95	488.95	468.31	309.22	488.95
474.63	474.47	474.47	455.05	303.44	474.47
463.41	463.26	463.26	444.97	295.83	463.26
434.03	433.89	433.89	416.73	276.66	433.89
391.64	391.50	391.50	375.34	243.65	391.50
358.24	358.11	358.11	342.89	224.05	358.11
342.93	342.81	342.81	330.75	222.84	342.81
333.09	333.08	333.08	325.58	234.08	333.08
289.35	289.35	289.35	284.77	236.81	289.35
271.09	271.09	271.09	267.24	229.26	271.09
282.20	282.20	282.20	278.33	235.60	282.20
287.39	287.39	287.39	283.49	241.83	287.39
397.84	314.19	658.06	272.63	226.36	658.06
493.08	336.21	1130.63	265.31	210.03	1130.63
647.39	386.05	1612.45	271.63	206.75	1612.45
716.35	403.80	1958.26	263.92	195.20	1958.26
823.76	451.79	2270.01	242.25	175.64	2270.01
926.65	519.04	2480.52	231.84	153.23	2480.52
982.16	538.37	2685.73	231.51	145.21	2685.73
1008.55	543.11	2796.09	216.91	126.40	2796.09
1162.89	655.31	3074.01	181.52	82.36	3074.01
1279.19	705.89	3305.32	182.77	54.60	3305.32
1274.50	716.85	3052.44	185.61	51.74	3052.44

1290.94	749.09	2776.98	195.76	56.04	2674.45
1169.30	738.02	2306.39	200.11	59.76	2176.00
1145.53	754.37	1947.23	219.48	71.23	1806.82
997.51	666.64	1576.87	215.58	75.02	1429.20
849.05	528.61	1383.14	168.89	72.24	1228.75
839.51	531.60	1247.35	158.18	62.09	1085.37
852.89	541.16	1239.41	162.00	59.65	1070.19
611.93	319.87	967.93	144.71	54.77	794.97
474.15	240.16	822.90	99.70	46.16	651.21
306.83	174.90	650.20	76.54	39.05	481.17
171.23	118.38	285.22	62.18	38.12	253.30
114.89	86.39	147.10	53.14	34.10	141.76
80.83	64.72	94.54	41.29	25.47	93.96
74.91	60.24	84.53	38.07	23.42	84.55
57.44	52.03	55.98	36.51	23.30	56.00
42.18	42.12	42.10	35.81	24.17	42.11
36.49	36.43	36.42	33.01	24.98	36.43
35.07	35.02	35.00	32.37	26.23	35.01
36.62	36.58	36.56	34.26	28.90	36.57
37.24	37.21	37.19	35.05	29.41	37.19
35.60	35.57	35.56	33.51	28.21	35.56
36.24	36.22	36.21	34.24	30.06	36.21
42.31	42.30	42.30	40.61	37.57	42.30
42.40	42.40	42.40	41.21	38.83	42.40
41.36	41.35	41.36	40.96	39.18	41.36
40.36	40.34	40.36	40.27	39.47	40.36
40.43	40.41	40.43	40.40	39.67	40.43
40.47	40.45	40.47	40.01	38.99	40.47
39.20	39.18	39.20	37.33	35.98	39.20
37.98	37.95	37.98	34.75	33.89	37.98
40.39	40.28	40.31	34.27	33.03	40.31
42.65	42.53	42.57	32.68	30.12	42.57
38.02	37.91	37.94	27.28	23.44	37.94
37.00	36.89	36.92	25.94	21.87	36.92
37.84	37.73	37.75	26.38	22.03	37.75
39.83	39.73	39.75	27.64	22.95	39.75
42.61	42.51	42.53	29.85	25.14	42.53
46.45	46.34	46.36	33.91	28.18	46.36
53.30	53.19	53.21	38.34	30.43	53.21
54.86	54.76	54.77	41.59	33.33	54.77
53.04	53.04	53.04	43.08	34.74	53.04
49.60	49.60	49.60	42.58	33.88	49.60
47.97	47.97	47.97	38.72	30.14	47.97
51.73	51.73	51.73	42.06	32.82	51.73
53.10	53.10	53.10	43.30	34.08	53.10
62.51	62.51	62.51	52.82	42.60	62.51
62.70	62.70	62.70	52.86	42.27	62.70

60.82	60.82	60.82	50.47	39.35	60.82
54.87	54.87	54.87	48.25	38.34	54.87
54.75	54.75	54.75	47.71	37.71	54.75
55.03	55.00	55.00	47.76	38.00	55.00
52.46	52.41	52.41	46.91	39.40	52.41
50.57	50.13	50.13	47.80	41.26	50.13
46.99	46.56	46.56	44.70	38.64	46.56
46.33	45.88	45.88	44.11	38.08	45.88
34.84	34.37	34.37	32.69	27.64	34.37
33.46	32.93	32.93	31.33	26.00	32.93
32.71	32.11	32.11	30.75	27.20	32.11
32.01	31.33	31.33	30.63	28.57	31.33
32.08	31.27	31.27	30.46	28.24	31.27
34.17	33.24	33.24	32.26	29.63	33.24
84.35	84.35	84.35	84.35	84.35	84.35
88.66	88.66	88.66	88.66	88.66	88.66
97.01	97.01	97.01	97.01	97.01	97.01
121.43	121.43	121.43	121.43	121.43	121.43
142.65	142.65	142.65	142.65	140.28	142.65
167.05	167.05	167.05	167.05	159.40	167.05
218.75	218.75	218.75	218.75	189.19	218.75
303.33	303.33	303.33	303.33	234.03	303.33
369.79	369.79	369.79	369.79	280.01	369.79
419.68	419.68	419.68	419.68	323.31	419.68
488.64	488.64	488.64	488.64	341.37	488.64
531.15	531.15	531.15	531.15	364.85	531.15
538.15	538.15	537.71	537.71	367.29	538.15
525.22	525.22	524.77	524.77	351.88	525.22
522.51	522.51	522.05	522.05	347.86	522.51
538.98	538.98	538.49	538.49	356.51	538.98
543.79	543.15	532.48	532.48	352.85	543.15
525.92	519.45	490.43	490.43	330.77	519.45
511.00	503.57	468.39	468.39	308.70	503.57
503.13	494.16	447.33	447.33	265.76	494.16
481.36	469.37	386.93	386.93	242.66	469.37
483.38	469.56	363.81	363.81	196.15	469.56
516.74	500.86	380.59	380.59	170.96	500.86
586.41	568.01	422.00	422.00	167.40	568.01
694.55	674.89	440.27	440.27	155.45	674.89
706.23	686.10	439.66	439.66	144.32	686.10
702.30	677.29	438.19	438.19	148.28	677.29
708.26	678.08	441.91	441.91	154.41	678.08
722.77	691.37	445.62	445.62	158.44	691.37
808.05	724.84	423.50	423.50	146.96	724.84
773.19	643.78	371.84	371.84	151.61	643.78
772.93	611.02	327.32	327.32	148.44	611.02
835.86	615.65	293.96	293.96	138.48	615.65

912.32	664.41	308.37	308.37	132.96	664.41
884.88	620.50	353.17	353.17	143.60	620.50
958.40	677.65	389.89	389.89	143.55	677.65
1116.44	781.43	403.26	403.26	140.48	858.02
1196.09	842.08	416.88	416.88	143.52	999.54
1341.62	965.70	409.96	409.96	117.58	1166.77
1199.76	876.49	391.59	391.59	108.98	1077.71
1084.94	813.57	356.82	356.82	100.56	1007.20
1010.51	762.87	324.49	324.49	95.35	951.73
931.32	723.73	306.53	306.53	94.76	912.81
884.14	685.43	276.85	276.85	92.25	848.53
919.27	715.74	262.58	262.58	83.79	825.50
974.94	750.59	222.09	222.09	68.82	766.93
826.02	627.47	173.03	173.03	45.49	562.05
606.87	464.71	102.49	102.49	14.36	324.71
347.68	255.50	51.67	51.67	7.41	57.11
321.92	239.40	48.13	48.13	6.76	48.60
315.25	234.82	47.76	47.76	6.99	48.21
317.18	236.12	48.39	48.39	7.35	48.85
312.07	232.24	47.31	47.31	7.32	47.76
240.09	180.29	44.41	44.41	10.58	44.41
159.59	113.52	28.70	28.70	12.74	28.70
87.42	60.71	33.65	33.65	14.36	33.65
50.59	42.03	33.28	33.28	18.62	33.28
48.82	44.74	35.55	35.55	19.42	35.80
50.25	48.03	37.46	37.46	19.97	39.68
57.96	53.13	38.95	38.95	20.41	44.60
68.09	61.38	39.35	39.35	20.47	52.82
106.48	96.78	42.73	42.73	19.13	89.24
107.46	98.16	48.20	48.20	24.18	91.49
115.91	100.62	45.92	45.92	22.79	94.59
121.10	101.08	42.19	42.19	19.46	97.19
127.05	99.22	36.02	36.02	18.07	98.99
126.30	96.58	29.42	29.42	13.32	96.38
126.82	96.57	28.68	28.68	13.43	96.57
125.65	94.53	27.95	27.95	13.61	94.53
122.65	93.42	28.30	28.30	14.16	93.42
113.87	84.53	27.98	27.98	14.20	84.53
62.11	36.80	22.55	22.55	15.90	36.80
56.85	30.79	11.49	11.49	7.97	30.79
44.78	24.63	7.32	7.32	4.85	24.63
66.72	24.84	7.72	7.72	5.09	24.84
62.59	25.53	7.97	7.97	5.26	25.53
66.09	27.04	8.43	8.43	5.56	27.04
69.48	28.95	9.65	9.65	6.67	28.95
74.99	32.50	11.95	11.95	8.74	32.50
81.32	37.34	15.63	15.63	9.25	37.34

89.08	43.75	17.93	17.93	9.80	43.90
114.11	59.24	29.60	29.60	13.53	59.41
156.55	86.90	61.11	61.11	39.51	87.12
199.52	113.75	91.70	91.70	63.43	114.05
161.96	153.66	131.87	131.87	87.68	154.07
158.20	154.95	138.08	138.08	84.80	155.32
142.29	139.56	125.46	125.46	80.91	139.87
138.21	135.78	123.25	123.25	83.71	136.05
132.22	130.00	118.59	118.59	82.67	130.25
122.80	120.69	110.38	110.38	81.65	120.93
114.53	114.53	111.94	111.94	85.72	114.53
104.91	104.91	104.91	104.91	88.10	104.91
82.45	82.45	82.45	82.45	70.01	82.45
74.06	74.06	74.06	74.06	62.17	74.06
72.24	72.24	72.24	72.24	63.98	72.24
75.88	75.88	75.88	75.88	75.28	75.88
78.07	78.07	78.07	78.07	77.39	78.07
75.05	75.05	75.05	75.05	74.22	75.05
74.42	74.42	74.42	74.42	73.39	74.42
80.62	80.62	80.62	80.62	79.37	80.62
19.16	8.29	1.31	1.31	0.50	8.29
15.53	8.60	2.73	2.73	0.89	8.60
19.43	11.23	5.28	5.28	1.02	11.23
19.17	11.65	6.09	6.09	1.77	11.65
18.12	11.32	6.20	6.20	2.22	11.32
17.58	11.06	6.15	6.15	2.27	11.06
16.88	10.84	6.29	6.29	2.78	10.84
16.46	10.19	5.97	5.97	2.78	10.19
15.48	9.58	5.64	5.64	2.71	9.58
14.75	9.19	5.36	5.36	2.61	9.19
16.98	12.68	5.91	5.91	2.90	18.80
42.34	27.91	8.33	8.33	4.58	52.62
44.62	29.74	7.59	7.59	5.44	59.39
48.55	31.97	7.01	7.01	5.25	65.92
54.73	35.66	6.90	6.90	5.05	75.03
58.41	37.94	6.98	6.98	5.14	80.35
69.24	44.49	6.63	6.63	4.44	96.61
87.43	57.41	7.79	7.79	4.96	126.24
129.01	84.83	10.53	10.53	6.45	188.80
213.30	139.69	16.65	16.65	9.96	314.24
395.86	232.65	32.54	32.54	20.06	500.60

TABLE 5-18. Summary of Risks From Exposures to Beach Sediment[a]

Beach Location	Dockside Worker	Transients	Child Recreational Beach User[b]	Combined Adult and Child Recreational Beach User	Tribal Fisher	High Frequency Fisher	Low Frequency Fisher	Breastfeeding Infant[b]
B001W	NA	NA	--	5E-06	6E-06	--	--	NA
B002	--	NA	NA	NA	NA	NA	NA	--
B003W	NA	NA	--	4E-05	2E-05	4E-06	3E-06	NA
B004E	2E-06	NA	NA	NA	NA	NA	NA	--
B005W	NA	NA	--	2E-05	1E-05	3E-06	2E-06	NA
B006	--	NA	NA	NA	NA	NA	NA	--
03B030E	NA	--	NA	NA	5E-06	--	--	NA
03B031W	NA	--	--	1E-05	9E-06	2E-06	2E-06	NA
03B033W	NA	NA	--	6E-06	9E-06	2E-06	2E-06	NA
04B024W	NA	NA	--	5E-05	2E-05	6E-06	4.E-06	NA
04B023W	NA	NA	--	9E-06	8E-06	2E-06	--	NA
05B018E	NA	NA	--	1E-05	9E-06	2E-06	--	NA
05B019	--	NA	NA	NA	NA	NA	NA	--
06B025W	9E-05	NA	NA	NA	NA	NA	NA	--
06B030E	NA	NA	--	2E-05	2E-05	6E-06	4E-06	NA
06B026E	NA	NA	--	3E-06	4E-06	--	--	NA
06B029W	--	NA	NA	NA	NA	NA	NA	--
06B022E	NA	--	--	4E-06	6E-06	2E-06	--	NA
07B022	--	NA	NA	NA	NA	NA	NA	--
07B024W	NA	--	NA	NA	5E-06	--	--	NA
07B023E	NA	--	NA	NA	2E-06	--	--	NA
08B032	--	NA	NA	NA	NA	NA	NA	--
09B028E	NA	NA	--	2E-06	3E-06	--	--	NA
09B024E	NA	NA	--	3E-06	3E-06	--	--	NA
09B026E	NA	--	--	3E-06	6E-06	--	--	NA
09B027E	NA	--	--	3.E-06	4E-06	--	--	NA

Notes:

a Table presents cumulative risk (or cumulative hazard indices) per exposure area for reasonable maximum exposure scenarios, per beach location and per receptor

b Only hazard indices values are presented for child and breastfeeding infant exposure scenarios.

Abbreviations:

-- Exposure area does not result in risk greater than 1×10^{-6} or hazard index greater than 1.

NA Beach use does not coincide with exposure by a given receptor

Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 4, 2018

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Agreed Upon cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 85 µg/kg – Applicable to recreational beaches
  - Updated nearshore sediment CUL: 774 µg/kg – Applicable to in-water sediment (outside the Navigation Channel)
  - Updated clam consumption CUL: 107,600 µg/kg - Not exceeded on SWAC basis throughout the site
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

Potential Site-Wide PAH RAL Change

- Current total PAH site-wide RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - A total PAH RAL of 30,000 µg/kg addresses all areas with cPAH exceeding 774 µg/kg on a SWAC basis
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon
  - May need to consider affect of change on recreational beach areas adjacent to SMAs

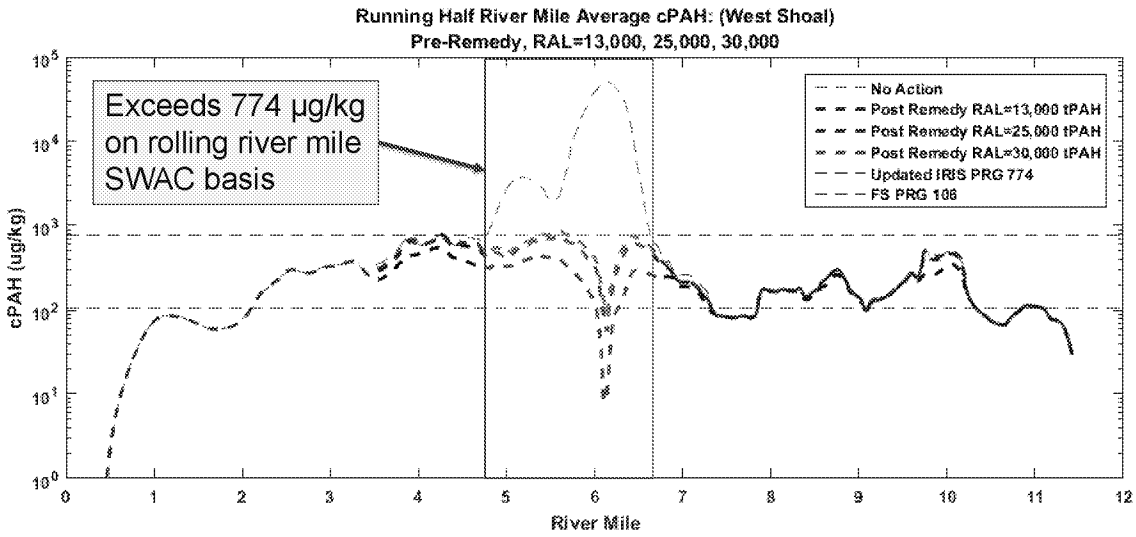
Potential Navigation Channel PAH RAL Change

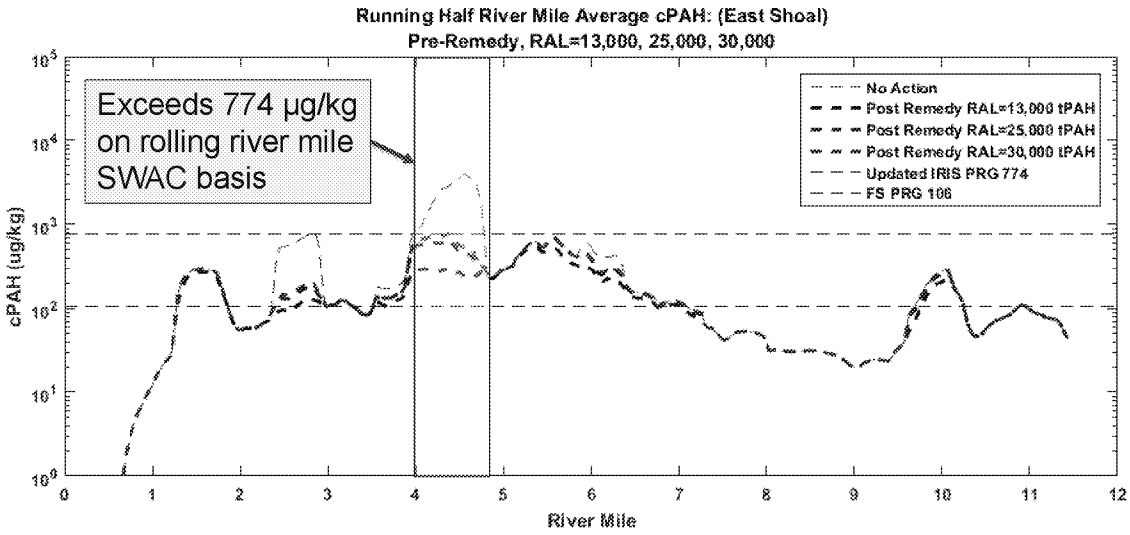
- Current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading has been observed downstream of RM 6.3
  - Increasing RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data

RAL Change Evaluation Summary

Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (TBD)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
Community and Tribal Acceptance	Yes	Unknown	Yes	Unknown

Backup Slides for Discussion


Running Half River Mile Average cPAH: (West Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
Exceeds 774 µg/kg on rolling river mile SWAC basis
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 108
cPAH (ug/kg)
River Mile


Running Half River Mile Average cPAH: (East Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
Exceeds 774 µg/kg on rolling river mile SWAC basis
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

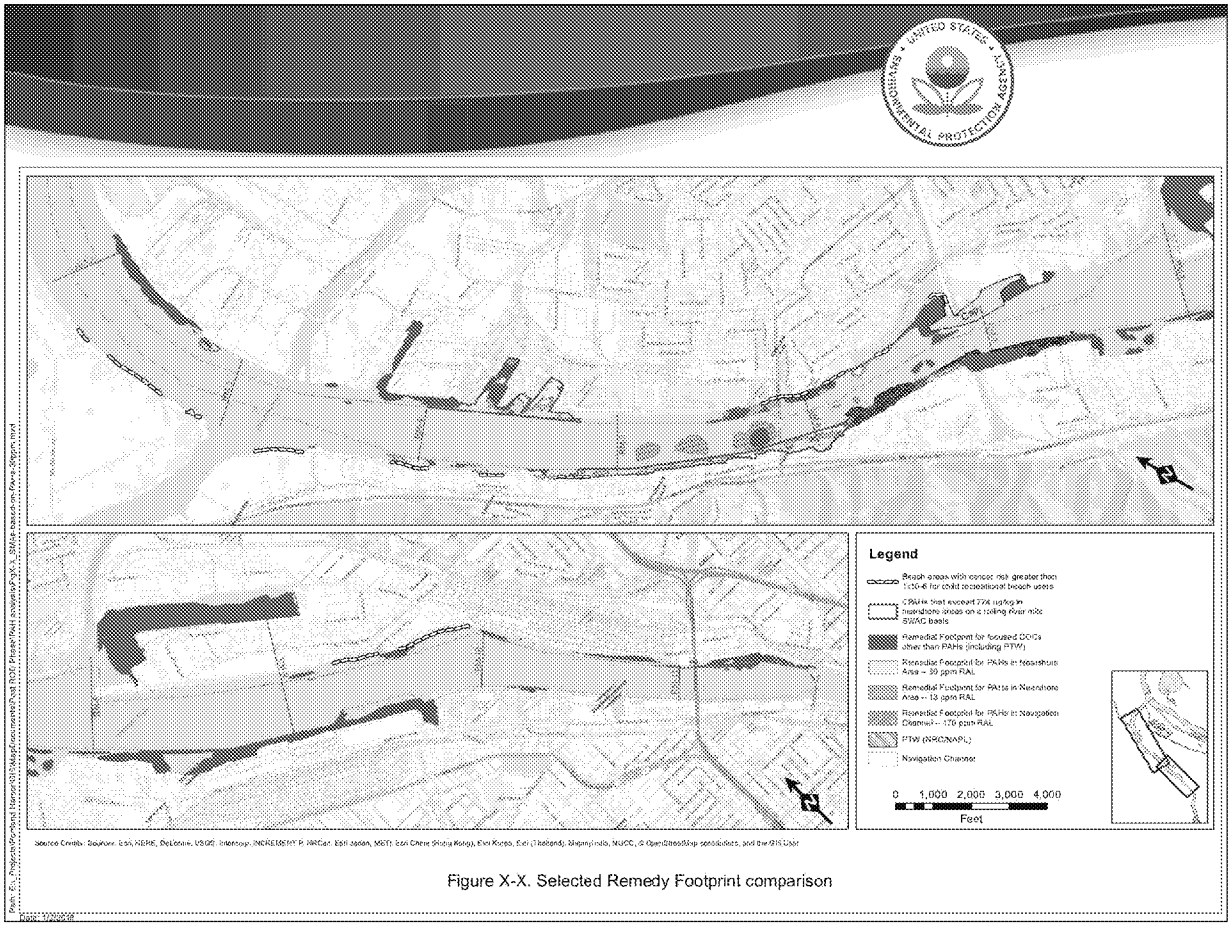
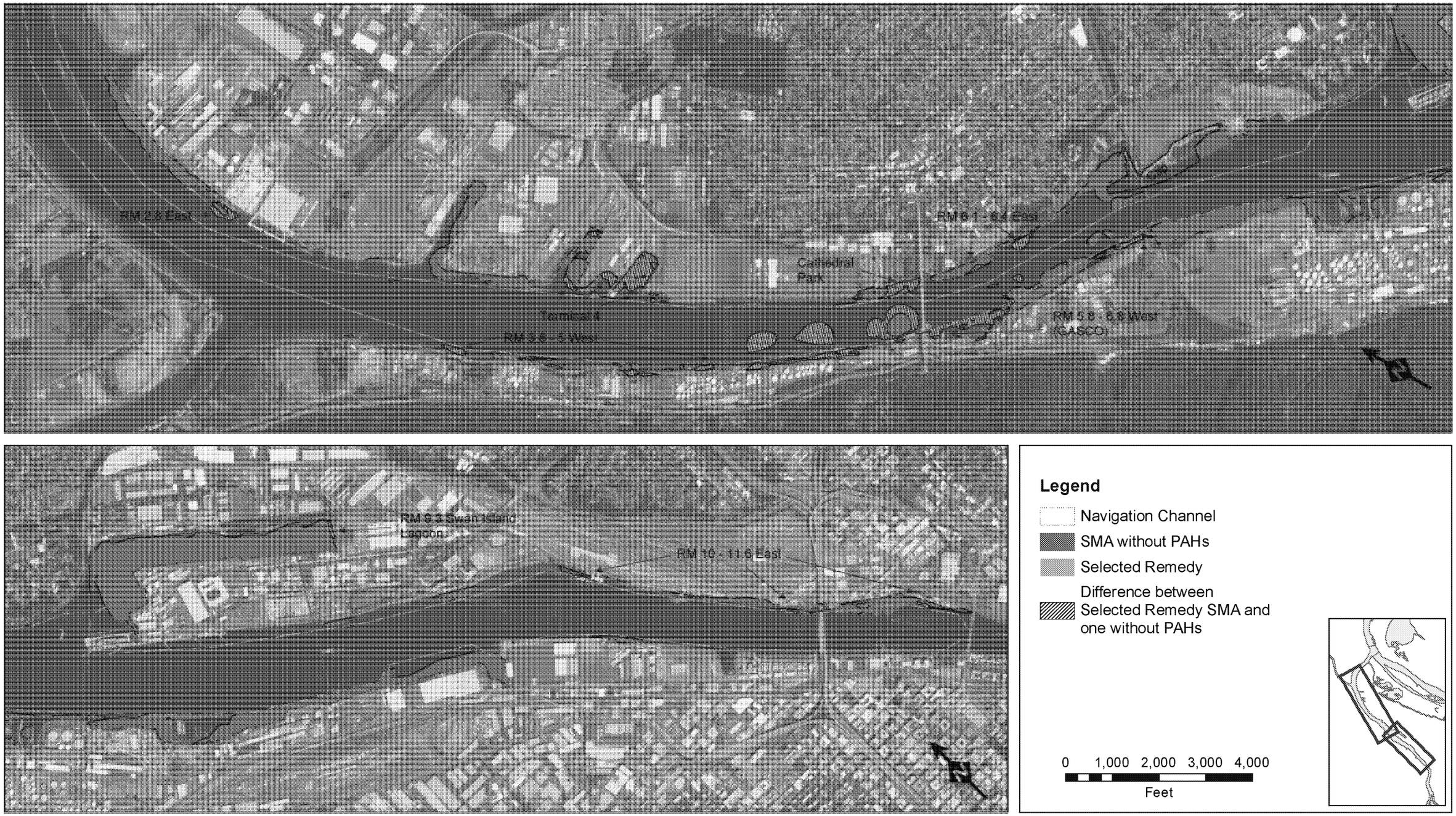


Figure X-X. Selected Remedy Footprint comparison

Remedial Footprint Area Summary

Scenario	Remedial Footprint (Acres)			Notes
	Current Remedy	Proposed Nearshore Total PAH RAL Change from 13 to 30 ppm	Remedial Footprint Change	
Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1 Selected Remedy Footprint comparison

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Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\PAH analysis\FigX-X_SMA-Selected-Remedy-minus-PAHs.mxd

Date: 12/2/2017

Figure 2

CPAH Rolling River Mile Plots

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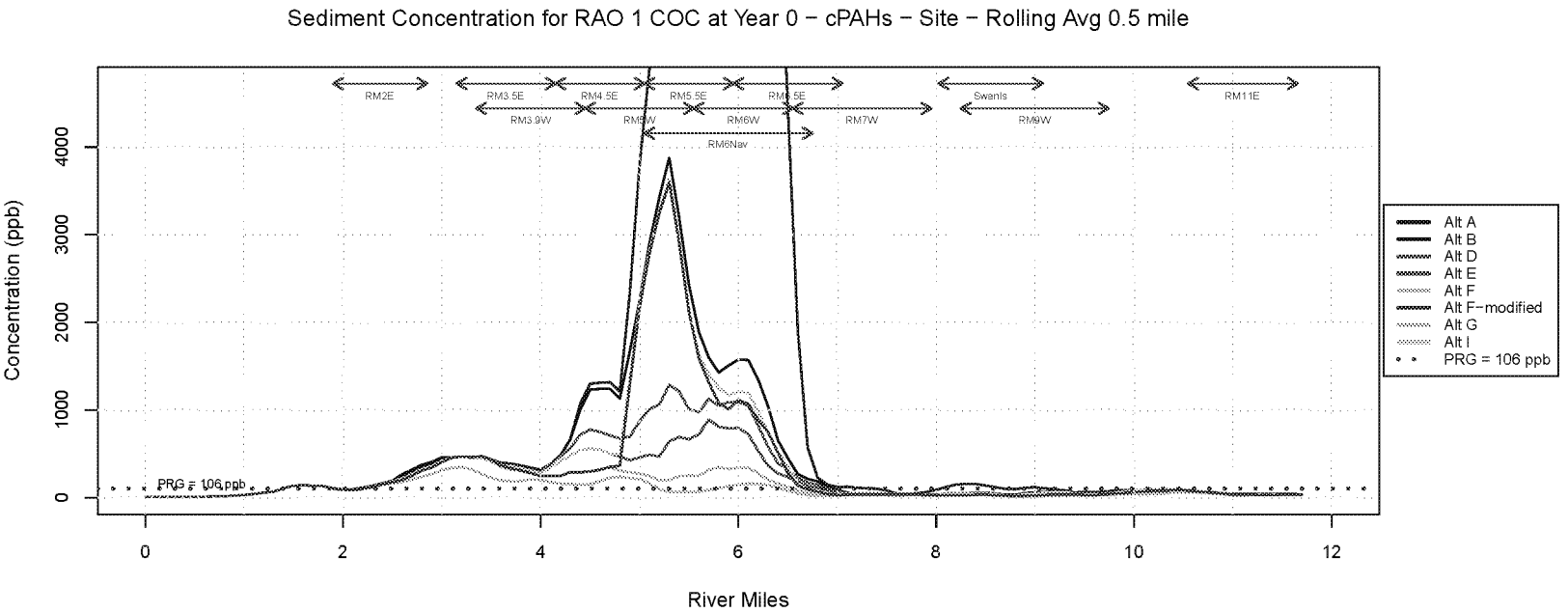

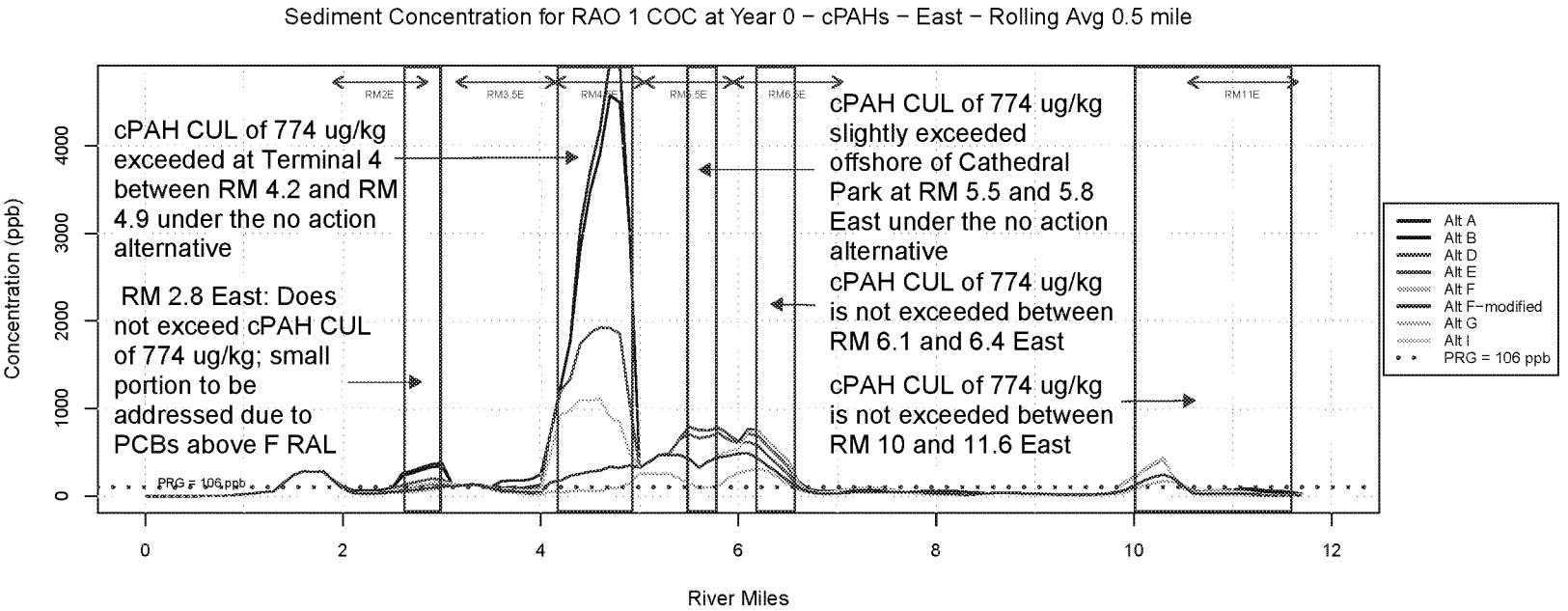

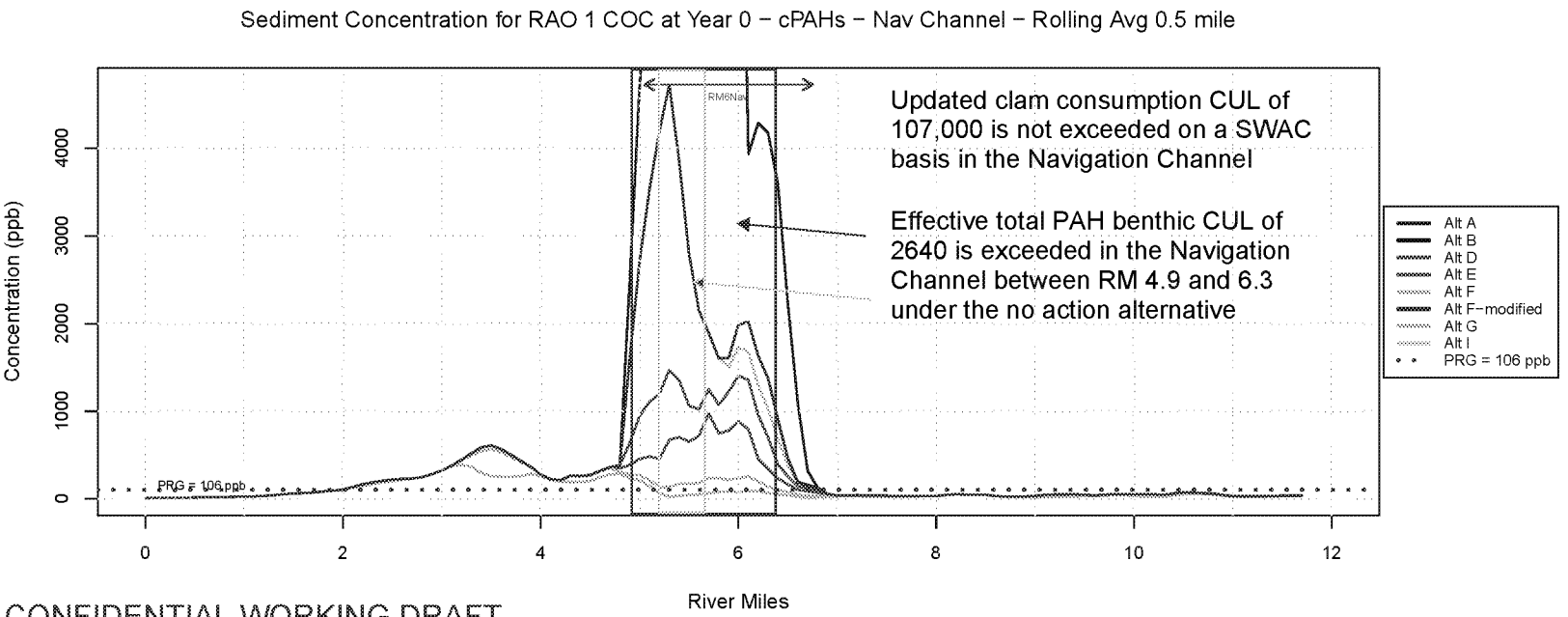

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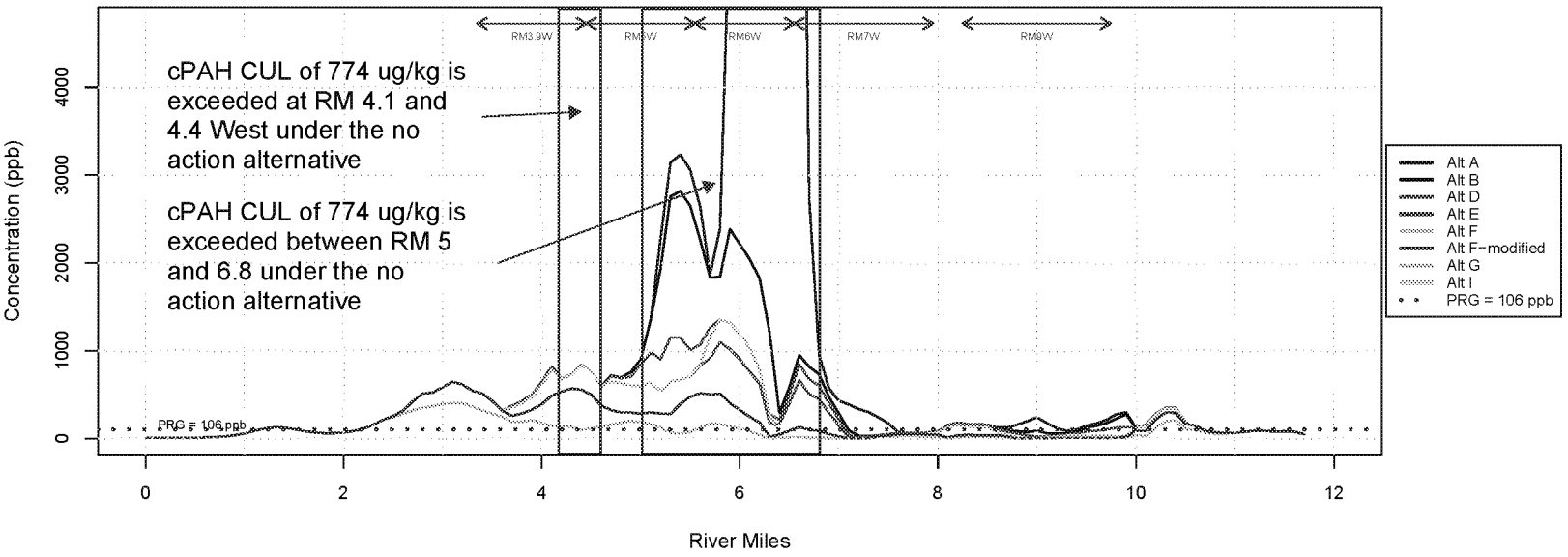
Figure D.10−1c. RAO1 COC Concentration (Year 0) − cPAHs

Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − West − Rolling Avg 0.5 mile



Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − Swan Isl − Rolling Avg 0.5 mile

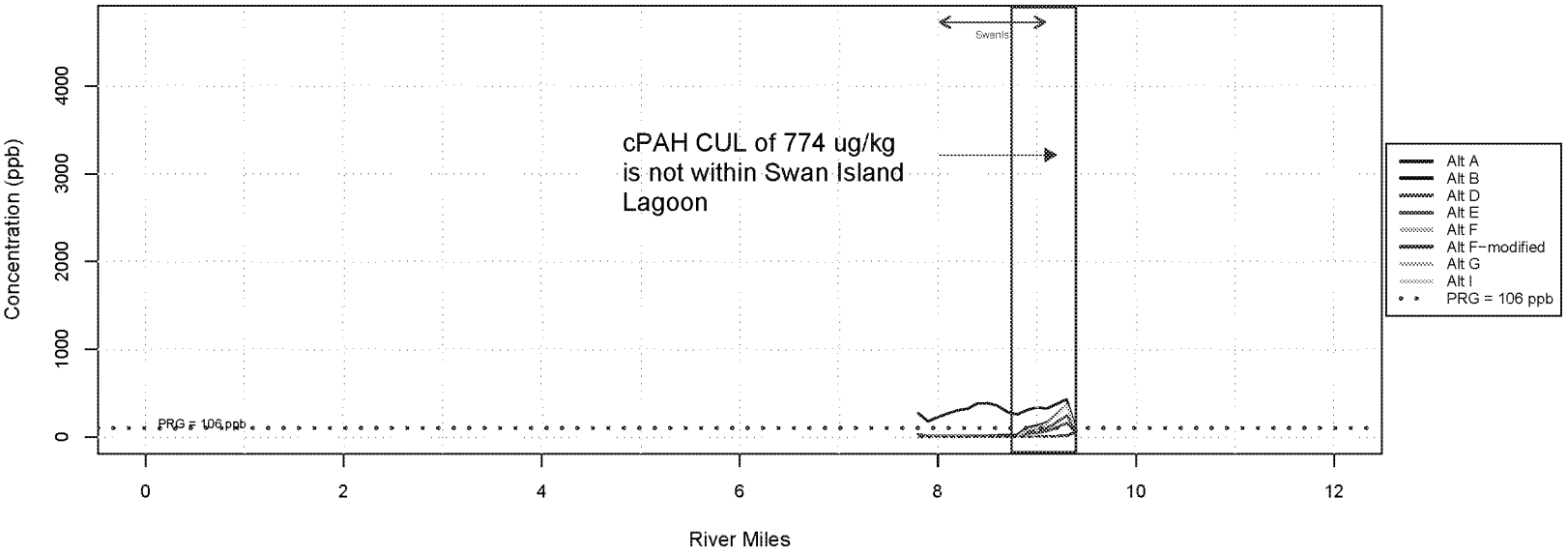


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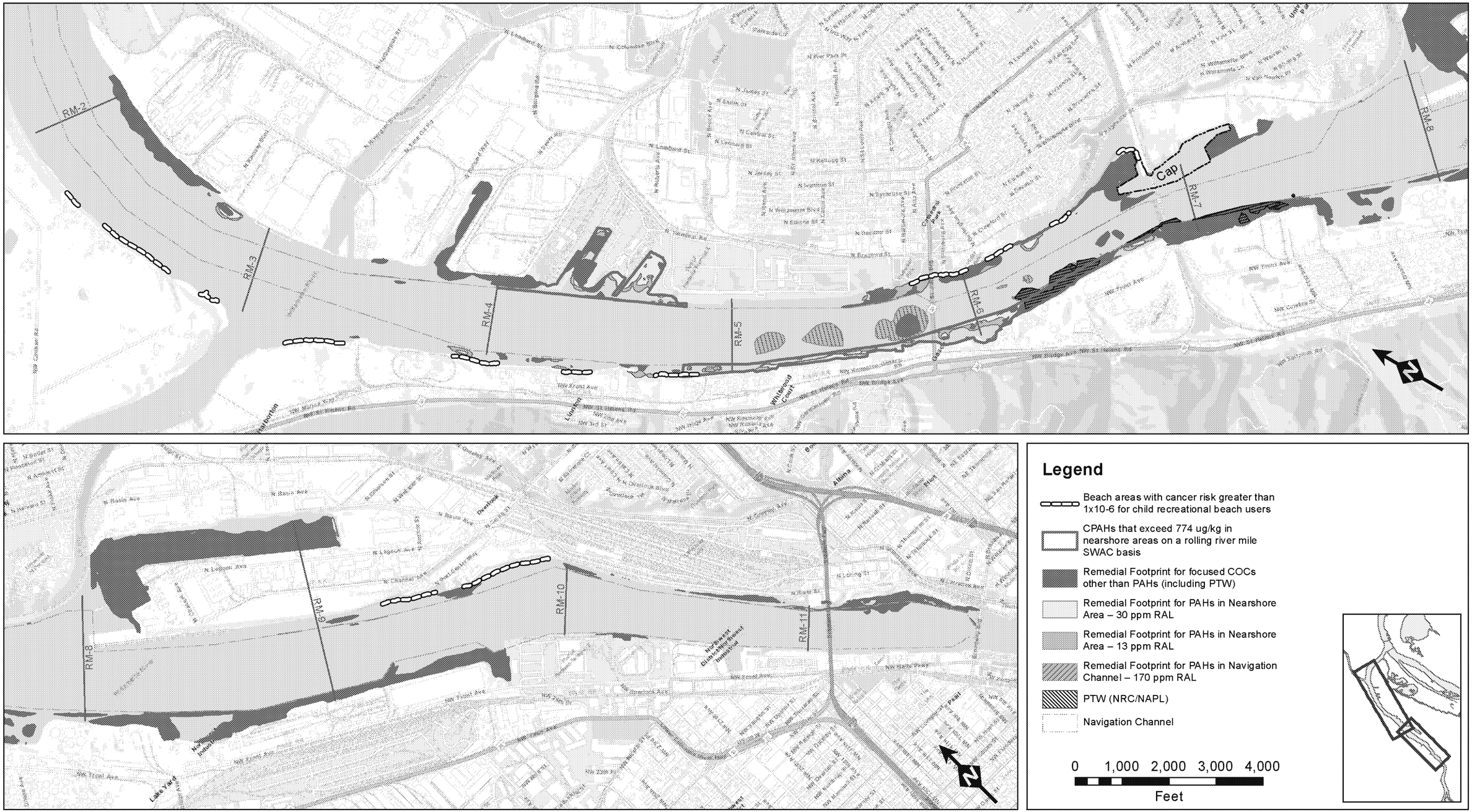
Figure 10.1−c(Continued). RAO1 COC Concentration (Year 0) − cPAHs



Source Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User

Figure X-X. Selected Remedy Footprint comparison

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Date: 1/2/2018

Evaluation of Current Total PAH RALs relative to PAH Cleanup Levels

Overall Question: If the total carcinogenic PAH (cPAH) cleanup level is elevated from 12 µg/kg to 774 µg/kg would remediation of PAHs above the current RAL result in remediation of areas of the site that do not pose risk relative to the following risk based thresholds?

1) Remediation of areas that do not pose risk relative to the cPAH CUL of 774 µg/kg
2) Remediation of areas that do not pose risk relative to the total PAH CUL of 23,000 µg/kg
3) Remediation of areas that do not pose risk relative to the other direct contact CULs
4) Remediation of areas that do not pose risk relative to the RAO 2 CULs

This evaluation focuses on areas that only require remediation based on an exceedance of the Site-Wide total PAH RAL of 13,000 µg/kg and the total PAH Navigation Channel RAL of 170,000 µg/kg as depicted on Figure 1. Each question and answer is presented in detail below:

Question 1:

Remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg may result in the remediation of nearshore sediments with cPAH concentrations that do not exceed the updated direct contact cPAH CUL of 774 µg/kg on a SWAC basis. The cPAH CUL of 774 µg/kg is not applicable to the Navigation Channel because the human health direct contact exposure pathway is not considered complete within the Navigation Channel.

Answer:

To evaluate whether remediation of sediments that do not pose a risk, areas that only require remediation due to the presence of PAHs were identified and summarized on Figure 2 and below:

RM 2.8 East: RM 2.8 East does not exceed F RAL for TCDD, PeCDD, PeCDF, or DDx. A portion of this areas exceeds the F RAL for PCBs. The maximum cPAH concentration on a rolling river mile SWAC basis is 379 µg/kg. As a result this area does not exceed updated cPAH CUL of 774 µg/kg under the no action alternative. As a result remediation of PAHs is not required and remedial efforts should focus exclusively on PCBs.

Terminal 4: Contaminated sediments within Terminal 4 do not exceed the F RAL for TCDD, PeCDD, PeCDF or DDx. However, the majority of Slip 1 exceeds F RAL for PCBs except for small area near mouth of slip. Within Slip 3, The F RAL for PCBs is exceeded in a small portion of SE corner of the slip. Total cPAH concentrations between RM 4.3 and 4.9 exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis and range between 1,250 and 4,960 µg/kg.

Cathedral Park: Contaminated sediments offshore of Cathedral Park do not exceed the F RAL for TCDD, PeCDD, PeCDF or DDx. However, some areas of contamination exceed the F RAL for PCBs. Total cPAH concentrations slightly exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis at RM 5.5 (791 µg/kg) and 5.8 (784 µg/kg).

RM 6. 1 to 6.4 East: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. The maximum cPAH concentration is 768 µg/kg (RM 6.1) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 9.3 Swan Island Lagoon: This area does not exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs although the F RAL is exceeded for PCBs and PeCDD elsewhere within Swan Island Lagoon. The maximum cPAH concentration is 432 µg/kg (RM 9.31) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 10 – 11.6 East: This area exceeds the F RAL for PCBs and for DDx and PeCDD in isolated areas. There are three isolated exceedances of the PCB F RAL in this reach. The maximum cPAH concentration is 436 µg/kg (RM 10.3) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 3.8 – 5 West: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF or DDx. PCBs exceed the F RAL in a few small, isolated locations. Total cPAH concentrations slightly exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis at RM 4.1 (822 µg/kg) and 5.8 (841 µg/kg).

RM 5.1 – 5.6 West: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. Total cPAH concentrations exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis throughout this entire reach with cPAH concentrations ranging between 905 and 3,230 µg/kg.

RM 5.8 – 6.8 West (GASCO): This area also exceeds the F RAL for DDX and PCBs. The cPAH CUL of 774 is exceeded on a rolling river mile SWAC basis throughout this entire reach with cPAH concentrations ranging between 960 and 40,100 µg/kg.

RM 5 – 6.5 Navigation Channel: This area does not exceed the B RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. The maximum cPAH concentration is 19,400 ug/kg on a rolling river mile SWAC basis which does not exceed the updated cPAH clam consumption CUL of 107,600 µg/kg. However, the total PAH CUL of 23,000 is exceeded on a point basis throughout this reach.

Consideration of Question 1 focused on areas that require remediation due to the presence of PAHs only. As summarized in Table 1 and Figure 2, areas that still exceed the direct contact cPAH CUL of 774 µg/kg as measured on a rolling river mile SWAC basis include Cathedral Park, Terminal 4, GASCO and isolated areas of PAH contamination between RM 3.8 and 5 on the west side of the Willamette River. Areas that exceed the F RAL for PAHs but do not exceed the do not exceed direct contact cPAH CUL of 774 µg/kg include RM 2.8 East, RM 6.1 – 6.4 East, Swan Island Lagoon, and RM 10 – 11.6 East. It should be noted that all areas with the exception of Cathedral Park exceed the benthic total PAH CUL of 23,000 µg/kg. In addition, some areas such as Cathedral Park, RM 6.1 – 6.4 East, the upper end of Swan Island Lagoon and certain areas between RM 3.8 and 5 West, may be subject to the beach sediment cleanup level of 85 µg/kg. Regarding the Navigation Channel, the clam consumption cPAH CUL of 107,600 µg/kg is not exceeded as measured on a rolling river mile SWAC basis. However, the benthic total PAH CUL of 23,000 µg/kg is exceeded within the Navigation Channel between RM 5 and 6.5 and is well below the applicable total PAH RAL of 170,000 µg/kg.

Question 2:

Remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg will result in the remediation of PAHs that that do not exceed 23,000 µg/kg total PAH CUL for protection of the benthic community and may result in the remediation of contaminated sediments that do not represent a risk to the benthic community

Answer:

Based on a comparison of Figure 3.4-8 (Total PAH RAL Contours) with Figure 4.1-1 (Benthic Risk Area exceeding RAO 5 PRGs) from the Portland Harbor FS, it can be demonstrated that remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg will not result in the remediation of contaminated sediments that do not pose a risk to the benthic community. Remediation of navigation channel sediments above the total PAH RAL of 170,000 µg/kg would not result in the remediation of contaminated sediments that SWAC basis.

Question 3:

Remediation of nearshore sediments above the site-wide total PAH RAL of 13,000 may result in the remediation of sediments that do not pose a risk to human health through the direct contact human health exposure pathway.

Answer:
Direct contact CULs are exceeded for PCBs and 2,3,7,8-TCDD under the no action alternative. The PCB direct contact CUL is achieved throughout the site through cleanup above the Alternative B RALs while the 2,3,7,8-TCDD direct contact CUL is achieved throughout the site through cleanup above the Alternative E RALs. As a result, remediation of cPAHs above 13,000 µg/kg is not required to address direct contact risk associated with other COCs.

Question 4:

Remediation of nearshore sediments above the site-wide total PAH RAL of 13,000 may result in the remediation of sediments that do not pose a risk to human health through the human health fish consumption exposure pathway.

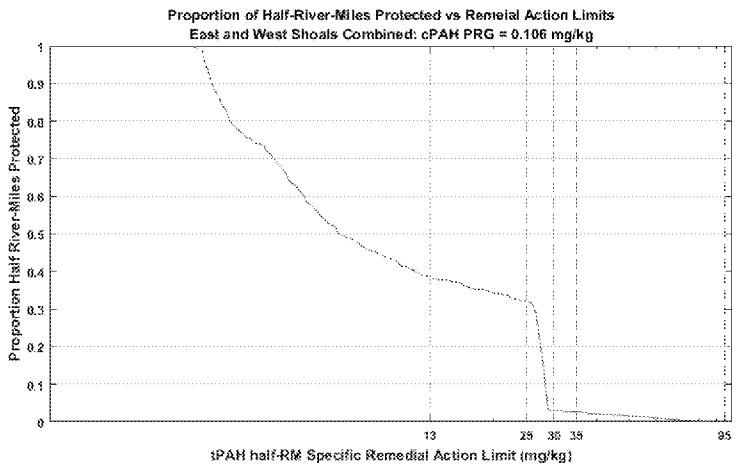
Answer:

Total PCBs exceed the background based fish consumption CUL of 9 µg/kg throughout the site while total DDX exceeds the fish consumption CUL through the majority of the site. In addition, the various dioxin CULs are exceeded at a range of locations. In particular, the PeCDF fish consumption CUL is exceeded in areas that may be affected by the change in PAH CUL such as Terminal 4, Cathedral Park, and scattered areas of PAH contamination along the west side of the river.

Table 1
Summary of Areas Requiring Remediation Due to PAHs only

Reach	CPAH exceeds 774 µg/kg on Rolling RM SWAC Basis?	CPAH exceeds 107,600 µg/kg on Rolling RM SWAC Basis?	Maximum cPAH Rolling River Mile SWAC Concentration	Total PAH exceeds 23,000 µg/kg on point by point basis?	Maximum total PAH concentration
RM 2.8 East	No	No	379 µg/kg	Yes	228,000 µg/kg
Terminal 4	Yes	No	4,960 µg/kg	Yes	561,000 µg/kg
Cathedral Park	Yes *	No	791 µg/kg	No	11,700 µg/kg
RM 6.1 – 6.4 East	No *	No	768 µg/kg	Yes	78,570 µg/kg
RM 9.3 Swan Island	No *	No	431 µg/kg	Yes	100,200 µg/kg
RM 10 – 11. 6 East	No	No	436 ug/kg	Yes	79,400 µg/kg
RM 3.8 – 5 West	Yes *	No	841 µg/kg	Yes	92,250 µg/kg
RM 5.8 – 6.8 West	Yes	No	40,100 µg/kg	Yes	62,400,000 µg/kg
RM 5 – 6.5 Nav	NA	No	19,400 µg/kg	Yes	6,414,000 µg/kg

* These reaches include or are adjacent to areas identified as recreation beach use areas in the Portland Harbor baseline human health risk assessment.



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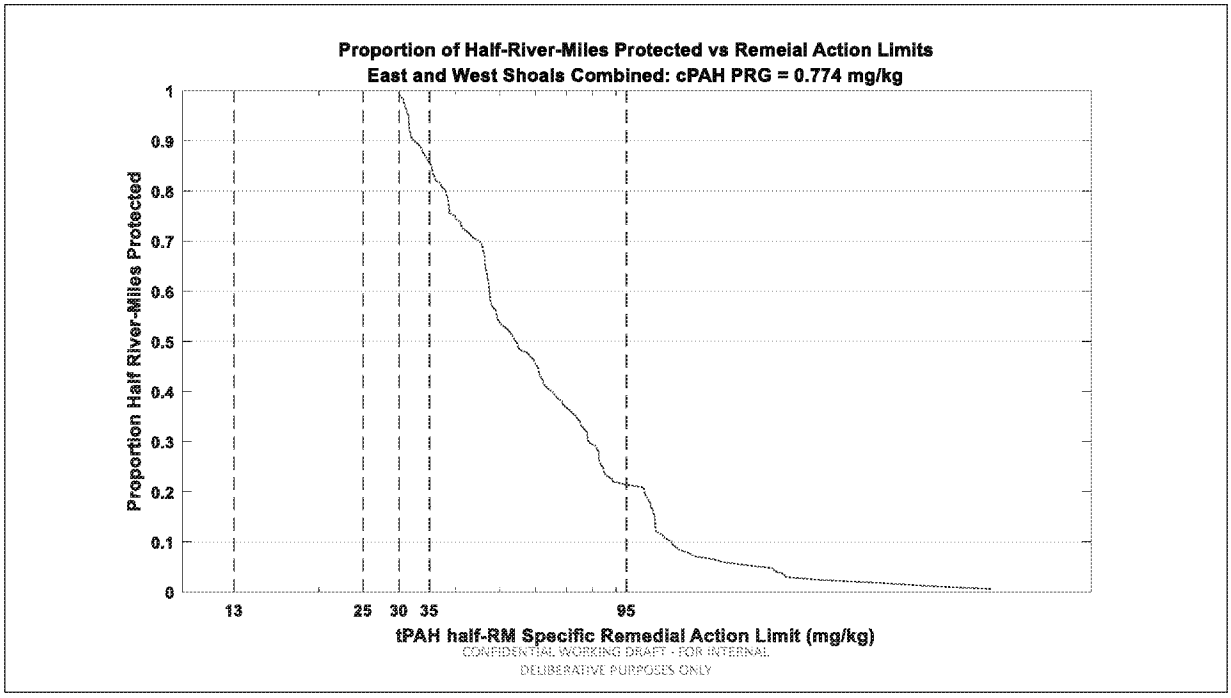
Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)
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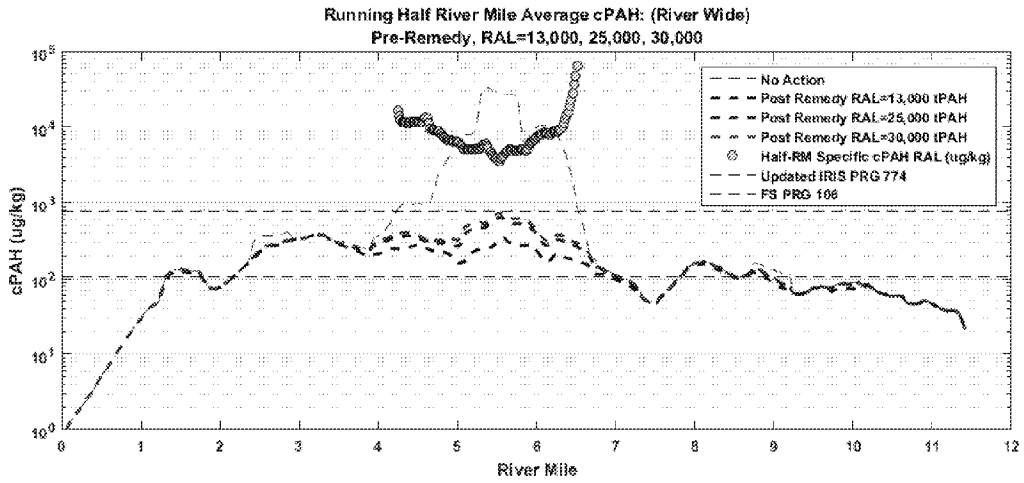

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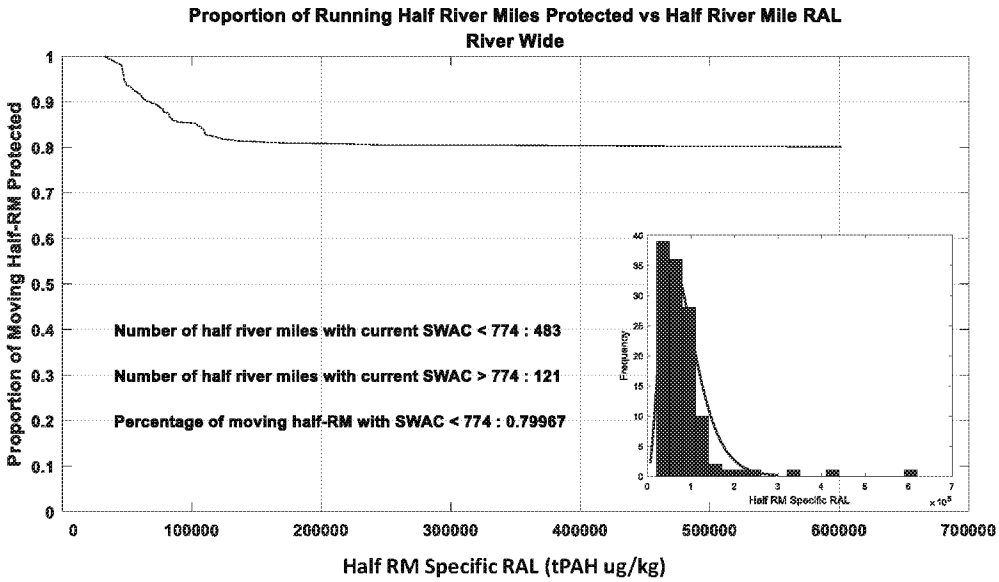

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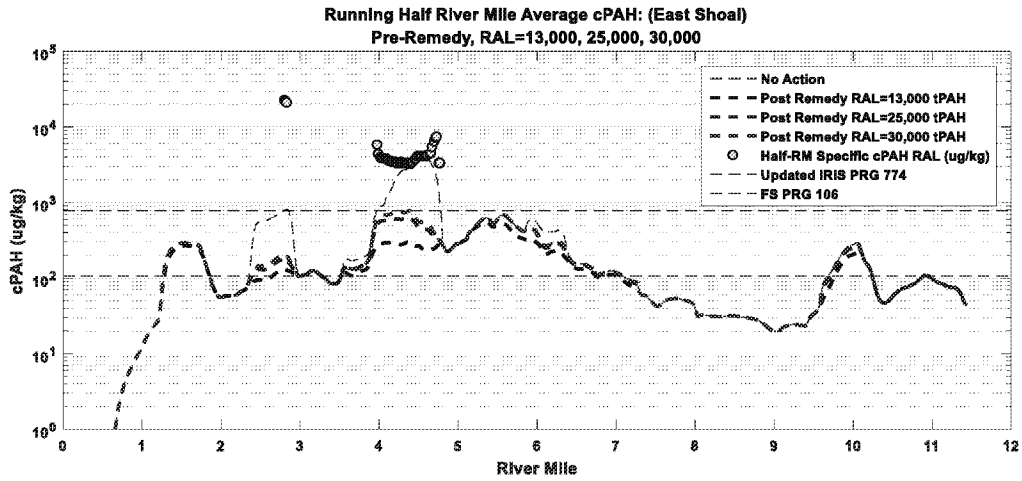

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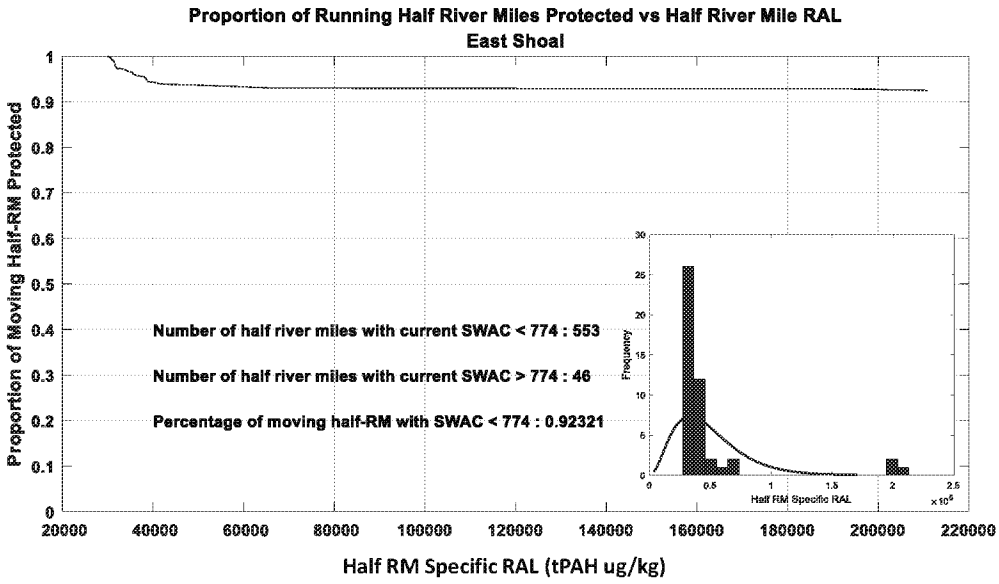

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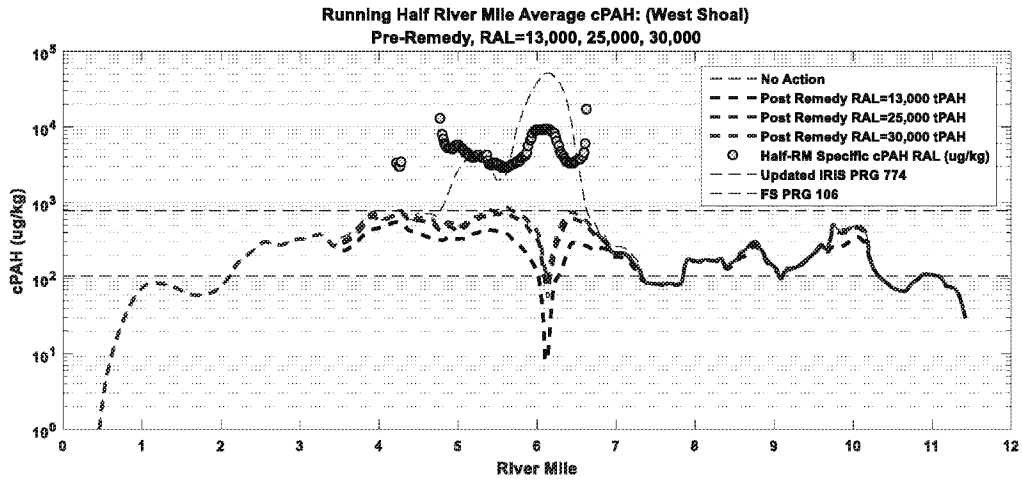

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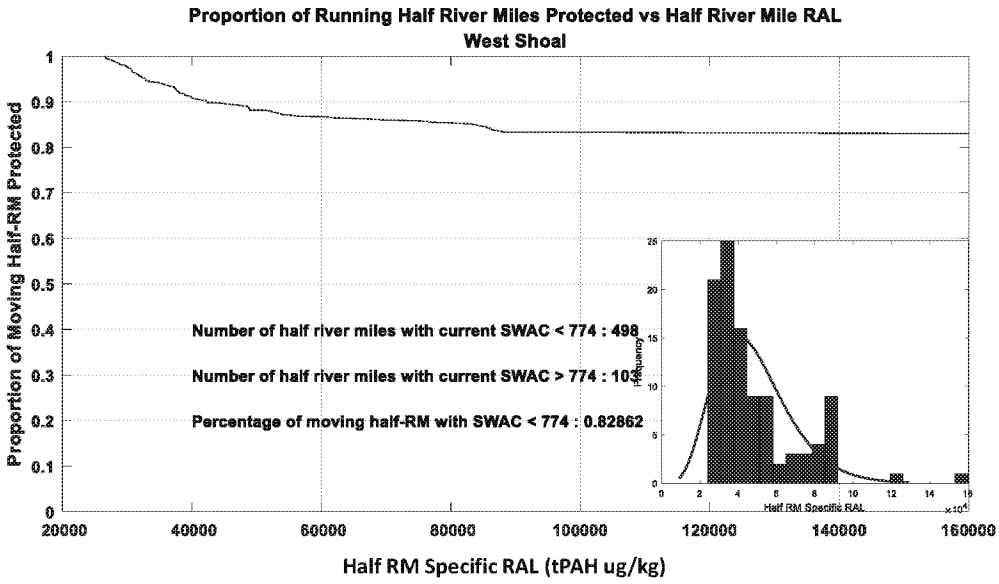

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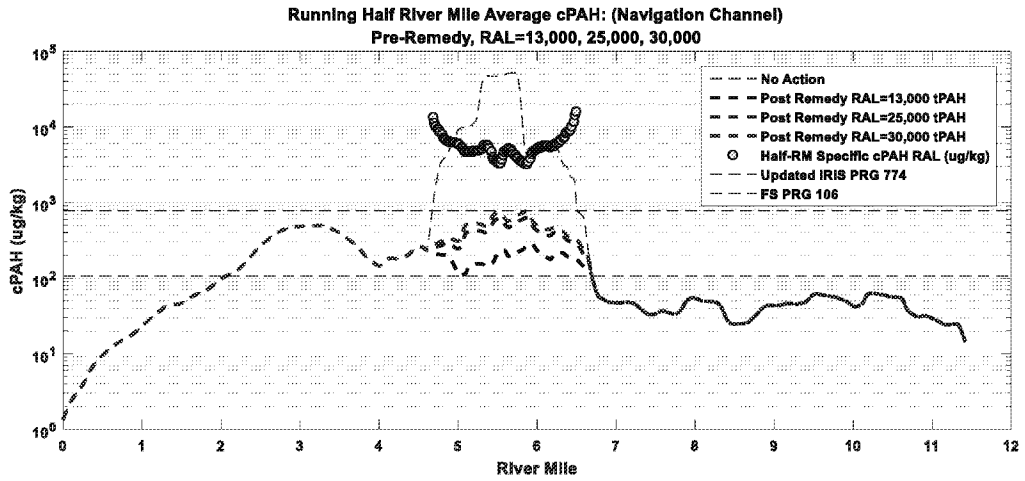

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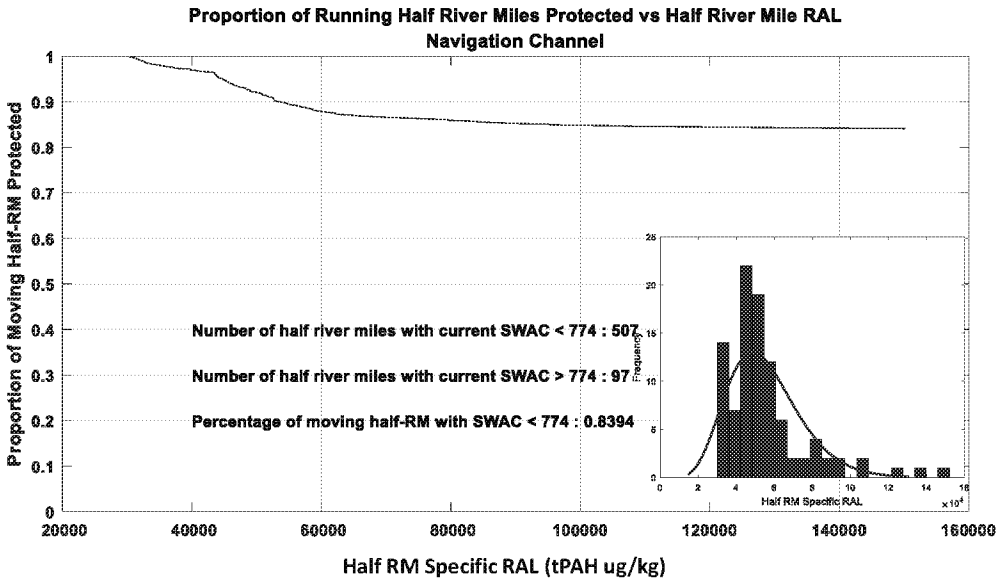

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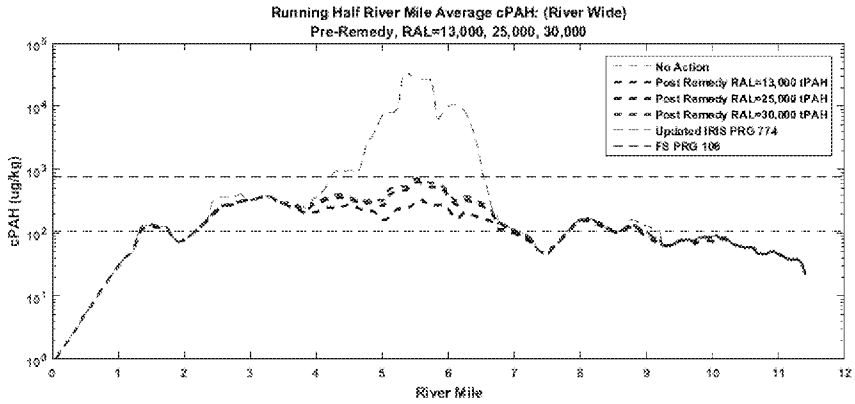

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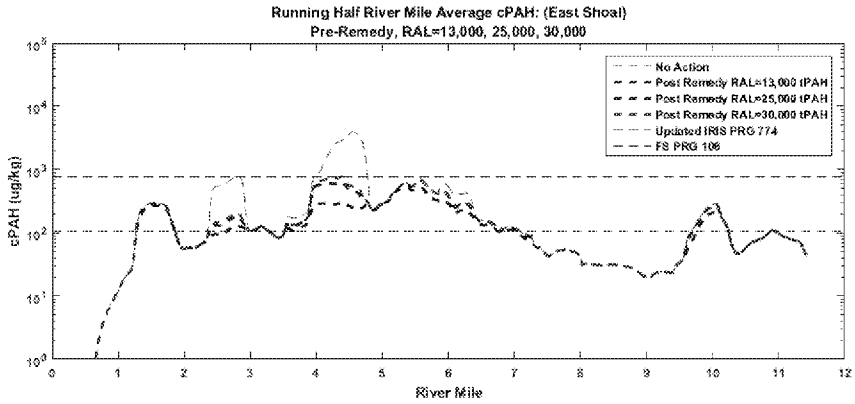

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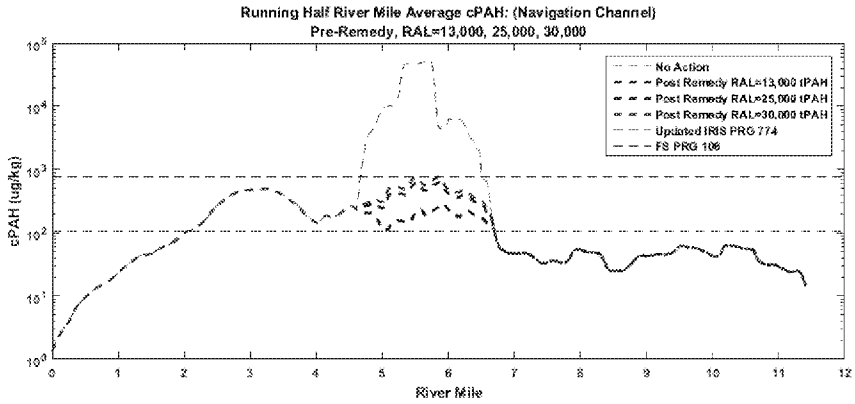

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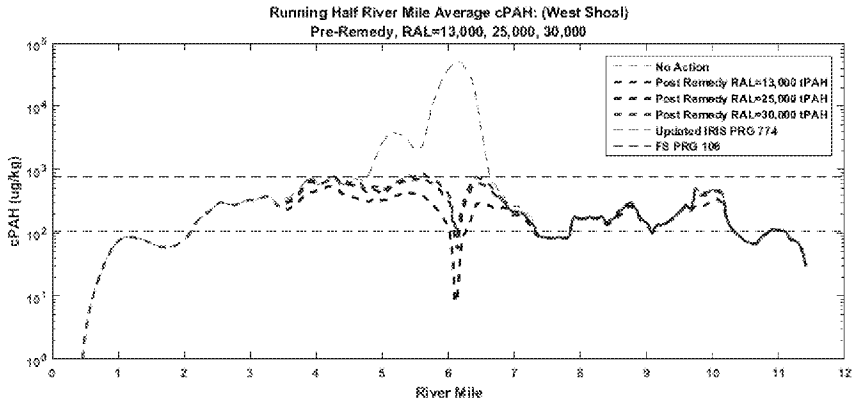

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Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* ([HYPERLINK "https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136"]).

Human Health Risk:

Within the navigation channel, the only complete human health exposure pathway is the clam consumption exposure pathway. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

Although PAH contaminated sediments within the Navigation Channel do not pose a risk to human health, risks to ecological receptors, specifically risk to the benthic community must also be considered. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg. This value is approximately 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." Although the total PAH Navigation Channel RAL of 170,000 µg/kg is less than the 10 times the benthic risk CUL of 23,000 µg/kg, exceedance of the of the Navigation Channel RAL within the Navigation Channel is limited to PAH contaminated sediments between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. As shown in Figures 3 and 4,

taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that PAH contamination within the Navigation Channel between RM 5 and 6.6 may be contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7 and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor change may limit the ability of the Portland Harbor remedy to achieve RAOs 3, 5 and 7.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

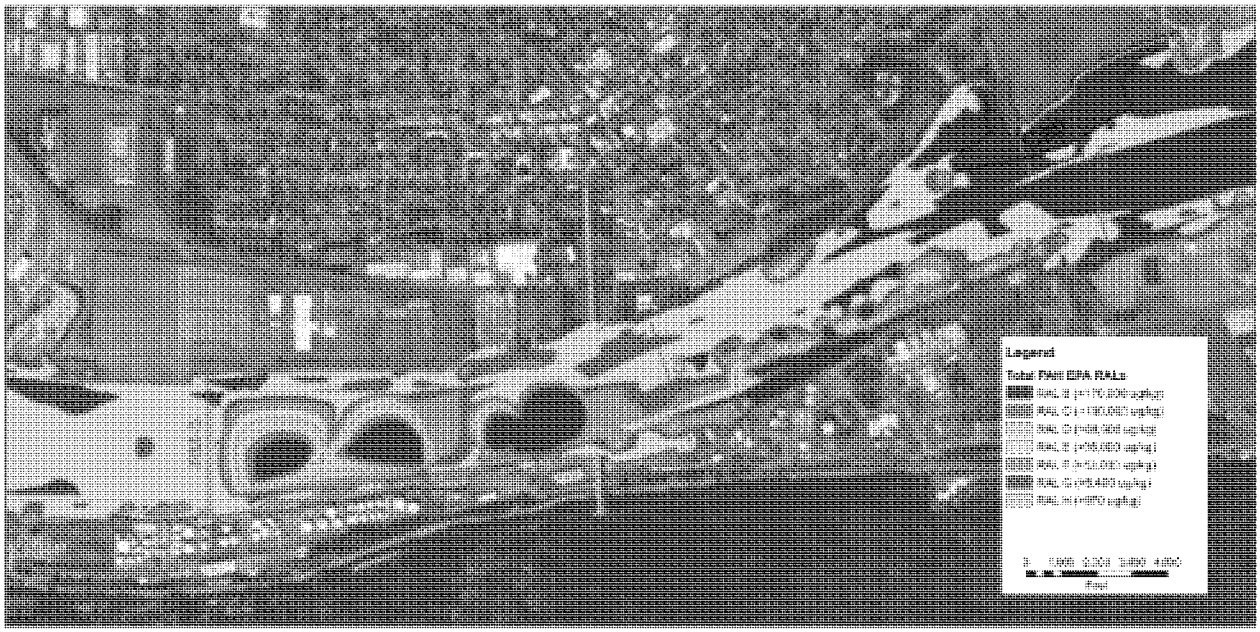


Figure 2 – MNR Average Score for Six Lines of Evidence

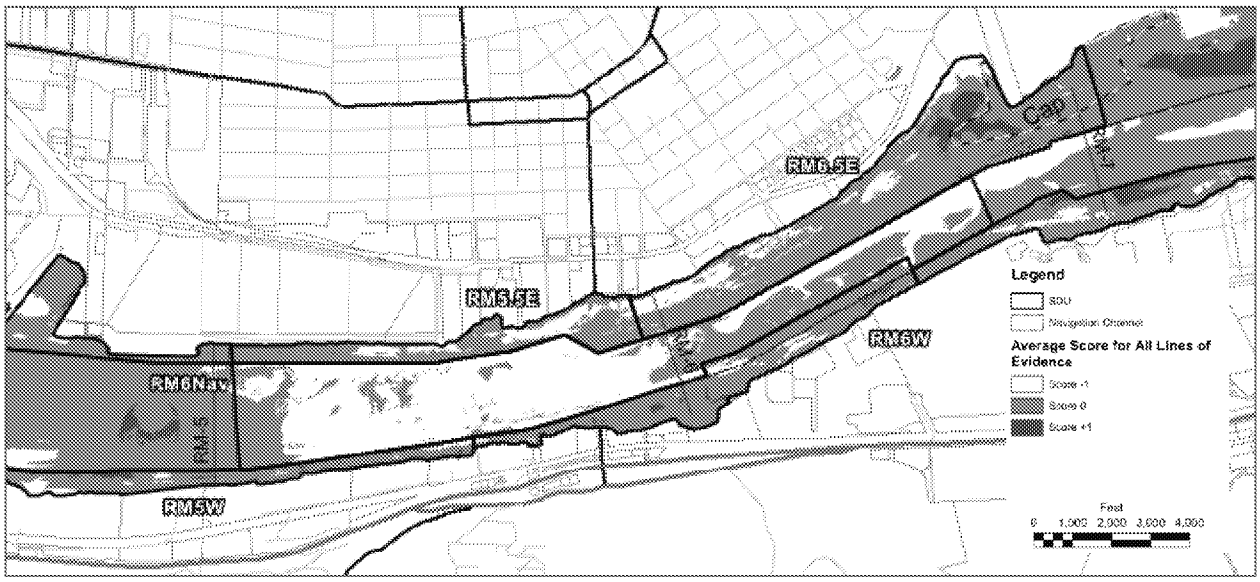


Figure 3 – PAH Loading under Low Flow Conditions

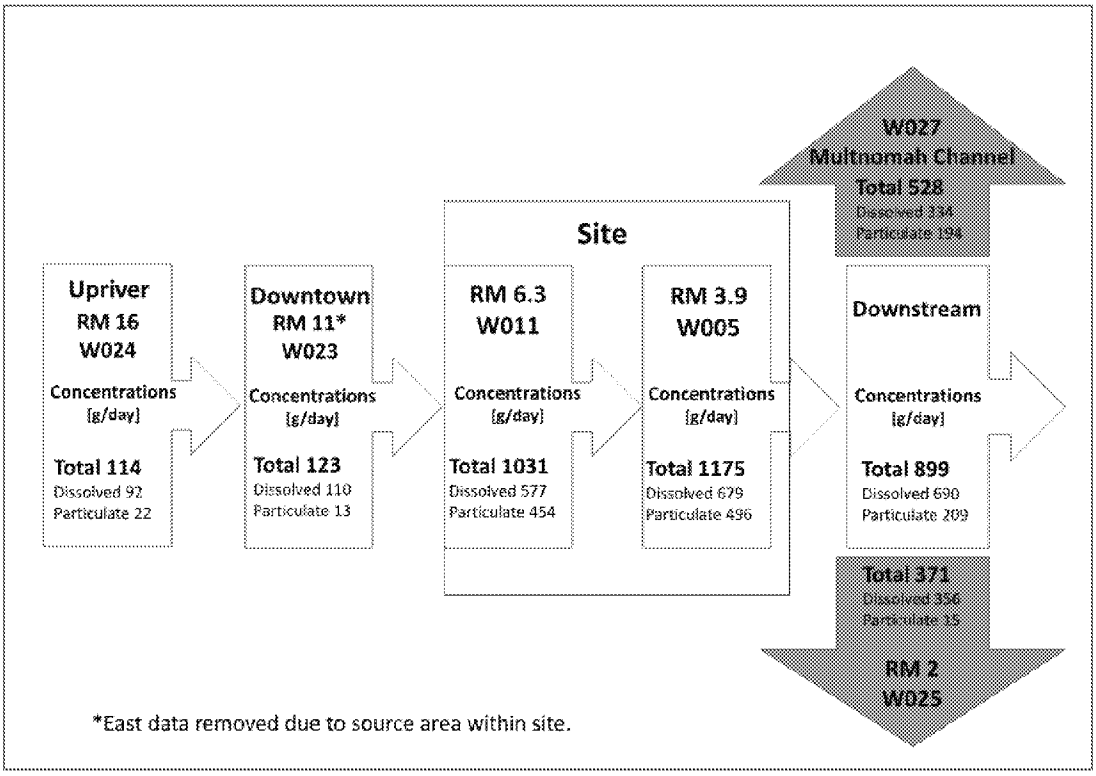
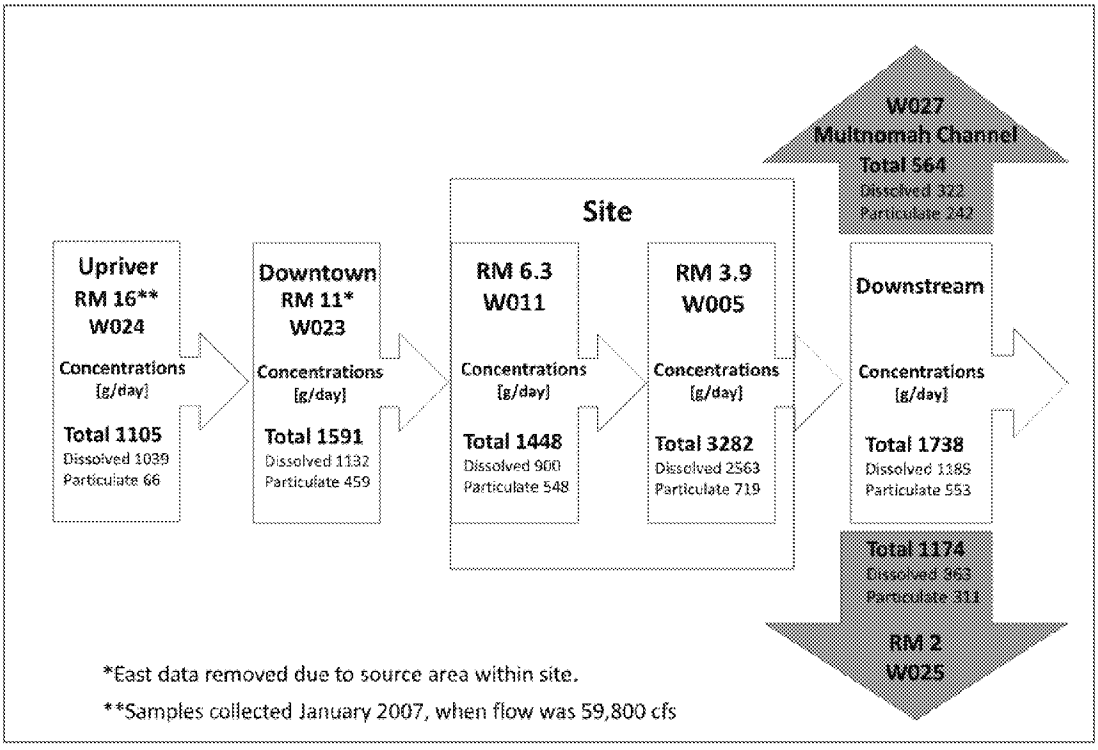


Figure 4 – PAH Loading under High Flow Conditions



Message

From: Ryan Barth [rbarth@anchorqea.com]
Sent: 8/11/2017 4:46:42 AM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
CC: Stuesse, Gregory L. [stuessegl@cdmsmith.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Foster, Malena L. (fosterml@cdmsmith.com) [fosterml@cdmsmith.com]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Bob Wyatt [rjw@nwnatural.com]; Jen Mott [jmott@anchorqea.com]
Subject: Portland Harbor GIS Layers - Application of Revised cPAH IRIS Values
Attachments: PH_IRISmodifiedSMAsPTW_20170810.gdb.zap

Sean –

Per Bob's message below, attached please find the harborwide GIS layers in the "zap" format you requested. The attached file includes the below layers along with the associated metadata. The bold descriptions below match the names of the layers in the files. Please let us know if your team has any questions.

1. **ROD SMAs**
2. **ROD PTW-Highly Toxic**
3. **IRIS-Modified RALs and PTW**
    a. Elimination of TPAH navigation channel RAL of 170,000 ppb
    b. Revision of TPAH nearshore RAL from 13,000 ppb to 92,000 ppb
    c. Revision of cPAH PTW-highly toxic from 106,000 ppb to 773,000 ppb
4. **IRIS-Modified Nearshore and Navigation RALs**
    a. Elimination of TPAH navigation channel RAL of 170,000 ppb
    b. Revision of TPAH nearshore RAL from 13,000 ppb to 92,000 ppb
5. **IRIS-Modified Nearshore RAL**
    a. Revision of TPAH nearshore RAL from 13,000 ppb to 92,000 ppb
6. **IRIS-Modified Navigation RAL**
    a. Elimination of TPAH navigation channel RAL of 170,000 ppb
7. **IRIS-Modified Navigation RAL and PTW**
    a. Elimination of TPAH navigation channel RAL of 170,000 ppb
    b. Revision of cPAH PTW-highly toxic from 106,000 ppb to 773,000 ppb

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From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Friday, August 04, 2017 4:24 PM
To: Bob Wyatt <rjw@nwnatural.com>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Ryan Barth <rbarth@anchorqea.com>; Foster, Malena L. (fosterml@cdmsmith.com)

<fosterml@cdmsmith.com>
Subject: RE: [External]GIS layers

Bob, Will do—thanks for clarifying so quickly as we're working hard to look at this asap.

Scott/Greg/Malena/Eric, can you verify the layers we'll need to work on the R-code run with Arthur?

Thanks everyone.

S

Sean Sheldrake, Unit Diving Officer, RPM
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206.553.1220 desk
206.225.6528 cell
http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

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From: Wyatt, Robert [mailto:rjw@nwnatural.com]
Sent: Friday, August 04, 2017 4:14 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; rbarth@anchorenv.com
Subject: RE: [External]GIS layers

Sean, we are working to compile the GIS layer files and want to make sure the list below is correct. Can you verify these are the GIS layers your team is looking for, and let me know if there are any others you'd like us to send?

- ROD SMA footprint
- SMA footprint – modified based on application of updated cPAH IRIS value in channel only
- SMA footprint – modified based on application of updated cPAH IRIS value in nearshore only (using the cPAH 106 ppb nearshore cleanup level consistent with FS/ROD)
- SMA footprint – modified based on application of updated cPAH IRIS value in channel and nearshore (using 106 ppb)
- SMA footprint – modified based on application of updated cPAH IRIS value in channel, nearshore (using 106 ppb), and PTW-highly toxic
- ROD PTW-highly toxic footprint
- PTW-highly toxic footprint – modified based on application of updated cPAH IRIS value

Thank you,

Bob

From: Sheldrake, Sean [sheldrake.sean@epa.gov]
Sent: Friday, August 04, 2017 8:50 AM
To: Wyatt, Robert
Cc: Stuesse, Gregory L.; Scott Coffey; Gustavson, Karl; rbarth@anchorenv.com
Subject: RE: [External]GIS layers

Much appreciated Bob. S

Sean Sheldrake, Unit Diving Officer, RPM
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From: Wyatt, Robert [mailto:rjw@nwnatural.com]
Sent: Friday, August 04, 2017 8:38 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; rbarth@anchorenv.com
Subject: RE: [External]GIS layers

Thank you, Sean. I appreciate your team's time and efforts on this issue. I am definitely glad to share the files, and will work on getting them transmitted soon.

Bob

From: Sheldrake, Sean [sheldrake.sean@epa.gov]
Sent: Friday, August 04, 2017 8:26 AM
To: Wyatt, Robert
Cc: Stuesse, Gregory L.; Scott Coffey; Gustavson, Karl; rbarth@anchorenv.com
Subject: [External]GIS layers

Bob, Thank you for coming up to Seattle for the meeting yesterday. So that we can analyze the data you presented, would it be possible to send us the GIS layers you used? If you change the zip extension for the files to "zap" it should make it through all our firewalls.

Thank you.

S

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Message

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 4/12/2018 10:00:17 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user1c445729]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]

CC: Foster, Malena L. [fosterml@cdmsmith.com]; Blischke, Eric [blischkee@cdmsmith.com]
Subject: RE: Updated PH Iris Draft Proposed ESD- confidential

Will do.

Malena Foster is helping me to send FTP links to DEQ (Madi and Sarah) at this moment.

TCT Partners: Please let me and Malena (cc'd here) know if you didn't receive the PDF (which is 20 mb) and need the ftp transmittal due to your email file size limitations.

Scott

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Thursday, April 12, 2018 2:17 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) <liverman.alex@deq.state.or.us>; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca <Chu.Rebecca@epa.gov>; Coffey, Scott <CoffeySE@cdmsmith.com>; Cora, Lori <Cora.Lori@epa.gov>; Courtney Johnson (courtney@crag.org) <courtney@crag.org>; Zhen, Davis <Zhen.Davis@epa.gov>; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) <deirdre.donahue@sol.doi.gov>; dexb@yakamafish-nsn.gov; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Gail Fricano (gfricano@indecon.com) <gfricano@indecon.com>; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) <Genevieve.Angle@noaa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Holly Partridge (Holly.Partridge@grandronde.org) <Holly.Partridge@grandronde.org>; Jen Graham <jennifer.graham@ctwsbnr.org>; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org) <joepitt@ctuir.org>; Josh Newton (jn@karnopp.com) <jn@karnopp.com>; Clark, Josie <Clark.Josie@epa.gov>; jweis@hk-law.com; Kevin Parrett <Parrett.Kevin@deq.state.or.us>; Knudsen, Laura <Knudsen.Laura@epa.gov>; Kristin Callahan <kristin@ridolfi.com>; Peterson, Lance <PetersonLE@cdmsmith.com>; Laura Klasner Shira <shil@yakamafish-nsn.gov>; Madi Novak (novak.madi@deq.state.or.us) <novak.madi@deq.state.or.us>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) <MatthewJohnson@ctuir.org>; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com) <MLW@karnopp.com>; NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com) <rdelvecchio@indecon.com>; Rita Cabral (rcabral@indecon.com) <rcabral@indecon.com>; Robert Brunoe (robert.brunoe@ctwsbnr.org) <robert.brunoe@ctwsbnr.org>; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) <Greenfield.Sarah@deq.state.or.us>; Sheldrake, Sean <sheldrake.sean@epa.gov>; Skadowski, Suzanne <Skadowski.Suzanne@epa.gov>; Buerger, Ted <ted_buerger@fws.gov>; tomd@ctsi.nsn.us
Subject: Updated PH Iris Draft Proposed ESD- confidential
Importance: High

(Scott, could you put on the FTP you offered to setup and email out a TCT notice such that those with limited capacity email servers, such as ODEQ, may access?

Hello TCT members,

EPA has revised its pre-decisional document review policy under the MOU as a result of TCT feedback. Please see the attached draft Proposed ESD. Compared to previous versions you have seen in the reading room, the following changes have been made:

- A new sub-section under Section 4.0 on Human Health Beach Exposure per Tribe's request. This added a new table (table 9) and figure (figure 12).
- Added sub-appendices to Appendix A for completeness of the AR on the ESD and indexed these in the table of contents.

- Added the Errata as Appendix B. Briefly describe this errata in an introduction section 1.3 of the ESD.

Let me know if you have any questions.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Sean Sheldrake RPM, Unit Diver Officer
U.S. Environmental Protection Agency
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https://www.facebook.com/EPADivers
https://www.epa.gov/superfund/portland-harbor

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/9/2018 1:03:34 AM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]

Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx
Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/11/2018 10:00:00 PM
End: 1/12/2018
Show Time As: Tentative

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018
2pm to 4pm Pacific Time
Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: Personal Privacy / Ex. 6

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
  - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Appointment

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 1/3/2018 10:15:12 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Blischke, Eric [blischkee@cdmsmith.com]; John Kern [kernstat@gmail.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]

Subject: Parallel meeting invite to provide materials for PAH discussion on January 4th
Attachments: 12-7-17_Portland Harbor cPAH Cleanup Levels Memo.docx; PAH_RAL_CUL_Evaluation.docx; Beach_Sediment_Risk_Summary.pdf; Attachment_1_CPAH_RRM_greater CUL.XLSX; Figure_2_cPAH_RRM_774 CUL_Comp.pdf; Figure_1_SMA-Selected-Remedy-minus-PAHs.pdf; RollingRiverMileStratifiedNaturalNeighborGrid (RAL 13000 25000 30000) Revised 2017_12_12.pptx; FigX-X_SMAs-based-on-PAHs-30ppm_20180102.pdf; PercentProtective_HalfRM_106_prg.pptx; Total_PAH_Navigation_Channel_RAL_Text_12-21-17.docx; CPAH_Slope_Factor_Change_1-3-17.pptx
Location: Personal Privacy / Ex. 6

Start: 1/4/2018 5:30:00 PM
End: 1/4/2018 7:30:00 PM
Show Time As: Tentative

Importance: High

Recurrence: (none)

Technical materials for PAH discussion/decision making meeting – Updated 1/3/18.

Eric's review summary and response on the three main points presented in the 11/28/2017 memo from Patty Dost to Elliott Laws (**MS Word file titled – 12-7-17_Portland Harbor cPAH Cleanup Levels Memo**)
Eric's rolling river mile evaluation which looks at where active remediation is designated (footprint) against the cPAH cleanup levels, including IRIS adjusted values. Eric presents a summary (MS Word file) of the cPAH questions that have been raised during relevant CUL and RAL adjustment discussions and provides answers gleaned from this analysis (**5 files immediately below**)
John Kern's analysis per Karl's direction to develop a statistically based Adjusted RAL for the nearshore (**Powerpoint slide titled: RollingRiverMileStratifiedNaturalNeighborGrid……)**
A supplemental John Kern analysis per Karl's request to show proportion of half RM protected at the 106 PRG as a function of selected RALs. (**Powerpoint slide titled: PercentProtective_HalfRM_106_prg.pptx**)
Updated GIS PAH coverage map showing footprint of SMA related to Total PAHs, the differences if nearshore TPAH RAL is revised to E-RAL and Stat based RAL of 30ppm
Slide summary of PAH decisions – those agreed upon, ongoing considerations/factors, Options with ranking summary table
Rationale Summary for retaining B-RAL in Nav Channel

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 6/13/2018 7:34:37 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham (Jennifer.graham@ctwsbnr.org) [Jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user1c445729]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; paul.seidel@state.or.us; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d];

tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]

Subject: FW: cPAH error correction and considered effects to PTW (sf)

Importance: High

Hello TCT members,

Regarding the PTW level relative to the clam sediment CUL error and the overall proposed IRIS update raised today at our meeting: The PTW threshold is unaffected by the clam consumption sediment CUL errata because the PTW threshold is based on the direct contact CUL of 774 ug/kg which is below the corrected clam consumption CUL of 1076 ug/kg. Thus the proposed IRIS updated direct contact PTW threshold of 774,000 ug/kg to go into a revised Table 21 would be below the clam consumption PTW threshold of 1,076,000 ug/kg.

Let me know if you have any questions on this.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer
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https://www.epa.gov/superfund/portland-harbor

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 5/22/2018 5:13:53 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham (Jennifer.graham@ctwsbnr.org) [Jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user1c445729]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; paul.seidel@state.or.us; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d];

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Subject: Revised ESD pptx- table (confidential)

Hello everyone, as many of us have discussed on the phone here is the revised clam consumption sediment CUL (grey highlight) being contemplated. Let me know if you have any questions.

Thank you.

S

VI. CONFIDENTIALITY

The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

CUL, PTW and RAL Change Summary

Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL	Site-Wide	3,950 µg/kg	1076 µg/kg
Benthic Risk total PAH Sediment CUL	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

* No Change Proposed

9

Sean Sheldrake RPM, Unit Diver Officer

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Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/2/2018 8:50:16 PM
To: Laura Shira [shil@yakamafish-nsn.gov]; Alex Liverman [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson [courtney@crag.org]; Dan Hafley [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue [deirdre.donahue@sol.doi.gov]; Robert Dexter [dexb@yakamafish-nsn.gov]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt [joepitt@ctuir.org]; Josh Newton [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson [PetersonLE@cdmsmith.com]; Madi Novak [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio [rdelvecchio@indecon.com]; Rita Cabral [rcabral@indecon.com]; Robert Brunoe [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]
Subject: RE: Portland Harbor Superfund Site Cleanup Levels (sf2)

Hi Laura,

Sorry I missed your call, but it's just as well to let everyone know the status, so thanks for emailing.

Internal deliberations have taken several months due to the complexity of the issues, and the fact that it takes us several weeks/months to fully digest each of these requests from NWN. The second one received in November is something we're working to internally understand and develop some sort of strawman direction forward before discussing more broadly. Also, workload for other issues of the day, such as the pre-RD agreement used up a bit of bandwidth.

Going forward, my hope is that we wrap up IRIS related issues this month internally, and start having TCT discussions over EPA's current thinking (either regularly scheduled, or ad-hoc—thinking the latter given the complexity) and listening to input well prior to any decision document drafting. That process of course will get pushed by early design work needs, e.g. "what are we designing this cap to achieve?" So we'll as usual need to balance a number of desires with the schedule.

Let me know what you think and of course hopefully others will as well. I have some time after 4 today if you'd like to get on the phone—and the rest of the week.

Thank you and happy new year to you too!

S

Sean Sheldrake, Unit Diving Officer, RPM
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From: Laura Shira [mailto:shil@yakamafish-nsn.gov]
Sent: Tuesday, January 02, 2018 12:29 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Alex Liverman <liverman.alex@deq.state.or.us>; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca <Chu.Rebecca@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>; Cora, Lori <Cora.Lori@epa.gov>; Courtney Johnson <courtney@crag.org>; Dan Hafley <HAFLEY.Dan@deq.state.or.us>; Zhen, Davis <Zhen.Davis@epa.gov>; Deirdre F. Donahue <deirdre.donahue@sol.doi.gov>; Robert Dexter <dexb@yakamafish-nsn.gov>; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Gail Fricano <gfricano@indecon.com>; Genevieve Angle - NOAA-NMFS <Genevieve.Angle@noaa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Holly Partridge <Holly.Partridge@grandronde.org>; Jen Graham <jennifer.graham@ctwsbnr.org>; Jeremy_Buck@fws.gov; Joe Pitt <joepitt@ctuir.org>; Josh Newton <jn@karnopp.com>; jweis@hk-law.com; Kevin Parrett <Parrett.Kevin@deq.state.or.us>; Knudsen, Laura <Knudsen.Laura@epa.gov>; Kristin Callahan <kristin@ridolfi.com>; Lance Peterson <PetersonLE@cdmsmith.com>; Madi Novak <novak.madi@deq.state.or.us>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Matt Johnson - JD Law Umatilla rep. <MatthewJohnson@ctuir.org>; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney <MLW@karnopp.com>; NaomiStacy@ctuir.org; Rachel DelVecchio <rdelvecchio@indecon.com>; Rita Cabral <rcabral@indecon.com>; Robert Brunoe <robert.brunoe@ctwsbnr.org>; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield <Greenfield.Sarah@deq.state.or.us>; Skadowski, Suzanne <Skadowski.Suzanne@epa.gov>; Buerger, Ted <ted_buerger@fws.gov>; tomd@ctsi.nsn.us
Subject: RE: Portland Harbor Superfund Site Cleanup Levels (sf)

Hi Sean,

Happy New Year to you and yours.

The attached Pearl Legal Group letter is dated 11/28/17. Will EPA please provide the TCT group context for what additional discussions, information, and agreements have occurred on this topic between 11/28/17 and now? Also, what is the timeline for these expedited discussions and TCT comment submittals? What are EPA's plans for deciding if/when an ESD or other action will occur?

Regards,

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To: Alex Liverman (liverman.alex@deq.state.or.us) <liverman.alex@deq.state.or.us>; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca <Chu.Rebecca@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>; Cora, Lori <Cora.Lori@epa.gov>; Courtney Johnson (courtney@crag.org) <courtney@crag.org>; Dan Hafley (HAFLEY.Dan@deq.state.or.us) <HAFLEY.Dan@deq.state.or.us>; Zhen, Davis <Zhen.Davis@epa.gov>; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) <deirdre.donahue@sol.doi.gov>; dexb@yakamafish-nsn.gov; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Gail Fricano (gfricano@indecon.com) <gfricano@indecon.com>; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) <Genevieve.Angle@noaa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Holly Partridge (Holly.Partridge@grandronde.org) <Holly.Partridge@grandronde.org>; Jen Graham <jennifer.graham@ctwsbnr.org>; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org) <joepitt@ctuir.org>; Josh Newton (jn@karnopp.com) <jn@karnopp.com>; jweis@hk-law.com; Kevin Parrett <Parrett.Kevin@deq.state.or.us>; Knudsen, Laura <Knudsen.Laura@epa.gov>; Kristin Callahan <kristin@ridolfi.com>; Lance Peterson (PetersonLE@cdmsmith.com) <PetersonLE@cdmsmith.com>; Laura Klasner Shira <shil@yakamafish-nsn.gov>; Madi Novak (novak.madi@deq.state.or.us) <novak.madi@deq.state.or.us>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) <MatthewJohnson@ctuir.org>; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com) <MLW@karnopp.com>; NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com) <rdelvecchio@indecon.com>; Rita Cabral (rcabral@indecon.com) <rcabral@indecon.com>; Robert Brunoe (robert.brunoe@ctwsbnr.org) <robert.brunoe@ctwsbnr.org>; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) <Greenfield.Sarah@deq.state.or.us>; Skadowski, Suzanne <Skadowski.Suzanne@epa.gov>; Buerger, Ted <ted_buerger@fws.gov>; tomd@ctsi.nsn.us
Subject: FW: Portland Harbor Superfund Site Cleanup Levels (sf)
Importance: High

Good morning everyone,

NWN, who sent this memo to EPA recently requested that it be shared with our partners to expedite discussions.

Let me know if you have any questions.

Thank you.

S

Sean Sheldrake, Unit Diving Officer, RPM

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Message

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Sent: 9/29/2017 3:03:42 PM
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Subject: FW: Five Tribes comments on BaP update (sf)
Attachments: Five Tribes Comments on NWN BaP memo 26Sept2017.pdf

Hello everyone,

I'm sharing these good comments with the entire TCT with the permission of the Five Tribes. EPA will consider any feedback we receive in ongoing briefings, so this is very timely.

Thank you.

S

Sean Sheldrake, Unit Diving Officer, RPM
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Subject: Five Tribes comments on BaP update

Hi Sean,

Attached are comments on behalf of the Five Tribes on the topic of benzo(a)pyrene cancer slope factor update and its potential implications on Portland Harbor Superfund Site cleanup levels and remedial action levels.

As always, we appreciate the opportunity to provide feedback on this important project.

Best wishes,

Gail

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IEc

MEMORANDUM | September 26, 2017

TO Sean Sheldrake, United States Environmental Protection Agency (EPA)

FROM Gail Fricano, Rachel DelVecchio, and Dr. Rita Cabral (Industrial Economics, Inc.)

SUBJECT Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor

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PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" (from Amy Nelson and Taku Fuji, Anchor QEA, to Bob Wyatt, NW Natural).

OVERARCHING CONCERNS

1. The NW Natural memorandum advocates for increasing cleanup levels and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) at the Portland Harbor Superfund Site (PHSS) based on EPA's January 19, 2017, updates to the benzo(a)pyrene cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS). Modifying the cleanup levels and RALs would constitute a major change to the Record of Decision (ROD). In particular, a change to the RALs would warrant a ROD amendment. Issuing a ROD amendment is a very lengthy process that would significantly delay the cleanup schedule, likely by several years. As iterated in past comments to EPA, the Five Tribes urge EPA to achieve a timely and thorough cleanup of the PHSS in order to restore its myriad uses to the public and achieve a healthy ecosystem as quickly as possible. The community has waited long enough for a cleanup plan. We urge EPA to keep on schedule and begin in-water cleanup as soon as possible. We are deeply concerned about the effects of considering changes to the RALs on the project schedule.
2. EPA's cleanup plan was developed with meaningful input from the Five Tribes and other tribal, state, and federal partners, as well as the community and other interested parties. The Five Tribes have frequently provided input on numerous technical issues over many years. In developing the ROD, EPA weighed feedback provided at government-to-government consultations with the Five

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Tribes, as well as our written comments on the Proposed Plan provided during the public comment period. If EPA is considering changing the PAH RALs, a change that would likely require a ROD amendment, the Five Tribes assert our right to request government-to-government consultations with EPA so that our input on such an important potential change may be fully considered.

TECHNICAL COMMENTS

3. NW Natural's proposed change to the navigation channel cleanup level and RAL is based on the ROD remedial action objective (RAO) 2 (clam consumption by humans) cleanup level of 3,950 ug/kg carcinogenic PAH (cPAH). The ROD RAO 5 (benthic risk) cleanup level of 23,000 ug/kg total PAH (TPAH) that is also applicable to the navigation channel is not affected by the CSF update because the CSF is relevant to human health risk and not ecological risk. It appears that converting 23,000 ug/kg TPAH to cPAH using EPA's regression would yield a cPAH concentration of approximately 2,700 ug/kg. This value is substantially lower than NW Natural's proposed cPAH cleanup level of 108,000 ug/kg based on the ROD's RAO 2 cleanup level and the updated CSF. We are uncertain whether we are correctly applying the relevant risk-based concepts in this case, but the cleanup level should always default to the lowest value across RAOs; with the CSF update, the appropriate value for the navigation channel sediment cleanup level may now be based on RAO 5.

4. The ROD cPAH surface water cleanup level is based on the federal human health water quality criteria protective of fish consumption. NW Natural proposes changing the surface water cleanup level by applying the CSF update to the federal criteria. The federal criteria went through an extensive public review process and are published in the Federal Register (80 FR 36986). These criteria constitute applicable or relevant and appropriate requirements (ARARs) for the PHSS. Thus, the published values must be applied at the PHSS and cannot be changed without a rulemaking. Similarly, the Oregon water quality standards are promulgated standards that cannot be changed without a rulemaking.

5. The development of cPAH RALs for the nearshore area and navigation channel based on the updated CSF is not a straightforward exercise. NW Natural's two approaches to revising the RALs, "proportional adjustment approach" and "risk reduction approach," are inconsistent with the approach that EPA presented in the ROD, which instead considers surface-weighted average concentration (SWAC) reductions for a spectrum of RAL options. It may not be appropriate to adjust the RALs based on a direct relationship with cleanup levels. This inconsistency in methodology highlights the importance of careful consideration and discussion among EPA and their tribal, state, and federal partners of methods presented in the NW Natural memorandum, as well as alternative methods.

6. The CSF update to benzo(a)pyrene is only applicable to human health pathways and, as we assert above, is only relevant to sediment unless new federal and state water quality criteria are promulgated. EPA would need to evaluate whether NW Natural's proposed sediment RALs for the nearshore area and navigation channel are likely to achieve the surface water cleanup levels. In addition, as noted above, EPA must determine whether ecological pathways become driving factors of PAH cleanup (i.e., provide the basis for the PAH RAL) if the CSF update is applied to human health-based cleanup levels. Lastly, if PAH RALs were to be changed, EPA must determine the extent to which areas formerly considered PAH-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs) or non-aqueous phase liquid (NAPL)/not reliably contained (NRC) principal threat waste (PTW).

Message

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Subject: RE: Revised Draft ESD - confidential (with attachment)
Attachments: Portland_Harbor_DRAFT ESD_2018-06-06_clean.pdf

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Subject: Revised Draft ESD - confidential

Hello everyone,

As discussed earlier this week, I'd like to call your attention the revised draft ESD that will be conveyed to you via SFT link (I'll also email, but it's a large file and will likely bounce back). As a reminder, any comments will be going into our administrative record.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

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https://www.epa.gov/superfund/portland-harbor

DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES

Portland Harbor Superfund Site

Portland, Oregon

U.S. Environmental Protection Agency Region 10

Seattle, Washington

June 2018

TABLE OF CONTENTS

1.0 INTRODUCTION 8

1.1 Site Name and Location 8

1.2 Lead and Support Agencies 8

1.3 Statement of Purpose 8

1.4 Administrative Record 9

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY 10

2.1 Site History 10

2.2 Summary of Contamination 11

2.3 Selected Remedy in the ROD 15

3.0 BASIS FOR THE PROPOSED ESD 20

3.1 Changes to the Sediment Cleanup Levels, Target Tissue Levels, and Highly Toxic PTW Thresholds 20

3.2 Changes to Total PAH Remedial Action Level 23

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES 27

5.0 SUPPORT AGENCY COMMENTS 30

6.0 STATUTORY DETERMINATIONS 30

7.0 PUBLIC PARTICIPATION COMPLIANCE 31

8.0 REFERENCES 31

DRAFT

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APPENDICES

Appendix A Supporting Documentation and Information

- A1 Updated Record of Decision Tables 17 and 21
- A2 Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018
- A3 Discussion and Response to August 2, 2017 NW Natural Memo titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor", June 5, 2018
- A4 Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017
- A5 TCT Meeting Materials, January 11, 2018
- A6 9-7-17 Email from Kevin Parrett (DEQ), Subject: PH Benthic Risk - 8-23-17.pptx
- A7 9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx
- A8 Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017
- A9 Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017
- A10 Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017
- A11 Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017
- A12 Memorandum from Portland Harbor ESD Team to EPA Region 10, Subject: Comments received verbally from TCT members during reading room reviews on March 21, April 4 and April 18, 2018, April 24, 2018
- A13 April 19, 2018 e-mail from Sarah Greenfield (DEQ), Subject: DEQ Comments on ESD
- A14 April 27, 2018 e-mail from Sarah Greenfield (DEQ), Subject: DEQ Comments on ESD
- A15 cPAH Sediment CUL Summary

Appendix B Errata Memorandum

Appendix C Oregon Department of Environmental Quality Letter Supporting EPA's Explanation of Significant Differences

Appendix D Five Tribes Letter Supporting EPA's Explanation of Significant Differences

ED_002671A_00012956-00003

LIST OF FIGURES

ESD Figure 1	Site Area
ESD Figure 2	Total PAH Remedial Action Level Contours
ESD Figure 3	Principal Threat Waste
ESD Figure 4a	Running Half River Mile Average cPAH (West)
ESD Figure 4b	Running Half River Mile Average cPAH (East)
ESD Figure 5	Proportion of Half-River Miles Protected vs. Remedial Action Levels
ESD Figure 6	Total PAH RAL Curve
ESD Figure 7	Natural Recovery Summary Score
ESD Figure 8	Revised Remedial Footprint Summary
ESD Figure 9a	RAO 1 Risk Level – RM Basis (West)
ESD Figure 9b	RAO 1 Risk Level – RM Basis (East)
ESD Figure 9c	RAO 1 Risk Level – RM Basis (Swan Island Lagoon)
ESD Figure 10a	RAO 2 Risk Level – RM Basis (West)
ESD Figure 10b	RAO 2 Risk Level – RM Basis (East)
ESD Figure 10c	RAO 2 Risk Level – RM Basis (Navigation Channel)
ESD Figure 10d	RAO 2 Risk Level – RM Basis (Swan Island Lagoon)
ESD Figure 10e	RAO 2 Hazard Index Child – RM Basis (West)
ESD Figure 10f	RAO 2 Hazard Index Child – RM Basis (East)
ESD Figure 10g	RAO 2 Hazard Index Child – RM Basis (Navigation Channel)
ESD Figure 10h	RAO 2 Hazard Index Child – RM Basis (Swan Island Lagoon)
ESD Figure 10i	RAO 2 Hazard Index Infant – RM Basis (West)
ESD Figure 10j	RAO 2 Hazard Index Infant – RM Basis (East)
ESD Figure 10k	RAO 2 Hazard Index Infant – RM Basis (Navigation Channel)
ESD Figure 10l	RAO 2 Hazard Index Infant – RM Basis (Swan Island Lagoon)
ESD Figure 11	RAO 6 Hazard Index – SDU Basis
ESD Figure 12	Riverbank Change Summary
ESD Figure 13	Human Health Beach Exposure Risk Summary
ESD Figure 14a-f	Remedial Footprint and Technology Assignments, Revised Remedy.

DRAFT

LIST OF TABLES

ESD Table 1 Carcinogenic PAH Cleanup Levels and Highly Toxic PTW Thresholds

ESD Table 2 RAO 1 Risk Summary – RM Basis

ESD Table 3 RAO 2 Risk and Hazard Index Summary – RM Basis

ESD Table 4 RAO 5 Benthic Risk Summary

ESD Table 5 RAO 6 Fish and Wildlife Risk Summary

ESD Table 6 RAO 3 and 7 Surface Water Reduction Summary

ESD Table 7 RAO 4 and 8 Percent Groundwater Plume Area Addressed

ESD Table 8 Percentage Contaminated River Bank Addressed by Each Alternative

ESD Table 9 Human Health Beach Exposure Risk Summary

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ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
BaP	benzo(a)pyrene
BaPeq	benzo(a)pyrene equivalent
BEHP	bis(2-ethylhexyl)phthalate
bml	below mud line
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CRD	Columbia River datum
CSF	cancer slope factor
CUL	cleanup level
CWA	Clean Water Act
cy	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DDx	DDT+DDD+DDE
DEQ	Oregon Department of Environmental Quality
dioxins	polychlorinated dibenzo-p-dioxins
DMM	disposed material management
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FMD	future maintenance dredge
FS	feasibility study
ft	feet
mg/kg	milligram per kilogram
mg/kg-day	milligram per kilogram per day
MGP	manufactured gas production
MNR	monitored natural recovery
MOU	memorandum of understanding
NAPL	non-aqueous-phase liquid
NCP	National Contingency Plan
NPL	National Priorities List
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
PTW	principal threat waste
RAL	remedial action level

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RAO	remedial action objective
RM	river mile
ROD	Record of Decision
SDU	sediment decision unit
Site	Portland Harbor Superfund Site
SMA	sediment management area
SWAC	surface area weighted average concentration
TBT	tributyltin
tribes	Native American tribes
USC	United States Code
µg/kg	microgram per kilogram
%	percent

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DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES PORTLAND HARBOR SUPERFUND SITE

June 2018

1.0 INTRODUCTION

1.1 Site Name and Location

The Portland Harbor Superfund Site (the Site), as listed on the National Priorities List (NPL) (Superfund Site ID#: ORSFN1002155), includes an in-river and an upland portion. The Site was listed on the NPL in December 2000 mainly due to concerns about contamination in the sediments and the potential risks to human health and the environment from consuming the fish. The Site is in Multnomah County, Oregon, and is an urban and industrial section of the City of Portland that runs along the river north of, and downstream of, the central downtown area. The in-river portion of the Site covers approximately 2,190 acres and extends from river mile (RM) 1.9 (upriver end of the Port of Portland's Terminal 5) to RM 11.8 (near the Broadway Bridge) and is shown on the proposed Explanation of Significant Differences (proposed ESD) Figure 1.

1.2 Lead and Support Agencies

The lead agency for the in-river portion of the Site is the United States Environmental Protection Agency (EPA), in consultation with the support agency, the Oregon Department of Environmental Quality (DEQ). After listing the Site on the NPL, EPA entered into a 2001 Memorandum of Understanding (MOU) with DEQ, six federally recognized Native American tribes (tribes), two other federal agencies, and one other state agency.[1] Under the MOU, DEQ is the lead agency for addressing contamination in the upland portions of the Superfund site, and EPA is the support agency.

1.3 Statement of Purpose

The Record of Decision (ROD), which documents the selected in-river remedy, was signed on January 3, 2017 (EPA 2017a). The Selected Remedy is summarized in Section 2.3 below. This proposed ESD includes changes to the remedy to the Selected Remedy and the reasons for such changes that are significant but not fundamental changes. This proposed ESD is issued in accordance with §117(c) of the Comprehensive Environmental Response, Compensation, and

[1] Government parties that signed the MOU include DEQ, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Grand Ronde Community of Oregon, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Nez Perce Tribe, the National Oceanic and Atmospheric Administration, the U.S. Department of the Interior (National Marine Fisheries Service and U.S. Fish and Wildlife Service), and the Oregon Department of Fish and Wildlife.

ED_002671A_00012956-00008

Liability Act (CERCLA), 42 United States Code (USC) §9617(c), and the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) §300.435(c)(2)(i).

The purpose of the proposed ESD is to document changes to the sediment cleanup levels (CULs) and target tissue level for shellfish for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) measured as benzo(a)pyrene equivalents (BaPeq). This proposed ESD also documents a change to the remedial action level (RAL) for total polycyclic aromatic hydrocarbons (PAHs) for areas of the Site outside of the Navigation Channel.

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA, 2017b). The toxicological review was prepared under the auspices of EPA's Integrated Risk Information System (IRIS) program and developed a revised oral cancer slope factor based on a review of publicly available studies. IRIS is an EPA database containing human health risk information. Consistent with EPA guidance (EPA 1989), information in IRIS supersedes all other sources of toxicity information for conducting human health risk assessments under CERCLA. The toxicological review modified the oral cancer slope factor (CSF) for benzo(a)pyrene (BaP) from 7.3 to 1 milligram per kilogram per day (mg/kg-day). The CSF change means that BaP is less toxic for people who come into contact with or ingest BaP than previously analyzed. In addition, EPA identified an error in the application of the equation that describes the relationship between BaP in sediments and clam tissue that affects risk-based sediment cleanup levels based on acceptable clam tissue concentrations. This error results in a 100-fold reduction in the RAO 2 cPAH cleanup level based on the human health clam consumption exposure scenario.

Given this new toxicity information, EPA has determined that modifying the cPAH (BaPeq) CULs and total PAH RAL for contaminated sediments outside the Navigation Channel will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by approximately $35 million. Supporting information and analysis for this proposed ESD are contained in figures and tables included in Appendix A.

For completeness and expediency, this ESD also includes an Errata Memorandum dated April 3, 2018 as Appendix B. The Errata Memorandum documents minor corrections to various tables, figures and text items in the Portland Harbor ROD and are not considered significant differences.

1.4 Administrative Record

This proposed ESD and supporting documents will become part of the Site Administrative Record file, in accordance with the NCP, §300.825. The EPA Portland Harbor website is the main repository for all administrative records for the Site: https://www.epa.gov/superfund/portland-harbor The proposed ESD and supporting documents will be available at the following locations:

Multnomah County Central Library **St. Johns Library**

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801 SW 10th Avenue
Portland, OR 97205
(503) 988-5123
Monday 10 am–8 pm
Tuesday, Wednesday 12 pm–8 pm
Thursday, Friday, Saturday 10 am–6 pm
Sunday 10 am–5 pm

Kenton Library
8226 N. Denver Avenue
Portland, OR 97217
(503) 988-5123
Monday, Tuesday 12 pm–8 pm
Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Superfund Records Center
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-4494 or (800) 424-4372
Monday through Friday 9 am–4 pm

7510 N. Charleston Avenue
Portland, OR 97203
(503) 988-5123
Monday, Tuesday 12 pm–8 pm
Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Oregon Operations Office
805 SW Broadway
Suite 500
Portland, OR 97205
(503) 326-3250
Monday through Friday 9 am–4 pm

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

2.1 Site History

The Willamette River is the 19th largest river in the United States and one of 14 American Heritage Rivers in the country. It flows into the larger Columbia River, which eventually flows into the Pacific Ocean. Even though the Willamette River is nearly 100 river miles from the Pacific Ocean, there are tidal influences within the Site, and it is a large and dynamic river.

Since the late 1800s, the Portland Harbor section of the lower Willamette River has been extensively modified to accommodate a vigorous shipping industry. Modifications include redirection and channelization of the main river, draining seasonal and permanent wetlands in the lower floodplain, and dredging to maintain the navigation channel, access to docks, and wharf facilities. Constructed structures, such as wharfs, piers, floating docks, and pilings, are common in Portland Harbor where urbanization and industrialization are most prevalent.

The federal navigation channel, with an authorized depth of -40 feet (ft) Columbia River datum (CRD), extends from the confluence of the lower Willamette River with the Columbia River to RM 11.6. In 1999, Congress authorized the Willamette River to be deepened to -43 ft; however, this has not yet occurred. Swan Island Lagoon was created in the 1930s when dredge spoils were used to fill in part of the channel and connect Swan Island to the mainland.

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While the harbor area is heavily industrialized, it is located within a region characterized by commercial, residential, recreational, and agricultural uses. Land use along the lower Willamette River includes marine terminals, manufacturing and other commercial operations, public facilities, parks, and open spaces. In addition to industrial activities, the Willamette River and surrounding watershed historically offered access to abundant natural resources in the river and on land. Many of these resources are still present such as fish, marine mammals, waterfowl, land mammals, and native plants.

The Willamette River is also important to many tribes. Fish are among the resources most frequently utilized by the tribes in the Portland Basin and the Willamette Valley. Culturally significant species include salmonids, lamprey (eels), eulachon (smelt), and sturgeon. Native people also fished for a variety of other resident species, including mountain whitefish, chiselmouth, northern pikeminnow, peamouth, and suckers. Tribes have reserved hunting, fishing (particularly salmon and sturgeon species), and certain gathering rights through Treaties with the United States.

2.2 Summary of Contamination

Sources of Contamination

Historically, contaminants from many facilities entered the river system from different activities, including but not limited to ship building and repair; ship dismantling; wood treatment and lumber milling; storage of bulk fuels; manufactured gas production (MGP); chemical manufacturing and storage; metal recycling, production, and fabrication; steel mills, smelters, and foundries; and electrical production and distribution. These activities resulted in direct discharges from upland areas through stormwater and wastewater outfalls; releases and spills from commercial operations occurring over the water; municipal combined sewer overflows; and indirect discharges through overland flow, bank erosion, groundwater, and other nonpoint sources. In addition, contaminants from offsite sources have reached the Site through surface water and sediment transport from upstream and through atmospheric deposition. Operations that continue today along the river banks include bulk fuel storage, barge building, ship repair, automobile scrapping, recycling, steel manufacturing, cement manufacturing, operation and repair of electrical transformers (including electrical substations), and many smaller industrial operations.

Contaminants of Concern

The human health and ecological risk assessments identified 64 contaminants of concern (COCs) that contribute a significant amount of risk to the human and ecological receptors. COCs by media are listed in Tables 1 through 5 in Appendix II of the ROD. A subset of all COCs, called focused COCs, was developed to simplify analysis and evaluation of remedial alternatives. The focused COCs include polychlorinated biphenyls (PCBs), PAHs, dioxins and furans, and DDx,

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which represents collectively dichlorodiphenyltrichloroethane (DDT) and its primary breakdown products dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethene (DDE).

Principal Threat Waste

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

PTW was identified based on cancer risk (highly toxic) or non-aqueous phase liquid (NAPL) within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment. A capping model was used to determine whether there were concentrations of PTW that could not be reliably contained.

Contaminated Media

The environmental media contaminated by COCs include surface sediment (0 to 30 centimeters [cm] below mud line [bml]), subsurface sediment (below 30 cm bml), suspended sediment, surface water, groundwater, biota, and river banks. The surface sediment sample interval (0 to 30 cm bml) is designed to capture that portion of the sediment column that has the potential to be disturbed or transported under typical annual conditions. River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. The following nature and extent of contamination discussion focuses on sediments, surface water, and river banks. A full description of site contamination is included in Section 6 of the ROD.

Nature and Extent of Contamination

Surface and Subsurface Sediment

Contamination in subsurface sediment was identified as deep as 17 ft bml in the navigation channel and 19 ft bml in the sediment future maintenance dredge (FMD) areas. FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. In the intermediate region, defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD, the maximum depth of contamination was estimated to be 34 ft bml, but most contamination was less than 10 ft. In the shallow region, defined as shoreward of the riverbed elevation of approximately -2 ft CRD, the maximum depth of contamination was estimated to be 33.5 ft bml. Based on contaminant distribution trends, some general patterns emerged among subsets of different contaminants that

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reflect fate and transport processes at the Site as well as the relative importance of regional versus site sources, as described below. Additional details are included in the ROD (EPA 2017a).

Sediment contaminant concentrations were greatest in nearshore areas. Concentrations of contaminants were generally higher in nearshore and off-channel areas such as slips, embayments, and shallow areas, and near some known or suspected sources, as compared to sediments in the navigation channel, Multnomah Channel, and downstream areas.

Organic contaminant concentrations were greater in subsurface sediments. Concentrations of organic contaminants tended to be higher in subsurface sediments than in surface sediments. Concentrations of total PCBs, total DDx, total PAHs, hexachlorobenzene, total chlordanes, aldrin and dieldrin, gamma-hexachlorocyclohexane (Lindane), lead, and tributyltin (TBT) were higher in subsurface than in surface sediments, indicating that historical inputs were likely greater than current inputs. Subsurface contamination was detected as deep as 34 ft bml. In contrast, arsenic, copper, chromium, mercury, and zinc did not have large concentration ranges and generally showed similar levels in surface and subsurface sediments. Other exceptions included areas where higher surface sediment concentrations appeared to be associated with ongoing Site sources, low rates of sediment deposition, and physical sediment disturbance (e.g., from boat scour).

Regional inputs exhibited uniform concentrations across the area. Contaminants that may have been derived predominantly from regional or upstream inputs showed widespread surface sediment distributions without distinct, isolated areas of higher concentrations. Examples of this were arsenic, chromium, and mercury, which occurred at relatively low concentrations throughout the Site with no apparent strong concentration gradients.

Areas of high concentrations were present throughout the Site and generally were located near likely upland sources. A number of contaminants exhibited relatively high sediment concentrations in distinct areas offshore of known or likely sources. These areas were separated by large areas with relatively lower concentrations lacking obvious concentration gradients. Contaminants that exhibited this trend included total PCBs, dioxins, bis(2-ethylhexyl)phthalate (BEHP), butylbenzyl phthalate, pentachlorophenol, hexachlorobenzene, total chlordanes, Lindane, copper, zinc, and TBT.

Some contaminants had areas of high concentrations that were more common in the lower (downstream) half of the Site. Total DDx and total PAHs exhibited elevated concentrations in some locations of the river. Concentrations of certain metals were correlated to sediment grain size. A comparison of metals concentrations to the distributions of percent fines in the Site showed that where sediments were comprised of less than 40 percent (%) fines, chromium and copper concentrations were relatively low (above RM 10, between RM 5 and 7, and in the Multnomah Channel; RI Map 3.1-3). A similar, but less pronounced, correspondence existed between sandy sediments and zinc concentrations.

Multiple contaminants co-occurred. In most areas of the Site, multiple COCs are comingled. At all of the highest surface sediment concentration areas, more than one contaminant is found. This degree of contaminant co-occurrence reflects the variety of sources to the in-river portion of

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concentrations protective of human health or the environment from the risk assessment, applicable or relevant and appropriate requirements (ARARs), and background values. Sixty-four COCs found in sediment, surface water, groundwater, and tissue were identified. For each contaminant and in all media such as sediments and surface water, the lowest number protective of human health or the environment was selected unless the available background value was higher, in which case the background value was selected. Table 17 in the ROD provides the CULs and tissue targets as well as the basis for the selected number. The CULs for the Site are expected to reduce unacceptable risk within the river by setting standards for sediment, biota, surface water, groundwater, and river banks. Remediation of the sediment will reduce loading and resuspension of contamination to surface water, which collectively will reduce fish and shellfish exposure to the contamination.

Areas to be capped or dredged called Sediment Management Areas (SMAs) are defined by remedial action levels (RALs) and PTW for the Selected Remedy (Table 21 in the ROD). SMAs for the Selected Remedy are shown on Figure 30 in the ROD. The SMAs represent areas with contaminant concentrations in surface sediment where natural recovery is not occurring or is not likely to be effective in reducing concentrations of COCs within a reasonable time frame. RALs are contaminant-specific sediment concentrations of focused COCs used to define areas for more active cleanup and will reduce contaminant concentrations and risks more effectively than ENR or MNR from current site wide average concentrations. Technology assignments and the approximate areas that will be remediated through dredging, capping, ENR, and areas where COC concentrations will be reduced through MNR are shown on Figures 31a-e in the ROD.

The COCs used to define the SMA boundaries are PCBs, total PAHs, DDx and selected dioxin/furan congeners. These focused COCs encompass the majority of the spatial extent of contaminants posing the majority of the risks as identified in the baseline risk assessments. In the Feasibility Study (FS), RALs were developed by considering the volume or acreage of material that would be addressed to achieve reductions of contaminant concentrations (and therefore risk) throughout the Site. The relationships between RAL concentrations and resulting site-wide spatially-area weighted average concentrations (SWACs) or "RAL curves" were developed by plotting acres remediated against the post remediation surface weighted average surface sediment concentration. A range of RALs consisting of seven different concentrations bracketing the distribution of contamination were selected for each focused COC. The selected RALs are a function of the distribution of surface sediment data at the Site and reflect uncertainties in the distribution of contamination and the interpolation method utilized.

Each remedial alternative evaluated in the FS has a different set of sediment RALs. The lowest RALs are in Alternative H; therefore, the areas that are capped and/or dredged increase in acres from Alternatives B through H. A summary of RALs for the focused COCs used to develop Alternatives B through H are presented in Table 18 in the ROD.

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The Selected Remedy applies Alternative F RALs to nearshore sediments[2] and Alternative B RALs to the federally authorized navigation channel. Total PAH RAL contours presented in the Portland Harbor FS (EPA 2016b) are shown on proposed ESD Figure 2. For PAHs, RALs were based on total PAHs rather than cPAHs because total PAHs were selected as a focused COC for the Site. The relationship between total PAHs and cPAHs is presented in Appendix D of the FS. The total PAH RALs for the Selected Remedy are 13,000 µg/kg for nearshore sediments and 170,000 µg/kg for the federally authorized navigation channel.

The Selected Remedy in the ROD includes a total constructed area of 394 acres of sediment and 23,305 lineal feet of river bank and allows 1,774 acres of sediment to naturally recover. The Selected Remedy includes 365.4 acres of capping and dredging contaminated sediment and 28.2 acres of ENR. Of that, approximately 215.2 acres of sediment will be dredged to varying depths. Additionally, 23,305 lineal feet of river bank are assumed to be excavated and covered with either an augmented reactive cap or an engineered cap using beach mix or vegetation after excavating approximately 123,000 cubic yards (cy) of contaminated material from river banks. The dredged material removed from the Site will be managed under disposed material management (DMM) scenario 2, with approximately 3,017,000 cy of contaminated sediment and 123,000 cy of soil sent to offsite disposal facilities. Material testing will be used to determine the appropriate disposal facility, Subtitle D or C. Ex-situ treatment is assumed for approximately 191,500 cy of sediment and river bank soil prior to disposal and is based on complying with federal and state regulations and the 2004 dispute decision on MGP waste. The need for, and extent of, ex-situ treatment will be based on the offsite disposal requirements and material testing during design and construction. It is assumed that all other dredged material will not require treatment prior to disposal.

The various river areas and their remedy components are discussed in detail below. The final technology assignment will be identified in the remedial design after collection of additional sampling data. The technology assignment will be identified as indicated in the decision tree on Figure 28 in the ROD.

Navigation Channel

The Selected Remedy in the federally authorized navigation channel includes dredging to avoid constructing a cap or residual layer within the authorized dredge depth. Contaminated sediment will be dredged to the depth of the Alternative B RAL concentrations or PTW concentrations shown in Table 21 in the ROD, whichever is lower. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging and include the surrounding area that may have been impacted by dredge residuals. If RALs are not achieved or PTW is present below the feasible depth limit of the excavation technology, as approved by EPA, a cap is assumed to be placed after dredging. Navigation and maintenance dredge depth

[2] Nearshore sediments include all sediments outside the navigation channel. This includes beach sediments as well as areas designated in the FS as shallow areas, intermediate areas and future maintenance dredge areas.

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requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the authorized depth of the navigation channel, including an over dredge allowance/buffer zone. Implementing the Selected Remedy in the navigation channel will need to consider, and be coordinated with, cleanup conducted in the rest of the Site to minimize recontamination. This cleanup may occur at the same time or later than the other cleanup actions.

Future Maintenance Dredge Areas

FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. Contaminated sediment will be dredged to the depth of the sitewide RAL concentrations shown in Table 21 in the ROD or to a depth required to allow placement of a cap or backfill sufficient to be effective over the long term. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. A reactive residual layer (sand plus activated carbon) is assumed after dredging if PTW that can be contained lies below the feasible limits of excavation. Maintenance dredge depth requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the maintained depth, including an over dredge allowance or buffer zone.

Intermediate Region

The intermediate region is defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet Clean Water Act (CWA) (Section 404) and federal floodway requirements as well as climate change impacts. In the intermediate region, contaminated sediment will be dredged to the depth required to achieve RALs (see Table 21 in the ROD) and remove PTW or to a depth required to allow placement of cap or backfill material sufficient to be effective over the long term. The elevation of the top of the cap will be no higher than the pre-design elevation to avoid impacts to the floodway. EPA estimates the dredging depth required to accommodate a cap will generally be 5 feet. The final depth will be determined in remedial design. Where RAL concentrations are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. In the intermediate regions, residual layers will consist of sand (amended with activated carbon if determined to be appropriate) to prevent the transport and

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release of contaminants from dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. During design and construction, the final elevation of capped and dredged areas will be considered such that the leave surface of the constructed remedy is appropriate for the post-construction use of each specific area. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. If appropriate to protect sensitive species, a habitat layer will be incorporated into the constructed remedy.

Shallow Region

The shallow region is defined as shoreward of the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet CWA (Section 404) and federal floodway requirements as well as climate change impacts. Contaminated sediment in this area will be dredged to the depth required to remove all NAPL or PTW that cannot be reliably contained (see Table 21 in the ROD) unless it is present below the feasible depth limit of excavation technology in which case it will be capped. Where PTW is not present but the depth of excavation to achieve RAL concentrations is greater than 5 feet, the area will be dredged to 5 feet with placement of a cap and backfilled to grade. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. In the shallow regions, a habitat layer, such as beach mix, will be used for the final layer of clean cover in both residual management areas and capped areas to bring the surface back to the original (pre-dredge) elevation and to maintain the natural habitat.

River Bank Region

River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. Remediation of contaminated river banks is included in the Selected Remedy where it is determined that it should be conducted in conjunction with the in-river actions and to protect the remedy (Figure 9 and Table 21 in the ROD). Other river banks may be included in the remedial action if contamination contiguous with contaminated river sediment is found during remedial design sampling. Engineered caps or vegetation with beach mix will be placed as the final cover based on area-specific designs, which will account for appropriate slope according to the programmatic or site-specific Biological Opinion, as appropriate. NAPL or PTW that cannot be reliably contained, if present, will be fully excavated and not capped unless it is present below the depth limit of excavation technology, as approved by EPA. In those locations, a significantly augmented cap will be constructed below the habitat layer. The state may also undertake actions at some river banks that are the subject of

ED_002671A_00012956-00017

this ROD to expedite source control of contaminated upland areas, as necessary. Those actions will be consistent with the Selected Remedy and meet CERCLA requirements.

3.0 BASIS FOR THE PROPOSED ESD

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA 2017b). The updated toxicological review modified the oral CSF for BaP from 7.3 to 1 mg/kg-day resulting in a lower risk estimate associated with exposure to BaP and other cPAHs. Given that humans have less cancer risk from exposure to BaP, the modified CSF has potential implications for the risk-based human health CULs, target tissue levels, and highly toxic PTW thresholds for cPAHs measured as BaPeq selected in the January 3, 2017 ROD (EPA 2017a). CULs for cPAHs were calculated using a CSF to achieve a 1×10^{-6} cancer risk level and the PTW thresholds were set at a 1×10^{-3} level based on the CUL[3].

Although not directly related to a CSF or a measurement of risk, EPA evaluated potential implications of the BaP slope factor change on the total PAH RALs selected in the ROD to determine whether any areas slated for active cleanup primarily or solely due to cPAH risk from direct contact with contaminated sediments or shellfish consumption no longer presented risk or may no longer require active cleanup. However, while undertaking this review, EPA also considered the effect of these changes on other human health and ecological RAOs. In particular, EPA evaluated impacts to surface water CULs and whether ecological risks presented by PAHs, carcinogenic or not, would be adequately addressed if changes to cPAH CULs and/or the total PAH RALs were implemented.

3.1 Changes to the Sediment Cleanup Levels, Shellfish Target Tissue Levels, and Highly Toxic PTW Thresholds

Human health sediment CULs and shellfish target tissue levels as well as the highly toxic PTW threshold for PAHs in the ROD are based on cPAHs. As a result, the change in the CSF for BaP has a direct effect on the risk-based sediment CULs and target tissue levels for cPAHs. These changes are summarized below.

cPAH Direct Contact Sediment CULs

The Portland Harbor baseline human health risk assessment included in the *Final Remedial Investigation Report* (RI Report – EPA 2016a) evaluated a range of direct contact exposure

[3] Risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10^{-4} to 10^{-6} established in the NCP. EPA's goal of protection for cancer risk is 10^{-6}, and risks greater than 10^{-4} typically will require remedial action. Highly toxic PTW is generally based a 10^{-3} risk level.

ED_002671A_00012956-00018

scenarios for beach sediment and in-water sediment. Potentially exposed populations evaluated under the beach exposure scenarios included dockside workers, transients, recreational beach users, high frequency fishers, and tribal fishers. Potentially exposed populations evaluated under the in-water sediment exposure scenarios included in-water workers, high frequency fishers, tribal fishers, diver wet suit, and diver dry suit.

Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in an increase in the direct contact sediment CUL specified in the ROD by a factor of 7.3. The ROD selected a cPAH (BaPeq) sediment CUL of 12 micrograms per kilogram (µg/kg) for nearshore sediments based on the recreational beach sediment exposure scenario. Increasing the beach sediment PRG of 12 µg/kg by a factor of 7.3 results in a revised beach sediment PRG and CUL of 85 µg/kg.
The ROD applied the cPAH recreational beach sediment CUL to all nearshore sediments outside the navigation channel. EPA evaluated whether a sediment CUL based on the tribal fisher exposure scenario should be applied to nearshore sediments outside of the navigation channel where recreational beach exposures are not expected to occur. The in-water sediment preliminary remediation goal (PRG) based on the tribal fisher exposure scenario is 106 µg/kg. Increasing the in-water sediment PRG of 106 µg/kg by a factor of 7.3 results in a revised nearshore sediment PRG and CUL of 774 µg/kg.

cPAH Shellfish Consumption Target Tissue Levels

The ROD included target tissue levels for cPAHs in shellfish tissue of 7.1 µg/kg based on the shellfish consumption exposure scenario, herein after referred to as shellfish target tissue levels. Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in a proportional increase in the target tissue level from 7.1 to 51.6 µg/kg. This target tissue level would apply to shellfish tissue throughout the Site. The ROD did not include target tissue levels for cPAHs in fish tissue.

cPAH Shellfish Consumption Sediment Cleanup Levels

The ROD selected a shellfish consumption sediment CUL of 3,950 µg/kg based on human consumption of clams. The shellfish consumption sediment CUL for cPAHs of 3,950 µg/kg is applicable to the entire Site, whereas the direct contact sediment CUL is only applicable to nearshore sediment areas because direct contact exposure pathways are not considered to be complete within the navigation channel at the Site.

For the shellfish consumption sediment CUL, the target tissue level increases by a factor of 7.3. However, the relationship between cPAH (BaPeq) shellfish (clam) tissue levels and sediment levels is a non-linear relationship represented by the following equation presented in Appendix B of the FS (EPA 2016b):

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue}) - (\ln(f_{lipid}) - \ln(CF) + 2.47)}{0.6} + ln(f_{oc}) \quad \text{(Equation 1)}$$

Where:

ED_002671A_00012956-00019

PRG_{sed} = Risk-based sediment preliminary remediation goal, dry weight (µg/kg)
C_{tissue} = Risk-based acceptable tissue concentration, wet weight (µg/kg)
CF = Correction factor of 2.3
F_{oc} = Fraction organic carbon, dry weight (0.0171)
F_{lipid} = Fraction of lipid in shellfish (clam) tissue, wet weight (0.022)

During review of potential changes to the cPAH cleanup level resulting from the change in the BaP CSF, EPA became aware of an error in application of the Equation 1. This error resulted from calculating the sediment cleanup level using the units of µg/kg rather than mg/kg (the equation was developed based on a log-log regression equation developed in units of mg/kg). The error reduces the cPAH CUL presented in the ROD by a factor of 100 from 3,950 µg/kg to 39.5 µg/kg. Due to the non-linear relationship between bulk sediment BaP concentrations and shellfish (clam) tissue BaP concentrations, revising the acceptable tissue concentration from 7.1 to 51.6 µg/kg and solving for PRG_{sed} using Equation 1 increases the shellfish consumption cPAH sediment CUL from 39.5 to 1,076 µg/kg.

cPAH Principal Threat Waste Thresholds

The ROD (EPA 2017a) identified the presence of PTW at the Site. PTW types identified include source material in the form of NAPL, highly toxic material based on a 1×10^{-3} risk level, and material that is not reliably contained. The presence of NAPL and not reliably contained PTW associated with PAH contamination is unaffected by the BaP slope factor change. However, the highly toxic PTW threshold for cPAHs of 106,000 µg/kg increases by a factor of 7.3 to 774,000 µg/kg due to the BaP slope factor change.

As noted above, PTW types identified at the Site include source material in the form of NAPL, highly toxic material based on a 1×10^{-3} risk level, and material that is not reliably contained. Increasing the highly toxic PTW threshold from 106,000 to 774,000 µg/kg will limit the presence of highly toxic PTW at the Site. Areas of PTW identified in the Portland Harbor ROD (EPA 2017a) are shown on proposed ESD Figure 3.

Application of Sediment Cleanup Levels

The ROD established a cPAH CUL of 12 µg/kg for nearshore sediments based on a recreational beach exposure scenario that included both child and adult exposures. The ROD also established a sediment CUL of 3,950 µg/kg applicable to the navigation channel based on the clam consumption exposure scenario.

EPA has re-evaluated application of the nearshore sediment CUL based on the recreational beach exposure scenario and determined that two cPAH direct contact CULs should apply to nearshore sediments. The updated cPAH direct contact beach CUL of 85 µg/kg will apply to recreational beaches based on existing or reasonably anticipated future use. EPA also developed a cPAH

ED_002671A_00012956-00020

direct contact CUL of 774 µg/kg based on the tribal fisher exposure scenario. The cPAH direct contact tribal fisher CUL for in-water sediment of 774 µg/kg will apply to the remainder of nearshore sediments (including non-recreational beach areas). The updated cPAH shellfish consumption CUL of 107,600 µg/kg will apply to the federally authorized navigation channel. This change does not affect the sediment CUL for any other COC at the Site.

Changes to the direct contact sediment CULs, the shellfish consumption target tissue level, the shellfish consumption sediment CUL, and highly toxic PTW threshold for cPAHs (BaPeq) are summarized in proposed ESD Table 1.

3.2 Changes to Total PAH Remedial Action Level

EPA evaluated whether a change to the total PAH RALs for the Selected Remedy was appropriate based on the change to the BaP CSF. This evaluation considered both the total PAH nearshore sediment RAL of 13,000 µg/kg and the total PAH navigation channel RAL of 170,000 µg/kg. The navigation channel RAL is applicable to all contaminated sediments within the federally authorized navigation channel while the nearshore RAL is applicable to all sediments outside the navigation channel.

The evaluation considered whether the Selected Remedy RALs would result in the remediation of PAH contaminated sediment that no longer poses unacceptable risk to human health due to the BaP CSF change based on an evaluation of post construction risk. The evaluation also considered whether a change in the total PAH RAL would affect the ability of the remedy to attain all other RAOs specified in the ROD. The evaluation considered both the tribal fisher and recreational beach exposure scenarios (RAO 1) and other RAOs where PAHs are identified as a COC (RAOs 2, 3, 5 and 7). The evaluation did not consider groundwater RAOs (RAOs 4 and 8) since these will be dependent on engineered caps applied along with the adequacy of source control actions.

Nearshore Total PAH RAL

<u>cPAH Direct Contact In-water Sediment Risk (RAO 1):</u> Updating the direct contact cPAH sediment CUL from 106 µg/kg to 774 µg/kg without adjustment of the nearshore total PAH RAL will result in the remediation of some sediments that do not exceed 774 µg/kg as measured on a one-half rolling river mile SWAC basis. As shown on proposed ESD Figures 4a and 4b, one-half rolling river mile SWACs, if the Alternative F total PAH RAL is used, would exceed 774 µg/kg between approximately RM 4.8 and 6.6 in nearshore sediments along the west shore of the Willamette River (West Shoal) and between approximately RM 3.9 and 4.9 along the east shore of the Willamette River (East Shoal).

EPA conducted an evaluation to determine the percentage of nearshore half-river miles protected based on a range of total PAH RALs. This evaluation is consistent with the direct contact residual risk evaluation presented in Appendix IV of the Portland Harbor ROD. EPA evaluated

ED_002671A_00012956-00021

increasing the total PAH RAL for the Selected Remedy of 13,000 µg/kg by a factor of 7.3 to 95,000 µg/kg (the factor of 7.3 represents the magnitude of the change to the BaP CSF). As is shown in proposed ESD Figure 5, a total PAH RAL of 95,000 µg/kg will protect 22% of nearshore half-river miles. Figure 5 also shows that a total PAH RAL of 30,000 µg/kg will protect 100% of the nearshore half-river mile by achieving the updated direct contact cPAH CUL of 774 µg/kg as measured on one-half rolling river mile SWACs throughout the Site. Based on the results of this evaluation, EPA determined that revising the nearshore total PAH RAL from 13,000 µg/kg to 30,000 µg/kg was appropriate.

cPAH Direct Contact Beach Exposure (RAO 1): In general, the remedial footprint for the Selected Remedy as presented in the ROD does not include beach areas. The exception to this is a beach area near Linnton at approximately RM 4.8 along the east bank of the Willamette River (Beach 04B024) and a beach area near Cathedral Park at approximately RM 5.9 along the west bank of the Willamette River (Beach 05B018). The baseline human health risk assessment (EPA 2016a) determined that the risk associated with these beaches was 5×10^{-5} and 1×10^{-5}, respectively. Updated risk estimates based on the BaP CSF change are 1×10^{-5} and 4×10^{-6}, respectively. These risk estimates are within EPA's risk range and do not need to be addressed through active remediation. In addition, it is expected that risks to human health in beach areas will be further reduced through natural recovery processes. As a result, revising the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg based on the tribal fisher in-water sediment exsposure scenario will not significantly affect the ability of the remedy to protect recreational beach users. Long-term monitoring will be performed to verify that the Selected Remedy is protective of recreation beach exposures.

cPAH Shellfish Consumption Risk (RAO 2): As noted above, the BaP CSF change along with the correct application of Equation 1 will increase the corrected shellfish consumption cPAH sediment CUL from 39.5 to 1,076 µg/kg. However, because this concentration is below the updated direct contract CUL of 774 µg/kg, post-construction risk to human health based on the shellfish consumption exposure pathway does not exceed 1×10^{-6} on a rolling river mile basis in nearshore sediments at the Site and no further adjustment of the RAL is needed to address human health risks associated with this exposure pathway.

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the selected remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): The total PAH sediment CUL for benthic risk as presented in Table 17 of the ROD is 23,000 µg/kg. The Selected Remedy is estimated to address 72% of benthic risk areas based on 10 times unacceptable benthic risks at the end of construction with the remainder to be addressed through MNR. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, PAHs in sediment present unacceptable risk to the benthic community. Therefore, changes in total PAH RALs must be evaluated to determine the effect on

ED_002671A_00012956-00022

the attainment of RAO 5 and the CUL. Because the revised total PAH RAL of 30,000 µg/kg is only slightly above the total PAH CUL for protection of the benthic community of 23,000 µg/kg, increasing the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg will have a minimal effect on attainment of RAO 5 or the post-construction metric of 10 times the benthic risk CUL.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

Based on its evaluation, EPA determined that the nearshore RAL should be revised from 13,000 to 30,000 µg/kg to avoid remediation of PAH-contaminated sediments that no longer pose a risk to human health for direct contact based on the changes to the nearshore sediment cPAH CUL. EPA has also determined that increasing the total PAH RAL from 13,000 to 30,000 µg/kg will not have a significant effect on the ability of the remedy to protect recreational beach users or to attain RAOs 2, 3, 5, or 7. The total PAH RAL curve utilizing the revised total PAH RAL is shown on proposed ESD Figure 6. The change in the remedial footprint associated with this change is estimated to be 17 acres.

Navigation Channel RAL

EPA evaluated whether the change in BaP CSF necessitated revising the total PAH RAL of 170,000 µg/kg applicable to the navigation channel. This evaluation considered the effect of the RAL change on post-construction risk estimates and whether the change would affect attainment of the RAOs established for the Site. The evaluation focused on RAOs 3, 5, and 7. The evaluation did not consider RAO 1 because the human health direct contact exposure pathway is considered incomplete within the navigation channel and did not consider RAO 2 because the cPAH shellfish consumption sediment CUL is not exceeded on a SWAC basis within the navigation channel.

cPAH Shellfish Consumption Risk (RAO 2): As noted above, the BaP CSF change along with the correct application of Equation 1 will increase the corrected shellfish consumption cPAH sediment CUL from 39.5 to 1,076 µg/kg. This change will result in a maximum risk to human health based on the shellfish consumption exposure pathway of 3×10^{-6} as measured on a rolling river mile basis. However, risks to human health associated with the fish and shellfish exposure scenario within the navigation channel range between 1×10^{-4} and 9×10^{-5} due to the presence of PCBs and dioxin congeners in fish tissue. Although the contribution of cPAH to total risk associated with fish and shellfish consumption is small, EPA has determined based on its evaluation that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may increase the risks to human health associated with cPAHs present in shellfish at the Site.

ED_002671A_00012956-00023

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Increasing the total PAH navigation channel RAL above 170,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): As noted above, the total PAH sediment CUL, as presented in the ROD, is 23,000 µg/kg. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, changes in total PAH RALs must be evaluated to determine the effect on attainment of RAO 5. The total PAH RAL applicable to the navigation channel of 170,000 µg/kg is well above the total PAH CUL for protection of the benthic community of 23,000 µg/kg. As a result, any evaluation in changes to the navigation channel RAL must consider the effectiveness of MNR to achieve the total PAH CUL.

As shown on proposed ESD Figure 2, the total PAH navigation channel RAL is exceeded within the navigation channel only between approximately RM 5.1 and RM 6.6. An evaluation of natural recovery processes at the Site determined that the navigation channel between RM 5 and RM 7 is generally not conducive to natural recovery. A multiple line of evidence natural recovery framework considered changes in sediment bed elevation based on two bathymetric surveys conducted in May 2003 and January 2009, the consistency in changes in sediment bed elevation based on five bathymetric surveys conducted between January 2002 and January 2009, sediment grain size, the potential for propeller wash induced erosion, the ratio of subsurface to surface sediment concentrations, and the erosion potential associated with wind and vessel wake generated waves. The results of this multiple line of evidence natural recovery framework are shown on proposed ESD Figure 7. Areas that are conducive to natural recovery are scored as +1, whereas areas where natural recovery is unlikely to be effective are scored as -1. Areas where natural recover is neither favorable nor unfavorable are scored as 0. As shown on proposed ESD Figure 7, natural recovery processes are generally unfavorable within the navigation channel between RM 5.1 and RM 6.6. As a result, increasing the navigation channel RAL above 170,000 µg/kg may limit the ability of the remedy to achieve the total PAH CUL of 23,000 µg/kg over time.

Based on its evaluation, EPA determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5). This is because the selected total PAH RAL of 170,000 µg/kg is well above the total PAH CUL and the lack of natural recovery processes within the navigation channel between RM 5 and RM 7 where the total PAH RAL is exceeded.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Increasing the total PAH nearshore RAL above 170,000 µg/kg to will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

ED_002671A_00012956-00024

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES

This section describes the significant differences between the Selected Remedy presented in the Portland Harbor ROD and the proposed changes to the Selected Remedy resulting from proposed change in sediment CULs, shellfish target tissue levels, and highly toxic PTW thresholds for carcinogenic PAHs and remedial action levels for total PAHs.

Summary of Significant Changes

EPA has considered the effect of the change in the CSF for BaP on the Selected Remedy for the Site and evaluated the effect of the changes on the ability of the remedy to attain the RAOs established in the ROD and the cost of the remedy. The following changes to the remedy are being made to the Selected Remedy and other expected outcomes from the changes are summarized below:

- Update the beach sediment CUL for cPAHs from 12 to 85 µg/kg. This sediment cleanup level is based on the recreational beach exposure scenario as described in Sections 8.1.2.3 and 8.1.4.1 of the ROD and applicable to recreational beach sediments only based upon existing or reasonably anticipated future use.
- Include a direct contact sediment CUL for cPAHs of 774 µg/kg applicable to nearshore sediments (see ROD Table 17 in Appendix A). This sediment CUL is based on the tribal fisher direct contact exposure scenario and applicable to all near nearshore sediments, except for recreational beach areas.
- Update the shellfish consumption sediment CUL for cPAHs from 39.5 to 1,076 µg/kg. This sediment CUL is based on a subsistence fisher exposure scenario and applicable to the entire Site.
- Update the target tissue level for cPAHs in shellfish tissue from 7.1 to 51.6 µg/kg. This target tissue level for shellfish is based on a subsistence fisher exposure scenario and applicable to the entire Site. Target fish tissue levels were not developed for cPAHs and are unaffected by this ESD.
- Update the highly toxic PTW threshold for cPAHs from 106,000 to 774,000 µg/kg. This PTW threshold is applicable to the entire Site.
- Update the total PAH RAL applicable to sediments outside the navigation channel from 13,000 to 30,000 µg/kg.
- For beaches where recreational use is possible based on existing and reasonably anticipated land use and any sediment CULs are significantly exceeded, signage or other educational institutional controls may be used until CULs are achieved.

All other elements of the Selected Remedy remain unchanged, including the surface water and groundwater CULs, total PAH sediment CULs, and total PAH RALs applicable to navigation channel sediments. EPA has determined that these changes will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by

ED_002671A_00012956-00025

approximately $35 million. A discussion of changes in scope, performance, and cost is summarized below.

SMA Footprint Changes

Revising the remedial action level for total PAHs from 13,000 to 30,000 µg/kg results in a change to the remedial footprint for the Selected Remedy as depicted on proposed ESD Figure 8. Although this change is based solely on PAHs, post-construction concentrations and risk estimates for other COCs at the Site are also affected. Changes are limited to areas where cleanup is driven solely by PAHs and includes Terminal 4, the west side of the Willamette River between RM 4 and RM 7, the upper portion of Swan Island Lagoon, and the east side of the Willamette River between RM 2.5 and RM 3. The amount of PTW addressed by the remedy is unchanged.

RAO Evaluation

Sediment RAOs

RAO 1 (Human Health Direct Contact): The changes in post-construction risk estimates resulting from this change are presented in proposed ESD Table 2 and on proposed ESD Figures 9a through 9c. RAO 1 post-construction risk estimates are presented on a ½ rolling river mile basis. For RAO 1, direct contact risk, the greatest change in the post-construction risk, occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 6×10^{-7} to 1×10^{-6}, whereas at RM 4.5 East, post-construction risks are estimated to increase from 2×10^{-6} to 3×10^{-6}. Because direct contact non-cancer risk is acceptable, changes in non-cancer hazard indices were not calculated.

RAO 2 (Human Health Shellfish Ingestion): The changes in post-construction risk estimates are presented in proposed ESD Table 3 and on proposed ESD Figures 10a through 10l. RAO 2 post-construction risk estimates are presented on a rolling river mile basis. For RAO 2, shellfish consumption risk, the greatest change in the post-construction risk occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 2×10^{-5} to 4×10^{-5}, whereas at RM 4.5 East, post-construction risks are estimated to increase from 8×10^{-5} to 1×10^{-4}. Post-construction non-cancer hazard indices quotients also increase. The largest estimated hazard index increases are from 0.8 to 1.7 for a child and from 25 to 48 for an infant at RM 6.5.

RAO 5 (Benthic Organisms): The changes in post-construction benthic risk estimates are presented in proposed ESD Table 4. For RAO 5, revising the total PAH RAL will reduce the percentage of the Site achieving 10 times the benthic risk CULs from 72% to 69% of the Site following construction.

ED_002671A_00012956-00026

RAO 6 (Fish and Wildlife Prey Consumption): The changes in post-construction fish and wildlife prey consumption are presented on a sediment decision unit (SDU) basis in proposed ESD Table 5 and on proposed ESD Figure 11. The maximum changes were observed in SDU 4.5 East and SDU 6 West. The total hazard index increased from 1.2 to 1.5 for both SDU 4.5 East and SDU 6 West.

Surface Water and Groundwater RAOs

RAOs 3 and 7 (Human Health and Aquatic Life Surface Water): The changes in post-construction reductions in surface water concentration are summarized in proposed ESD Table 6. Reductions in surface water concentrations associated with the Selected Remedy were estimated in the ROD to range between 26% and 91%, depending on the chemical following construction. Revised reductions are expected to range between 25% and 91%, depending on the chemical following construction. In all cases, changes in the reduction in surface water concentrations are 1% or less. For example, reductions in cPAH surface water concentrations were estimated as 78% for the Selected Remedy. Based on the changes to the Selected Remedy, the reduction in cPAH surface water concentrations is estimated as 77%. It is estimated that all surface water COC concentrations will be reduced to 10 times the CULs. Consistent with the ROD, it is expected that CULs (both risk-based and ARAR-based surface water levels) will be achieved over time through a combination of in-river cleanup with source control actions within the Site and actions taken to address toxic media within the watershed.

RAOs 4 and 8 (Human Health and Aquatic Life Groundwater): The area of groundwater plumes addressed by the in-water portion of the updated remedy following construction is estimated to be reduced from 39% to 32% as shown in proposed ESD Table 7. Consistent with the ROD, the remainder of the contaminated groundwater will be dependent on the adequacy of source control actions.

River Banks and Principal Threat Waste

ROD riverbanks with adjacent offshore active remediation areas that have been reduced or removed by the proposed ESD changes have been identified and removed from the selected remedy cost estimate for the purpose of capturing potential cost changes. Actual costs will be determined based on remedial design. The lineal feet of river bank addressed by the updated remedy is estimated to be reduced from 23,305 to 22,592 lineal feet as shown on proposed ESD Table 8 and Figure 12. This represents a reduction from 78% to 75% of contaminated river banks. It is important to note that ROD river banks with no active remediation offshore must still undergo characterization of riverbank CULs and potential active remediation for focused COC's exceeding RALs and/or presence of PTW. Also, consistent with the ROD, the remaining river bank areas are expected to be addressed through other cleanup actions (i.e., upland source control measures).

No change to the amount of PTW addressed by the updated remedy is expected.

ED_002671A_00012956-00027

Human Health Beach Exposure

In addition to changes in post construction risk, changes in the results of the human risk assessment associated with the change in the CSF for BaP were also evaluated for the human health direct contact beach exposure scenario. Beach areas at the Portland Harbor site were evaluated for dockworkers, transients, recreational beach users and tribal, high frequency and low frequency fishers. The evaluation focused on the exposure scenario that presents the maximum risk for each beach area (tribal fisher or dockworker). The evaluation shows that human health beach exposure risk estimates decline between 0 and 86% depending on the contribution of cPAHs to the total risk at each beach area. The results of this evaluation are shown in proposed ESD Table 9 and Figure 13.

Remedial Quantities and Cost

EPA evaluated the changes in remedial quantities and cost associated with changing the total PAH RAL applicable to nearshore sediments outside the navigation channel. The revised remedial footprint including technology assignments is presented in Figure 14a – f. EPA determined that this change would reduce the total nearshore remedial footprint by 17 acres, reduce the capping area by 8 acres, and reduce the dredging volume by 43,800 cy. This results in a decrease in the present value cost for the Selected Remedy of approximately $35 million. This represents a 3.4% decrease in the overall present value cost of the Selected Remedy. Cost assumptions are included in Appendix A.

5.0 SUPPORT AGENCY COMMENTS

DEQ has reviewed and agrees to the modifications to the CULs for cPAH (BaPeq) and RALs for total PAHs for the Selected Remedy. The support agency letter of concurrence is included in Appendix C of this proposed ESD.

The Five Tribes support EPA's approach regarding updating CULs for cPAH (BaPeq) and RALs for total PAHs in response to the BaP revision in a proposed ESD. The Five Tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon. The letter of concurrence is included in Appendix D of this proposed ESD.

6.0 STATUTORY DETERMINATIONS

The Selected Remedy for the Portland Harbor Superfund Site, as modified by this proposed ESD, continues to satisfy the statutory requirements of CERCLA §121, 43 USC 9621 to protect human health and the environment, comply with federal and state requirements that are

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applicable or relevant and appropriate to the remedial action, are cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

7.0 PUBLIC PARTICIPATION COMPLIANCE

The public participation requirements set out in the NCP, 40 CFR §300.435(c)(2), have been met by adding the ESD and supporting information to the administrative record established under §300.815. EPA will publish a notice that briefly summarizes the final ESD, including the reasons for such differences in a major local newspaper of general circulation. EPA also recognized that there is strong community interest in the Portland Harbor Superfund Site and that there was a need for additional public participation opportunities regarding the proposed ESD. As a result, the proposed ESD and supporting administrative record were made available to the public through a 30-day public comment period. In addition, EPA held a public meeting to discuss the changes to the Selected Remedy in the proposed ESD.

8.0 REFERENCES

Environmental Protection Agency (EPA). 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002. December.

EPA. 2016a. *Final Remedial Investigation Report, Portland Harbor Remedial Investigation/Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. February 8.

EPA. 2016b. *Draft Final Portland Harbor Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. June.

EPA. 2017a. *Record of Decision for the Portland Harbor Superfund Site*, Portland, Oregon. January 3.

EPA. 2017b. *Toxicological Review of Benzo[a]pyrene*. Integrated Risk Information System, National Center for Environmental Assessment, Office of Research and Development. Washington, DC. January 19.

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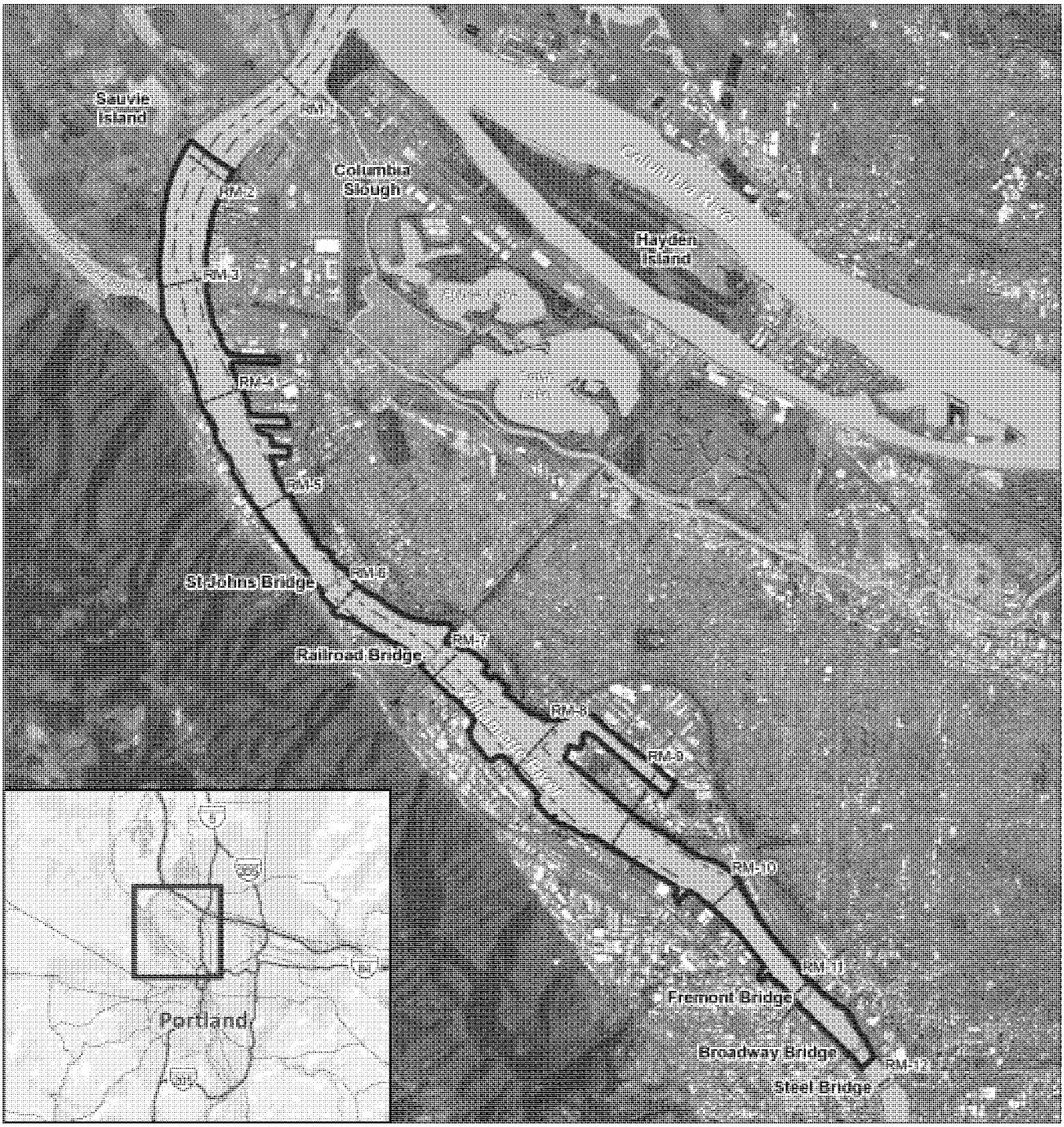
Figures



LEGEND

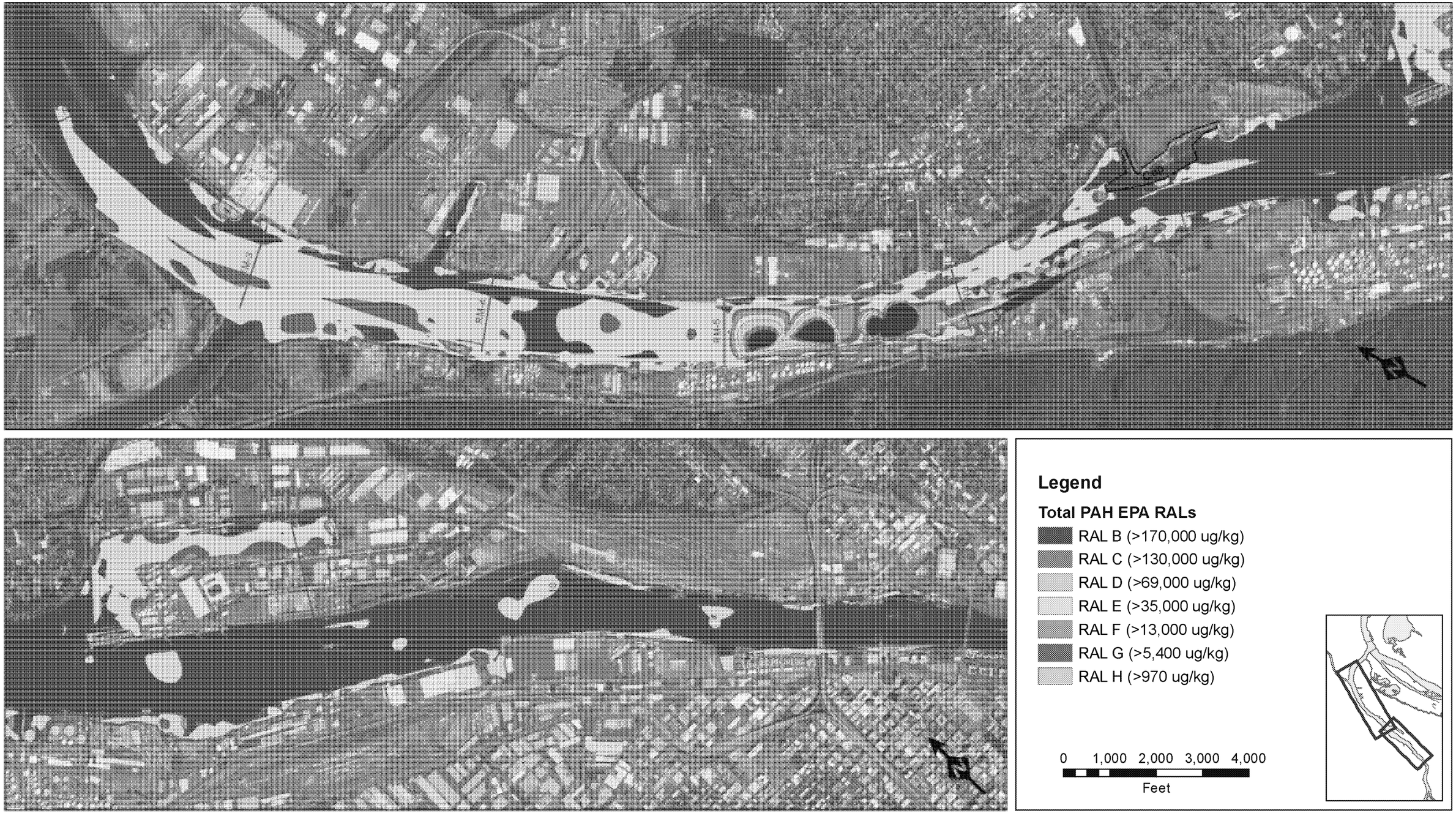
- Portland Harbor Study Area
- River miles
- Navigation Channel

N

Miles
0 0.3 0.6 0.9 1.2

ESD Figure 1. Site Area

Portland Harbor Superfund Site



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ESD Figure 2. Total PAH Remedial Action Level Contours

Portland Harbor Superfund Site

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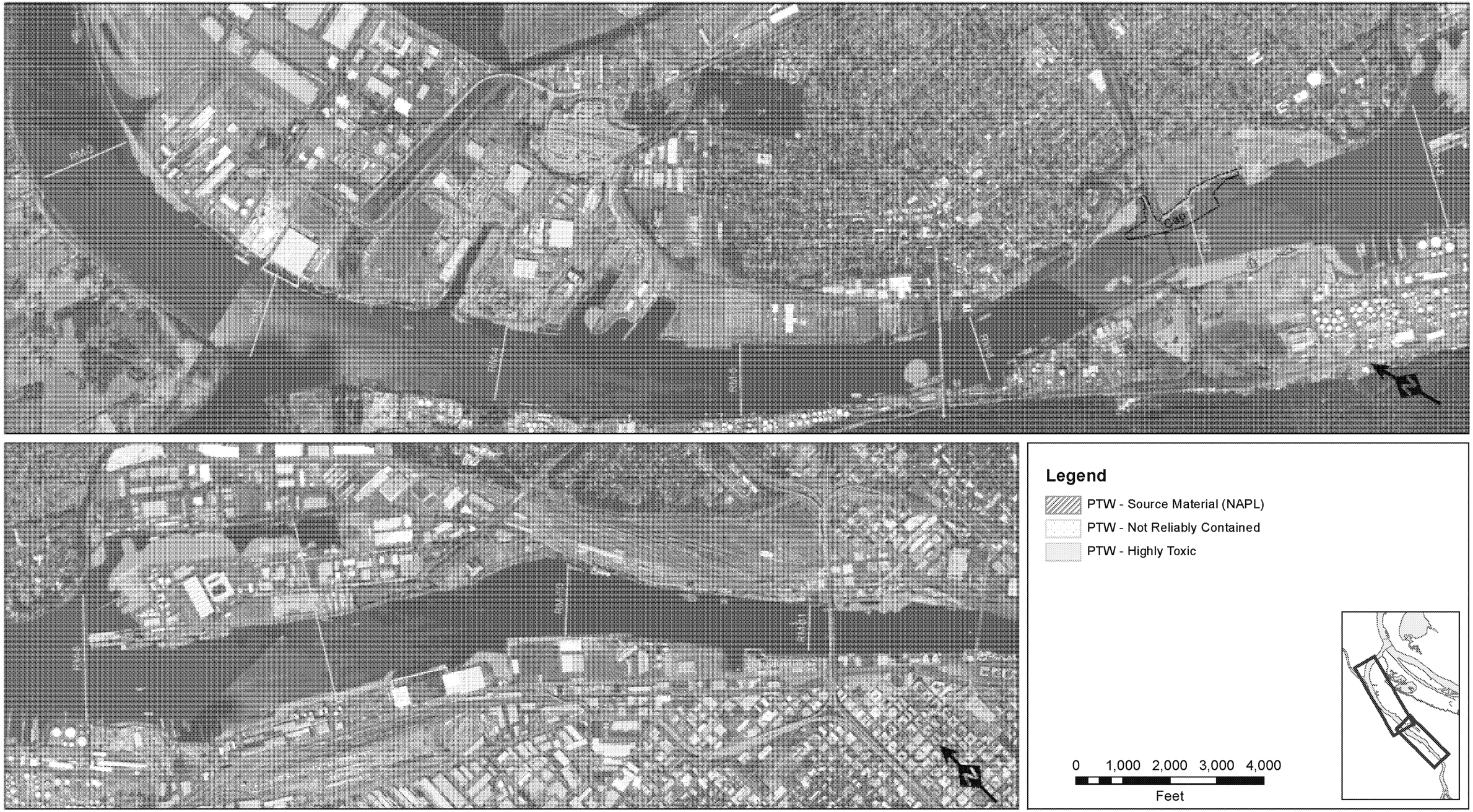
Date: 3/20/2018



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ESD Figure 3. Principal Threat Waste

Portland Harbor Superfund Site

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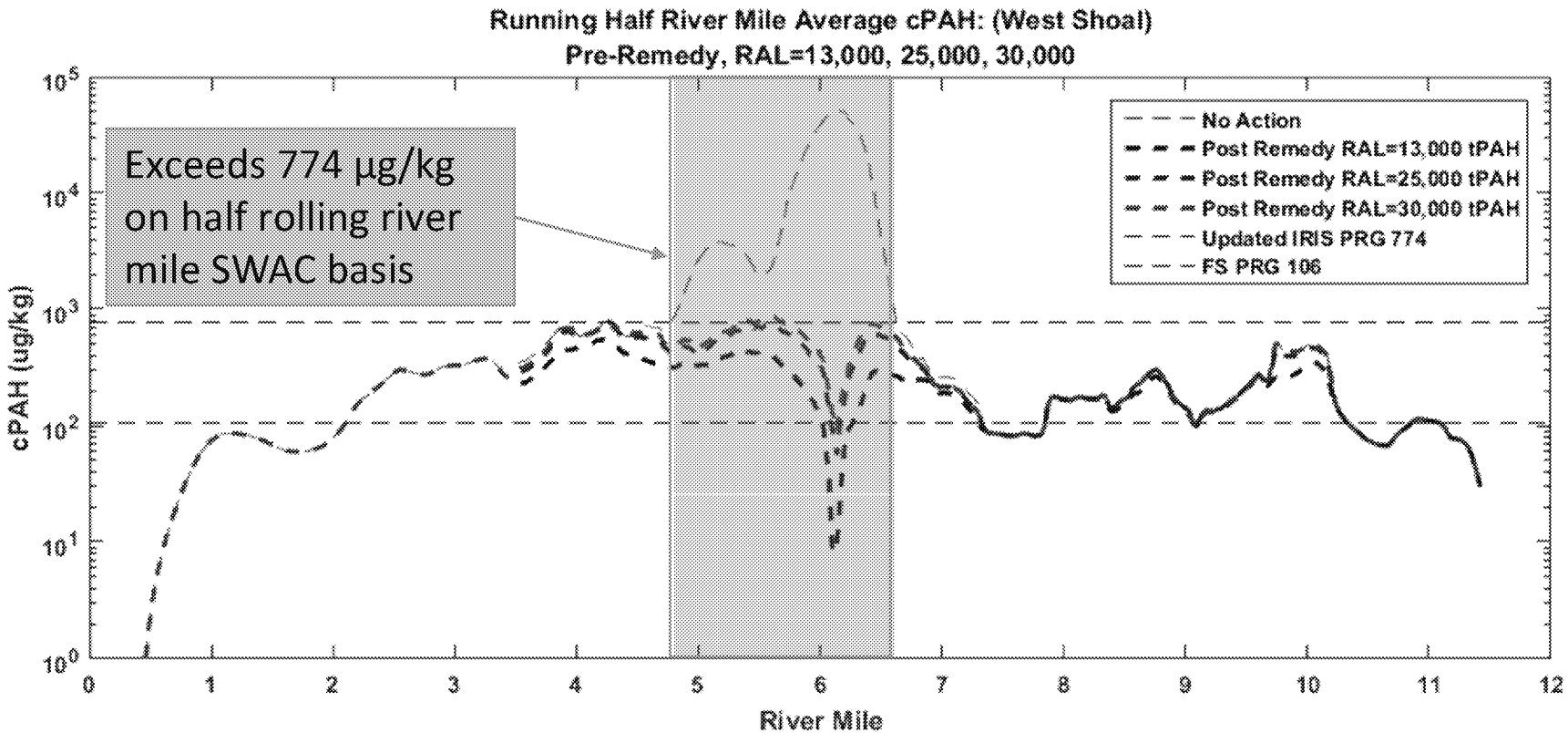
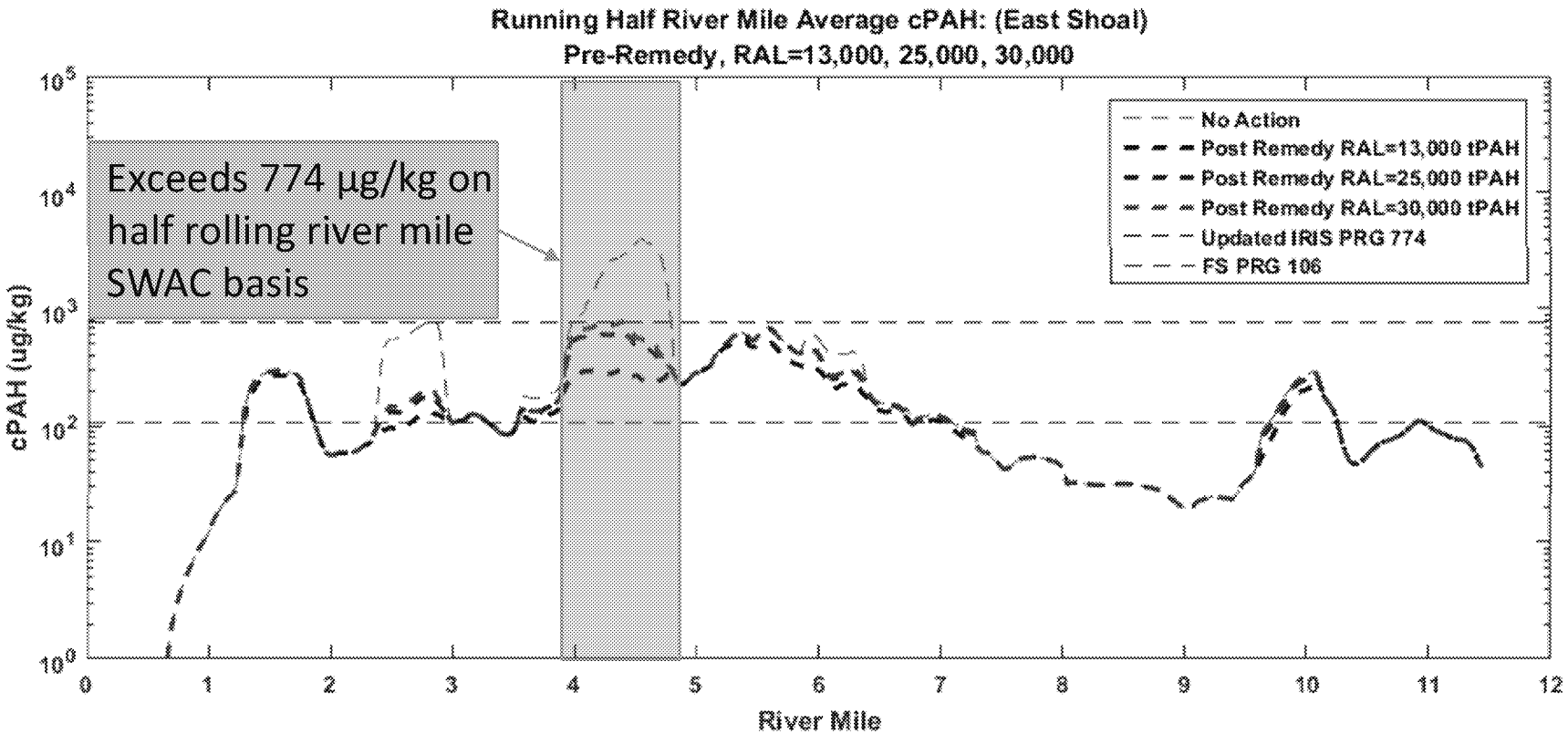


Note: cPAH half rolling river mile SWAC was estimated assuming cleanup above tPAH RAL for each scenario

ESD Figure 4a. Running Half Mile Average cPAH (West)

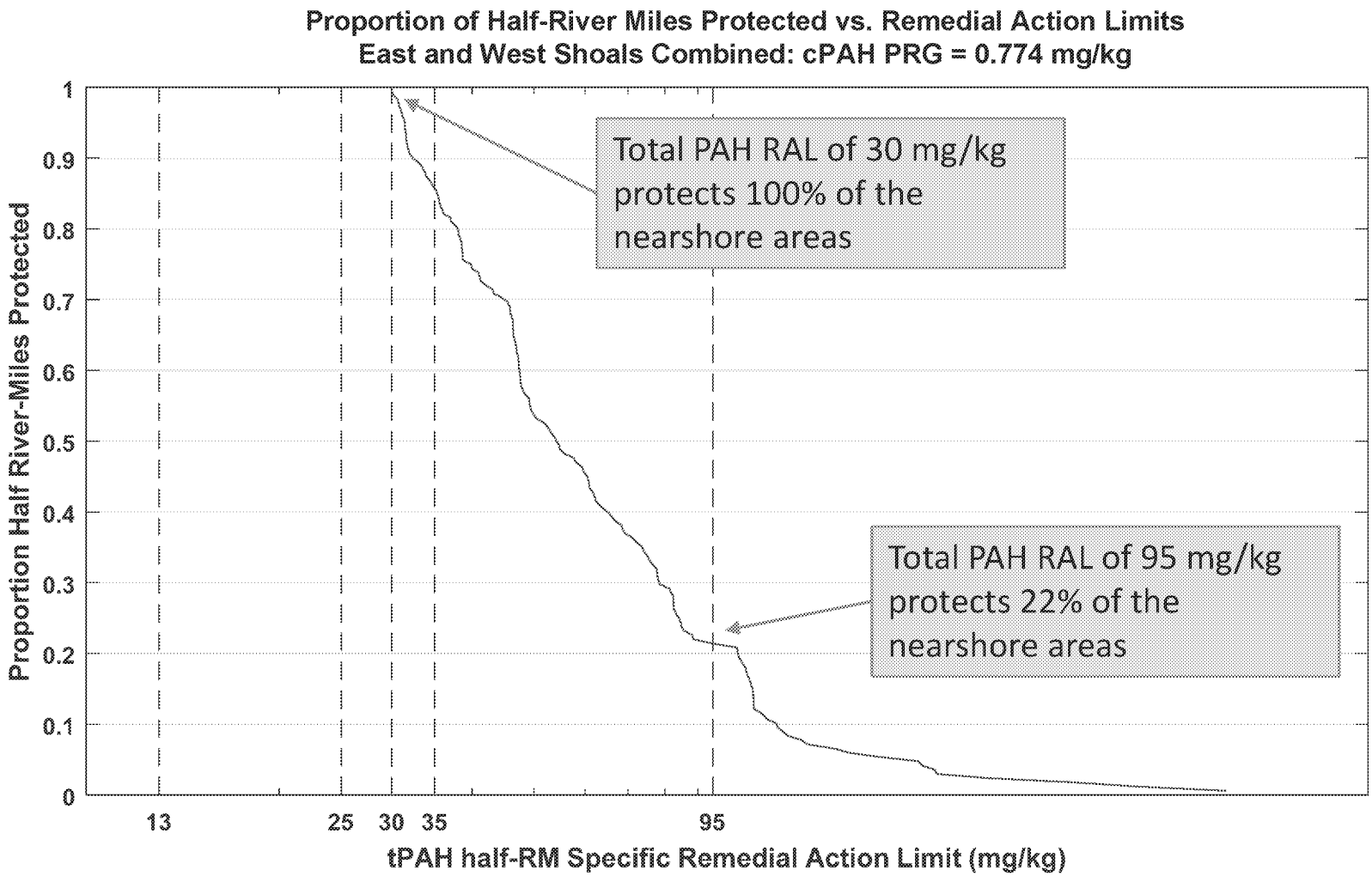
Portland Harbor Superfund Site



Note: cPAH half rolling river mile SWAC was estimated assuming cleanup above tPAH RAL for each scenario

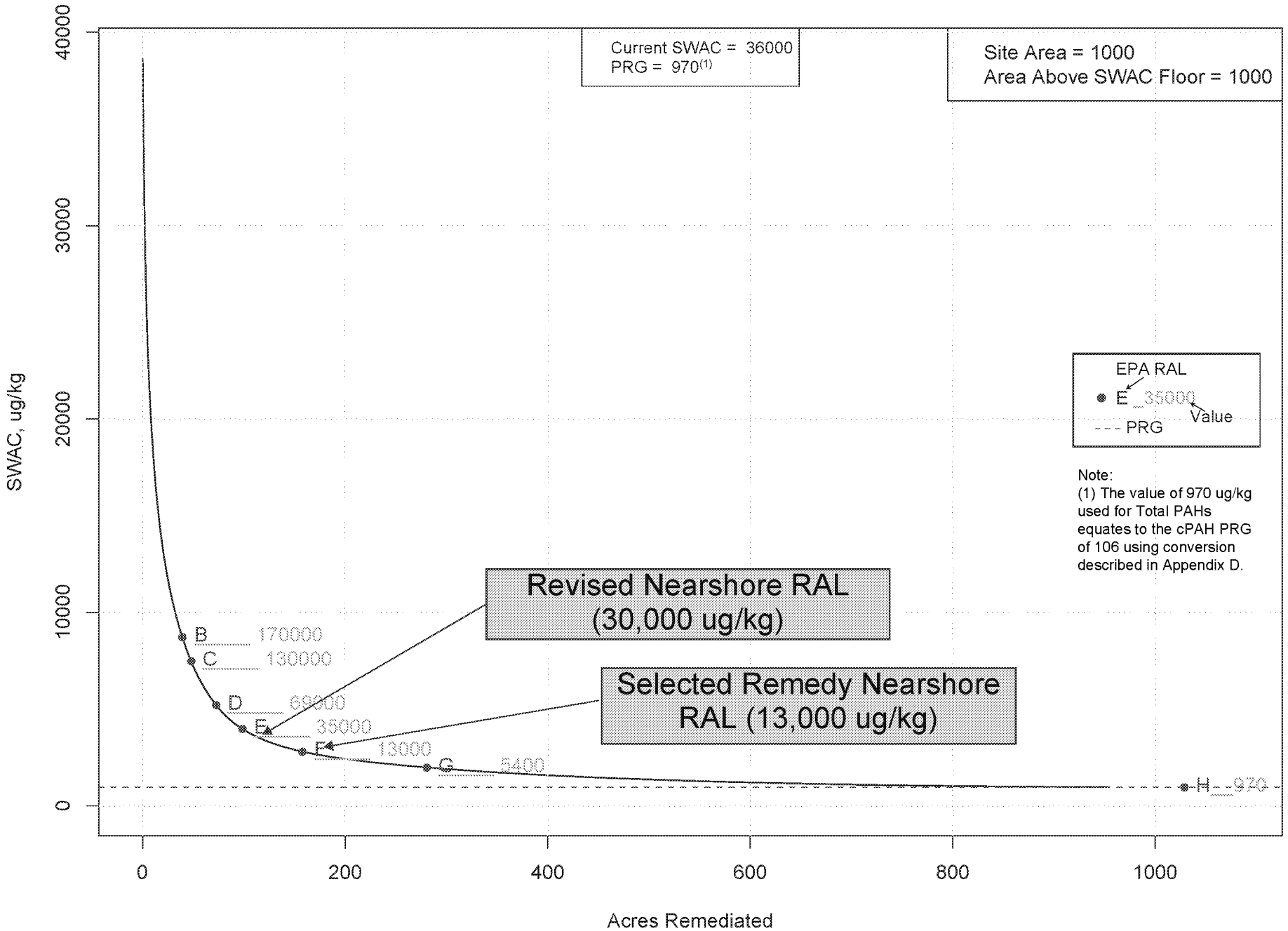
ESD Figure 4b. Running Half Mile Average cPAH (East)

Portland Harbor Superfund Site



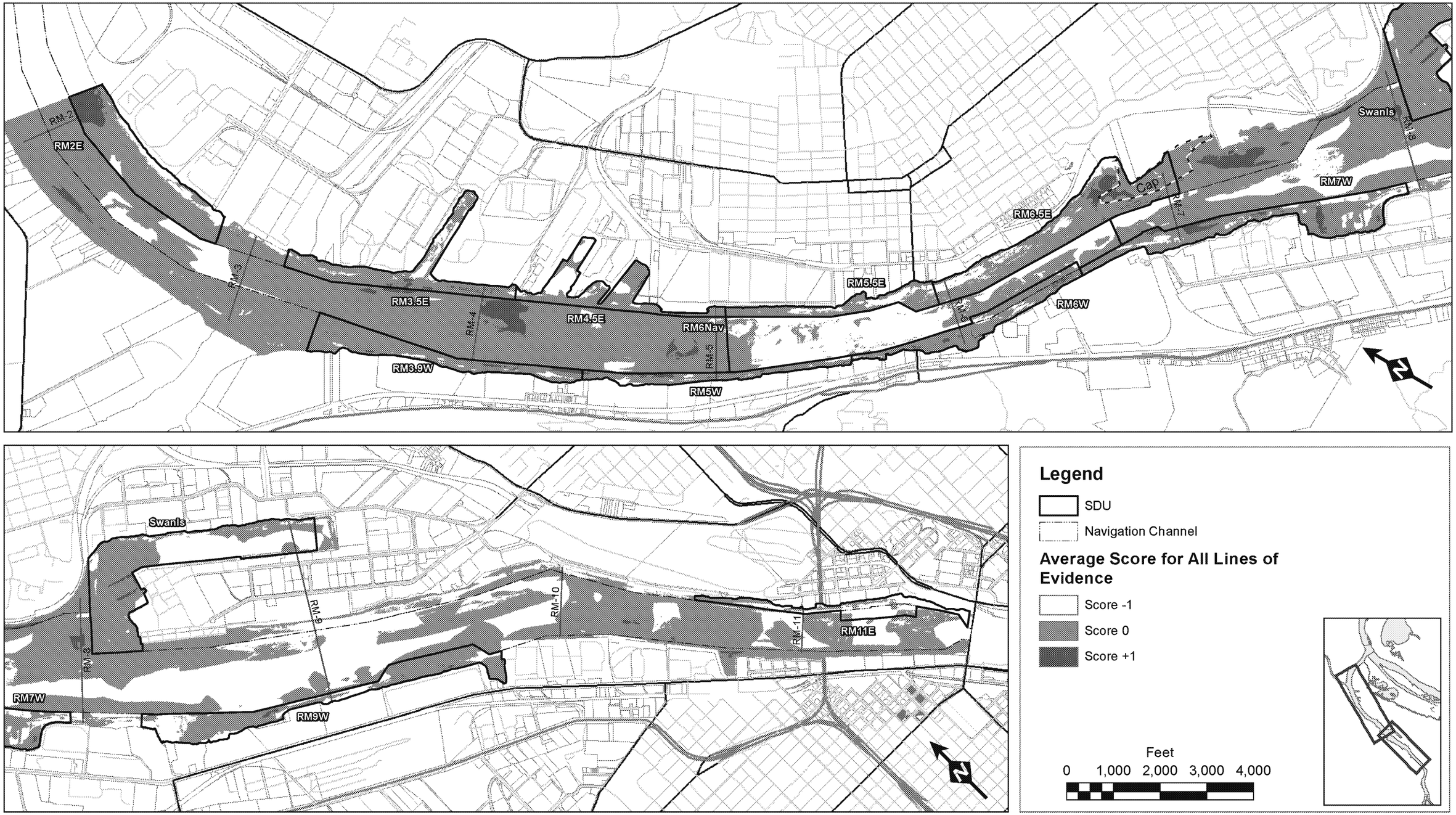
ESD Figure 5. Proportion of Half-River Miles Protected vs. Remedial Action Levels

Portland Harbor Superfund Site



ESD Figure 6. Total PAH RAL Curve

Portland Harbor Superfund Site



ESD Figure 7. Natural Recovery Summary Score

Portland Harbor Superfund Site

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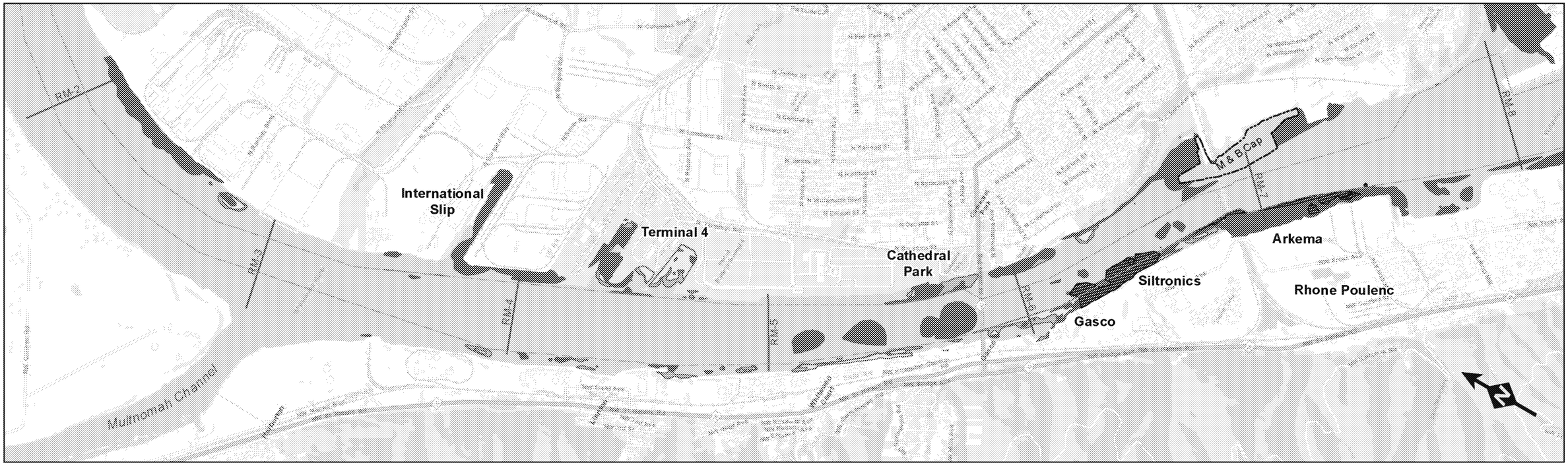
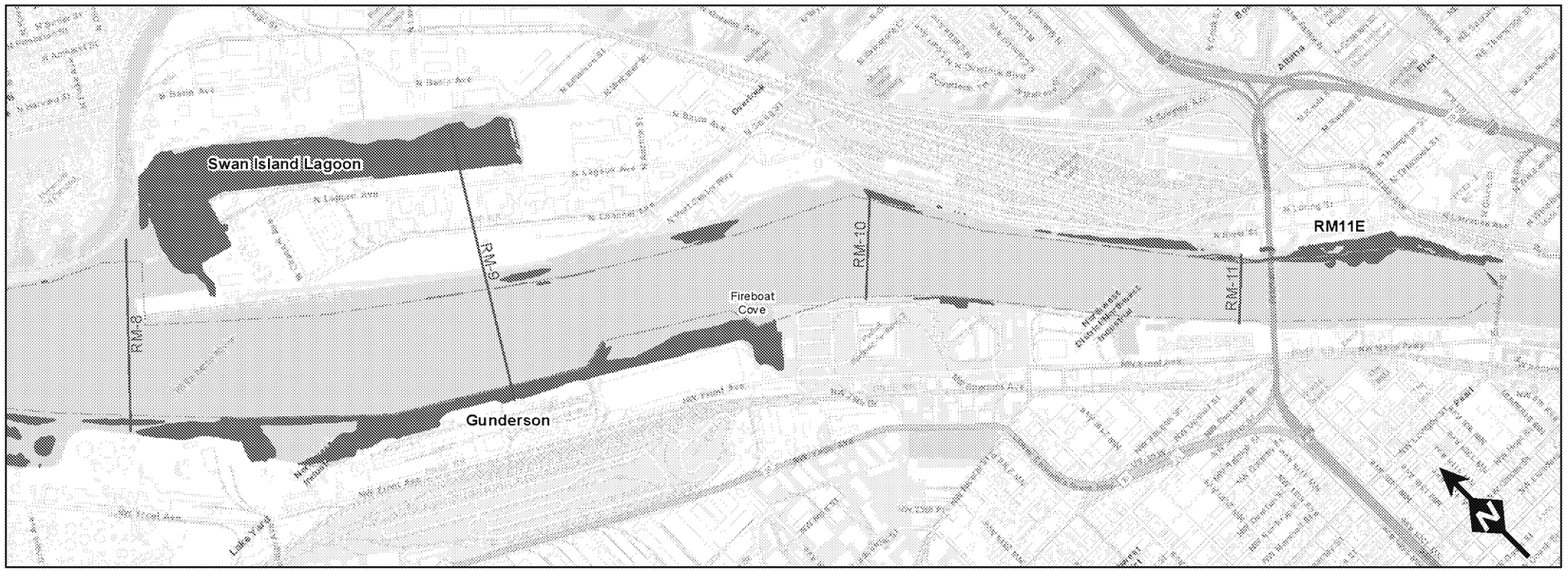
Date: 5/23/2016

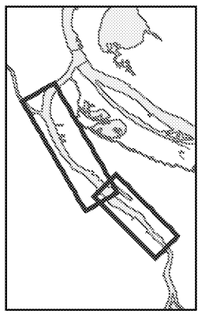




Legend

- Remedial footprint for focused COCs other than PAHs (including PTW)
- Remedial footprint for PAHs in Nearshore Area – 30 mg/kg RAL
- Remedial footprint for PAHs in Nearshore Area – 13 mg/kg RAL
- Remedial Footprint for PAHs in Navigation Channel – 170 mg/kg RAL
- PTW (NRC/NAPL)
- Navigation Channel

0 1,000 2,000 3,000 4,000
Feet



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ESD Figure 8. Revised Remedial Footprint Summary

Portland Harbor Superfund Site

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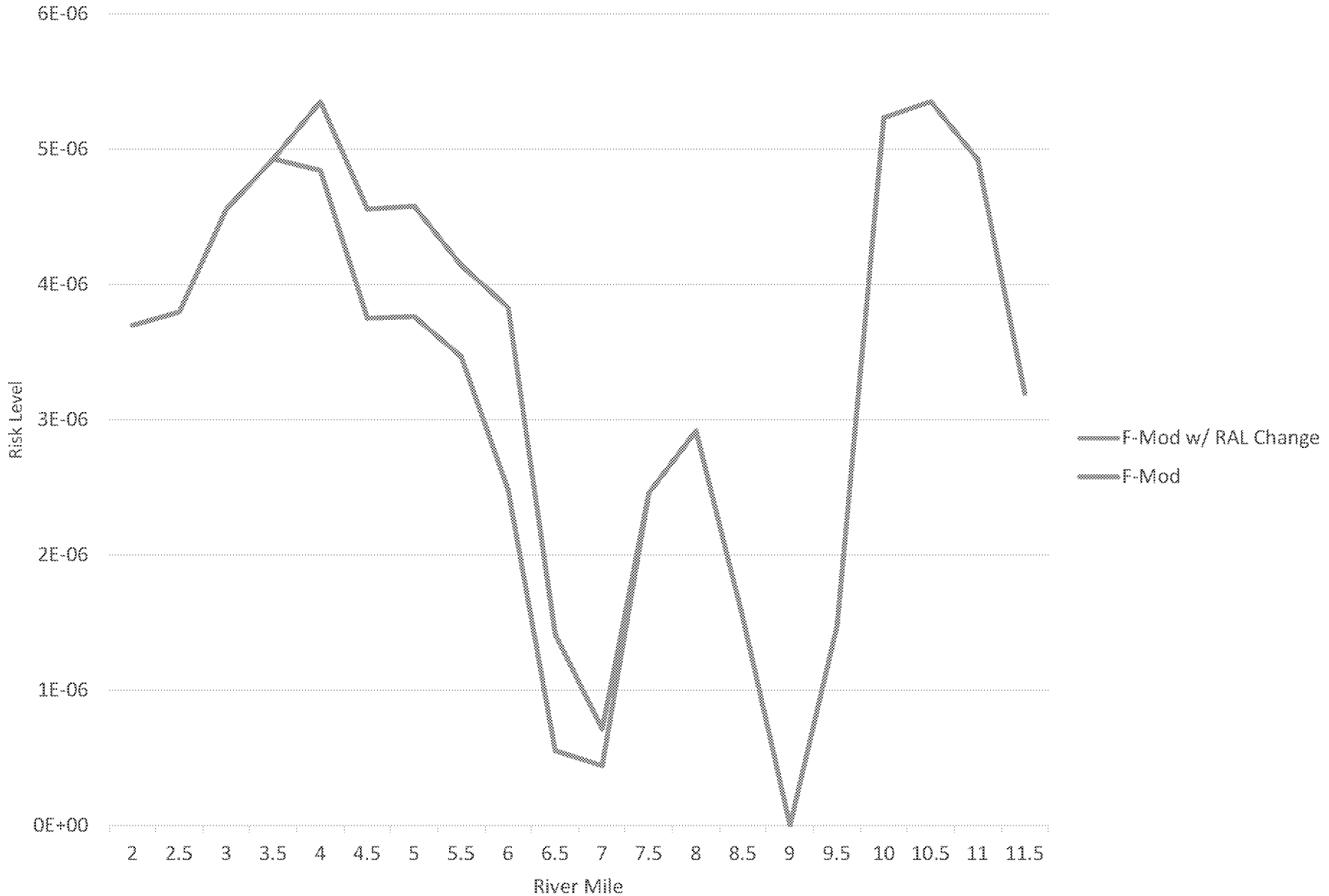
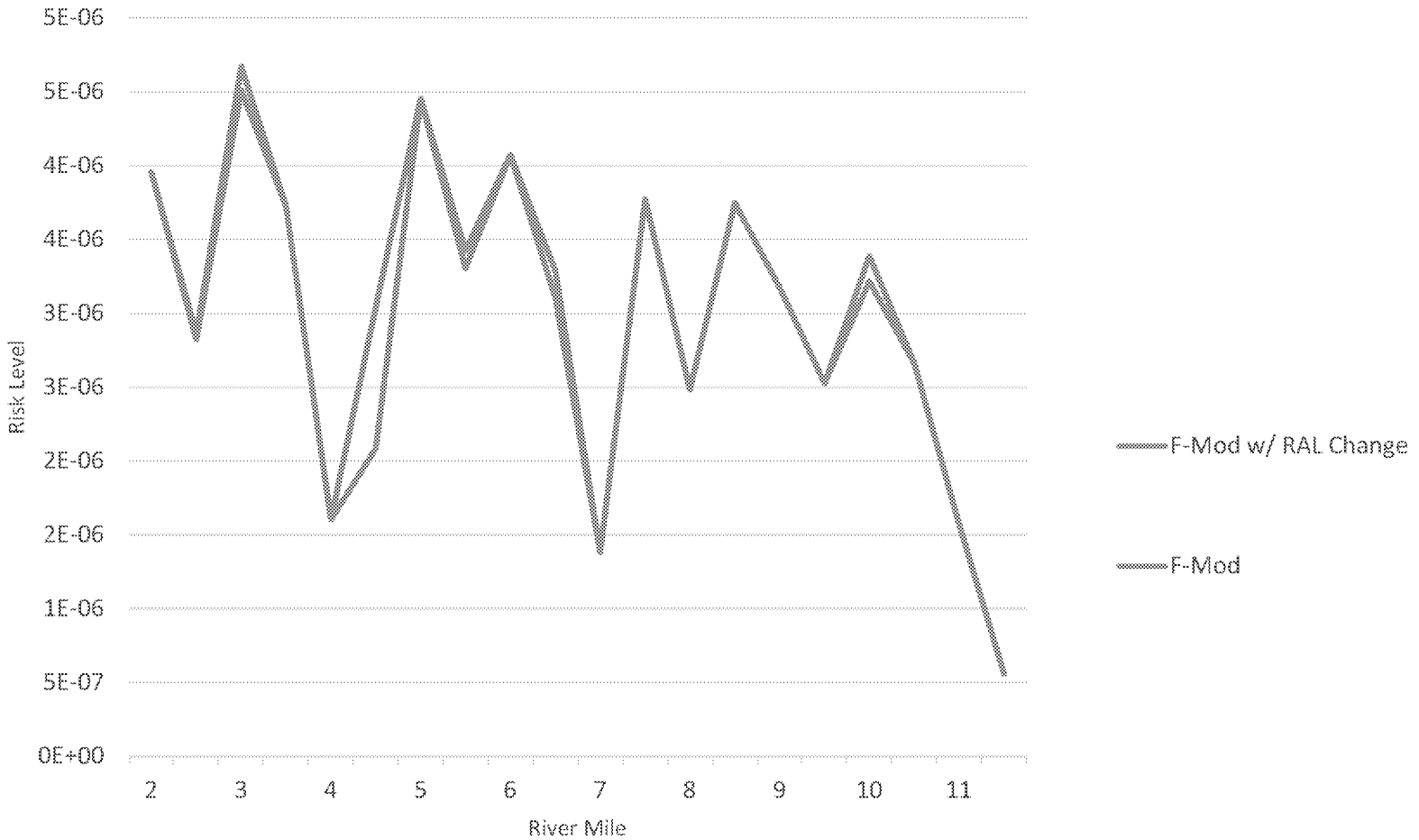


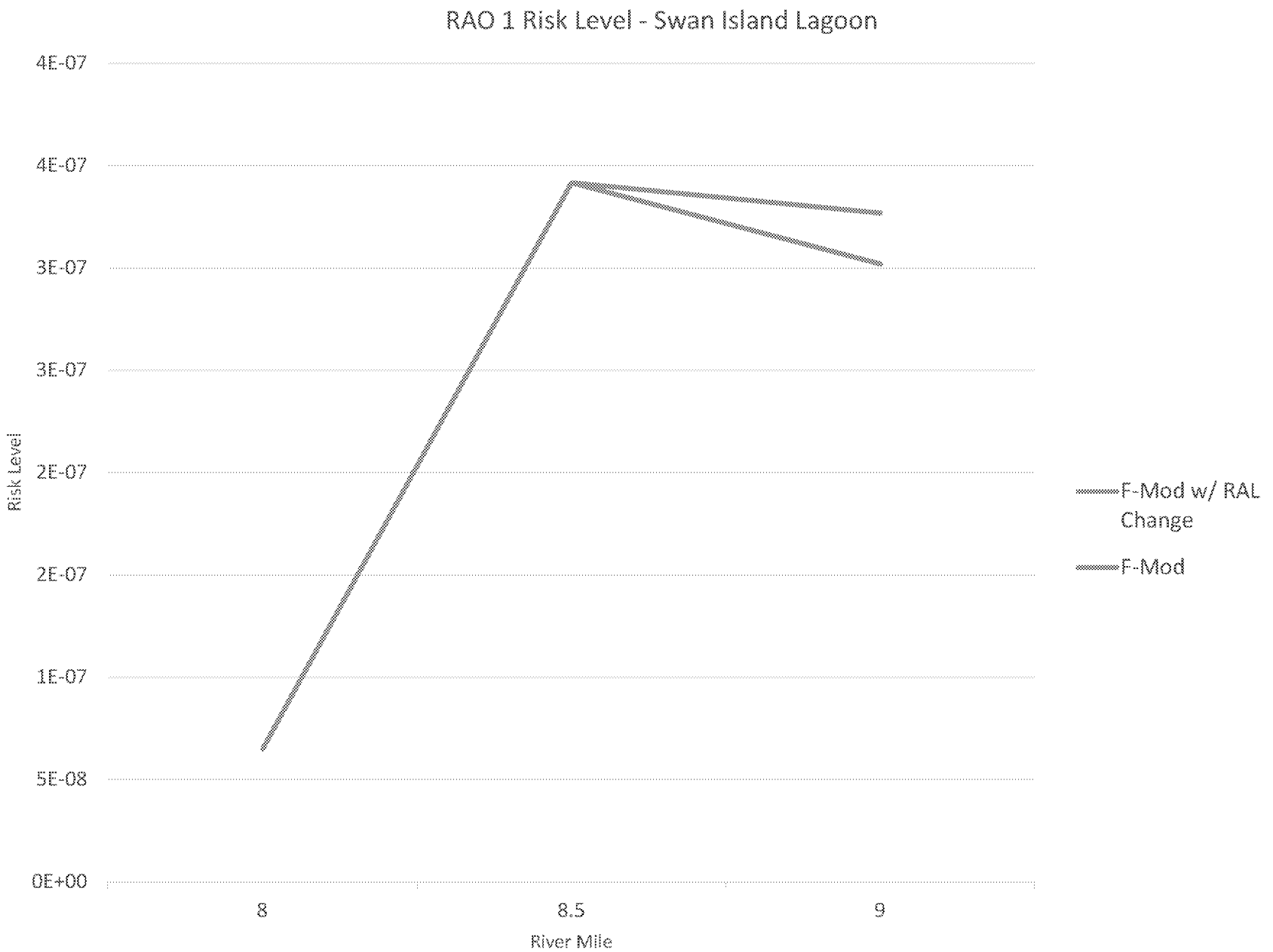
ESD Figure 9a. RAO 1 Risk Level - RM Basis (West)

Portland Harbor Superfund Site



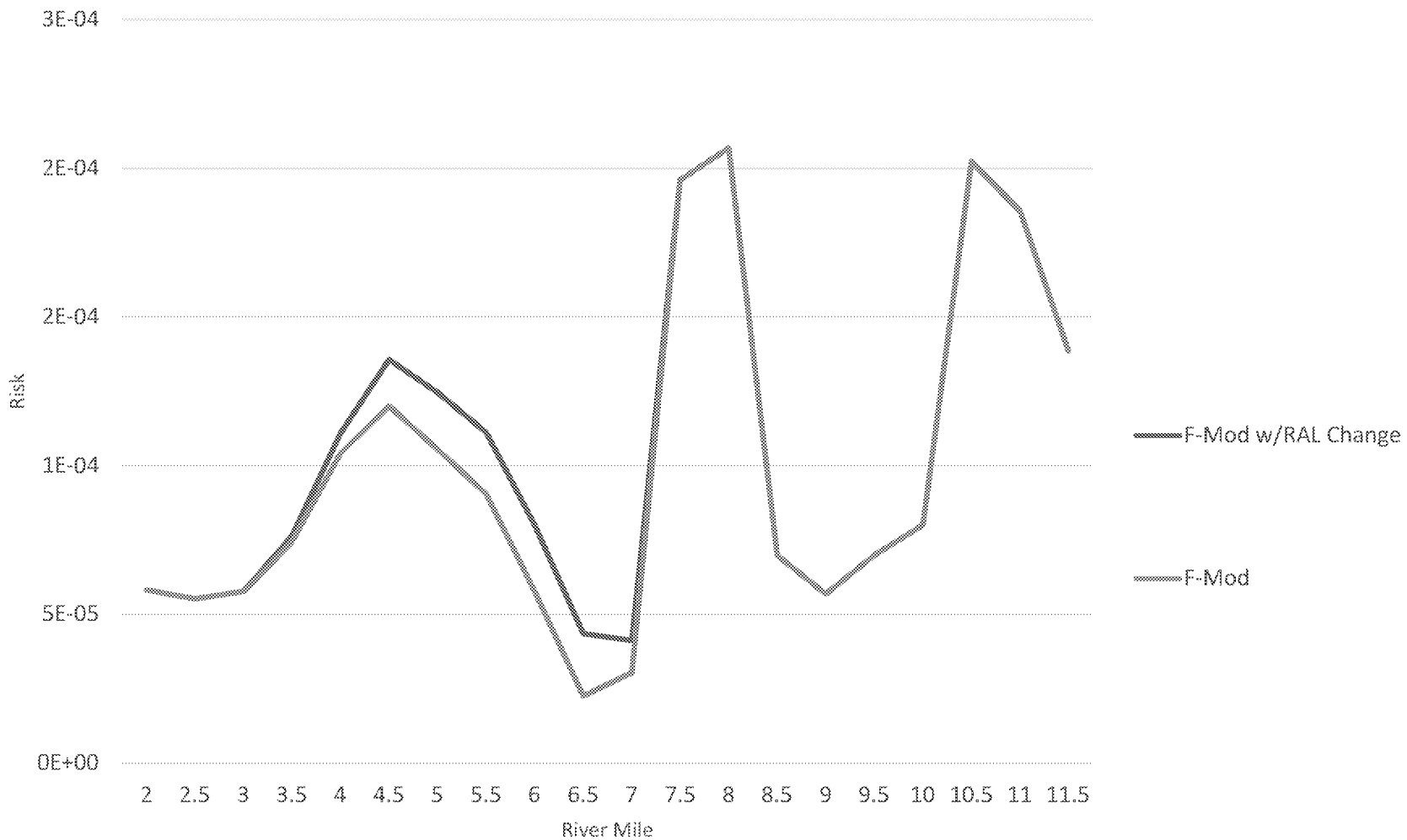
ESD Figure 9b. RAO 1 Risk Level - RM Basis (East)

Portland Harbor Superfund Site



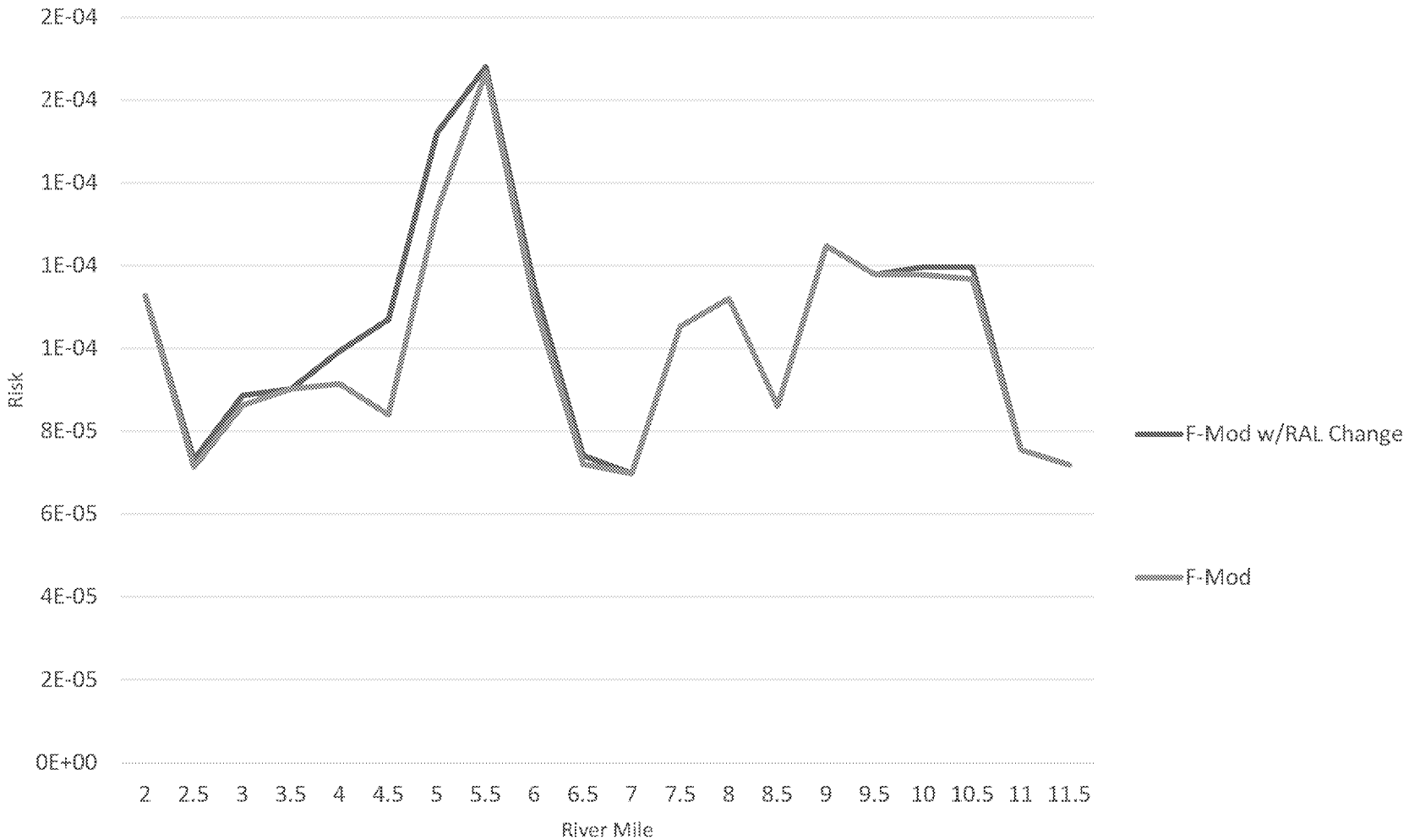
ESD Figure 9c. RAO 1 Risk Level - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



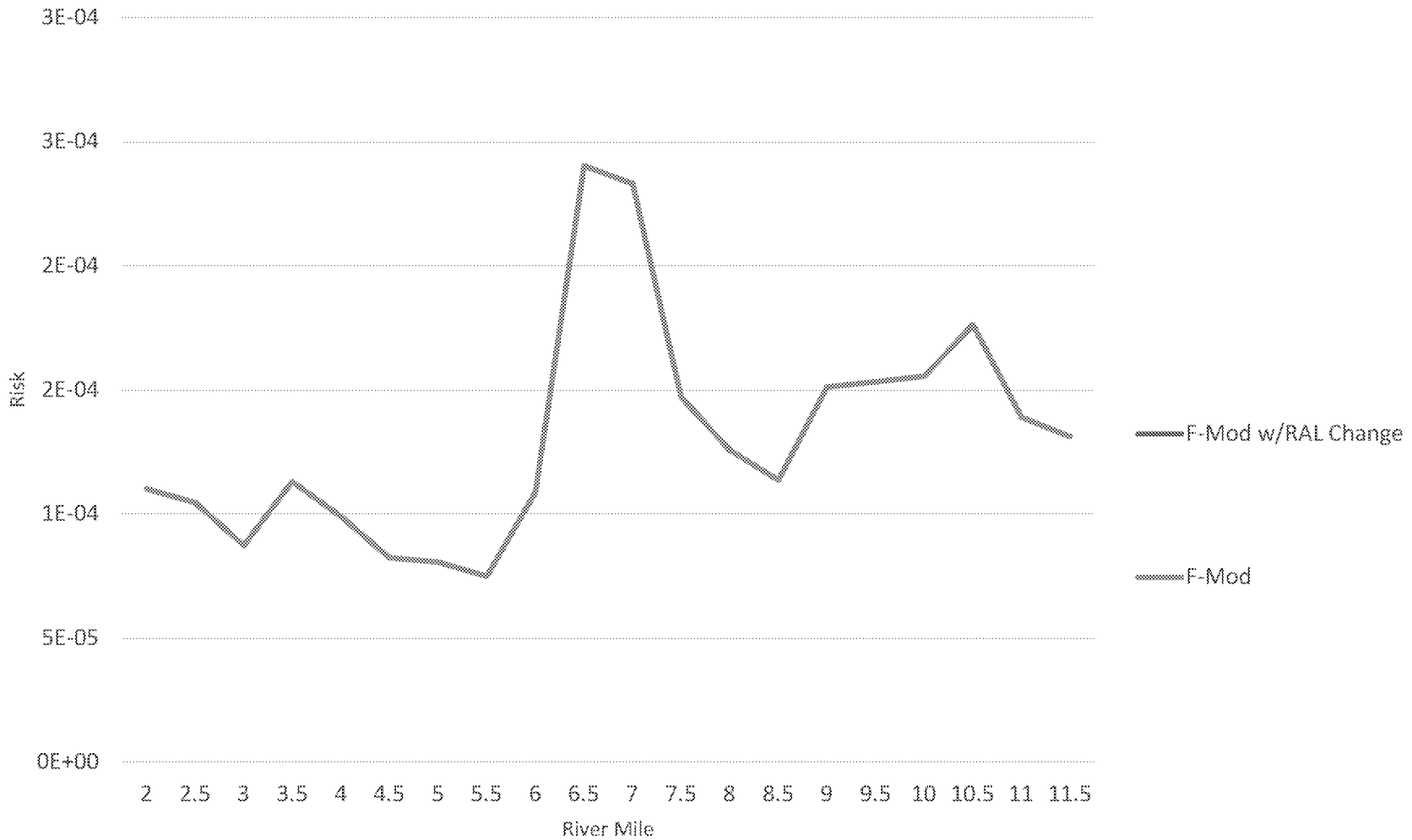
ESD Figure 10a. RAO 2 Risk Level - RM Basis (West)

Portland Harbor Superfund Site



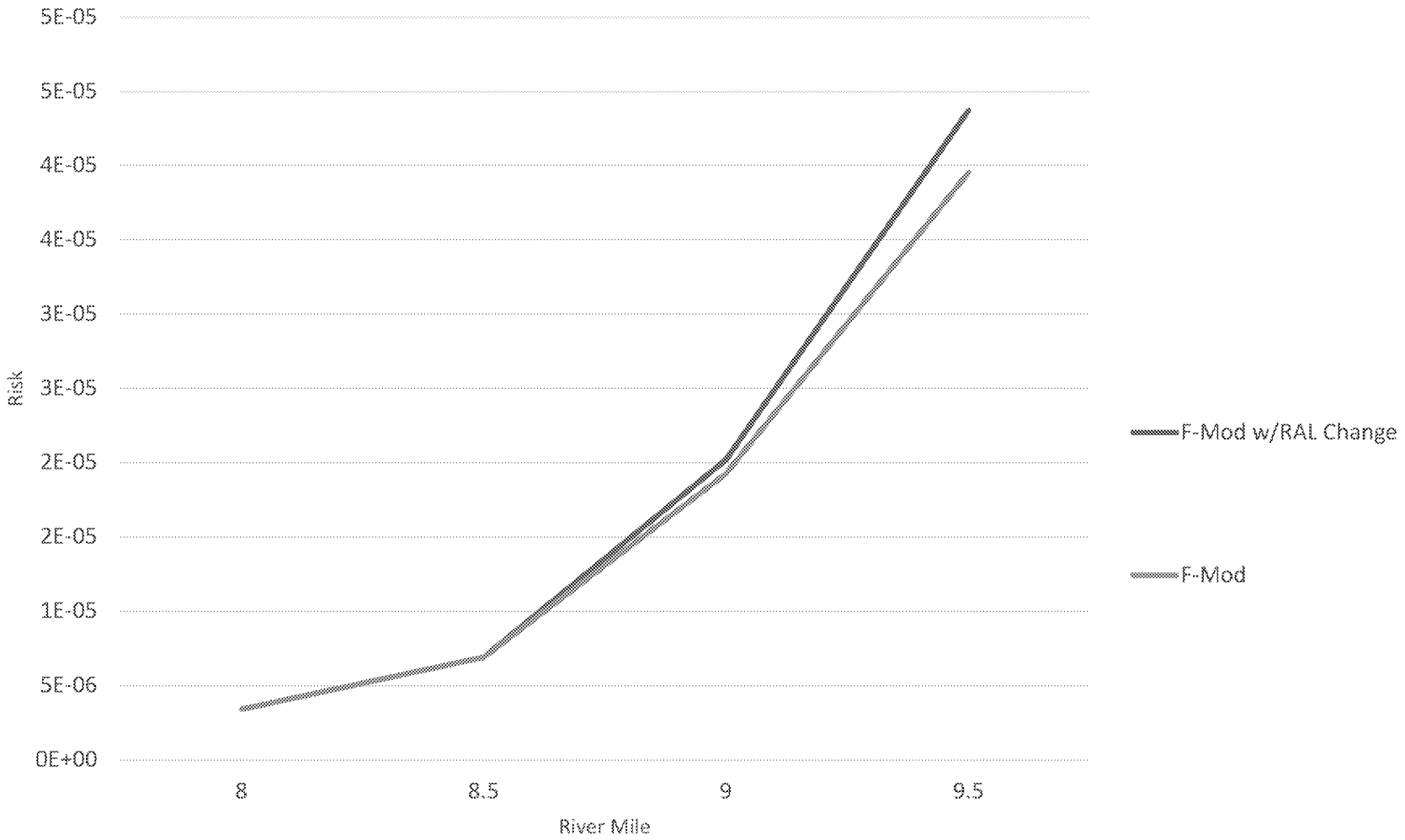
ESD Figure 10b. RAO 2 Risk Level - RM Basis (East)

Portland Harbor Superfund Site



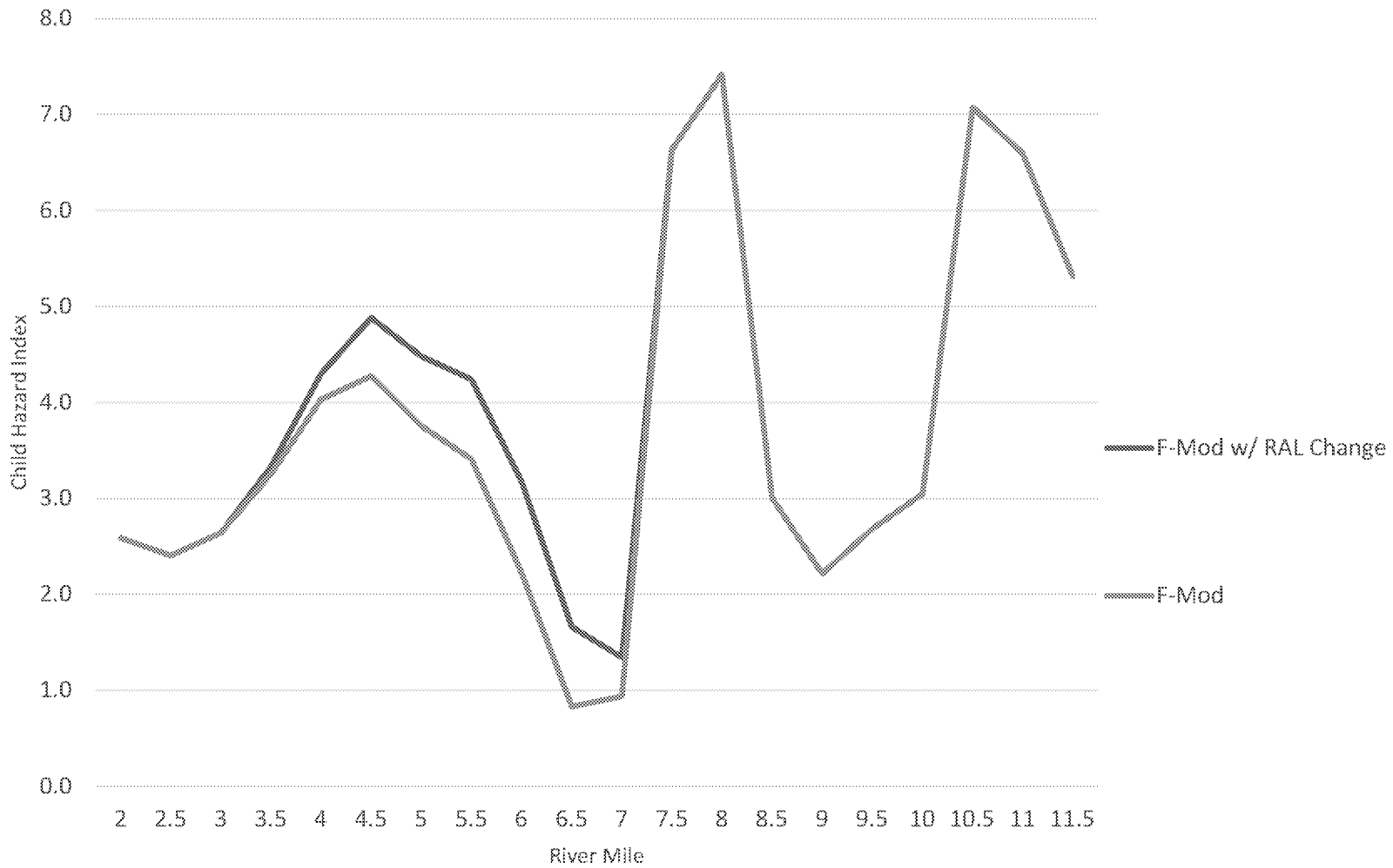
ESD Figure 10c. RAO 2 Risk Level - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



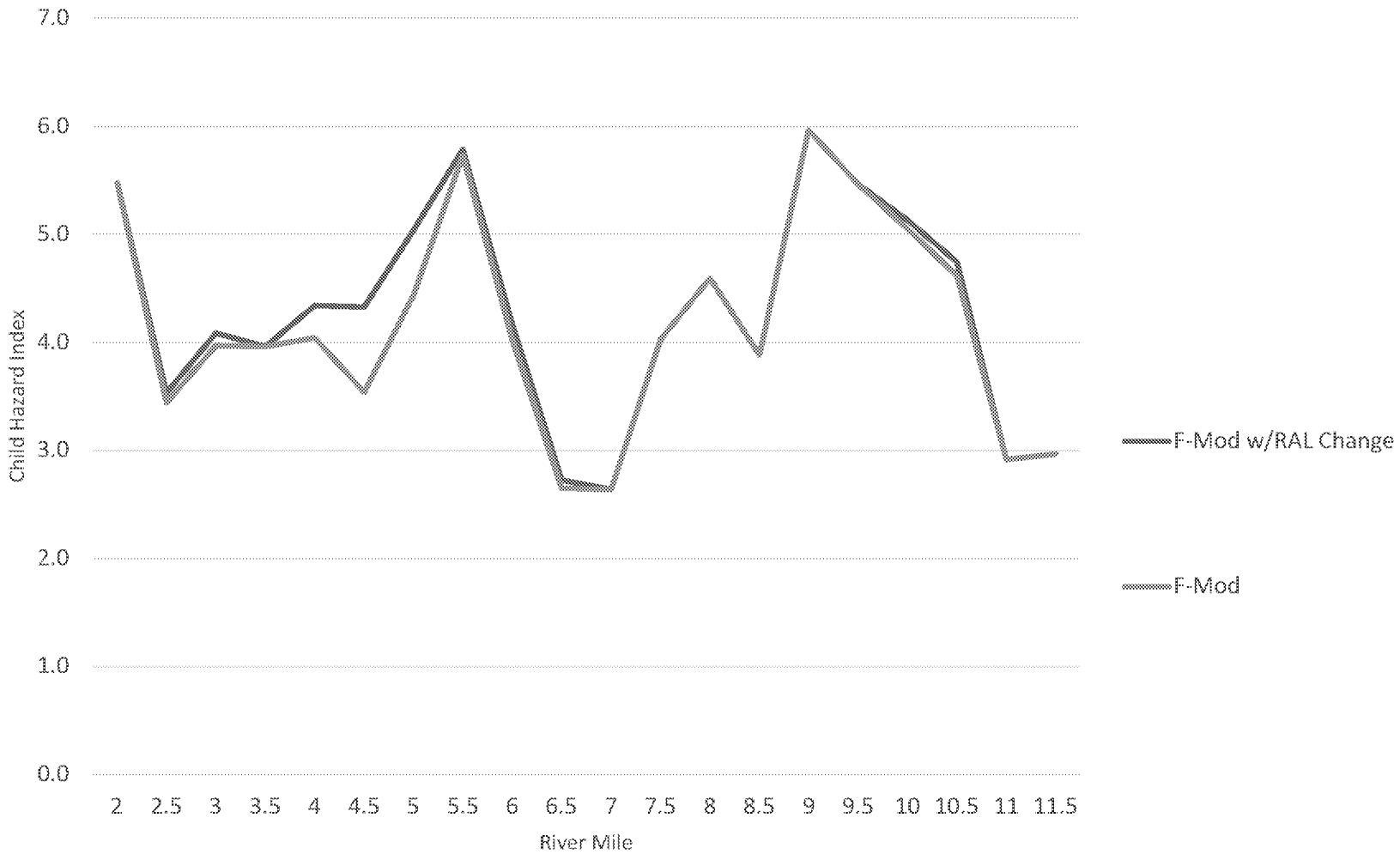
ESD Figure 10d. RAO 2 Risk Level - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



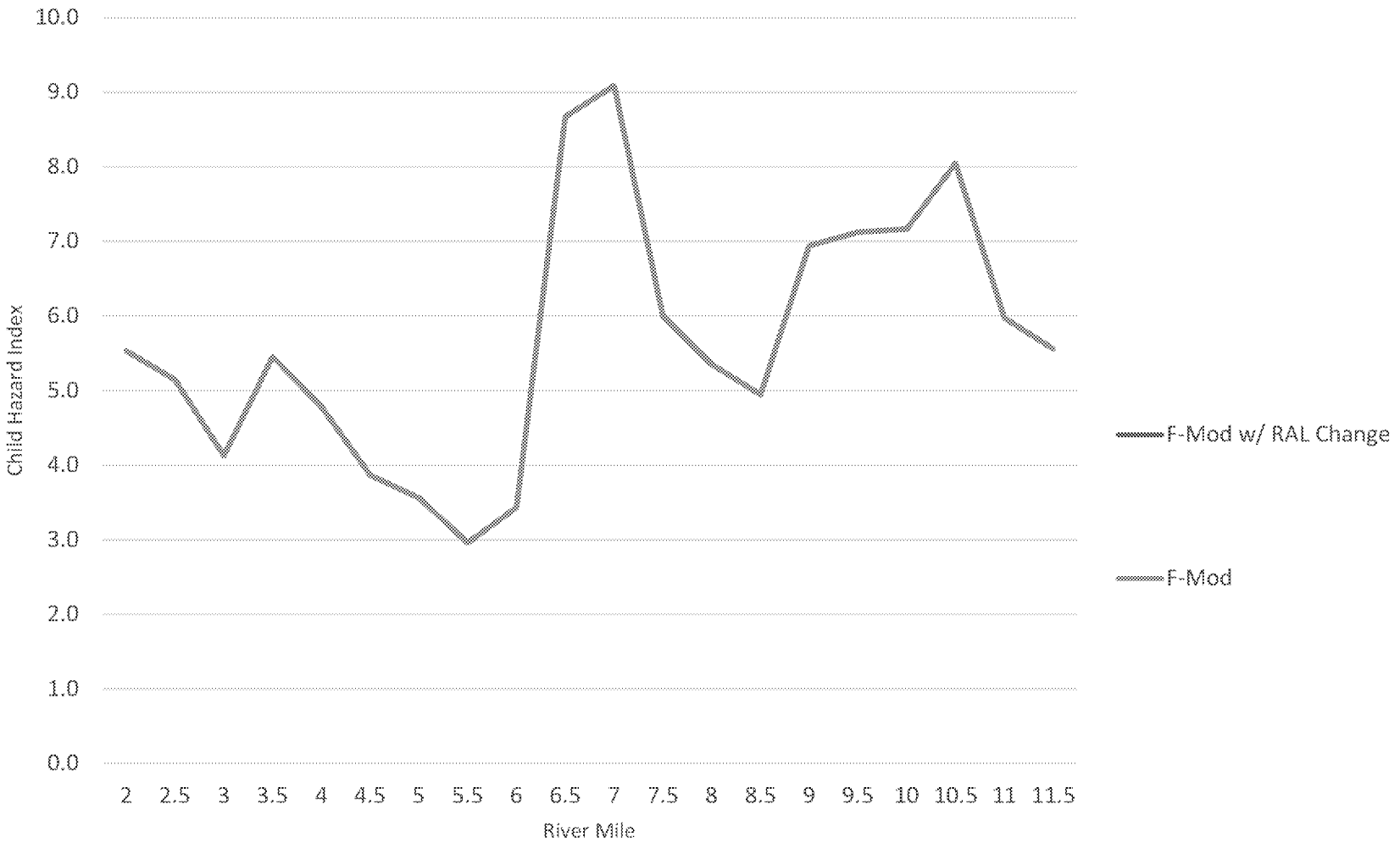
ESD Figure 10e. RAO 2 Hazard Index Child - RM Basis (West)

Portland Harbor Superfund Site



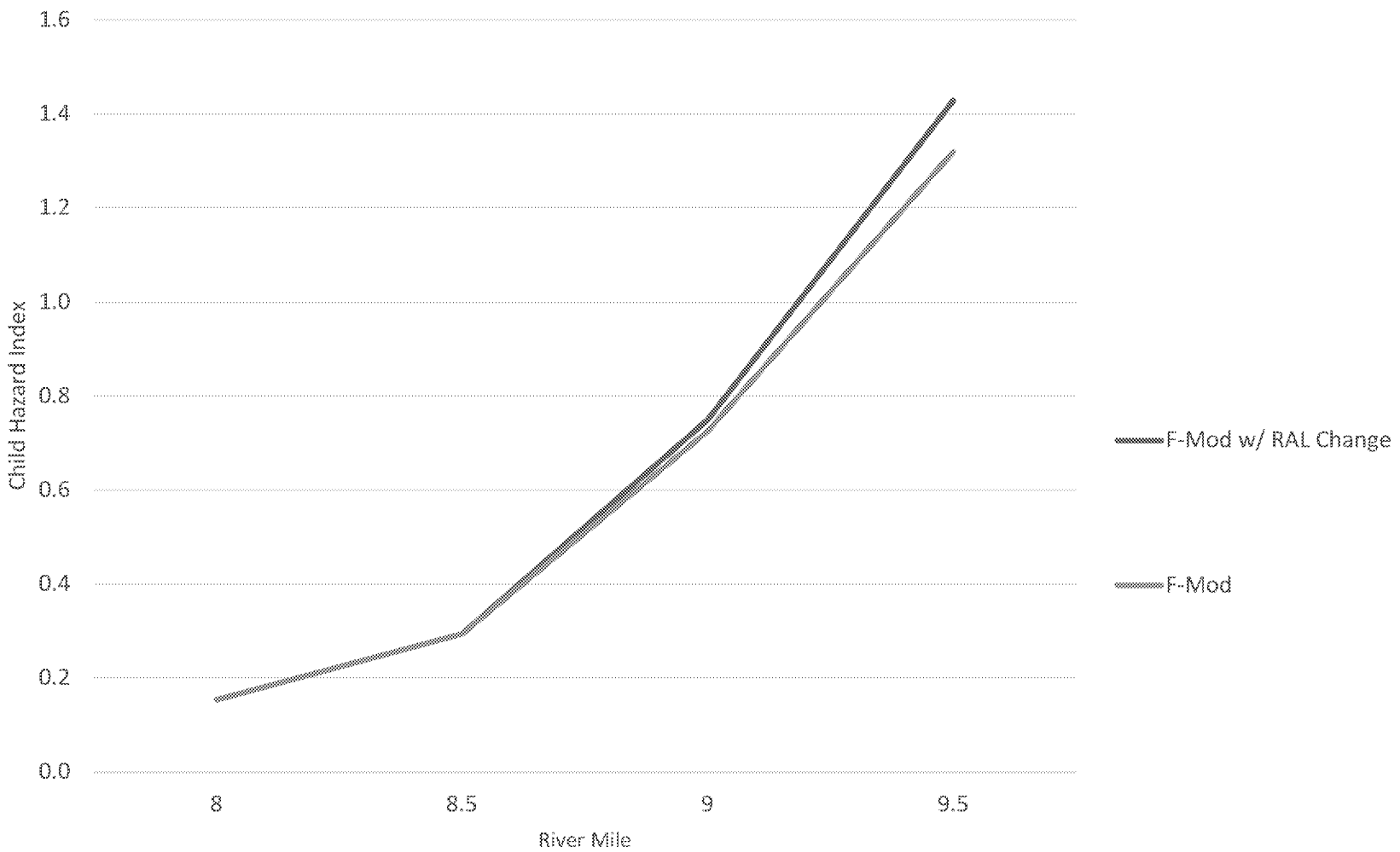
ESD Figure 10f. RAO 2 Hazard Index Child - RM Basis (East)

Portland Harbor Superfund Site



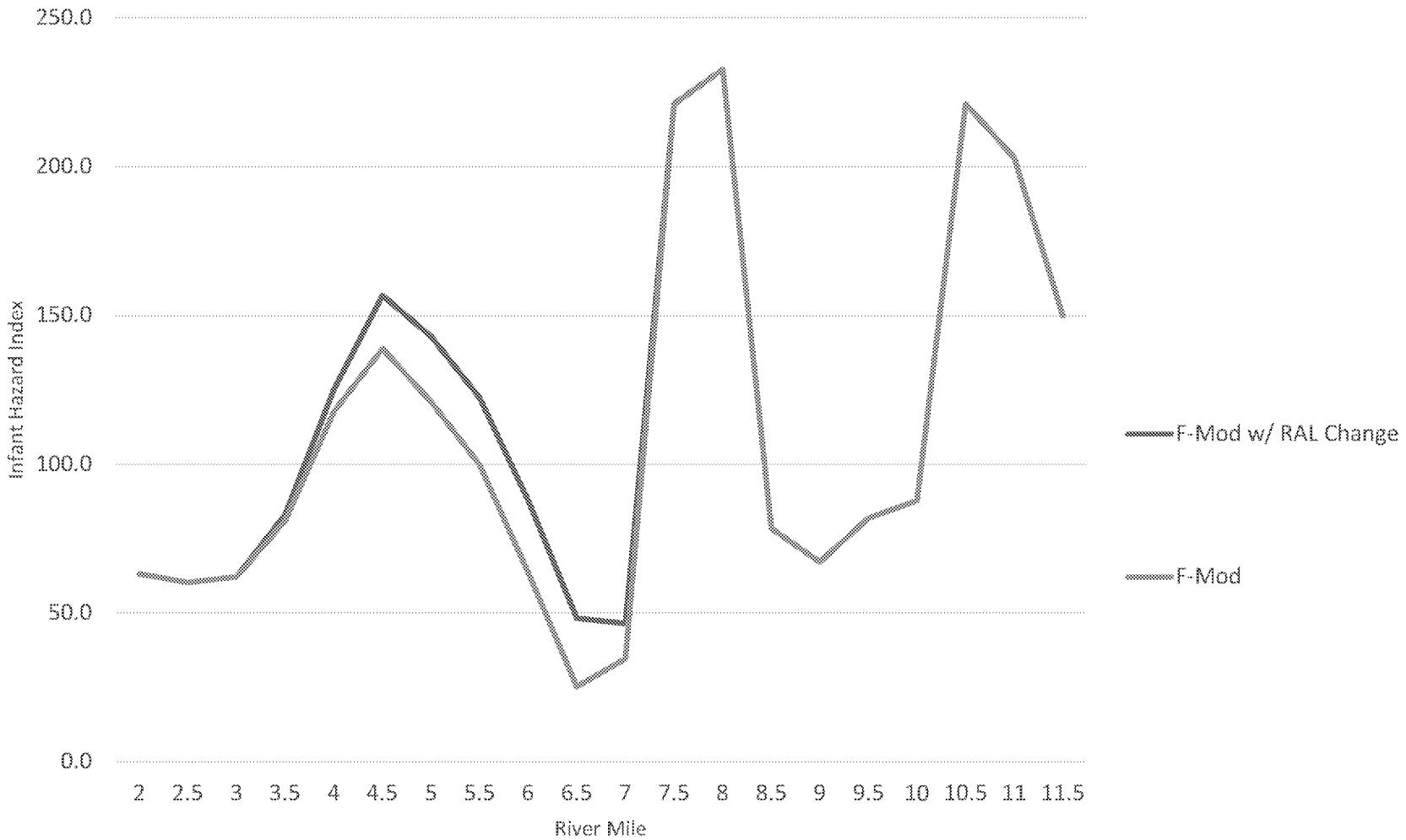
ESD Figure 10g. RAO 2 Hazard Index Child - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



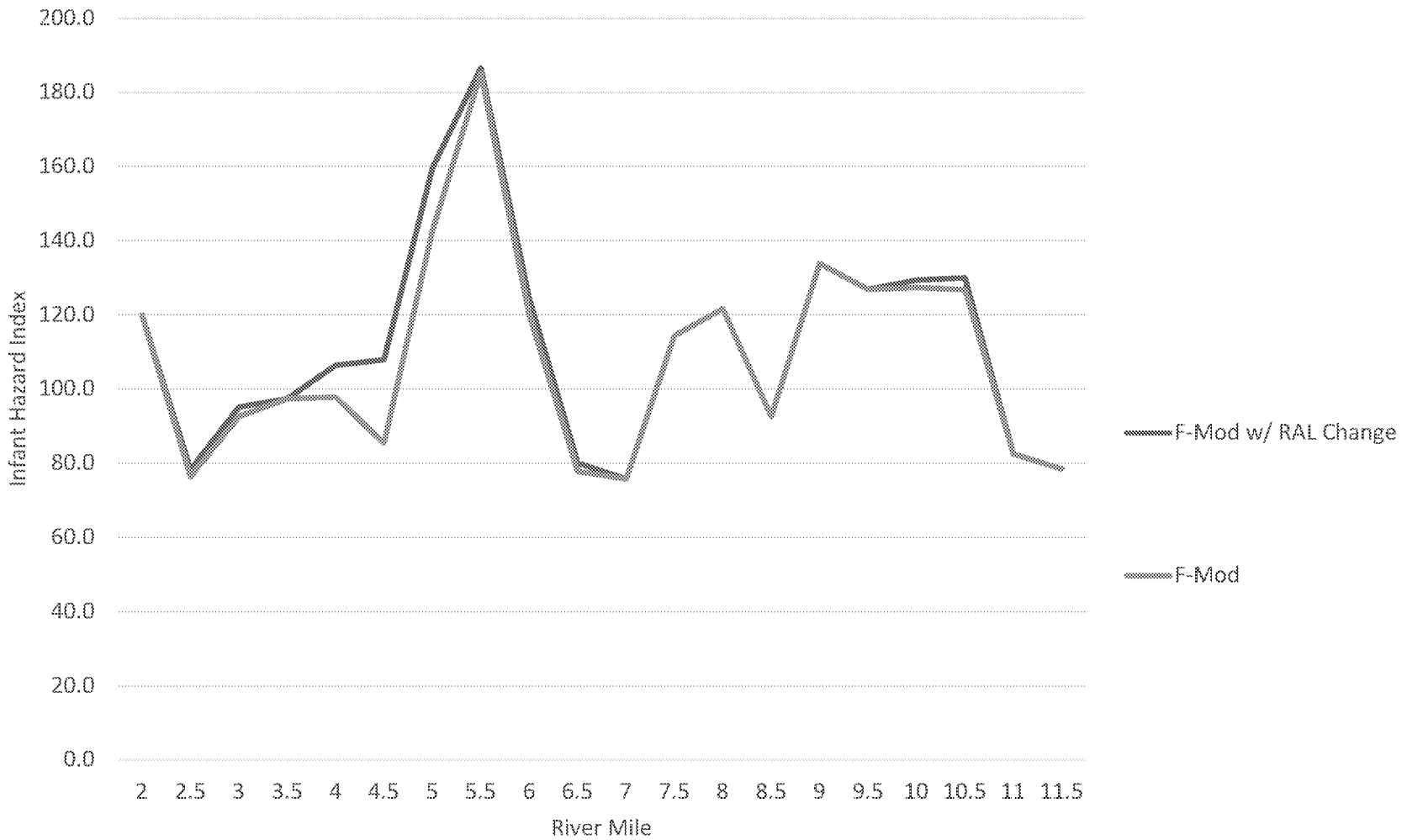
ESD Figure 10h. RAO 2 Hazard Index Child - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



ESD Figure 10i. RAO 2 Hazard Index Infant- RM Basis (West)

Portland Harbor Superfund Site



ESD Figure 10j. RAO 2 Hazard Index Infant - RM Basis (East)

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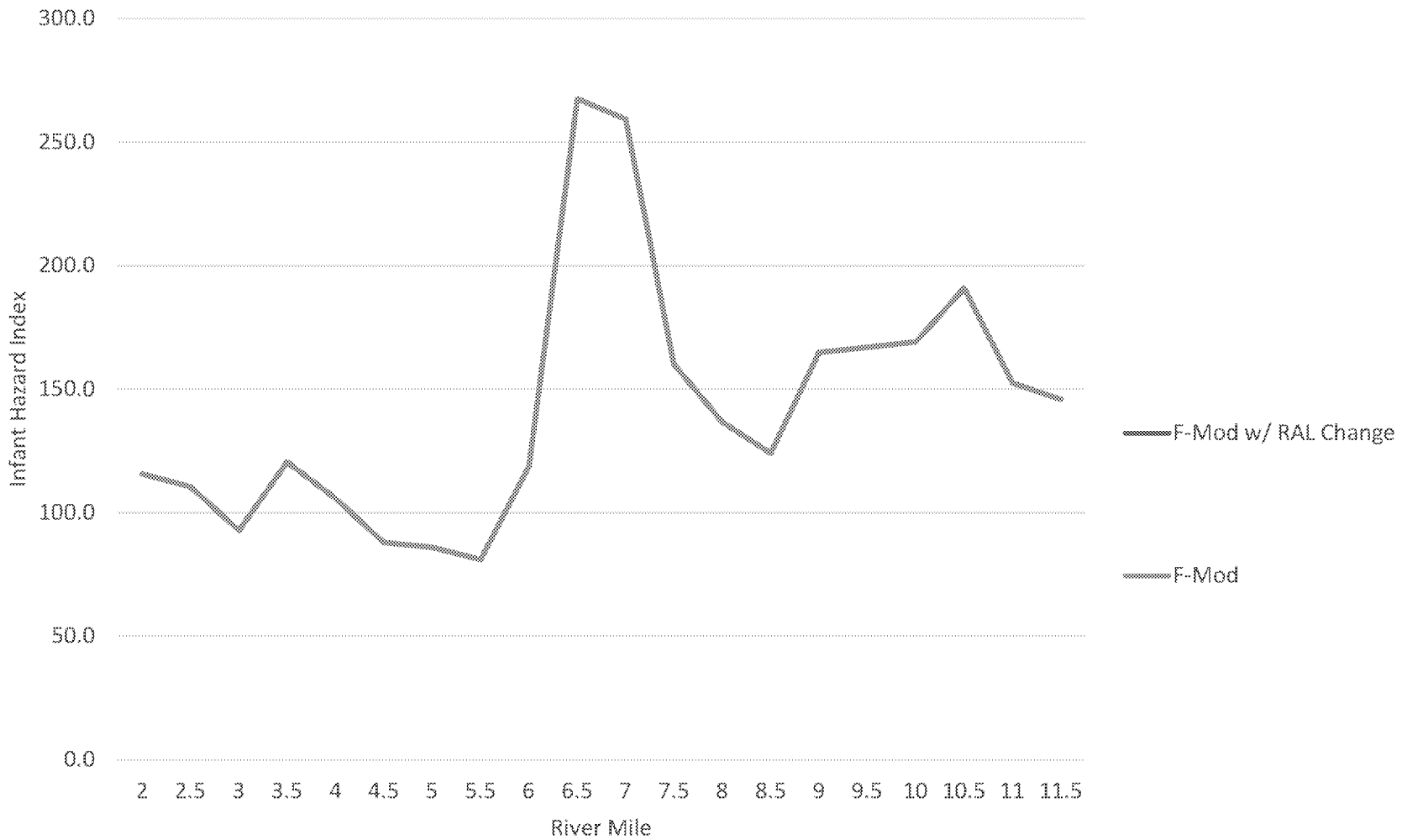
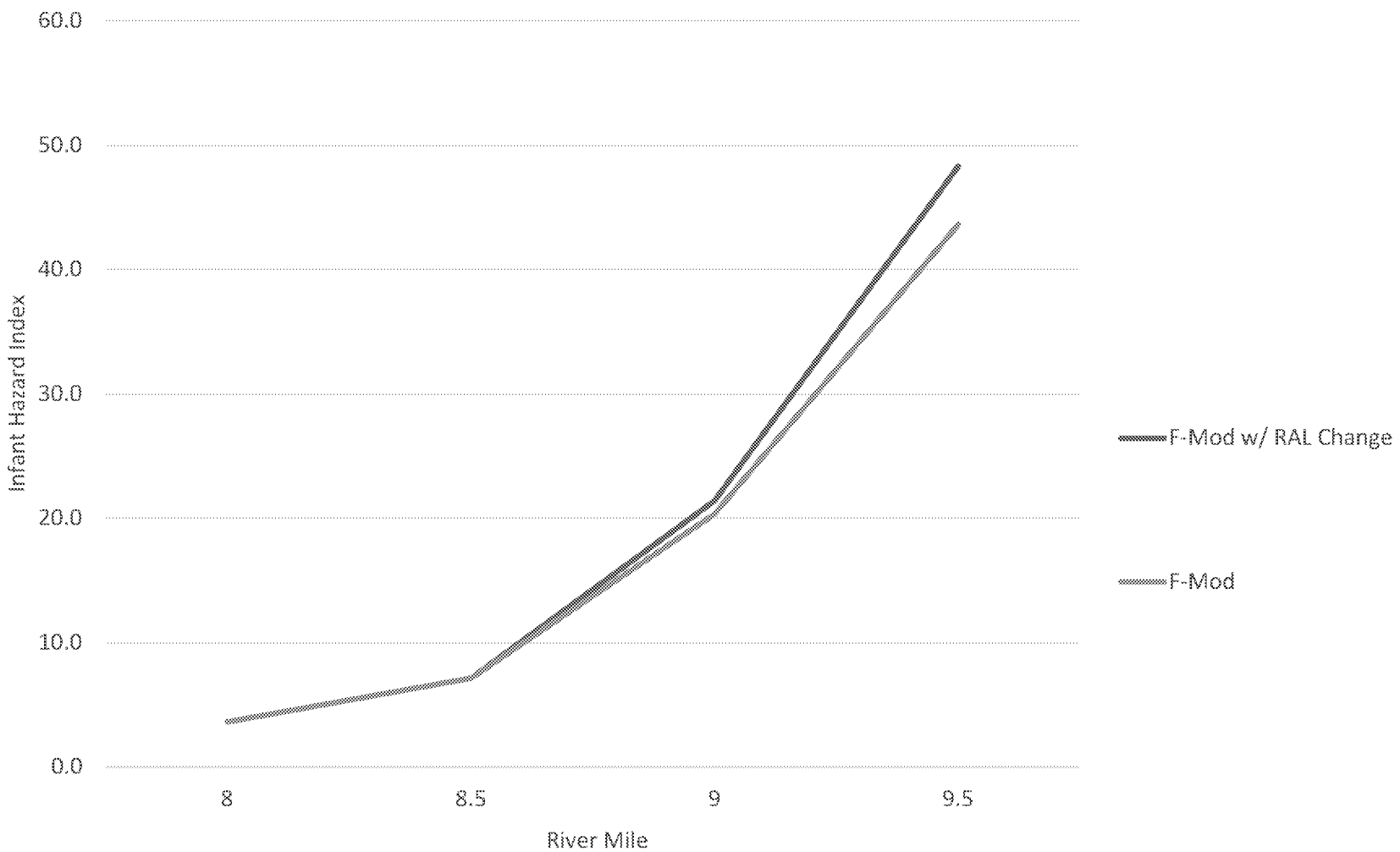


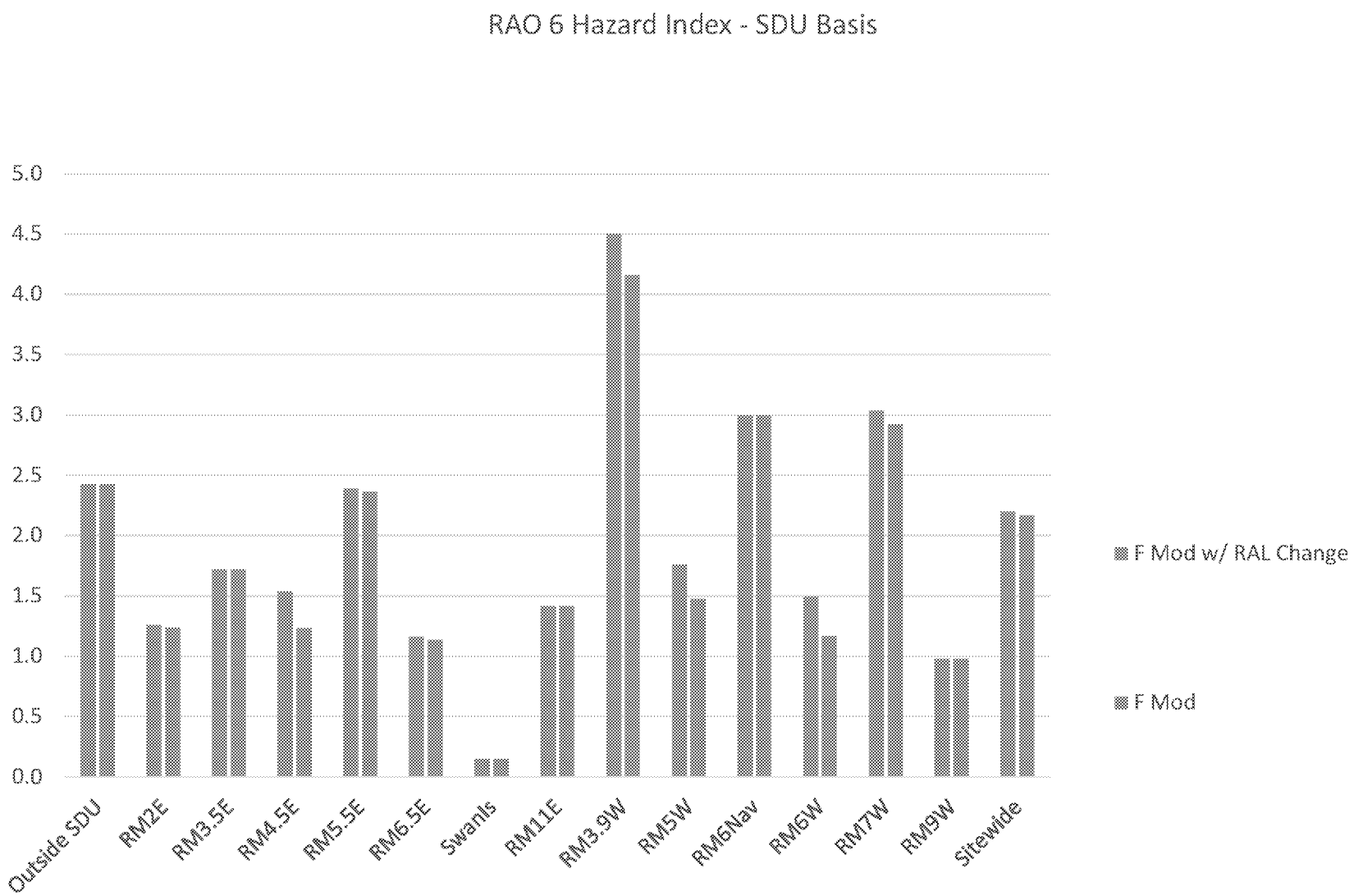
ESD Figure 10k. RAO 2 Hazard Index Infant - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



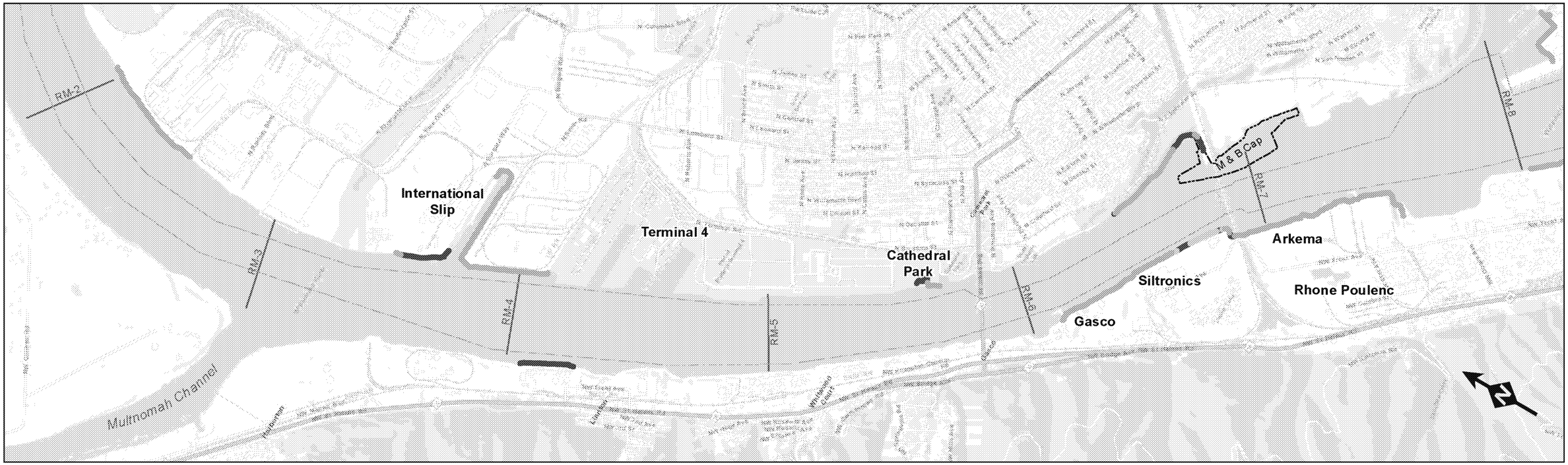
ESD Figure 10l. RAO 2 Hazard Index Infant - RM Basis (Swan Island Lagoon)

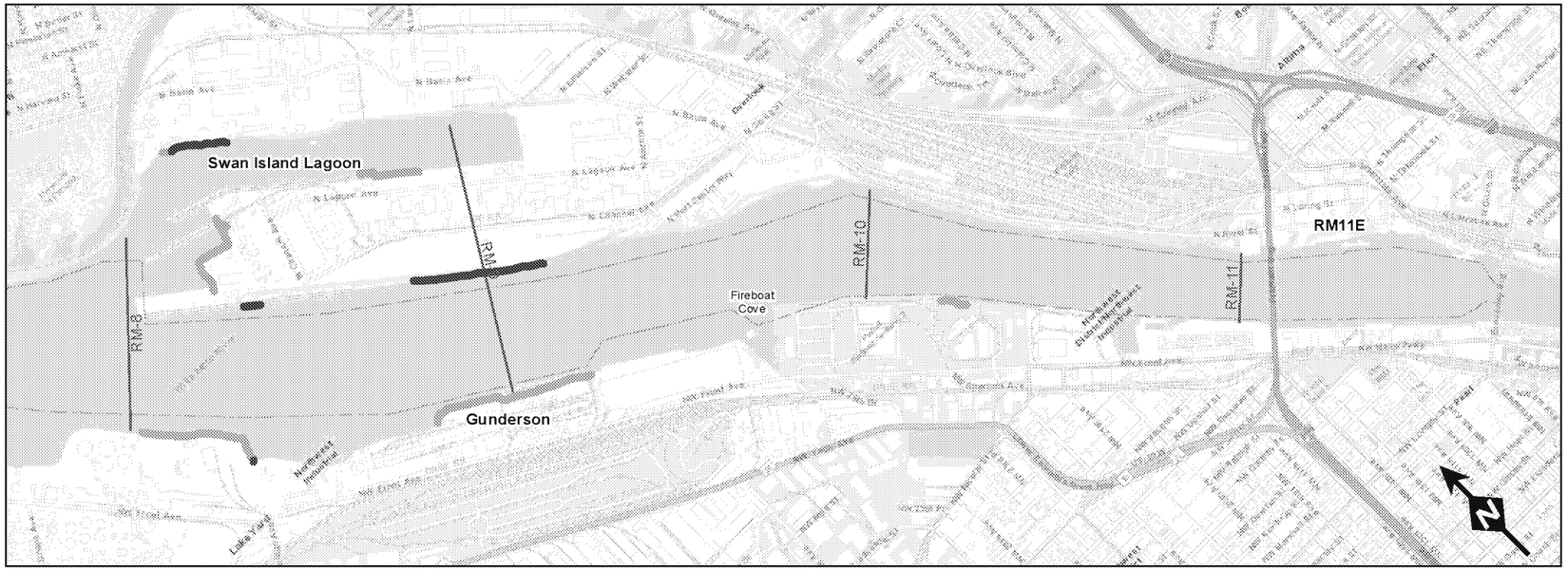
Portland Harbor Superfund Site



ESD Figure 11. RAO 6 Hazard Index - SDU Basis

Portland Harbor Superfund Site



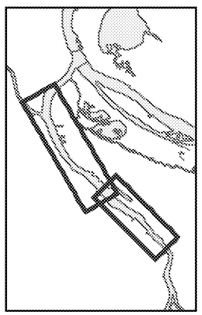


Legend

ROD River Bank Changes

- ROD river bank with active remediation offshore unchanged by proposed ESD
- ROD river bank with active remediation offshore removed by proposed ESD*
- ROD river bank with no active remediation offshore unchanged by proposed ESD*
- Navigation Channel

Note:
* - Rod river banks with no active remediation offshore are still in need of characterization and potential active remediation for focused COCs exceeding RALs and/or presence of PTW. However for the purpose of capturing potential cost changes, the river banks with active remediation removed by the proposed ESD have been identified and removed from the cost estimate of river bank work for the selected remedy.



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Feet

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ESD Figure 12. River Bank Change Summary

Portland Harbor Superfund Site

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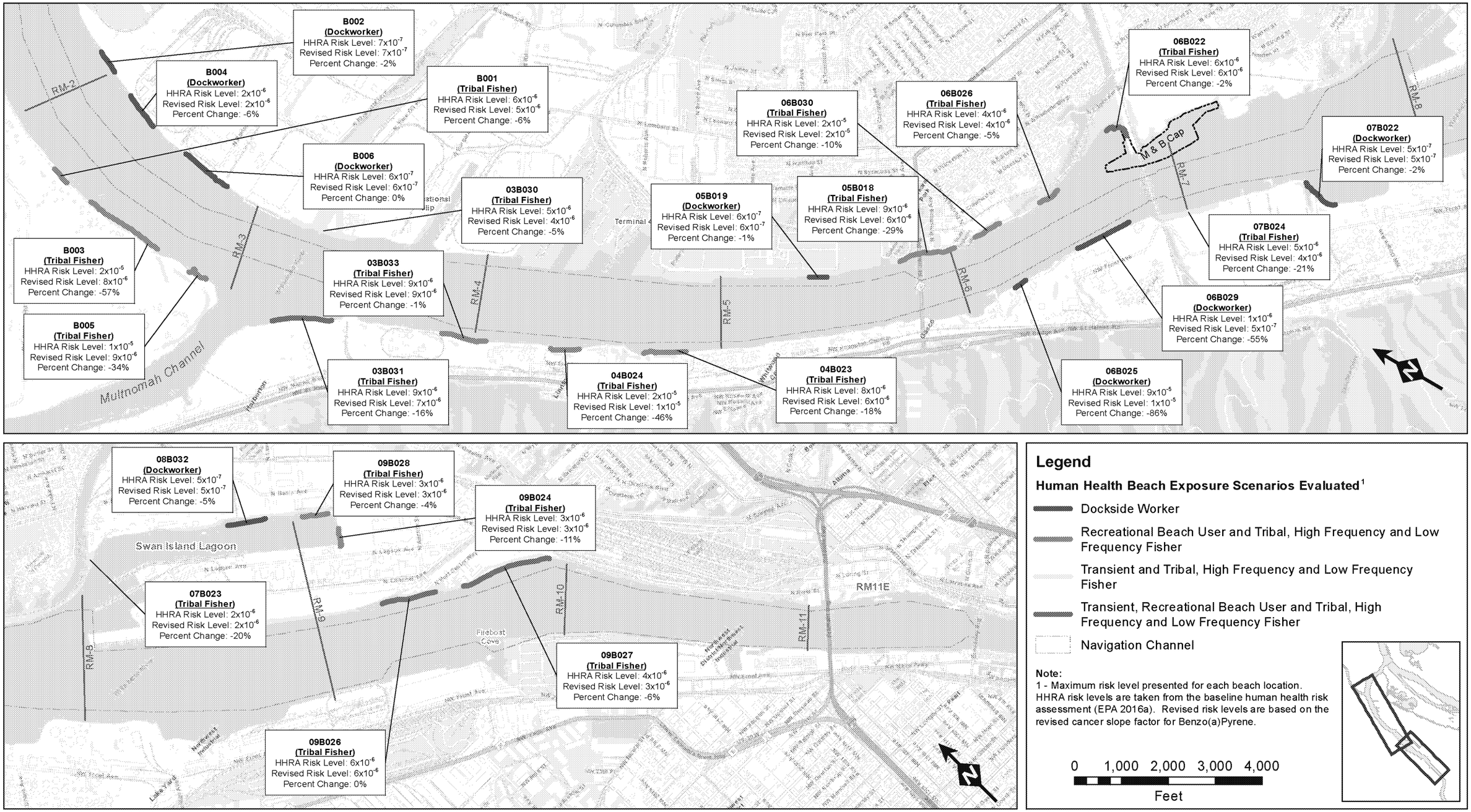

Legend

Human Health Beach Exposure Scenarios Evaluated[1]

- Dockside Worker
- Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Transient and Tribal, High Frequency and Low Frequency Fisher
- Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Navigation Channel

Note:
1 - Maximum risk level presented for each beach location. HHRA risk levels are taken from the baseline human health risk assessment (EPA 2016a). Revised risk levels are based on the revised cancer slope factor for Benzo(a)Pyrene.

0 1,000 2,000 3,000 4,000
Feet

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ESD Figure 13. Human Health Beach Exposure Risk Summary

Portland Harbor Superfund Site

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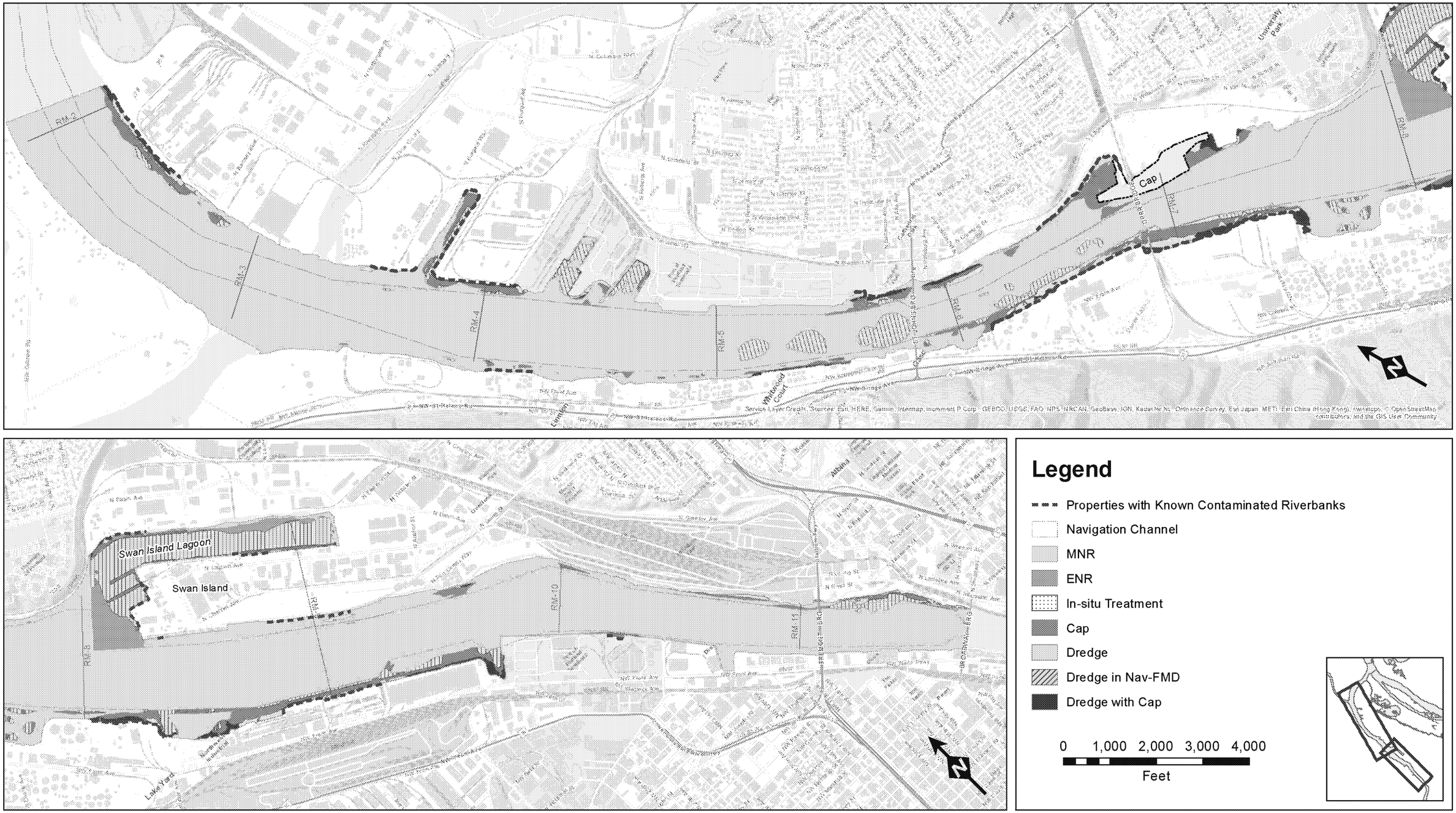

ESD Figure 14a. Remedial Footprint and Technology Assignments, Revised Remedy

Portland Harbor Superfund Site

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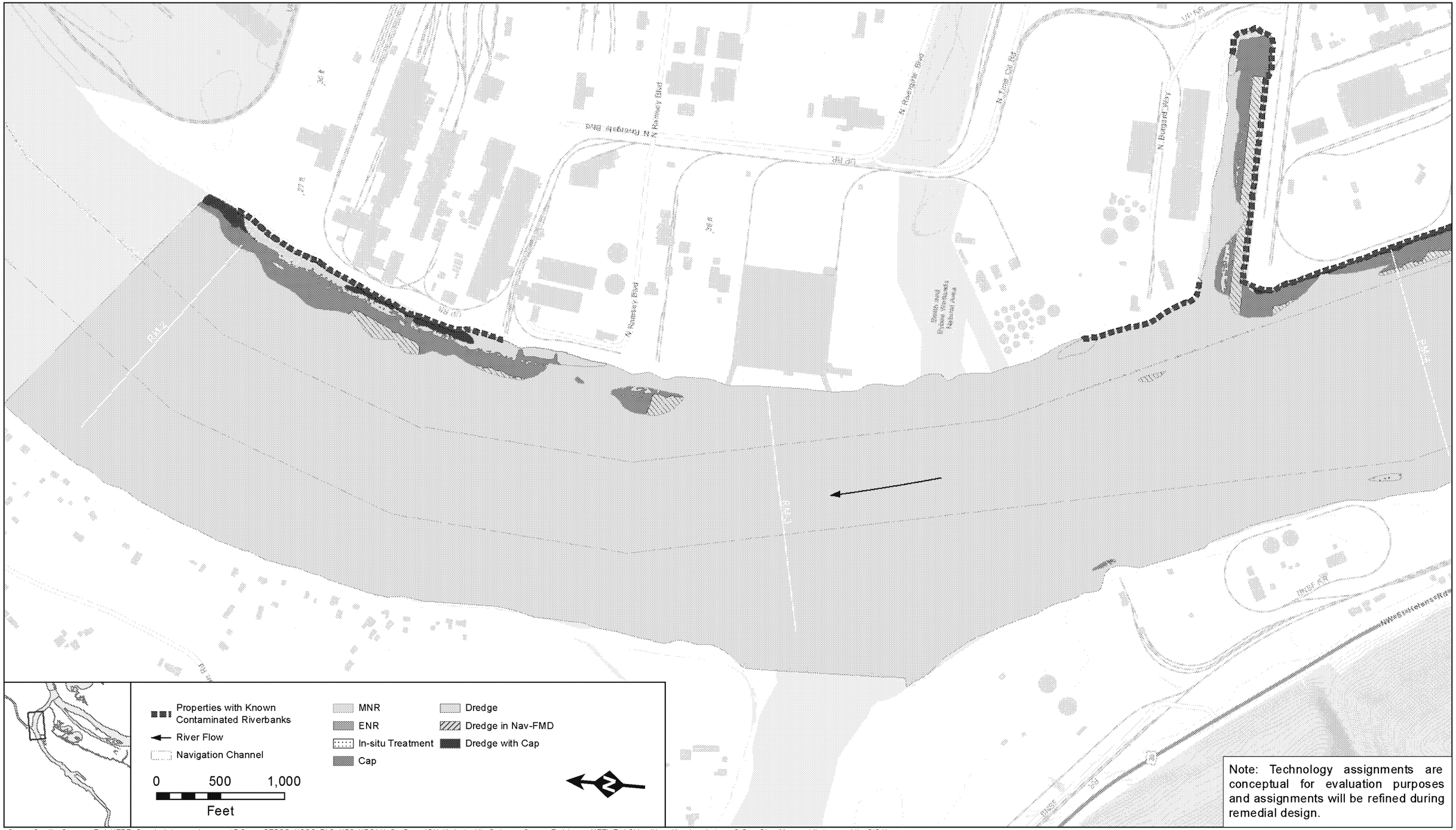

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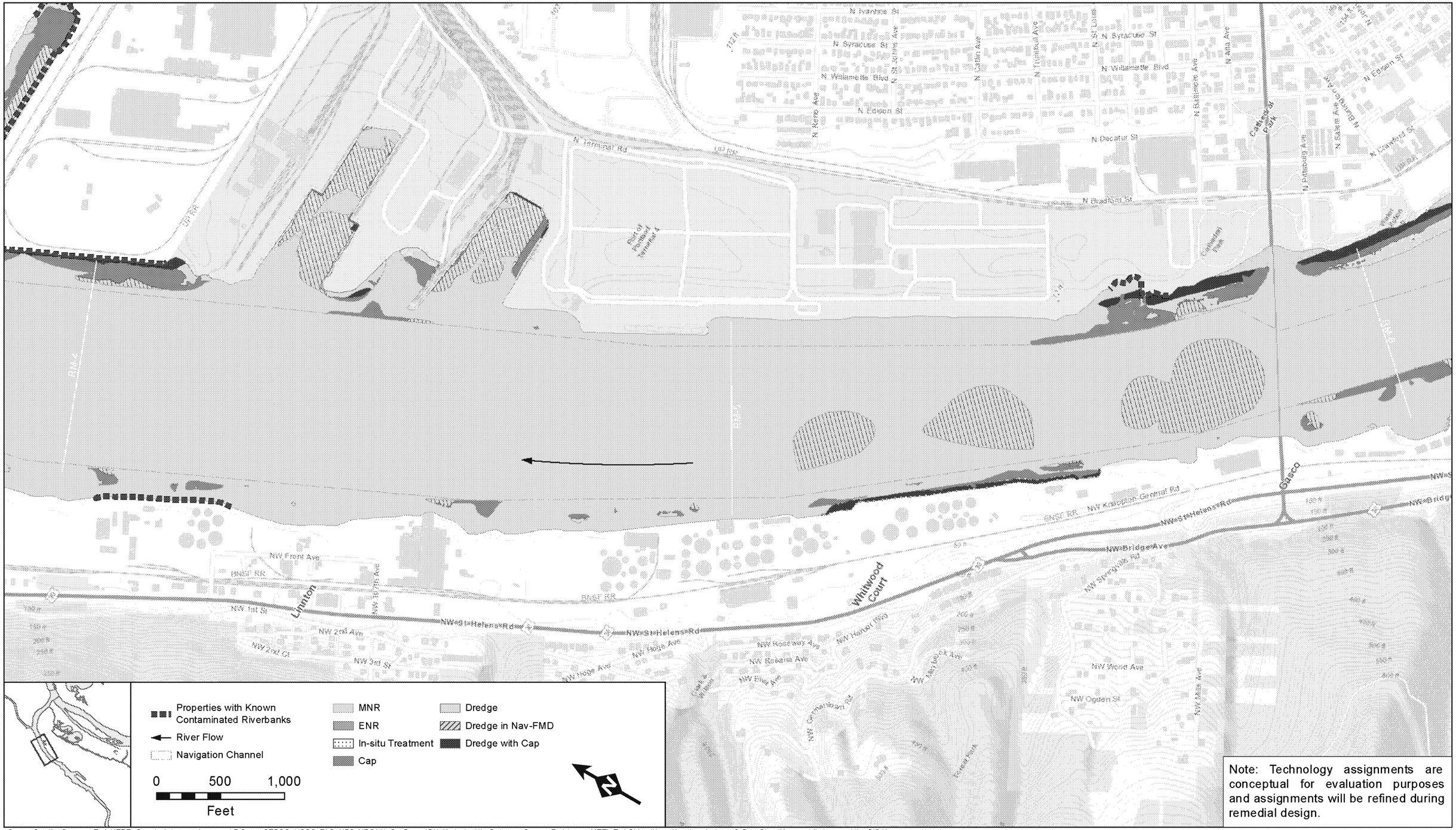
ESD Figure 14b. Remedial Footprint and Technology Assignments, Revised Remedy
River Mile 1.9 to 4
Portland Harbor Superfund Site



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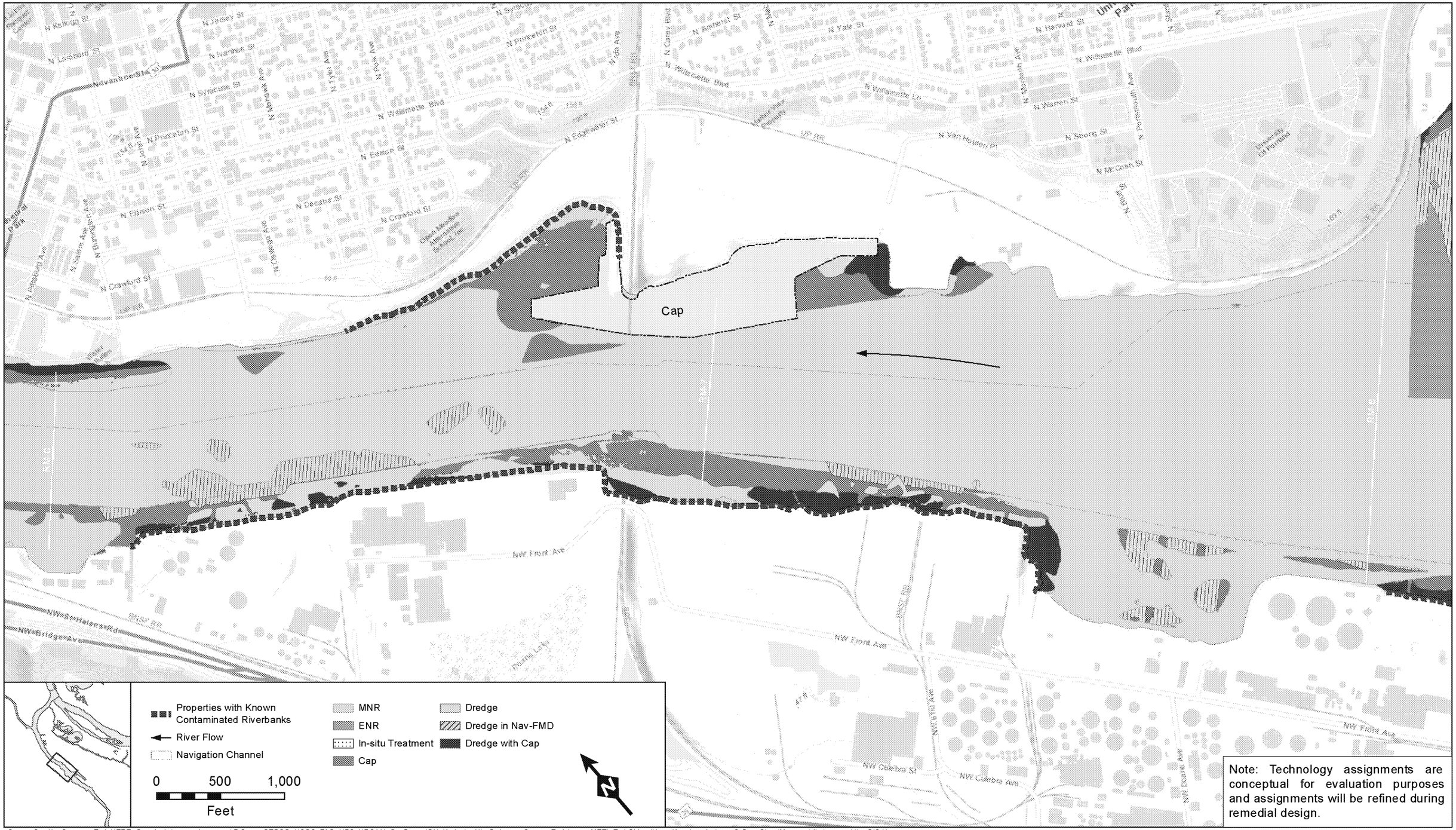
ESD Figure 14c. Remedial Footprint and Technology Assignments, Revised Remedy

River Mile 4 to 6

Portland Harbor Superfund Site



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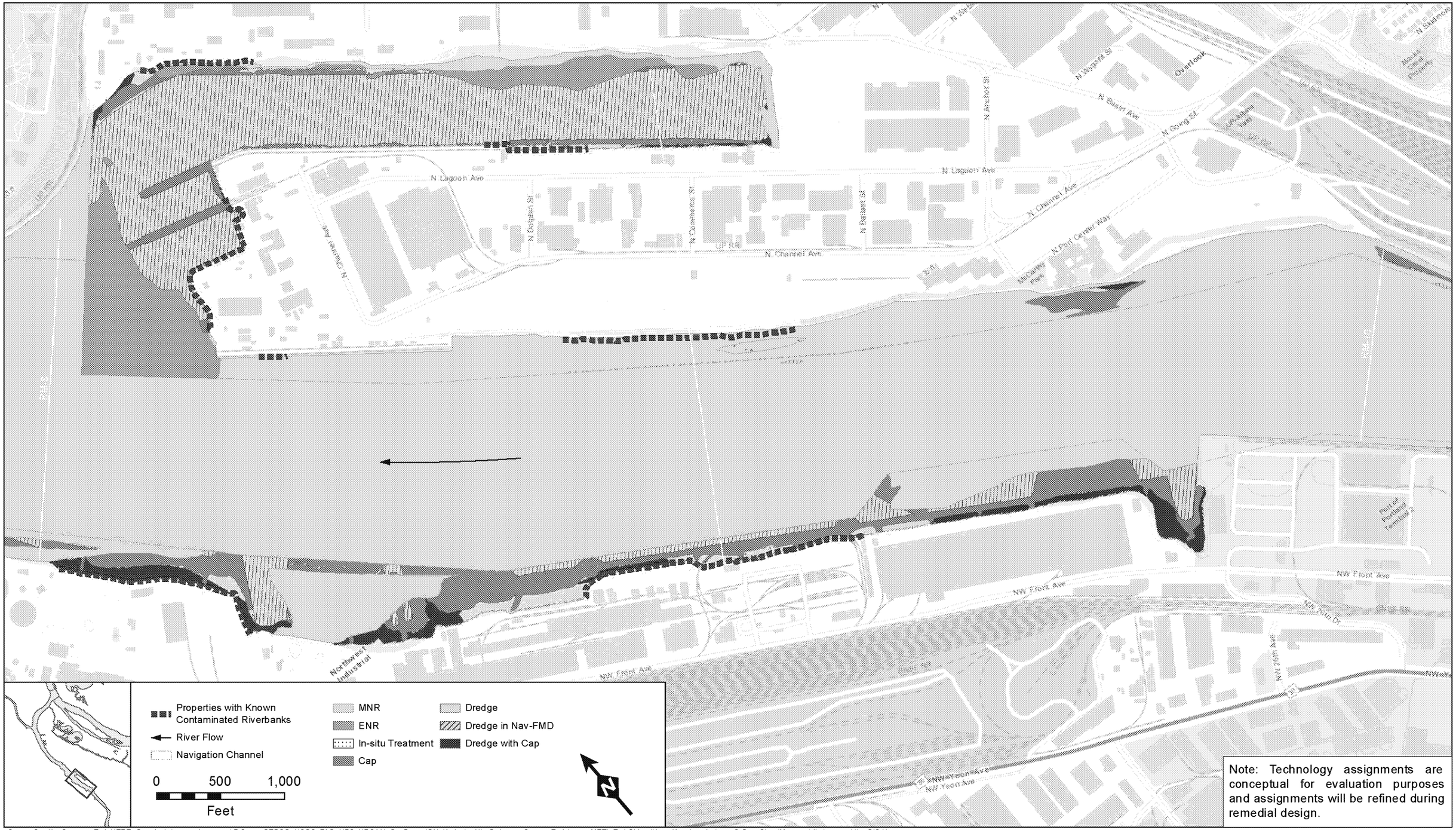
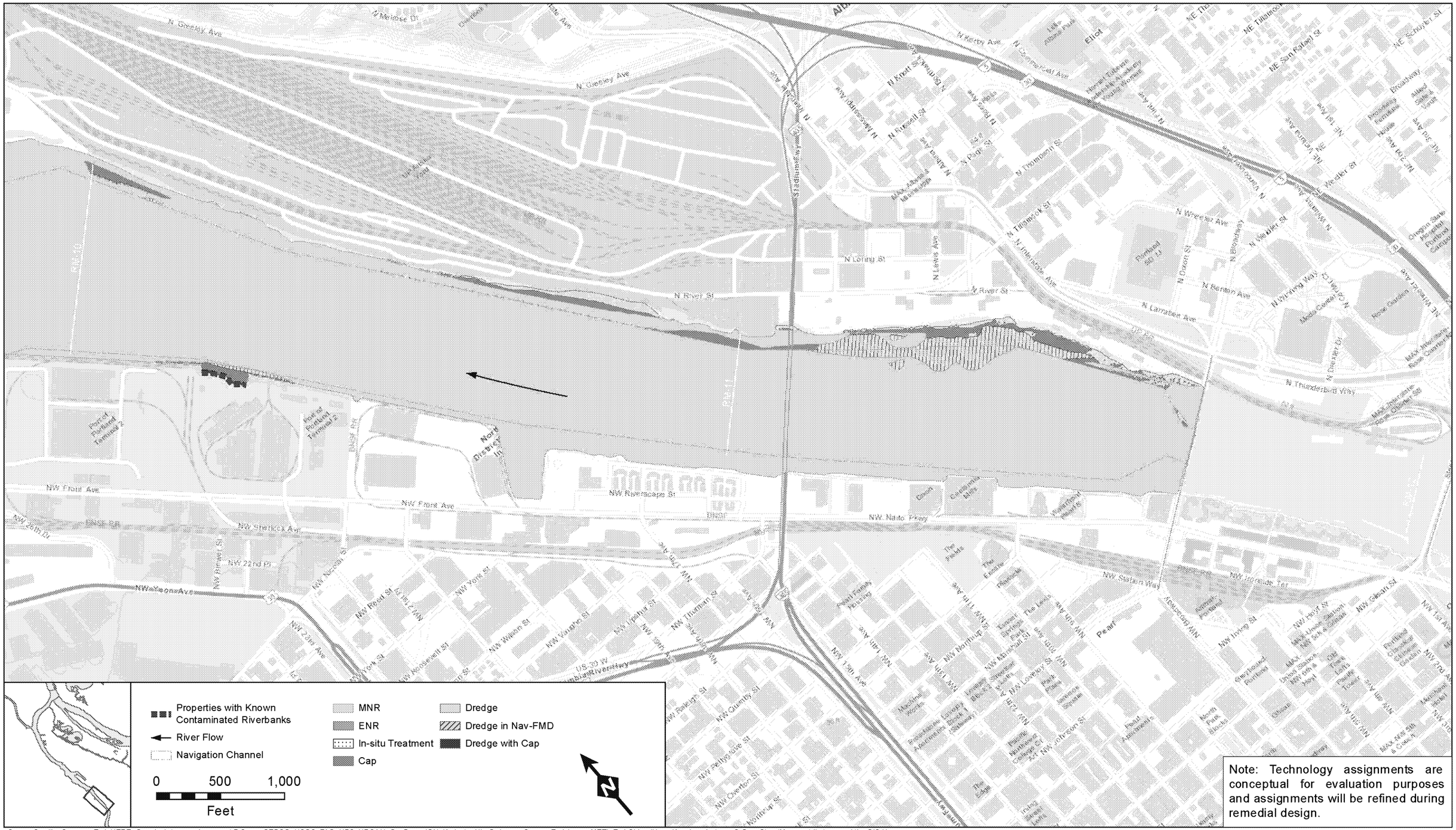
ESD Figure 14d. Remedial Footprint and Technology Assignments, Revised Remedy
River Mile 6 to 8
Portland Harbor Superfund Site



Note: Technology assignments are conceptual for evaluation purposes and assignments will be refined during remedial design.

Source Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User

ESD Figure 14e. Remedial Footprint and Technology Assignments, Revised Remedy
River Mile 8 to 10
Portland Harbor Superfund Site



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ESD Figure 14f. Remedial Footprint and Technology Assignments, Revised Remedy

River Mile 10 to 11.8

Portland Harbor Superfund Site

Tables

ESD Table 1. cPAH (BaPeq) CUL and Highly Toxic PTW Thresholds
Portland Harbor Superfund Site
Portland, OR

Scenario	Application Area	ROD Value	Updated Value [1]
Direct Contact Sediment CUL	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact Sediment CUL	Nearshore sediment (excluding beach areas)	Not provided	774 µg/kg
Clam Consumption Tissue Target Level	Navigation Channel Sediment	7.1 µg/kg	51.6 µg/kg
Clam Consumption Sediment CUL	Navigation Channel Sediment	3,950 µg/kg	107,600 µg/kg
Highly Toxic PTW Threshold	Sitewide	106,000 µg/kg	774,000 µg/kg

[1] Updated Value is based on change in BaP CSF from 7.3 to 1 mg/kg-day.

ESD Table 2. RAO 1 Risk Summary - RM Basis
Portland Harbor Superfund Site
Portland, OR

COC	River Mile	Alternative								
		East			West			Swan Island		
		F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change
Total	2	4×10^{-6}	4×10^{-6}	0%	4×10^{-6}	4×10^{-6}	0%			
	2.5	3×10^{-6}	3×10^{-6}	1%	4×10^{-6}	4×10^{-6}	0%			
	3	5×10^{-6}	5×10^{-6}	4%	5×10^{-6}	5×10^{-6}	0%			
	3.5	4×10^{-6}	4×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	4	2×10^{-6}	2×10^{-6}	0%	5×10^{-6}	5×10^{-6}	11%			
	4.5	3×10^{-6}	2×10^{-6}	46%	5×10^{-6}	4×10^{-6}	22%			
	5	4×10^{-6}	4×10^{-6}	0%	5×10^{-6}	4×10^{-6}	22%			
	5.5	3×10^{-6}	3×10^{-6}	4%	4×10^{-6}	3×10^{-6}	20%			
	6	4×10^{-6}	4×10^{-6}	0%	4×10^{-6}	2×10^{-6}	54%			
	6.5	3×10^{-6}	3×10^{-6}	6%	1×10^{-6}	6×10^{-7}	156%			
	7	1×10^{-6}	1×10^{-6}	0%	7×10^{-7}	4×10^{-7}	61%			
	7.5	4×10^{-6}	4×10^{-6}	0%	2×10^{-6}	2×10^{-6}	0%			
	8	2×10^{-6}	2×10^{-6}	0%	3×10^{-6}	3×10^{-6}	0%	6×10^{-8}	6×10^{-8}	0%
	8.5	4×10^{-6}	4×10^{-6}	0%	2×10^{-6}	2×10^{-6}	0%	3×10^{-7}	3×10^{-7}	0%
	9	3×10^{-6}	3×10^{-6}	0%	0	0	n/a	3×10^{-7}	3×10^{-7}	8%
	9.5	3×10^{-6}	3×10^{-6}	0%	1×10^{-6}	1×10^{-6}	0%			
	10	3×10^{-6}	3×10^{-6}	5%	5×10^{-6}	5×10^{-6}	0%			
	10.5	3×10^{-6}	3×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	11	2×10^{-6}	2×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	11.5	6×10^{-7}	6×10^{-7}	0%	3×10^{-6}	3×10^{-6}	0%			

ESD Table 3. RAO 2 Risk and Hazard Index Summary - RM
Basis Portland Harbor Superfund Site
Portland, OR

		Alternative											
		East			Nav Channel			West			Swan Island		
COC	River Mile	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change
Total Cancer Risk	2	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%			
	2.5	7×10^{-5}	7×10^{-5}	2%	1×10^{-4}	1×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%			
	3	9×10^{-5}	9×10^{-5}	3%	9×10^{-5}	9×10^{-5}	0%	6×10^{-5}	6×10^{-5}	0%			
	3.5	9×10^{-5}	9×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	8×10^{-5}	7×10^{-5}	2%			
	4	1×10^{-4}	9×10^{-5}	9%	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	6%			
	4.5	1×10^{-4}	8×10^{-5}	27%	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	13%			
	5	2×10^{-4}	1×10^{-4}	14%	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	18%			
	5.5	2×10^{-4}	2×10^{-4}	1%	7×10^{-5}	7×10^{-5}	0%	1×10^{-4}	9×10^{-5}	23%			
	6	1×10^{-4}	1×10^{-4}	4%	1×10^{-4}	1×10^{-4}	0%	8×10^{-5}	6×10^{-5}	39%			
	6.5	7×10^{-5}	7×10^{-5}	3%	2×10^{-4}	2×10^{-4}	0%	4×10^{-5}	2×10^{-5}	93%			
	7	7×10^{-5}	7×10^{-5}	0%	2×10^{-4}	2×10^{-4}	0%	4×10^{-5}	3×10^{-5}	35%			
	7.5	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	8	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	3×10^{-6}	3×10^{-6}	0%
	8.5	9×10^{-5}	9×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	7×10^{-5}	7×10^{-5}	0%	7×10^{-6}	7×10^{-6}	0%
	9	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%	2×10^{-5}	2×10^{-5}	5%
	9.5	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	7×10^{-5}	7×10^{-5}	0%	4×10^{-5}	4×10^{-5}	11%
	10	1×10^{-4}	1×10^{-4}	2%	2×10^{-4}	2×10^{-4}	0%	8×10^{-5}	8×10^{-5}	0%			
	10.5	1×10^{-4}	1×10^{-4}	2%	2×10^{-4}	2×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	11	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	11.5	7×10^{-5}	7×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%			
Total Non-Cancer Risk (Child)	2.5	4	3	3%	5	5	0%	2	2	0%			
	3	4	4	3%	4	4	0%	3	3	0%			
	3.5	4	4	0%	5	5	0%	3	3	2%			
	4	4	4	7%	5	5	0%	4	4	7%			
	4.5	4	4	22%	4	4	0%	5	4	14%			
	5	5	4	14%	4	4	0%	4	4	19%			
	5.5	6	6	1%	3	3	0%	4	3	24%			
	6	4	4	4%	3	3	0%	3	2	43%			
	6.5	3	3	3%	9	9	0%	2	1	100%			
	7	3	3	0%	9	9	0%	1	1	43%			
	7.5	4	4	0%	6	6	0%	7	7	0%			
	8	5	5	0%	5	5	0%	7	7	0%	0	0	0%
	8.5	4	4	0%	5	5	0%	3	3	0%	0	0	0%
	9	6	6	0%	7	7	0%	2	2	0%	1	1	3%
	9.5	5	5	0%	7	7	0%	3	3	0%	1	1	8%
	10	5	5	2%	7	7	0%	3	3	0%			
	10.5	5	5	3%	8	8	0%	7	7	0%			
	11	3	3	0%	6	6	0%	7	7	0%			
	11.5	3	3	0%	6	6	0%	5	5	0%			
Total Non-Cancer Risk (Infant)	2	120	120	0%	116	116	0%	63	63	0%			
	2.5	78	76	2%	110	110	0%	60	60	0%			
	3	95	93	3%	93	93	0%	62	62	0%			
	3.5	97	97	0%	121	121	0%	83	81	3%			
	4	106	98	9%	106	106	0%	125	118	6%			
	4.5	108	85	26%	88	88	0%	157	139	13%			
	5	160	143	12%	86	86	0%	143	121	18%			
	5.5	187	185	1%	81	81	0%	122	100	23%			
	6	124	120	4%	119	119	0%	88	64	38%			
	6.5	80	78	3%	268	268	0%	48	25	91%			
	7	76	76	0%	259	259	0%	46	35	34%			
	7.5	114	114	0%	160	160	0%	221	221	0%			
	8	122	122	0%	137	137	0%	233	233	0%	4	4	0%
	8.5	93	93	0%	124	124	0%	78	78	0%	7	7	0%
	9	134	134	0%	165	165	0%	67	67	0%	21	20	5%
	9.5	127	127	0%	167	167	0%	82	82	0%	48	44	11%
	10	129	127	2%	169	169	0%	88	88	0%			
	10.5	130	127	2%	191	191	0%	221	221	0%			
	11	82	82	0%	153	153	0%	203	203	0%			
	11.5	78	78	0%	146	146	0%	150	150	0%			

ESD Table 4. RAO 5 Benthic Risk Summary

Portland Harbor Superfund Site

Portland, OR

Alternative	Benthic Risk*	10x Benthic Risk	100x Benthic Risk
F Mod w/ RAL Change	25%	69%	90%
F Mod	27%	72%	90%
Change	-1%	-3%	0%

*Benthic risk area within Site = 1,289 acres

ESD Table 5. RAO 6 Fish and Wildlife Risk Summary
Portland Harbor Superfund Site
Portland, OR

SDU	Alternative		
	F Mod w/ RAL Change	F Mod	Difference
Outside SDU	2.4	2.4	0%
RM2E	1.3	1.2	2%
RM3.5E	1.7	1.7	0%
RM4.5E	1.5	1.2	25%
RM5.5E	2.4	2.4	1%
RM6.5E	1.2	1.1	2%
SwanIs	0.1	0.1	0%
RM11E	1.4	1.4	0%
RM3.9W	4.5	4.2	8%
RM5W	1.8	1.5	19%
RM6Nav	3.0	3.0	0%
RM6W	1.5	1.2	28%
RM7W	3.0	2.9	4%
RM9W	1.0	1.0	0%
Sitewide	2.2	2.2	1%

ESD Table 6. RAO 3 and 7 Surface Water Reduction Summary
Portland Harbor Superfund Site
Portland, OR

Contaminant of Concern	Surface Water Reduction		
	F-Mod w/RAL change	F-Mod	Change
PCB	72%	72%	0%
cPAH	77%	78%	-1%
DDD	67%	68%	-1%
DDE	58%	59%	-1%
DDT	85%	85%	0%
TCDD TEQ	91%	91%	0%
Arsenic	25%	26%	-1%
BEHP	55%	55%	-1%
Chlordanes	50%	51%	-1%

ESD Table 7. RAO 4 and 8 Percent Groundwater Plume Area Adressed

Portland Harbor Superfund Site

Portland, OR

	Alternative		
	F Mod w/ RAL Change	**F Mod**	**Change**
% Reactive Cap within SMA	15%	21%	-7%
% Reactive residual layer within SMA	17%	17%	0%
Total % groundwater plume Area Adressed	32%	39%	-7%

*Groundwater plume area within Site = 243 acres

*Groundwater plume area within Site = 243 acres

ESD Table 8. Percentage Contaminated River Bank Addressed by Each Alternative

Portland Harbor Superfund Site

Portland, OR

Alternative	Feet Contaminated River Bank Addressed	Total Feet Contaminated River Bank	Contaminated River Bank Addressed
F Mod w/RAL change	22,592	30,048	75%
F Mod	23,305	30,048	78%
Change	713	0	-2%

ESD Table 9. Human Health Beach Exposure Risk Summary
Portland Harbor Superfund Site
Portland, OR

Beach Sample	Exposure Scenarios Evaluated	Exposure Scenario with Maximum Risk	Maximum HHRA Risk *	Maximum Revised Risk **	Percent Change in Risk Level
B001	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	5.E-06	-6%
B002	Dockworker	Dockworker	7.E-07	7.E-07	-2%
B003	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	8.E-06	-57%
B004	Dockworker	Dockworker	2.E-06	2.E-06	-6%
B005	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	1.E-05	9.E-06	-34%
B006	Dockworker	Dockworker	6.E-07	6.E-07	0%
03B030	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	5.E-06	4.E-06	-5%
03B031	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	7.E-06	-16%
03B033	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	9.E-06	-1%
04B023	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	8.E-06	6.E-06	-18%
04B024	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	1.E-05	-46%
05B018	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	6.E-06	-29%
05B019	Dockworker	Dockworker	6.E-07	6.E-07	-1%
06B022	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	6.E-06	-2%
06B025	Dockworker	Dockworker	9.E-05	1.E-05	-86%
06B026	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	4.E-06	4.E-06	-5%
06B029	Dockworker	Dockworker	1.E-06	5.E-07	-55%
06B030	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	2.E-05	-10%
07B022	Dockworker	Dockworker	5.E-07	5.E-07	-2%
07B023	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-06	2.E-06	-20%
07B024	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	5.E-06	4.E-06	-21%
08B032	Dockworker	Dockworker	5.E-07	5.E-07	-5%
09B024	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	3.E-06	3.E-06	-11%
09B026	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	6.E-06	0%
09B027	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	4.E-06	3.E-06	-6%
09B028	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	3.E-06	3.E-06	-4%

Notes:
* As presented in the Portland Harbor Baseline Human Health Risk Assessment
** Revised risk estimates take into account the updated cancer slope factor for Benzo(a)Pyrene

Appendix A

Supporting Documentation and Information

DRAFT

Appendix A1

Updated Record of Decision Tables 17 and 21

DRAFT

ROD Table 17. Summary of Cleanup Levels or Targets by Media - Updated for ESD

	Surface Water (1)			Groundwater (2)			River Bank Soil/Sediment (3)			Fish Tissue (4)		
Contaminant	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**
Aldrin	µg/L	0.00000077	A				µg/kg	2	R	µg/kg	0.06	R
Arsenic	µg/L	0.018	A	µg/L	0.018	A	mg/kg	3	B	mg/kg	0.001	R
Benzene				µg/L	0.44	A						
BEHP	µg/L	0.2	A				µg/kg	135	R	µg/kg	72	R
Cadmium				µg/L	0.091	A/R(5)	mg/kg	0.51	R			
Chlordanes	µg/L	0.000081	A				µg/kg	1.4	R	µg/kg	3	R
Chlorobenzene				µg/L	64	R						
Chromium	µg/L	100	A	µg/L	11	A						
Copper	µg/L	2.74	A	µg/L	2.74	A/R	mg/kg	359	R			
Cyanide				µg/L	4	A						
DDx	µg/L	0.01	R	µg/L	0.001	A	µg/kg	6.1	R	µg/kg	3	R
DDD	µg/L	0.000031	A	µg/L	0.000031	A	µg/kg	114	R			
DDE	µg/L	0.000018	A	µg/L	0.000018	A	µg/kg	226	R			
DDT	µg/L	0.000022	A	µg/L	0.000022	A	µg/kg	246	R			
1,1-Dichloroethene				µg/L	7	A						
cis-1,2-Dichloroethene				µg/L	70	A						
Dieldrin							µg/kg	0.07	R	µg/kg	0.06	R
2,4-Dichlorophenoxyacetic acid				µg/L	70	A						
Ethylbenzene	µg/L	7.3	R	µg/L	7.3	R						
Hexachlorobenzene	µg/L	0.000029	A							µg/kg	0.6	R
Lindane							µg/kg	5	R			
Lead				µg/L	0.54	A/R	mg/kg	196	R			
Manganese				µg/L	430	R						
MCPP	µg/L	16	R									
Mercury							mg/kg	0.085	R	mg/kg	0.03	A
Pentachlorophenol	µg/L	0.03	A	µg/L	0.03	A				µg/kg	2.5	R
Perchlorate				µg/L	15	A						
PBDEs										µg/kg	26	R
PCBs	µg/L	0.0000064	A	µg/L	0.014	A/R	µg/kg	9	B	µg/kg	0.25 (6)	R
PAHs							µg/kg	23000	R			
cPAHs (BaP eq)	µg/L	0.00012	A	µg/L	0.00012	A	µg/kg	774 (7)	B	µg/kg	51.6	R
Acenaphthene				µg/L	23	R						
Acenaphthylene												
Anthracene				µg/L	0.73	R						
Benzo(a)anthracene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(a)pyrene	µg/L	0.00012	A	µg/L	0.00012	A						
Benzo(b)fluoranthene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene	µg/L	0.0013	A	µg/L	0.0013	A						
Chrysene	µg/L	0.0013	A	µg/L	0.0013	A						
Dibenz(a,h)anthracene	µg/L	0.00012	A	µg/L	0.00012	A						
Fluoranthene												
Fluorene												
Indeno(1,2,3-c,d)pyrene	µg/L	0.0012	A	µg/L	0.0012	A						
2-Methylnaphthalene												
Naphthalene	µg/L	12	R									
Phenanthrene												
Pyrene												
Dioxins/Furans (2,3,7,8-TCDD eq)	µg/L	0.0000000005	A									
1,2,3,4,7,8-HxCDF							µg/kg	0.0004	B	µg/kg	0.00008	R
1,2,3,7,8-PeCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
2,3,4,7,8-PeCDF							µg/kg	0.0003	B	µg/kg	0.00003	R
2,3,7,8-TCDF							µg/kg	0.00040658	R	µg/kg	0.00008	R
2,3,7,8-TCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
Tetrachloroethene				µg/L	0.24	A						
Toluene				µg/L	9.8	R						
TPH-Diesel							mg/kg	91	R			
Aliphatic Hydrocarbons C10-C12				µg/L	2.6	R						
Tributyltin	µg/L	0.063	A				µg/kg	3080	R			
Trichloroethene				µg/L	0.6	A						
2,4,5-TP (Silvex)				µg/L	50	A						
Vanadium				µg/L	20	R						
Vinyl Chloride				µg/L	0.022	A						
Xylenes				µg/L	13	R						
Zinc	µg/L	36.5	R	µg/L	36.5	R	mg/kg	459	R			

Notes:
(1) Surface Water Cleanup Levels - RAOs 3 and 7
(2) Groundwater Cleanup Levels - RAOs 4 and 8
(3) Sediment Cleanup Levels - RAOs 1 and 5
(4) Fish Tissue Targets - RAOs 2 and 6
(5) A/R indicates that the ARARs-based number and the risk-based number are the same.
(6) The tissue target is a risk-based number and does not represent background levels. Additional data will be collected to determine background fish tissue concentrations for PCBs during design and construction of the Selected Remedy.
(7) The cleanup level for cPAHs of 774 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment exclusive of beaches and navigation channel sediments. The cleanup level applicable to beach sediments is 85 µg/kg and the cleanup level applicable to the navigation channel is 1076 µg/kg and is based on human consumption of clams.

Abbreviations:
2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex
ARAR - applicable or relevant and appropriate requirement
B - Background-based number
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
C - carbon

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations (continued):
Conc - concentration
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - hexachlorodibenzofuran
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbon
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
R - risk-based number
RAO - remedial action objective
TCDD - tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

ED_002671A_00012956-00077

ROD Table 21. Sediment RALs and PTW Thresholds for Selected Remedy - Updated for ESD

Contaminants	Site Wide RALs[1] (µg/kg)	PTW Thresholds [2] (µg/kg)	Navigation Channel RALs (µg/kg)
Focused COCs			
PCBs	75	200	1,000
Total PAHs	30,000	NA	170,000
2,3,7,8-TCDD	0.0006	0.01	0.002
1,2,3,7,8-PeCDD	0.0008	0.01	0.003
2,3,4,7,8-PeCDF	0.2	0.2	1
DDx	160	7,050	650
Additional Contaminants			
2,3,7,8-TCDF	NA	0.6	NA
1,2,3,4,7,8-HxCDF	NA	0.04	NA
cPAHs (BaP Eq)	NA	774,000	NA
Chlorobenzene	NA	>320	NA
Naphthalene	NA	>140,000	NA

Notes:
1 – Site wide includes all areas of the Site except the navigation channel. FMD areas are subject to these RALs.
2 – PTW thresholds are based on highly toxic PTW values (10^{-3} risk) except chlorobenzene and naphthalene, which are threshold values for not reliably contained PTW.

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

Appendix A2

Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018

CDM Smith

Memorandum

To: *Sean Sheldrake, U.S. Environmental Protection Agency (EPA) Region 10*

From: *Scott Coffey and Gary Hazen, CDM Federal Programs Corporation*

Date: *February 23, 2018*

Subject: *Evaluation of Cost Impacts to Alternative F Modified from Changes Documented in the Explanation of Significant Difference, Portland Harbor Superfund Site*

Introduction

CDM Federal Programs Corporation (CDM Smith) has been tasked to provide an evaluation of the cost impacts from changes to Alternative F Modified from the January 2017 Portland Harbor Superfund Site Record of Decision (ROD) (EPA 2017) as documented in the accompanying Explanation of Significant Difference (ESD). The changes include modifying the total polycyclic aromatic hydrocarbon (TPAH) remedial action level (RAL) for nearshore sediments (RAL F) from 13,000 µg/kg to 30,000 µg/kg. This effort is hereafter referred to as the "ESD cost evaluation".

Purpose and Intended Uses

The intended use of the ESD cost evaluation is to provide a ROD-level cost estimate revision of Alternative F Modified using the modifications as documented in the ESD. The results of these changes in terms of cost to the revised Alternative F Modified, hereafter referred to as "Alternative F Modified with RAL Change", are compared to the original Alternative F Modified costs presented as part of the ROD. This ESD cost evaluation is intended to provide EPA with an evaluation of the cost impacts from the proposed modifications to support the development of the ESD.

Methodology and Cost Guidance

The ESD cost evaluation was developed based on the same methodology and guidance as described in Appendix IV, Appendix G *(Methodology and Organization of Selected Remedy Cost Estimate)* of the ROD. As detailed in that appendix, these costs are expected to have an accuracy between -30% to +50% of actual cost, based on the scope presented in the ROD. They are prepared solely to facilitate relative comparisons between alternatives for remedy selection purposes, not for establishing project budgets or negotiating Superfund enforcement settlements.

The ESD cost evaluation focuses on changes as documented in ESD. These changes include the modification of the TPAH RALs for only the nearshore areas. The nearshore areas include shallow, intermediate, and future maintenance dredge (FMD) areas. The RALs for the navigation channel were not modified; therefore, quantities and costs for navigation channel areas remained the same as Alternative F Modified from the ROD.

New quantities were developed for Alternative F Modified with RAL Change based on the changes described in the ESD. These quantities were independently derived for this evaluation and were not previously presented in the ROD.

Key Assumptions for the Cost Evaluation

Key assumptions for the ESD cost evaluation include:

1. This evaluation assesses changes as documented in the ESD, including modifications to the TPAH RAL for nearshore sediments (RAL F).

2. The modifications presented in the ESD resulted in small reductions in the quantities of sand, AquaGate, armor, beach mix, and dredging volumes as well as structures impacted (i.e. docks and piles).

3. The estimated construction duration for Alternative F Modified with RAL Change was kept consistent with the construction duration for Alternative F Modified in the ROD cost estimate. As noted in the previous bullet, quantity reductions were relatively small; therefore, the quantity reductions would not likely change the number of years required for construction.

4. Costs for the Alternative F Modified with RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate

5. All other costs estimate assumptions unrelated to the quantity modifications were kept consistent with what was presented in the ROD cost estimate.

Conclusions

As shown in Table 1, the modifications to quantities based on the changes documented in the ESD would decrease the present value cost from Alternative F Modified as presented in the ROD by approximately $35 million (3.4 percent decrease) when modifications are applied across the entire site.

Organization

The ESD cost evaluation is organized into the following components:

a. Overview – Evaluation of Cost Impacts to Alternative F Modified from Changes Documented in the Explanation of Significant Difference, Portland Harbor Superfund Site

   This is the memorandum you are currently reading that summarizes the approach to developing the ESD cost evaluation.

b. Cost Comparison of Alternative F Modified from the ROD to Revised Alternative F Modified with RAL Change (Table A1)

c. Detailed Cost Estimate Summary – Alternative F Modified with RAL Change (Table A2)

References

EPA. 2017. Record of Decision, Portland Harbor Superfund Site. January 3.

Table A1 - Cost Comparison of Alternative F Modified from the ROD to Revised Alternative F Modified with RAL Change

EXPLANATION OF SIGNIFICANT DIFFERENCES COST SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Explanation of Significant Differences (-30% to +50%)
Base Year: 2016

Alternative	Total Capital Cost	Total Periodic Cost	Total Non-Discounted Cost	Present Value Cost
F Modified[1] (2017 ROD)	$1,184,607,000	$524,028,000	$1,708,635,000	$1,054,200,000
F Modified w/RAL Change[2]	$1,145,793,000	$504,654,000	$1,650,447,000	$1,018,830,000
Cost Difference[3]	***-$38,814,000***	***-$19,374,000***	***-$58,188,000***	***-$35,370,000***
Percent Difference[4]	***-3.3%***	***-3.7%***	***-3.4%***	***-3.4%***

Notes:

[1] - Costs for Alternative F Modified (2017 ROD) represent the costs presented for Alternative F Modified in the Portland Harbor Superfund Site ROD (EPA 2017).

[2] - Costs for Alternative F Modified w/RAL Change represent Alternative F Modified with adjustments made as documented in the accompanying Explanation of Significant Differences (EPA 2018).

[3] - Represents the cost difference between Alternative F Modified w/RAL Change and the Alternative F Modified from the ROD.

[4] - Represents the percent difference between Alternative F Modified w/RAL Change and the Alternative F Modified from the ROD.

Costs for Alternative F Modified w/RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate.

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Institutional Controls	1	LS	$3,623,355	$3,623,355
SUBTOTAL				$3,623,355
Contingency (Scope and Bid)	15%			$543,503
SUBTOTAL				$4,166,858
Project Management	2%			$83,337
Remedial Design	2%			$83,337
Construction Management	3%			$125,006
TOTAL				$4,458,538
TOTAL CAPITAL COST				**$4,459,000**

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	1,819	AC	$3,686	$6,703,954
SUBTOTAL				$6,703,954
Contingency (Scope and Bid)	20%			$1,340,791
SUBTOTAL				$8,044,745
Project Management	5%			$402,237
Remedial Design	8%			$643,580
Construction Management	6%			$482,685
TOTAL				$9,573,247
TOTAL CAPITAL COST				**$9,573,000**

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Mobilization / Demobilization	1	LS	$13,881,000	$13,881,000
Transload Facility Development	1	LS	$15,651,213	$15,651,213
Debris Removal and Disposal	377	AC	$13,107	$4,941,343
Obstruction Removal and Relocation	1	LS	$20,308,861	$20,308,861
Erosion/Residual Control Measures	1	LS	$27,166,335	$27,166,335
Dredging of Contaminated Sediments (Open Water)	2,694,951	CY	$24.53	$66,107,148
Dredging of Contaminated Sediments (Confined)	122,831	CY	$31.10	$3,820,044
Excavation of Riverbanks	119,071	CY	$5.19	$617,978
Dewatering and Water Treatment for Dredging Operations	1	LS	$12,450,462	$12,450,462
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	358,891	TON	$191	$68,536,125
Subtitle D Disposal (Handling, Transportation, and Disposal)	4,465,403	TON	$111	$494,570,473
Mitigation	53	AC	$1,070,827	$56,753,831
Sand Placement for Technology Assignments	874,434	CY	$33.80	$29,555,683
Beach Mix Placement for Technology Assignments	66,031	CY	$73.04	$4,822,649
Armor Placement for Technology Assignments	139,983	CY	$72.06	$10,087,157
Reactive/GAC Placement for Technology Assignments	1	LS	$50,696,074	$50,696,074
Geofabric for Riverbanks	24.7	AC	$14,311	$353,488
Organoclay Mat Placement for Technology Assignments	174,300	SF	$6.39	$1,113,777
SUBTOTAL				$881,433,641
Contingency (Scope and Bid)	20%			$176,286,728
SUBTOTAL				$1,057,720,369
Project Management	2%			$21,154,407
Remedial Design	2%			$21,154,407
Construction Management	3%			$31,731,611
TOTAL				$1,131,760,794
TOTAL CAPITAL COST				**$1,131,761,000**

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10, 14, 18, 22, 26, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	1,819	AC	$3,686	$6,703,954
Site-Wide Monitoring	1	LS	$957,659	$957,659
Cap Area Monitoring and Reactive Layer Monitoring	1	LS	$27,961,876	$27,961,876
SUBTOTAL				$35,623,489
Contingency (Scope and Bid)	20%			$7,124,698
SUBTOTAL				$42,748,187
Project Management	2%			$854,964
Technical Support	5%			$2,137,409
TOTAL				$45,740,560
TOTAL PERIODIC COST				**$45,741,000**

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	1	LS	$4,908,126	$4,908,126
SUBTOTAL				$4,908,126
Contingency (Scope and Bid)	20%			$981,625
SUBTOTAL				$5,889,751
Project Management	5%			$294,488
Technical Support	10%			$588,975
TOTAL				$6,773,214
TOTAL PERIODIC COST				**$6,773,000**

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Evaluating and Updating Institutional Controls	1	LS	$626,873	$626,873
SUBTOTAL				$626,873
Contingency (Scope and Bid)	10%			$62,687
SUBTOTAL				$689,560
Project Management	5%			$34,478
Technical Support	10%			$68,956
TOTAL				$792,994
TOTAL PERIODIC COST				**$793,000**

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
5-Year Site Review	1	LS	$243,687	$243,687
SUBTOTAL				$243,687
Contingency (Scope and Bid)	10%			$24,369
SUBTOTAL				$268,056
Project Management	5%			$13,403
Technical Support	10%			$26,806
TOTAL				$308,265
TOTAL PERIODIC COST				**$308,000**

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

Summary of Present Value Analysis - Alternative F Modified w/ RAL Change

Year[1]	Capital Costs	Periodic Costs	Total Annual Expenditure[2]	Discount Factor (7.0%)	Present Value[3]
0	$96,974,538	$0	$96,974,538	1.0000	$96,974,538
1	$87,401,538	$0	$87,401,538	0.9346	$81,685,477
2	$87,401,538	$45,741,000	$133,142,538	0.8734	$116,286,693
3	$87,401,538	$0	$87,401,538	0.8163	$71,345,875
4	$87,401,538	$45,741,000	$133,142,538	0.7629	$101,574,442
5	$87,401,538	$7,874,000	$95,275,538	0.7130	$67,931,459
6	$87,401,538	$45,741,000	$133,142,538	0.6663	$88,712,873
7	$87,401,538	$0	$87,401,538	0.6227	$54,424,938
8	$87,401,538	$45,741,000	$133,142,538	0.5820	$77,488,957
9	$87,401,538	$0	$87,401,538	0.5439	$47,537,697
10	$87,401,538	$53,615,000	$141,016,538	0.5083	$71,678,706
11	$87,401,538	$0	$87,401,538	0.4751	$41,524,471
12	$87,401,538	$0	$87,401,538	0.4440	$38,806,283
13	$0	$0	$0	0.4150	$0
14	$0	$45,741,000	$45,741,000	0.3878	$17,738,360
15	$0	$7,874,000	$7,874,000	0.3624	$2,853,538
16	$0	$0	$0	0.3387	$0
17	$0	$0	$0	0.3166	$0
18	$0	$45,741,000	$45,741,000	0.2959	$13,534,762
19	$0	$0	$0	0.2765	$0
20	$0	$7,874,000	$7,874,000	0.2584	$2,034,642
21	$0	$0	$0	0.2415	$0
22	$0	$45,741,000	$45,741,000	0.2257	$10,323,744
23	$0	$0	$0	0.2109	$0
24	$0	$0	$0	0.1971	$0
25	$0	$7,874,000	$7,874,000	0.1842	$1,450,391
26	$0	$45,741,000	$45,741,000	0.1722	$7,876,600
27	$0	$0	$0	0.1609	$0
28	$0	$0	$0	0.1504	$0
29	$0	$0	$0	0.1406	$0
30	$0	$53,615,000	$53,615,000	0.1314	$7,045,011
TOTALS:	$1,145,793,000	$504,654,000	$1,650,447,000		$1,018,829,457

TOTAL PRESENT VALUE OF ALTERNATIVE F MODIFIED WITH RAL CHANGE [4] **$1,018,830,000**

Notes:

[1] Alternative F Modified with RAL Change is expected to require cost expenditures for perpetuity since some contamination addressed by the remedy within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However, the period of analysis was assumed to be 30 yrs beyond the start of construction in Year 0.

[2] Total annual expenditure is the total cost per year with no discounting.

[3] Present value cost by year is the total annual expenditure discounted by a factor for that year representing the 7.0% real discount rate recommended by "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

[4] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs for Alternative F Modified w/RAL Change were developed based on the same methodology and guidance as described in Appendix IV, Appendix G (Methodology and Organization of Selected Remedy Cost Estimate) of the ROD.

Costs presented for the selected remedy are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Appendix IV, Appendix G of the ROD.

The estimated construction duration for the Alternative F Modified w/RAL Change was kept consistent with the construction duration for Alternative F Modified in the ROD cost estimate.

Costs for Alternative F Modified w/RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate.

Abbreviations:

AC Acre
CY Cubic Yard
LS Lump Sum
QTY Quantity
SF Square Foot
TON Ton

Appendix A3

Discussion and Response to August 2, 2017 NW Natural Memo, June 5, 2018

DRAFT

Discussion and Response to August 2, 2017 NW Natural Memo titled "*USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor*"

DRAFT - June 5, 2018

Introduction and Purpose

On January 19, 2017, the U.S. Environmental Protection Agency (EPA) released an updated Toxicological Review of Benzo(a)pyrene (USEPA 2017a). The updated toxicological review modified the oral cancer slope factor for benzo(a)pyrene (BaP) from 7.3 per milligram per kilogram-day $(mg/kg\text{-}day)^{-1}$ to 1 $(mg/kg\text{-}day)^{-1}$. The change in the cancer slope factor has potential implications for the risk-based human health cleanup levels (CULs), target tissue levels, and risk-based highly toxic principal threat waste (PTW) thresholds for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) measured as BaP equivalents (BaP Eq) selected in the January 3, 2017 Record of Decision (ROD) for the Portland Harbor Superfund Site (ROD) (USEPA 2017b)[1]. Although not directly related to a cancer slope factor or a measurement of risk, the change in the BAP slope also has implications for the total PAH remedial action levels (RALs) used to establish the remedial footprint of the Selected Remedy presented in the ROD.

This memorandum discusses EPA's evaluation of information presented in document provided by NW Natural titled: "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor" dated August 2, 2017 (NWN BaP Memo) (Anchor QEA 2017) and summarizes EPA's evaluation and conclusions regarding the effect of the cancer slope factor (CSF) change on the Selected Remedy.

The change in the cancer slope factor for BaP does not impact the Portland Harbor ROD's human health PRGs for surface water because they are based on water quality criteria promulgated by the State of Oregon and these criteria have not been changed. Similarly, risks to ecological receptors are also unaffected by this change. As a result, EPA's evaluation only considered potential changes to the risk-based cPAH CULs based on the direct contact and clam consumption exposure scenarios, the risk based cPAH highly toxic PTW threshold and potential changes in RALs resulting from these changes.

Specifically, this memorandum discusses the following:

- Potential change in direct contact beach and nearshore sediment CUL based on changes to the BaP CSF
- Potential change in fish consumption sediment CUL based on changes to the BaP CSF
- Potential change in highly toxic PTW threshold based on changes to the BaP CSF

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[1] cPAH CULs were calculated using a cancer slope factor to achieve a 1×10^{-6} cancer risk level and the principle threat waste (PTW) thresholds are set at a 1×10^{-3} risk level based on the CUL. The Toxicological Review of Benzo(a)pyrene (USEPA 2017a) also included an updated non-cancer oral reference dose of 0.0003 mg/kg-day. However, this updated value was already utilized in the human health baseline risk assessment and development of preliminary remedial goals (PRGs) for the Portland Harbor Site.

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- Potential change in nearshore and navigation channel RALs for total PAHs
- Potential application of the cPAH in-water sediment PRG as cPAH CUL for in-water sediments (exclusive of beach and navigation channel sediments).

Carcinogenic PAH Cleanup Levels and Principal Threat Waste Thresholds

Reducing the BaP CSF from 7.3 to 1 $(mg/kg\text{-}day)^{-1}$ results in an increase in the direct contact sediment CUL and highly toxic PTW thresholds specified in the PH ROD by a factor of 7.3. Target tissue thresholds for cPAHs and clam tissue are similarly adjusted. Due to the non-linear relationship between cPAHs in clam tissue and sediment, the clam consumption CUL is adjusted by a factor of approximately 25. Changes to cPAH CULs, target tissue levels and PTW thresholds are summarized in Table 1. The basis for these changes is described in greater detail below.

Table 1 – cPAH (BaP Eq) CUL and Highly Toxic PTW Thresholds

Scenario	Application Area	ROD cPAH CUL	Updated cPAH CUL [1]
Direct Contact Sediment CUL	Nearshore Sediment	12 µg/kg	85 µg/kg
Direct Contact Sediment CUL	Nearshore sediment (excluding beach areas)	Not provided	774 µg/kg
Clam Consumption Tissue Target Level	Navigation Channel Sediment	7.1 µg/kg	51.6 µg/kg
Clam Consumption Sediment CUL	Navigation Channel Sediment	39.5 µg/kg[2]	1,076 µg/kg
Highly Toxic PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg

[1] Updated Value is based on change in BaP CSF from 7.3 to 1 $(mg/kg\text{-}day)^{-1}$

Human Health Direct Contact In-Water Sediment Cleanup Level

The Portland Harbor Human Health Risk Assessment presented in the Portland Harbor Remedial Investigation Report (USEPA 2016a) evaluated a range of direct contact exposure scenarios for beach sediment and in-water sediment. Potentially exposed populations evaluated under the beach exposure scenarios included dockside workers, transients, recreational beach users, high frequency fishers, and tribal fishers. Potentially exposed populations evaluated under the in-water sediment exposure scenarios included in-water workers, high frequency fishers, tribal fishers, diver wet suit, and diver dry suit.

The human health direct contact sediment CUL for cPAHs established in ROD of 12 µg/kg established in the Portland Harbor ROD was based on a recreational beach exposure scenario. Adjusting the human health direct contact sediment CUL by a factor of 7.3 results in a revised CUL of 85 µg/kg.

The Portland Harbor ROD did not develop cleanup levels based on the in-water exposure scenarios evaluated in the baseline human health risk assessment. In-water sediment PRGs ranged from 106

[2] Due to an error in the application of Equation 1, the cPAH cleanup level presented in the ROD has been revised from 3,950 µg/kg to 39.5 µg/kg. This results in cPAH CUL based on the shellfish consumption exposure scenario of 1,076 µg/kg.

µg/kg for the tribal fisher exposure scenario to 8,572 µg/kg for the in-water worker exposure scenario. Adjusting the in-water nearshore sediment PRG of 106 µg/kg by a factor of 7.3 results in a revised PRG of 774 µg/kg.

EPA has re-evaluated application of the nearshore sediment CUL based on the recreational beach exposure scenario and determined that two cPAH direct contact CULs should apply to nearshore sediments. The updated cPAH direct contact beach CUL of 85 µg/kg will apply to recreational beaches identified in the baseline human health risk assessment and RI Report (EPA 2016a) (EPA 2016a). EPA also developed a cPAH direct contact CUL of 774 µg/kg based on the tribal fisher exposure scenario. The cPAH direct contact tribal fisher CUL for tribal in-water sediment of 774 µg/kg will apply to the remainder of nearshore sediments (non-recreational beach areas).

Human Health Clam Consumption Cleanup Level

For the clam consumption exposure scenario, the target tissue level also increases by a factor of 7.3. However, the relationship between cPAH (BaP Eq) clam tissue levels and sediment levels is a non-linear relationship represented by the following equation presented in Appendix B of the Portland Harbor FS (USEPA 2016b):

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue})-(\ln(f_{lipid})-\ln(CF)+2.47)}{0.6} + ln(f_{oc}) \text{ (Equation 1)}$$

Where:

PRG_{sed} = Risk-Based Sediment Preliminary Remediation Goal, dry weight (µg/kg)
C_{tissue} = Risk-Based Acceptable Tissue Concentration, wet weight (µg/kg)
CF = Correction Factor of 2.31
f_{oc} = Fraction Organic Carbon, dry weight (0.0171)
f_{lipid} = Fraction of lipid in clam tissue, wet weight (0.22)

During review of potential changes to the cPAH cleanup level resulting from the change in the BaP CSF, EPA became aware of an error in application of the Equation 1. This error resulted from calculating the sediment cleanup level in the units of µg/kg rather than mg/kg (the equation was developed based on mg/kg). The error reduces the cPAH CUL presented in the ROD by a factor of 100 from 3,950 µg/kg to 39.5 µg/kgAs a result of the non-linear relationship between bulk sediment BaP concentrations and clam tissue BaP concentrations, the cPAH sediment CUL bases on the clam consumption scenario increases from 39.5 to 1,076 µg/kg.

Benthic Risk Direct Contact Cleanup Level

The total PAH cleanup level for protection of the benthic community was established in the Portland Harbor ROD at 23,000 µg/kg. This concentration is above the nearshore total PAH RAL of 13,000 µg/kg established in the Portland Harbor ROD but below both the navigation channel total PAH RAL of 170,000 µg/kg and the highly toxic PTW threshold of 106,000 µg/kg. Although the benthic risk direct contact total PAH sediment CUL is unaffected by the change in BaP CSF, any changes to the remedial action levels for the Selected Remedy will have to consider the impact on benthic risk.

Principal Threat Waste Thresholds

The Portland Harbor ROD established a highly toxic principal threat waste (PTW) threshold for cPAHs of 106,000 µg/kg based on a 1 x 10^{-3} risk level. Because the cPAH highly toxic PTW threshold is based on cancer risk, it is also affected by the BaP CSF change. Adjusting the highly toxic PTW threshold by a factor of 7.3 results in a revised PTW threshold of 774,000 µg/kg.

Remedial Action Levels

Remedial action levels (RALs) are a range of contaminant concentrations that fall between the site-wide spatially area weighted average concentrations (SWACs) prior to initiation of remedial action and cleanup levels for the focused COCs. The Portland Harbor FS developed RALs for six focused chemicals of concern (COCs), including total PAHs[3], by plotting site-acres remediated against the estimated post-remediation SWAC.

Thus, six sets of RALs bracketing the distribution of contamination for seven remedial alternatives (Alternatives B through H) were evaluated in the FS based on this relationship for each focused COC. The RAL curve for total PAHs is presented in Figure 1. For total PAHs, RALs ranged from 170,000 to 970 µg/kg. As noted in Figure 1, the most conservative RAL of 970 µg/kg equates to a cPAH (BaP Eq) concentration of 106 µg/kg based on a regression analysis between total PAH and total cPAH (BaP Eq) sediment concentrations at the Portland Harbor Site developed in the FS. This relationship is represented by the following equation:

$$Total\ PAHs = (BaP\ Eq)(BaP\ EQ)^m \times 10^b \text{ (Equation 2)}$$

Where: m = 0.984 and b = 0.996

The remedial footprint for the Selected Remedy established in the Portland Harbor ROD are defined by exceedances of RALs and the presence of PTW. RALs are contaminant-specific sediment concentrations of focused COCs used to identify areas where capping and/or dredging will be conducted. The Selected Remedy for the Site identified remedial footprints based on two sets of RALs—one applicable to nearshore sediments (the Alternative F RAL) and one applicable to the federally authorized navigation channel (the Alternative B RAL). The total PAH RALs for the Selected Remedy are 13,000 µg/kg for nearshore sediments and 170,000 µg/kg for the federally authorized navigation channel.

EPA evaluated whether changes to the total PAH RALs were necessary due to the BaP CSF change. The evaluation considered both the nearshore RAL and the navigation channel RAL. The evaluation assessed the effect of the RAL change on post-construction risk estimates and if the change would affect attainment of the RAOs established for the Site.

Based on its evaluation, EPA determined that the nearshore RAL should be revised from 13,000 to 30,000 µg/kg to avoid remediation of PAH-contaminated sediments that no longer pose a risk to human health based on the changes to the nearshore sediment cPAH CUL. EPA determined that this change would result in a negligible change to the protectiveness of the remedy, including human health risks

[3] It should be noted that although RALs were developed for both total PAHs, CULs were established for both total PAHs and cPAHs.

associated with shellfish consumption, and would not appreciably change the ability of the remedy to attain the RAOs established for the Portland Harbor Site.

Based on its evaluation, EPA determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to protect humans who consume shellfish collected from the navigation channel (RAO 2) and achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5). This is because the selected total PAH RAL of 170,000 µg/kg is well above the total PAH CUL and the lack of natural recovery processes within the navigation channel between RM 5 and RM 7 where the total PAH RAL is exceeded. A summary of the total PAH RALs is presented in Table 2 below.

Table 2 – Total PAH RAL Summary

Application Area	ROD Total PAH RAL	Updated Total PAH RAL
Nearshore Sediment (RAL F)	13,000 µg/kg	30,000 µg/kg
Navigation Channel (RAL B)	170,000 µg/kg	No Change

Remedial Quantity and Cost Implications Quantities

EPA evaluated the changes in remedial quantities and cost associated with changing the total PAH RAL applicable to nearshore sediments outside the navigation channel. EPA determined that this change would reduce the total nearshore remedial footprint by 17 acres, reduce the capping area by 8 acres, and reduce the dredging volume by 43,800 cy. This results in a decrease in the present value cost for the Selected Remedy of approximately $35 million. This represents a 3.4% decrease in the overall present value cost of the Selected Remedy.

Summary

EPA evaluated the effect of changes to the BaP CSF will result on risk-based CULs, target tissue levels and risk-based highly toxic PTW thresholds for cPAHs selected in the Portland Harbor ROD. This evaluation considered the information and analysis included in the document provided by NW Natural titled: "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor" dated August 2, 2017 (NWN BaP Memo) (Anchor QEA 2017). The evaluation also considered an error in the application of Equation 1 that describes the relationship between BaP in sediment and clam tissue.

Based on its analysis, EPA determined that changes to the cPAH CULs and PTW thresholds were warranted. EPA also determined that including a human health direct contact cPAH CUL based on the tribal fisher exposure scenario was appropriate. Finally, EPA determined that a change to the total PAH nearshore sediment RAL was appropriated but that a change to the total PAH navigation channel RAL was not appropriate because it may affect the ability of the remedy to attain the RAOs established in the Portland Harbor.

References:

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Anchor QEA. 2017. Memorandum: USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor. August 2.

USEPA. 2016a. *Final Remedial Investigation Report, Portland Harbor Remedial Investigation/Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. February 8.

USEPA. 2016b. *Draft Final Portland Harbor Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. June.

USEPA. 2017a. Toxicological Review of Benzo(a)pyrene. EPA/635/R-17/003Fa. January.

USEPA. 2017b. Record of Decision, Portland Harbor Superfund Site. January 3.

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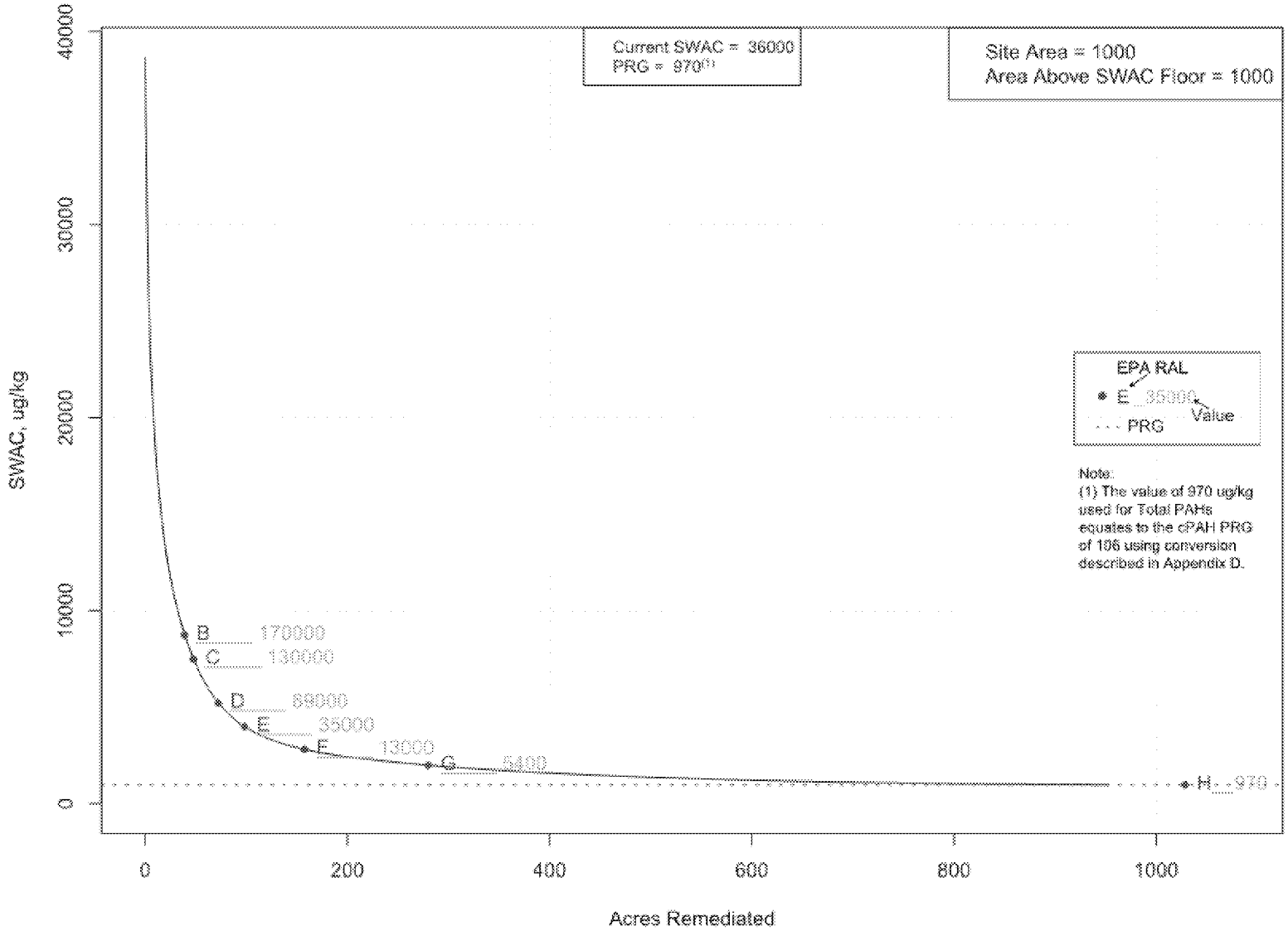
Figure 1 – Total PAH RAL Curve



Appendix A4

Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017

DRAFT

PEARL LEGAL GROUP PC

MEMORANDUM

TO: Elliott Laws

FROM: Patty Dost

DATE: November 28, 2017

RE: Portland Harbor cPAH Cleanup Levels

When you, Tom and Margaret met with Jim Woolford and others on November 15, you requested three changes to the cleanup levels in the ROD. First, EPA's current Portland Harbor cleanup level for direct contact with underwater sediments impacted by carcinogenic polycyclic aromatic hydrocarbons (cPAHs) appears to be a mistake – instead of 12 µg/kg, it should be 106 µg/kg to be consistent with the risk assessment.

Second, EPA's cPAH cleanup level of 3,950 µg/kg for the navigation channel is based on consumption of clams, an exposure scenario EPA had determined in the risk assessment to be incomplete. Accordingly, it should be removed.

Third, all Portland Harbor cPAH cleanup levels should be updated using EPA's current toxicity values so that remedial actions can be designed using the best scientific information to efficiently and cost-effectively reduce risk.

I understand that you promised to send EPA legal and other support for making the requested changes. That support is set forth below.

I. <u>EPA's cPAH cleanup levels are inconsistent with the Baseline Risk Assessment and therefore legally indefensible</u>.

EPA completed the Portland Harbor Baseline Human Health Risk Assessment (BHHRA) in March 2013. The BHHRA identified potential risks to human health from cPAHs in sediment through several different exposure scenarios, including direct contact with soil or sediment on upland beaches, direct contact with in-water sediment during fishing or occupational activities, and consumption of clams and fish. Based upon the BHHRA, EPA developed preliminary remediation goals (PRGs) it believed would be protective of humans exposed to cPAHs in Portland Harbor sediments: 12 µg/kg for direct contact exposure to beach sediment, 106 µg/kg for direct contact with in-water sediment, and 3,950 µg/kg for consumption of clams.[1] EPA was unable to develop a technically sound cPAH sediment PRG for fish consumption.[2]

The Portland Harbor Record of Decision (ROD) adopts two of these three PRGs as cleanup levels, but applies them to areas of the site in which the BHHRA concluded that the exposure pathways for which the PRGs were developed are not complete. First, the ROD applies the 12 µg/kg beach sediment PRG to nearshore in-water sediments. Second, the ROD applies the 3,950 µg/kg clam consumption PRG to sediments in the navigation channel. In both cases, this results in the ROD requiring large areas of cleanup where the BHHRA identified no unacceptable human health risk from cPAHs in sediment.

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[1] Portland Harbor Feasibility Study (June 2016), Table 2.2-1a.

[2] EPA memorandum, *Evaluation of Analyses Used to Calculate Bioaccumulation Calculation Results Portland Harbor Superfund Site RAC Contract Number EP-W-05-049* (May 2016), attached at Tab 1.

EPA has no legal basis for requiring remediation in the absence of unacceptable risk.[3] EPA's remedial investigation must include a site-specific baseline risk assessment.[4] The baseline risk assessment provides "the basis for determining whether remedial action is necessary as well as the framework for developing risk-based remediation goals."[5] "As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority."[6]

EPA's selection of in-water cleanup levels that are inconsistent with the BHHRA would likely not survive a judicial challenge. EPA's remedy decisions must be based in reason and science, and EPA must articulate a rational connection between the facts it has found and the choices it has made.[7] EPA has a legal obligation to "explain the key assumptions that underpin its remedy"[8] and must explain decisions that run counter to evidence before it.[9] Although EPA's technical decisions are entitled to deference, courts will review EPA's analysis to "ensure that it is 'rational' and 'makes sense'" and will not absolve EPA of "obvious mistakes."[10]

A. *EPA's ROD applies an upland beach cleanup level to in-water sediments that the baseline risk assessment found posed no direct contact risk.*

EPA's BHHRA identified potential risk from direct contact with cPAHs in nearshore in-water sediment to in-water workers, fishers, and divers. Based upon the BHHRA, EPA developed a direct contact PRG of 106 µg/kg for in-water sediment to be protective of tribal fishers.[11] In the ROD, however, EPA selected a cPAH in-water sediment cleanup level of 12 µg/kg, based upon a child recreational beach exposure scenario.[12] EPA provided no explanation for its application of a beach exposure PRG to in-water sediments other than the statement that its selected cleanup levels "represent the lowest value in each medium (beach or in-river sediment) to be protective of all receptors."[13] EPA did not explain why it abandoned the finding of the BHHRA that the tribal fisher was

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[3] 42 U.S.C §9606(a).
[4] 40 CFR §300.430(d)(4).
[5] *Contaminated Sediment Remediation Guidance or Hazardous Waste* Site (EPA-540-R-05-012, December 2005) ("Sediment Guidance"), p. 2-9.
[6] *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (OSWER Directive 9355.0-30) (April 22, 1991), p. 3.
[7] *United States v. NCR Corp.*, 911 F. Supp. 2d 767, 773 (E.D. Wis. 2012) *aff'd sub nom*. United States v. P.H. Glatfelter Co., 768 F.3d 662 (7th Cir. 2014); *United States v. Newmont USA Ltd.*, 504 F. Supp. 2d 1077, 1082 (E.D. Wash. 2007).
[8] *Emhart Industries, Inc. v. New England Container Company, Inc.*, 2017 WL 3535003, *11-12 (D.R.I. 2017) (citations omitted) (finding EPA assumptions concerning use of groundwater and risks from fish consumption on which remedy selection was based arbitrary and capricious).
[9] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.,* 463 U.S. 29, 43, 103 S. Ct. 2856, 2867 (1983).
[10] *Emhart Industries* at *11.
[11] Portland Harbor Feasibility Study, Appendix B, Table B3-4.
[12] *Id.* The 12 µg/kg cPAH sediment cleanup level actually represents a background value, because the acceptable risk value for children on recreational beaches was below EPA's calculated background value for cPAHs. See Portland Harbor Feasibility Study Table 2.2-4. This cleanup level is applicable to nearshore in-water sediments. *See*, ROD, Table 17, n.7.
[13] ROD, § 9.1.1

the most sensitive receptor for in-water sediment and assumed instead that children would be playing in underwater sediments offshore of industrial facilities.

Although EPA's cPAH in-water sediment cleanup level is based upon a child recreational beach exposure assumption, virtually all of EPA's evaluations supporting its remedy selection for nearshore sediments are based upon the 106 µg/kg PRG for tribal fishers. For example, the Remedial Action Levels (RALs) for cPAHs developed in the Feasibility Study and used to define action areas in the ROD were based on the 106 µg/kg PRG for in-water sediment exposure.[14] "Highly toxic" principal threat waste concentrations in the Feasibility Study and ROD are based on the 106 µg/kg PRG.[15] Most importantly, the Feasibility Study evaluated the performance of all alternatives (including the selected alternative) for EPA's Remedial Action Objective (RAO 1) (reduce risks to people from direct contact with chemicals in sediment and beaches) against the 106 µg/kg tribal fisher PRG.[16] EPA's residual risk evaluations led it to conclude that its selected remedy would be protective of direct contact with sediments "immediately after construction."[17] However, even a cursory review of EPA's residual risk tables in the final Feasibility Study (as well as a set of EPA figures prepared for an earlier draft of the Feasibility Study) reveals that the 12 µg/kg cPAH sediment cleanup level would not be met in almost every segment of the river at the rolling half-mile scale evaluated for RAO1 immediately following construction.[18]

EPA's selection of the 12 µg/kg cPAH cleanup level for in-water sediments looks like an "obvious mistake."[19] EPA should correct the ROD to identify the nearshore in-water cPAH sediment cleanup level as 106 µg/kg.

B. *EPA's ROD applies a clam consumption cleanup level to areas of the river in which the baseline risk assessment correctly assumed that clams would not be harvested.*

The ROD applies a cPAH sediment cleanup level for clam consumption in areas of the river in which the BHHRA found no clam consumption risk: "The cleanup level applicable to sediments in the navigation channel is 3,950 µg/kg and is based on human consumption of clams."[20] This is a change from EPA's Feasibility Study and the Proposed Plan, which identified a PRG of 3,950 µg/kg cPAH as protective of humans consuming fish and shellfish.[21]

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[14] Portland Harbor Feasibility Study, Figure 3.4-2.
[15] ROD, Table 6.
[16] ROD, Appendix J – Update, Calculation of Residual Risk and Post Construction Risk Estimates, Table J2.2-2c. *See also*, ROD Responsiveness Summary at p. 2-126 ("the evaluation of direct contact human health presented in Appendix J (of the FS) only considered direct contact with sediment and did not consider beach exposures").
[17] ROD, p. 121.
[18] ROD, Appendix J, Table J2.2-1c, attached at Tab 2; EPA draft August 2015 draft Feasibility Study, Figure 4.2-7a-h, attached at Tab 3. Indeed, cPAH concentrations alone would exceed 1 x 10^{-5} levels in many segments of the river. Note also that the ROD states that "at the end of construction ... people will be protected from risks associated with playing on beaches and swimming in the river," even though the detailed comparative analysis of remedial alternatives states that, "[r]esidual risk estimates are based on direct contact exposure to shallow sediments. There is insufficient data to estimate post construction risks based on exposure to beach sediments." ROD, p. 121; ROD, Table 22 n. 1.
[19] *Emhart Industries* at *11.
[20] ROD, Table 17, note 7.
[21] EPA FS (June 2016), Table 2.2-1a.

During the RI/FS, EPA was unable to develop a technically sound cPAH sediment PRG for fish consumption, because there is no observable relationship between sediment sources and PAH concentrations in fish tissue.[22] Because it was unable to link cPAHs in sediment to fish consumption risk, and despite marginal cPAH fish consumption risk, EPA originally assigned a shellfish consumption PRG to the navigation channel as a surrogate for fish consumption.[23] After several potentially responsible parties, including NW Natural, commented on the lack of technical basis for the fish consumption PRG, EPA dropped the PRG for fish consumption from the ROD but established a 3,950 µg/kg cleanup level for the navigation channel based on clam consumption.

EPA's BHHRA found no risk to humans from clams harvested in the navigation channel.[24] EPA explicitly assumed in the BHHRA that clam harvesting occurred only in nearshore areas: "EPA acknowledges that an appropriate exposure area should be determined in consideration of water depth (i.e., nearshore areas) and the area over which a sustainable shellfish harvest consistent with the clam consumption is possible."[25] Nonetheless, EPA's responsiveness summary states that "EPA ... disagrees that the shellfish consumption pathway is not complete for the navigation channel. The commenter has not provided any information to support this statement."[26] On this basis, EPA has determined that approximately 25 acres of the navigation channel must be dredged at an estimated cost in the tens of millions of dollars.

EPA must "explain the key assumptions that underpin its remedy"[27] and must explain decisions that run counter to evidence before it and its own prior findings.[28] EPA itself determined that the clam consumption exposure pathway was complete only in nearshore areas of the site; it cannot put the burden on responsible parties or members of the public to provide "information" supporting the assumptions in EPA's own risk assessment. EPA's requirement for cleanup of large areas not shown by

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[22] *See,* Lower Willamette Group Comments on Portland Harbor Proposed Plan (September 6, 2017), attached at Tab 4, p. 26. EPA's own internal reviews indicate its inability to establish this relationship. *See supra*, note 2. Further, the science is extensive that PAHs do not readily accumulate in vertebrate fish tissue. See Meador et al. 1995, *Reviews of Environmental Contamination and Toxicology* 143:79-164; September 2014 *Toxicological Review of* Benzo(a)pyrene, ORD EPA/635/R-14/312a; Varanasi, et al. 1989, Biotransformation and Disposition of Polycyclic Aromatic Hydrocarbons (PAHs) in Fish: In Varanasi U (ed); Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment, CRC Press; and Metabolism of PAHs in Teleost Fish-Scientific Findings, Memorandum from the Northwest Fisheries Science Center of NMFS, available at http://sero.nmfs.noaa.gov/deepwater_horizon/previous_reopening/index.html, October 22, 2010.

[23] 2016 draft Final FS Appendix B, p. B-35.

[24] See Map 5-4.1 (Portland Harbor RI/FS Appendix F, March 28, 2013 – Risks from Clam Consumption, RME), attached at Tab 5.

[25] EPA Comments on Comprehensive Round 2 Site Summary and Data Gaps Analysis Report (January 15, 2008), p. 26.

[26] ROD, Responsiveness Summary, p. 2-35. The extent to which the freshwater clams found in Portland Harbor (which are an invasive species illegal to possess in Oregon) are actually consumed is unknown. BHHRA, p. 29. EPA's decision to include the clam consumption exposure scenario in the risk assessment was based on a single round of interviews of 23 transient individuals. Wagner, letter to DHS (June 6, 2004), attached at Tab 6. The interviews were conducted by an individual with "a severe problem with alcohol" while drinking and fishing with the interviewees; four interviewees reported harvesting clams. *Id*. None of the interviewees reported harvesting clams from the navigation channel.

[27] *Emhart Industries* at *11-12 (D. R.I. 2017) (citations omitted) (finding EPA assumptions concerning use of groundwater and risks from fish consumption on which remedy selection was based arbitrary and capricious).

[28] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.,* 463 U.S. 29 at 43.

the BHHRA to present unacceptable risk based on the unexplained, last minute abandonment of prior decisions is the very definition of arbitrary and capricious.[29]

II. EPA should recalculate cPAH cleanup levels based upon current IRIS toxicity values before requiring PRPs to design remedies for areas of the river that present no unacceptable risk.

On January 19, 2017, approximately two weeks after EPA issued the Portland Harbor ROD, EPA updated its Integrated Risk Information System (IRIS) toxicity values for benzo(a)pyrene. It is appropriate for EPA to update the cPAH cleanup levels (which are calculated as benzo(a)pyrene equivalent values) with the new IRIS toxicity values now, before requiring potentially responsible parties to incur the substantial expense of designing remedies for areas of the site that EPA could no longer consider to present unacceptable risk based on EPA's own current scientific information.

EPA guidance is clear that risk estimates and the cleanup levels that follow from those estimates should be based upon the most current IRIS values available. EPA "generally recommends IRIS as the principal source for toxicological data in preparing superfund risk assessments."[30]

> In general, if health assessment information is available in the Integrated Risk Information System for the contaminant under evaluation, risk assessors normally need not search further for additional sources of information. Since EPA's development and use of peer review in toxicity assessments, IRIS assessments have undergone external peer review in accordance with Agency peer review guidance at the time of the assessment. IRIS health assessments contain Agency consensus toxicity values.[31]

IRIS "represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review."[32] When selecting remedial goals, EPA site managers should "[u]se the most current toxicity values provided by the Integrated Risk Information System (IRIS) or the Health Effects Assessment Summary Tables (HEAST)."[33] Indeed, if the new IRIS values had been announced two weeks before the Portland Harbor ROD issued, rather than two weeks after, EPA would have been required to take a step back and update the FS to consider the updated cleanup levels.[34]

Even after a remedy is selected, EPA guidance directs site managers to review existing cleanup levels against updated IRIS values. "It is EPA's policy to encourage appropriate remedy changes in response to advances in remediation science and technology."[35] EPA "recognizes that some remedy decisions made at Superfund sites in the past should be modified to bring those decisions up to date

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[29] *United States v. NCR Corp.*, 911 F. Supp. 2d at 773 (agency must not rush through the process, "throw darts," "flip a coin," or make a "sudden, knee-jerk decision.").
[30] *Use of IRIS Values in Superfund Risk Assessment,* OSWER directive 9285.7-16 (December 21, 1993), p. 1
[31] *Human Health Toxicity Values in Superfund Risk Assessments*, OSWER directive 9285.7-53 (December 5, 2003), p. 2.
[32] *Id.*
[33] *Rules of Thumb for Superfund Remedy Selection*, OSWER 9355.0-69 (August 1997), p. 6.
[34] *Emhart Industries* at *13 ("Soon after its publication, EPA released a nationwide change to its non-cancer toxicity value for dioxin. Since dioxin is present at the Site, EPA was forced to issue a "Technical Memorandum" updating the BHHRA, cleanup levels, and FS for the Site.").
[35] *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents,* EPA 540-R-98-031 (July 1991) ("ROD Guidance), p. 7-1.

with the current state of the science."[36] EPA's *Comprehensive Five-Year Review Guidance* instructs site managers to check for updated toxicity values:

> Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid? In conducting your five-year review, you should evaluate the effects of significant changes in standards and assumptions that were used at the time of remedy selection. *** Similarly, you should investigate the effect of significant changes in the risk parameters that were used to support the remedy selection, such as reference doses, cancer potency factors and exposure pathways of concern.[37]

At other sites, EPA has recalculated cleanup levels based on updated IRIS values by issuing Explanation of Significant Difference (ESD) documents. Here are some examples:

- Salem Acres (Salem, MA) January 1998 ESD (revising cPAH cleanup levels based upon updated B(a)P IRIS values ("benzo(a)pyrene less potent than it was believed when the ROD was written").[38]

- Burlington Northern Somers Plant (Somers, Montana) July 1998 ESD (revising soil remediation level for cPAHs from 36 to 57 ppm B(a)Peq based upon revised B(a)P cancer slope factor).[39]

- Petrochem Recycling Corp (Salt Lake City, Utah) March 1999 ESD (updating soil performance standard for PCBs from 0.15 ppm to 2.7 ppm based upon updated IRIS slope factors).[40]

- Commencement Bay November 1997 ESD (updating PCB cleanup levels for multiple reasons, including new toxicity information and updated exposure assumptions).[41]

We hope that EPA will consider our request to update the cPAH cleanup levels to incorporate the new IRIS toxicity values now.[42] As we have demonstrated in our prior technical submittals to EPA,[43] updating the cPAH cleanup values and the RALs based on those values would, alone, resolve the question of the clam consumption cleanup level, because all areas of the site would already meet protectiveness criteria at the appropriate exposure scale.[44] Updating the RALs and cleanup levels now would provide greater assurance to the public that direct contact with sediments will be protective

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[36] *Superfund Reforms: Updating Remedy Decisions*, EPA 540-F-96-026 (September 1996), p. 2.
[37] *Comprehensive Five-Year Review Guidance*, OSWER 9355.7-03B-P (June 2001), p. 4-4. *See also, Id.* p. 4-5 ("Have toxicity factors for contaminants of concern at the site changed (e.g. Integrated Risk Information System (IRIS) evaluations)?
[38] Attached at Tab 7.
[39] Attached at Tab 8.
[40] Attached at Tab 9.
[41] https://nepis.epa.gov/Exe/ZyPDF.cgi/9100NGII.PDF?Dockey=9100NGII.PDF
[42] "The lead agency is required to consider comments submitted by interested persons after the close of the public comment period only to the extent that the comments contain significant information not contained elsewhere in the administrative record file which could not have been submitted during the public comment period and which substantially support the need to significantly alter the response action. All such comments and any responses thereto shall be placed in the administrative record file." 40 C.F.R. §300.825(c).
[43] *USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor* (AnchorQEA, August 2, 2017), Attached at Tab 10.
[44] *Id.* at p. 8.

immediately after cleanup. Because updated cleanup values would significantly reduce the amount of unnecessary cleanup, they should also reduce disputes among potentially responsible parties and accelerate remedy implementation.[45]

As we understand it, EPA has just agreed to a baseline sampling program that will require approximately 2 years to complete. The extent to which site-specific pre-remedial design investigations, let alone remedial design, will commence at sites other than Gasco remains unclear, but there is certainly no compelling policy reason based upon the status of implementation of the ROD to delay recalculation of the cleanup values to reflect the most current EPA science on cPAH risk.[46]

CONCLUSION

EPA should recalculate its Portland Harbor cPAH sediment cleanup levels and RALs to incorporate the January 19, 2017 updated IRIS toxicity values for benzo(a)pyrene. Doing so now will reduce unnecessary costs for remedial design work based upon outdated values and will promote the harbor-wide settlement process by better defining the costs associated with cPAH cleanups. Updating the cleanup values in conjunction with correcting the nearshore direct contact cleanup level to be consistent with the risk assessment would provide greater assurance to the public that the site will be protective of direct contact with sediments immediately after construction of the remedy, and the update itself could prevent disagreements between EPA and potentially responsible parties over the legality of the clam consumption PRG.

cc: Tom Imeson
Mardilyn Saathoff
Bob Wyatt
Margaret Kirkpatrick

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[45] *Id.*

[46] NW Natural acknowledges that the IRIS update to the benzo(a)pyrene value would not affect EPA's RAO 5 TPAH cleanup level. We understand the ROD to support additional data collection to refine areas of benthic toxicity in areas that are not driven by risk via another RAO. ROD, Responsiveness Summary, p. 2-218.

TAB 1

MEMORANDUM

To: EPA Region 10 Portland Harbor RI/FS File

From: Portland Harbor RI/FS Team

Date: May 2016

Subject: Evaluation of analyses used to calculate bioaccumulation calculation results
Portland Harbor Superfund Site
RAC Contract Number EP-W-05-049

PURPOSE

The purpose of this memo is to confirm the analyses used to calculate biota-sediment accumulation factors (BSAFs) and biota-sediment accumulation regressions (BSARs) presented in the Portland Harbor Bioaccumulation Modeling Report (Winward Environmental, 2015) and Appendix Da of the draft Portland Harbor Feasibility Study (Anchor QEA, 2012). The primary steps in this evaluation are:

- Review Section 4 of the Bioaccumulation Modeling Report and the current set of PRGs to identify chemicals for which confirmatory analysis is required.
- Use the results presented in Appendix A of the bioaccumulation Report, the Portland Harbor RI data base and supplemental information provided by the Lower Willamette Group (LWG) to confirm the relationship (or lack thereof) between OC normalized sediment and lipid normalized tissue.
- Determine the potential impact on the current sediment PRGs for the human health fish consumption exposure pathway (RAO 2) and ecological receptor biota (predator) exposure pathway (RAO 6).

IDENTIFICATION OF CHEMICALS

This analysis is limited to chemicals for which BSAFs or BSARs were used to develop PRGs that were used to evaluate remedial action alternatives in the Portland Harbor FS. Based on a review of Tables 2.2-5 (RAO 2 PRG Derivation) and 2.2-9 (RAO 6 PRG Derivation), the following PRGs were selected for evaluation:

- Arsenic
- Mercury

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- Carcinogenic PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, dibenz(a,h)anthracene and chrysene
- Bis(2-ethylhexyl) phthalate
- Hexachlorobenzene
- Total PCBs

Human health sediment PRGs for carcinogenic PAHs, were based on consumption of shellfish. As a result, the analysis focused on benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene and chrysene in field collected clams. However, the analysis also looked at the development of BSARs for benzo(a)pyrene in smallmouth bass and the development of BSAFs for benzo(a)anthracene, benzo(a)pyrene and dibenz(a,h)anthracene in large home range fish.

In addition to the above chemicals, total PCBs were included in the smallmouth bass evaluation even though PRGs were developed using the mechanistic model to determine whether a BSAR relationship could be established for total PCBs.

Because the all of the RAO 6 sediment PRGs were developed using the Arnot and Gobas mechanistic food web model, the analysis focused specifically on RAO 2 and the BSARs developed for smallmouth bass and clams and the site-wide BSAFs developed for black crappie, brown bullhead and carp. The process for identifying chemicals for evaluation is presented in Tables 1 and 2.

BSAR AND BSAF RELATIONSHIP CONFIRMATION:

BSARs were developed for those species with exposure areas smaller than the site. These species include benthic invertebrates (laboratory worms, field clams, and crayfish), sculpin, and smallmouth bass. Because PRGs were not established based on tissue-sediment relationships for benthic invertebrates and sculpin, this analysis focused on field collected clam tissue and smallmouth bass.

According to the Bioaccumulation Modeling Report, BSARs were attempted using untransformed and log-transformed sediment and tissue data as follows:

1. Untransformed tissue concentrations vs. sediment concentrations
2. Untransformed tissue concentrations vs. log-transformed sediment concentrations
3. Log-transformed tissue concentrations vs. log-transformed sediment concentrations

BSAFs were developed for large home range fish species including brown bullhead, black crappie and carp.

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For organic chemicals, sediment concentrations were normalized based on OC content, and tissue chemical concentrations were normalized based on lipid content to account for the partitioning of these chemicals. No adjustments were made to sediment and tissue chemical concentrations for metals.

Field Clam BSARs:

Selected BSARs for field clams are presented in Table 4-1 of the Bioaccumulation Modeling Report. Of the 15 chemicals evaluated, relationships were established only for benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene and chrysene. BSAR equations for these chemicals are presented in Table 3.

To confirm the field clam BSARs, collocated clam tissue and sediment sample data were extracted from the July 2011 version of the Portland Harbor RI data base (RI_BERA20110727+RA-SummedParams.mdb). Table 1 of Appendix A of the Bioaccumulation Modeling Report presents the collocated sediment and field collected clam tissue sample identification numbers. Sediment and tissue results were normalized to total organic carbon and total lipids respectively consistent with the procedures described in the Bioaccumulation Modeling Report. In addition, any co-located data pair with non-detected tissue or sediment concentrations was removed from the BSAR analysis, so that only pairs of detected sediment and detected tissue concentrations were used in BSAR development.

As noted in Table 4-1, all field clam BSARs were developed based on log-log relationships. According to the Bioaccumulation Modeling Report and supplemental information provided to EPA by the LWG on February 12, 2016, a correction factor was utilized when the BSARs were derived using log-transformed data. Correction factors were applied using the the "smearing estimator" of Duan (1983), as described in Helsel and Hirsh (2002). According to Helsel and Hirsh, transforming estimates from a log regression equation back into the original units imparts a bias into the BSAF estimate. Specifically, the arithmetic mean of log-data provides an estimate of the geometric mean or median rather than the arithmetic mean. The correction factor or "smearing estimator" for a linear model requires re-expressing the residuals (difference between predicted and measured or observed value) from the log-log equation into the original units, and computing their mean. This mean is the correction factor. Correction factors presented in the Bioaccumulation Modeling Report were calculated using the equation presented in Duan (1983) and the R software package. R is a software package that allows a wide range of statistical tests and analyses to be performed. The text of the R code is included as attachment A.

The results of the regression analysis confirmation as obtained from Excel (and without application of the correction factor) are presented in Figure 1. A comparison of the regression equations and r^2 values presented in Figure 1 shows that it was possible to confirm the slope of the line and the r-squared values but not the intercept due to application of the correction factor. This is significant because according to information presented in Burkard (2009), unlike untransformed data where the slope of the line is the

BSAF, for log-log transformations, the log of the BSAF is the intercept of the regression line and not the slope:

$$\ln(C(tissue)) = slope\ x \ln\big(C(sediment)\big) + \ln BSAF$$

Although calculation of the correction factor used to developed field clam BSARs has not been confirmed, application of the correction factor is consistent with the statistical procedures presented in Helsel and Hirsh. In addition, because the R software code has been provided by the LWG, sufficient documentation is available to justify the use of the field clam BSARs developed for benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluroanthene and chrysene.

Smallmouth Bass BSARs:

BSARs for smallmouth bass were not established for RAO 2 PRG contaminants not included in the Food Web Model. In order to confirm the lack of a relationship, BASR relationships were attempted for arsenic, mercury, benzo(a)pyrene, bis(2-ethylhexyl) phthalate, and hexachlorobenzene. A BSAR relationship was also attempted for total PCBs to determine whether a BSAR could be developed for a chemical for which a relationship would be expected based on its physiochemical and bioaccumlative properties. Sediment SWAC data corresponding to each fish tissue sample were obtained from Appendix A of the Bioaccumulation Report. Smallmouth bass fish tissue data were taken from the July 2011 version of the Portland Harbor RI data base (RI_BERA20110727+RA-SummedParams.mdb). Whole body fish tissue (or combined fillet and body w/o fillet fractions) were lipid normalized on a sample by sample basis. Unlike the collocated clam tissue results, it does not appear that the non-detected results were eliminated from the data set prior to developing the BSARs. However, evaluation of the data with the non-detected results removed, did not improve the relationships. The results of the regression analysis are presented in Figure 2. With the exception of total PCBs, the results of the analysis confirmed the lack of a relationship between tissue and sediment. Values of r^2 for arsenic, mercury benzo(a)pyrene, bis(2-ethylhexyl)phthalate and hexachlorobenzene ranged between 0.0009 to 0.2564 depending on the transformation applied. For total PCBs, the r^2 values ranged between 0.44 and 0.50 with the untransformed data providing the best relationship. This confirms that a BSAR relationship could be developed for total PCBs.

Large Home Range Fish Tissue BSAFS:

BSAFs were calculated for large home range species. The tissue concentration was the average of available composite samples for each species, and the sediment concentration was the Study Area SWAC based on a natural neighbor interpolation. However, neither the average tissue concentrations nor the sediment SWAC results are presented in the Bioaccumulation Modeling Report.

As presented in Table 4-6, BSAFs for large home range fish species were developed for antimony, lead, benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, tributyltin and hexachlorobenzene. However, the only chemical for which large home range fish

tissue BSAFs were used to develop RAO 2 sediment PRGs is hexachlorobenzene. A summary of the BSAFs developed is presented in Table 4.

An evaluation of the detection frequency for hexachlorobenzene in large home range fish species indicates that there were infrequent detections of hexachlorobenzene in large home range fish tissue (Table 5). Similarly, although BSAFs were developed for brown bullhead and carp for benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene, there were no detections in 6 brown bullhead tissue samples and only 1 or 2 detections in carp samples. Although no model was developed for bis(2-ethylhexyl) phthalate, there was only one detection of this chemical in large home range fish species (brown bullhead).

Neither the Bioaccumulation Modeling Report nor the supplemental data provided by the LWG included organic carbon normalized SWACs for the chemicals of interest. As a result it is not possible to verify the BSAFs for large home range species presented in Table 4-6. However, there are limited detection of hexachlorobenzene in black crappie and brown bullhead and black crappie. The detection frequency of hexachlorobenzene in carp (9 out of 15 samples) is sufficient that this is only species for which hexachlorobenze BSAFs can reasonably be developed. The lack of detections of benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene in large home range fish species indicates that BSAFs should not be used to develop fish consumption based PRGs for these chemicals.

SUMMARY

The results of this analysis show that a BSAR with an r^2 value of greater than 0.3 can be developed for clam tissue and the four carcinogenic PAHs evaluated, and that the slope of the line of the log-log regression can be verified. Although calculation of the correction factor has not been confirmed, the application of the correction factor is consistent with the procedures presented in Helsel and Hirsh.

The analysis also confirms the lack of a tissue sediment relationship for smallmouth bass for all chemicals that were evaluated (arsenic, benzo(a)pyrene, bis(2-ethylhexyl) phthalate, hexachlorobenzene and mercury). However, the bioaccumulation report does not present the results of the regression analysis so it is not possible to verify the BSAR equations presented in Figure 2.

The analysis also shows that with the possible exception of hexachlorobenzene in carp, there are not sufficient detections of benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene in large home range fish species and hexachlorobenzene in black crappie and brown bullhead to warrant the use of BSAFs to develop PRGs for these chemicals and species. However, neither the Bioaccumulation Modeling Report or the supplemental data provided by the LWG included organic carbon normalized SWACs for the chemicals of interest for which BSAFs were developed (benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, and hexachlorobenzene).

Further, the underlying assumption BSAR in the analyses – that the BSAF should change in a linear or ln-linear fashion across all sediment concentrations – may be incorrect for some analytes and ranges of sediment and tissue concentrations. A BSAF may be applicable even when r^2 is zero (BSAF doesn't change with sediment concentration). One might still use a BSAF in this case to help guide monitoring during and after remediation.

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TAB 2

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
1.8	East	285.27	285.27	285.22	283.78	282.50	282.50	281.82	283.78
1.9	East	186.86	183.32	182.29	179.84	176.96	176.96	175.82	179.84
2	East	109.20	96.92	94.10	91.09	87.40	87.40	85.85	91.09
2.1	East	70.52	53.34	48.21	43.79	39.56	39.56	37.86	43.79
2.2	East	68.53	46.11	40.46	35.65	30.23	30.23	27.86	35.65
2.3	East	68.30	47.58	42.36	38.13	31.09	31.09	28.41	38.13
2.4	East	72.13	53.50	48.88	45.39	37.72	37.72	34.39	45.39
2.5	East	100.32	90.32	83.48	69.85	51.04	51.04	39.92	69.85
2.6	East	260.05	230.35	127.55	89.82	58.76	58.76	42.40	89.82
2.7	East	291.09	265.35	155.32	106.32	67.62	67.62	49.07	118.83
2.8	East	330.61	302.02	178.48	123.59	83.63	83.63	63.97	137.65
2.9	East	366.76	335.38	199.80	139.56	98.14	98.14	77.89	154.99
3	East	378.99	342.93	193.30	140.72	111.59	111.59	100.92	158.45
3.1	East	147.28	147.28	144.53	129.07	117.79	117.79	114.39	147.28
3.2	East	123.17	123.17	122.85	122.85	122.69	122.69	122.47	122.85
3.3	East	136.32	136.32	133.30	133.30	132.93	132.93	128.12	133.30
3.4	East	127.61	127.61	124.55	124.55	124.09	124.09	118.04	124.55
3.5	East	103.45	103.45	100.97	100.52	91.46	91.46	80.28	100.52
3.6	East	172.84	97.27	84.23	78.46	61.95	61.95	50.44	78.46
3.7	East	179.17	100.32	86.96	79.70	61.10	61.10	45.42	79.70
3.8	East	178.68	93.22	80.33	70.51	47.73	47.73	31.63	70.51
3.9	East	195.24	106.54	91.25	69.90	40.86	40.86	19.42	69.90
4	East	248.27	129.99	109.63	81.01	46.48	46.48	19.35	81.01
4.1	East	728.16	726.84	721.31	477.94	159.25	159.25	56.39	477.94
4.2	East	1246.57	1245.78	1198.34	929.37	181.08	181.08	43.96	929.37
4.3	East	1782.86	1773.03	1345.04	975.23	235.15	235.15	60.41	975.23
4.4	East	3074.92	2823.89	1741.18	1095.22	257.00	257.00	65.42	1095.22
4.5	East	3710.28	3478.82	1862.81	1093.30	281.79	281.79	61.57	1093.30
4.6	East	4185.69	3902.69	1927.87	1114.36	293.82	293.82	61.92	1114.36
4.7	East	4957.91	4571.35	1919.87	905.11	337.01	337.01	91.48	905.11
4.8	East	4953.33	4494.46	1855.23	841.19	324.02	324.02	100.17	841.19
4.9	East	3027.23	3027.23	1047.80	489.04	353.49	353.49	151.99	489.04
5	East	327.32	327.32	327.32	327.32	326.85	326.85	258.05	327.32
5.1	East	396.32	396.32	396.32	396.32	396.32	396.32	261.20	396.32
5.2	East	472.15	472.15	472.15	472.15	472.15	472.15	253.14	472.15
5.3	East	487.34	487.34	487.34	487.34	470.21	470.21	257.25	470.21
5.4	East	648.39	648.39	648.39	648.39	473.76	473.76	201.41	473.76
5.5	East	791.48	791.48	791.48	705.73	425.67	425.67	146.70	425.67
5.6	East	756.13	754.13	754.13	662.10	327.38	327.38	96.74	327.38
5.7	East	753.01	751.51	751.51	682.34	400.16	400.16	101.62	400.16
5.8	East	783.51	782.16	782.16	719.82	444.98	444.98	122.94	475.43

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
5.9	East	708.01	706.78	706.78	646.17	462.45	462.45	210.21	511.54
6	East	619.79	618.74	618.64	607.09	486.73	486.73	267.41	542.06
6.1	East	767.76	767.76	716.22	622.10	489.94	489.94	294.15	744.48
6.2	East	746.34	746.34	685.98	575.15	425.84	425.84	315.52	742.84
6.3	East	622.76	622.76	565.35	461.89	343.59	343.59	285.64	619.62
6.4	East	514.43	513.47	457.38	362.84	266.85	266.85	215.13	512.61
6.5	East	411.54	401.88	341.10	255.14	177.55	177.55	134.57	400.61
6.6	East	175.43	159.12	140.00	130.70	105.92	105.92	78.44	157.40
6.7	East	85.51	70.14	56.22	55.99	53.65	53.65	45.73	68.53
6.8	East	63.97	49.64	37.28	37.07	34.93	34.93	30.21	48.14
6.9	East	58.10	44.76	34.06	33.86	31.91	31.91	28.18	44.38
7	East	63.19	44.64	35.46	35.27	33.73	33.73	31.64	56.05
7.1	East	83.64	60.65	42.47	42.46	41.88	41.88	40.58	83.25
7.2	East	95.25	72.49	50.52	50.52	47.62	47.62	45.94	93.68
7.3	East	97.98	74.98	52.76	52.76	49.83	49.83	48.32	96.40
7.4	East	98.34	73.13	48.63	48.63	45.35	45.35	44.13	96.57
7.5	East	88.78	74.07	50.80	50.80	46.58	46.58	44.95	86.51
7.6	East	60.06	58.83	50.07	50.07	45.79	45.79	42.16	57.54
7.7	East	47.33	47.33	47.33	47.33	47.29	47.29	42.92	47.33
7.8	East	53.59	51.37	51.37	50.95	50.59	50.59	32.93	50.95
7.9	East	60.86	41.71	41.71	41.29	40.91	40.91	22.79	41.29
8	East	64.55	32.80	32.80	32.44	31.19	31.19	15.85	32.44
8.1	East	61.58	30.57	30.57	30.22	29.04	29.04	17.10	30.22
8.2	East	58.26	27.88	27.88	27.54	26.38	26.38	15.42	27.54
8.3	East	50.11	13.97	13.97	13.97	12.84	12.84	12.45	13.97
8.4	East	45.83	24.04	24.04	24.04	22.74	22.74	22.30	24.04
8.5	East	34.24	34.24	34.24	34.24	34.24	34.24	34.20	34.24
8.6	East	36.89	36.89	36.89	36.89	36.79	36.79	36.69	36.89
8.7	East	38.29	38.29	38.29	38.29	38.00	38.00	37.70	38.29
8.8	East	38.44	38.44	38.44	38.44	37.77	37.77	33.74	38.44
8.9	East	36.13	36.13	36.13	36.13	33.72	33.72	26.51	36.13
9	East	34.04	34.04	34.04	34.04	31.13	31.13	22.15	34.04
9.1	East	28.84	28.84	28.84	28.84	26.01	26.01	17.38	28.84
9.2	East	23.29	23.29	23.29	23.29	20.75	20.75	12.61	23.29
9.3	East	22.38	22.38	22.38	22.38	19.02	19.02	13.09	22.38
9.4	East	25.39	25.39	25.39	25.39	17.81	17.81	12.92	25.39
9.5	East	24.85	24.85	24.85	24.85	17.40	17.40	11.87	24.85
9.6	East	27.04	27.04	27.04	27.04	19.92	19.92	14.41	27.04
9.7	East	33.15	33.15	33.15	33.15	26.13	26.13	20.71	33.15
9.8	East	50.35	50.25	50.16	48.52	39.91	39.91	28.13	48.52
9.9	East	157.81	157.70	157.60	149.77	67.36	67.36	38.05	154.95

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
10	East	218.90	218.78	218.67	210.07	118.10	118.10	78.51	215.75
10.1	East	303.54	303.39	303.26	292.62	178.88	178.88	121.87	299.65
10.2	East	378.63	378.44	378.28	364.85	221.32	221.32	148.55	373.72
10.3	East	435.76	435.76	435.76	422.58	247.08	247.08	171.42	433.75
10.4	East	216.49	216.49	216.49	216.49	206.99	206.99	167.83	216.49
10.5	East	127.54	127.54	127.54	125.13	113.66	113.66	92.83	125.13
10.6	East	58.37	58.37	58.37	49.33	35.81	35.81	29.97	49.33
10.7	East	55.75	55.75	55.75	46.54	27.37	27.37	17.73	46.54
10.8	East	66.50	66.50	66.50	57.49	29.84	29.84	13.99	57.49
10.9	East	71.11	70.31	69.04	58.82	34.29	34.29	15.51	58.82
11	East	74.55	71.13	65.00	54.79	33.29	33.29	12.65	54.79
11.1	East	86.31	71.05	60.46	52.10	31.40	31.40	10.07	52.10
11.2	East	88.58	59.17	46.90	37.41	22.56	22.56	7.26	37.41
11.3	East	72.01	42.92	30.43	20.47	13.20	13.20	5.28	20.47
11.4	East	63.35	34.72	23.18	13.76	7.00	7.00	1.38	13.76
11.5	East	59.21	29.21	20.91	12.40	6.58	6.58	1.78	12.40
11.6	East	47.93	23.63	18.33	12.13	6.79	6.79	1.90	12.13
11.7	East	26.65	23.05	20.74	16.24	10.33	10.33	2.89	16.24
1.8	West	62.11	62.11	62.11	62.11	62.11	62.11	62.11	62.11
1.9	West	62.46	62.46	62.46	62.46	62.46	62.46	62.46	62.46
2	West	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
2.1	West	86.86	86.86	86.86	86.86	86.86	86.86	86.86	86.86
2.2	West	109.69	109.69	109.69	109.69	109.69	109.69	109.69	109.69
2.3	West	160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70
2.4	West	216.19	216.19	216.19	216.19	216.19	216.19	215.28	216.19
2.5	West	256.95	256.95	256.95	256.95	256.95	256.95	246.87	256.95
2.6	West	320.09	320.09	320.09	320.09	320.09	320.09	285.84	320.09
2.7	West	427.95	427.95	427.95	427.95	427.95	427.95	321.95	427.95
2.8	West	513.27	513.27	513.27	513.27	513.27	513.27	352.94	513.27
2.9	West	526.51	526.51	526.51	526.51	526.51	526.51	371.27	526.51
3	West	586.96	586.96	586.96	586.96	586.96	586.96	394.01	586.96
3.1	West	647.53	647.53	647.53	647.53	647.53	647.53	407.71	647.53
3.2	West	617.29	617.29	617.29	617.29	617.29	617.29	404.33	617.29
3.3	West	546.32	546.32	546.32	546.32	545.47	545.47	365.34	546.32
3.4	West	516.01	516.01	516.01	516.01	515.01	515.01	319.22	516.01
3.5	West	431.10	431.10	431.10	431.10	429.87	429.87	282.44	431.10
3.6	West	320.54	320.54	320.54	320.54	318.90	318.90	251.50	320.54
3.7	West	373.99	373.99	373.99	352.46	258.36	258.36	194.92	352.46
3.8	West	426.48	426.48	426.48	400.88	287.29	287.29	192.64	400.88
3.9	West	503.13	503.13	503.13	472.48	330.22	330.22	212.62	472.48
4	West	644.46	644.46	644.46	605.28	390.05	390.05	176.66	605.28

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
4.1	West	821.69	821.69	821.69	782.88	489.17	489.17	144.37	782.88
4.2	West	682.16	682.16	682.16	677.65	533.94	533.94	145.20	677.65
4.3	West	732.10	732.10	732.10	727.05	571.97	571.97	135.33	727.05
4.4	West	840.73	840.73	840.73	835.63	557.96	557.96	94.96	835.63
4.5	West	772.50	772.50	772.50	772.50	499.14	499.14	119.79	772.50
4.6	West	593.79	593.79	593.79	592.04	376.81	376.81	136.58	592.04
4.7	West	718.99	718.99	711.00	652.47	325.64	325.64	160.79	652.47
4.8	West	696.78	696.78	688.77	630.08	296.69	296.69	182.46	630.08
4.9	West	756.67	756.67	706.02	604.99	298.34	298.34	201.23	604.99
5	West	904.84	904.84	845.85	597.11	283.58	283.58	187.08	597.11
5.1	West	1352.60	1352.60	980.81	638.54	300.18	300.18	167.35	638.54
5.2	West	2277.41	1934.17	906.25	545.19	286.52	286.52	127.53	545.19
5.3	West	3143.22	2757.01	1149.48	648.54	279.96	279.96	65.85	648.54
5.4	West	3233.89	2819.33	1154.25	673.79	396.69	396.69	59.08	673.79
5.5	West	3059.56	2650.05	1008.27	707.00	475.85	475.85	75.97	707.00
5.6	West	2640.67	2264.25	1070.46	836.59	518.55	518.55	127.89	859.25
5.7	West	1869.14	1836.29	1266.85	917.04	504.08	504.08	171.97	1158.39
5.8	West	2391.43	1841.79	1354.01	1098.30	510.74	510.74	165.33	1354.01
5.9	West	6066.89	2386.42	1320.10	1019.74	404.12	404.12	140.70	1320.10
6	West	14260.55	2215.14	1193.81	906.11	328.49	328.49	116.58	1193.81
6.1	West	21991.86	2044.06	1034.16	760.87	249.80	249.80	81.87	1034.16
6.2	West	29236.75	1824.08	779.40	627.65	183.65	183.65	41.57	779.40
6.3	West	40104.32	1213.09	285.27	177.98	22.86	22.86	0.00	285.27
6.4	West	38796.86	294.52	214.70	165.60	46.48	46.48	10.64	47.78
6.5	West	25684.49	586.63	504.02	402.75	89.43	89.43	13.56	90.77
6.6	West	11444.97	950.62	843.35	662.72	130.46	130.46	15.80	131.76
6.7	West	2747.09	819.26	678.48	511.10	100.81	100.81	12.81	101.80
6.8	West	955.57	730.89	601.93	447.69	88.31	88.31	11.43	88.31
6.9	West	573.49	476.19	403.08	296.09	51.95	51.95	4.36	51.95
7	West	431.07	288.39	222.10	150.91	26.41	26.41	2.66	26.41
7.1	West	388.34	93.24	39.15	7.75	1.09	1.09	1.19	1.09
7.2	West	337.05	32.98	18.15	6.13	1.25	1.25	0.00	1.25
7.3	West	301.70	27.00	18.52	12.86	8.11	8.11	4.10	8.11
7.4	West	242.36	38.97	36.32	33.02	28.44	28.44	18.99	28.44
7.5	West	174.70	51.50	49.49	45.92	36.50	36.50	22.23	36.50
7.6	West	72.27	65.47	64.07	61.45	49.58	49.58	27.75	49.58
7.7	West	67.72	65.88	64.55	62.32	51.23	51.23	28.44	51.23
7.8	West	65.82	65.80	65.73	64.95	53.14	53.14	28.90	54.27
7.9	West	69.93	69.92	69.83	66.98	47.04	47.04	21.18	55.04
8	West	81.38	81.38	81.38	71.75	44.11	44.11	18.32	64.36
8.1	West	154.22	154.22	152.78	127.27	13.66	13.66	2.77	126.62

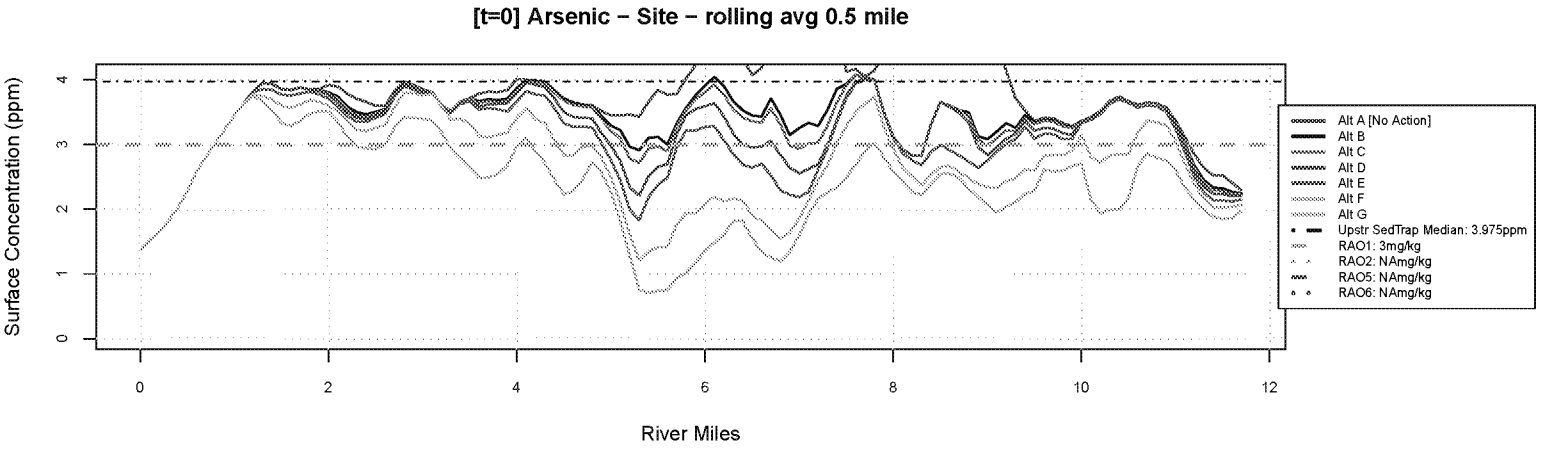
Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

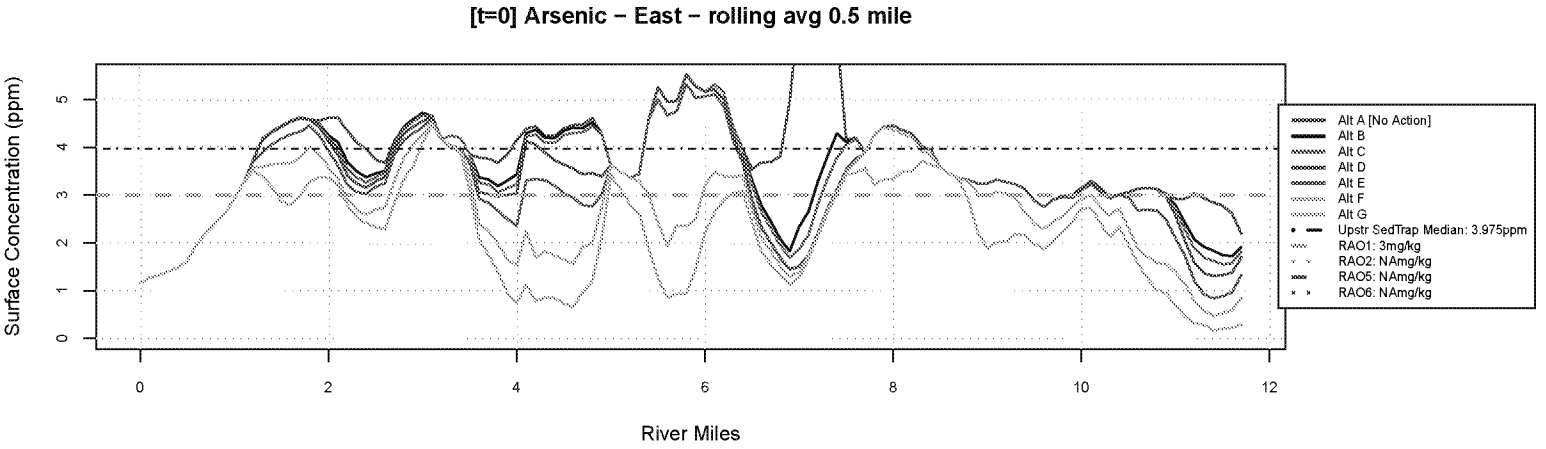
		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
8.2	West	182.11	182.11	180.96	158.76	37.60	37.60	8.66	158.76
8.3	West	166.50	165.99	165.12	142.72	43.08	43.08	20.70	142.72
8.4	West	164.84	163.87	163.05	131.35	39.75	39.75	19.52	131.35
8.5	West	157.94	156.98	156.07	122.94	38.06	38.06	19.12	122.94
8.6	West	127.83	119.42	110.27	78.72	40.20	40.20	20.23	78.72
8.7	West	126.22	90.14	77.50	40.06	21.28	21.28	17.73	40.06
8.8	West	157.77	85.13	59.05	15.14	2.29	2.29	0.58	15.14
8.9	West	199.49	73.54	34.76	5.52	0.00	0.00	0.00	5.52
9	West	244.30	88.99	22.98	3.73	0.00	0.00	0.00	3.73
9.1	West	177.20	61.01	24.76	13.06	4.58	4.58	2.95	13.06
9.2	West	117.12	60.71	33.93	24.75	10.68	10.68	6.83	24.75
9.3	West	88.48	58.85	42.66	34.62	11.69	11.69	7.59	34.62
9.4	West	102.36	77.62	61.19	36.99	12.35	12.35	8.13	36.99
9.5	West	148.22	125.81	81.07	34.07	10.73	10.73	7.05	34.07
9.6	West	173.60	145.67	90.06	34.97	10.55	10.55	7.00	34.97
9.7	West	212.97	176.37	103.49	31.20	7.10	7.10	5.20	31.20
9.8	West	277.97	226.84	125.00	23.84	8.75	8.75	7.45	23.84
9.9	West	300.06	277.99	132.37	28.88	19.25	19.25	12.56	28.88
10	West	122.87	122.87	121.18	110.42	90.67	90.67	38.14	112.11
10.1	West	156.51	156.51	155.27	144.59	87.73	87.73	31.04	145.83
10.2	West	282.49	282.49	281.38	272.30	222.85	222.85	121.80	273.41
10.3	West	354.58	354.58	353.49	344.85	297.10	297.10	199.55	345.93
10.4	West	352.57	352.57	351.48	342.73	295.04	295.04	208.29	343.81
10.5	West	186.72	186.72	186.72	185.45	167.31	167.31	106.71	185.45
10.6	West	146.85	146.85	146.85	146.85	146.85	146.85	100.48	146.85
10.7	West	92.15	92.15	92.15	92.15	92.15	92.15	70.90	92.15
10.8	West	70.85	70.85	70.85	70.85	70.85	70.85	52.63	70.85
10.9	West	66.88	66.88	66.88	66.88	66.88	66.88	50.18	66.88
11	West	65.35	65.35	65.35	65.35	65.35	65.35	65.33	65.35
11.1	West	77.48	77.48	77.48	77.48	77.48	77.48	77.48	77.48
11.2	West	91.43	91.43	91.43	91.43	91.43	91.43	90.27	91.43
11.3	West	89.88	89.88	89.88	89.88	89.88	89.88	88.54	89.88
11.4	West	79.16	79.16	79.16	79.16	79.16	79.16	77.95	79.16
11.5	West	84.56	84.56	84.56	84.56	84.56	84.56	83.18	84.56
11.6	West	77.70	77.70	77.70	77.70	77.70	77.70	75.99	77.70
11.7	West	49.64	49.64	49.64	49.64	49.64	49.64	49.64	49.64
7.8	Swan Isl	274.24	34.87	34.82	3.82	1.90	1.90	0.28	3.82
7.9	Swan Isl	180.11	14.06	13.93	7.22	1.90	1.90	0.72	7.22
8	Swan Isl	230.60	19.33	18.31	9.87	4.01	4.01	0.98	9.87
8.1	Swan Isl	270.08	21.30	19.69	11.76	5.88	5.88	1.26	11.76
8.2	Swan Isl	306.92	20.23	18.69	11.55	6.23	6.23	2.12	11.55

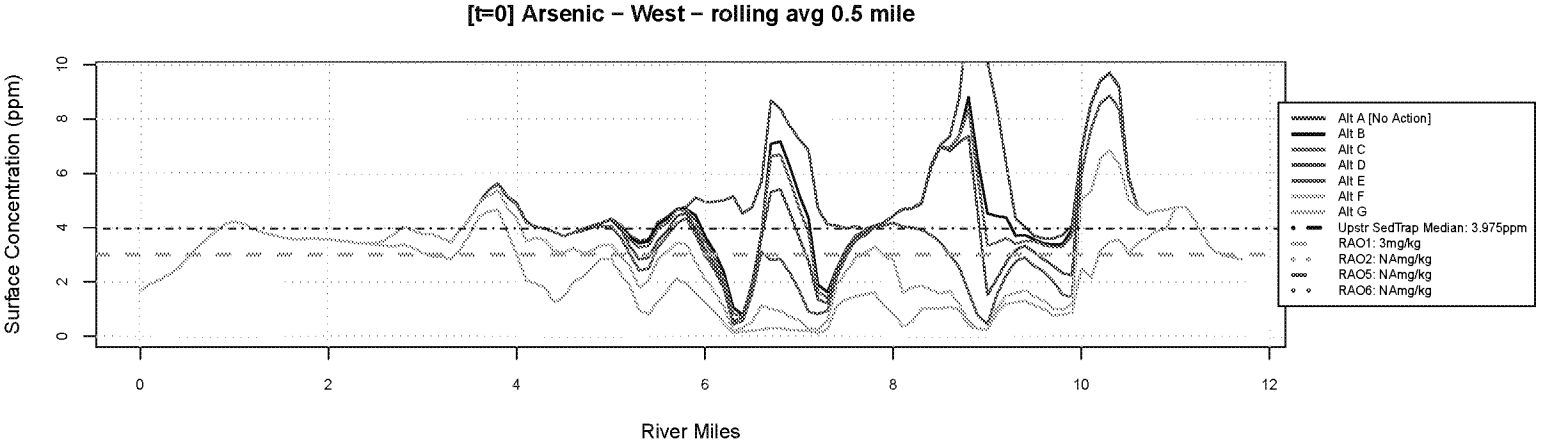
Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

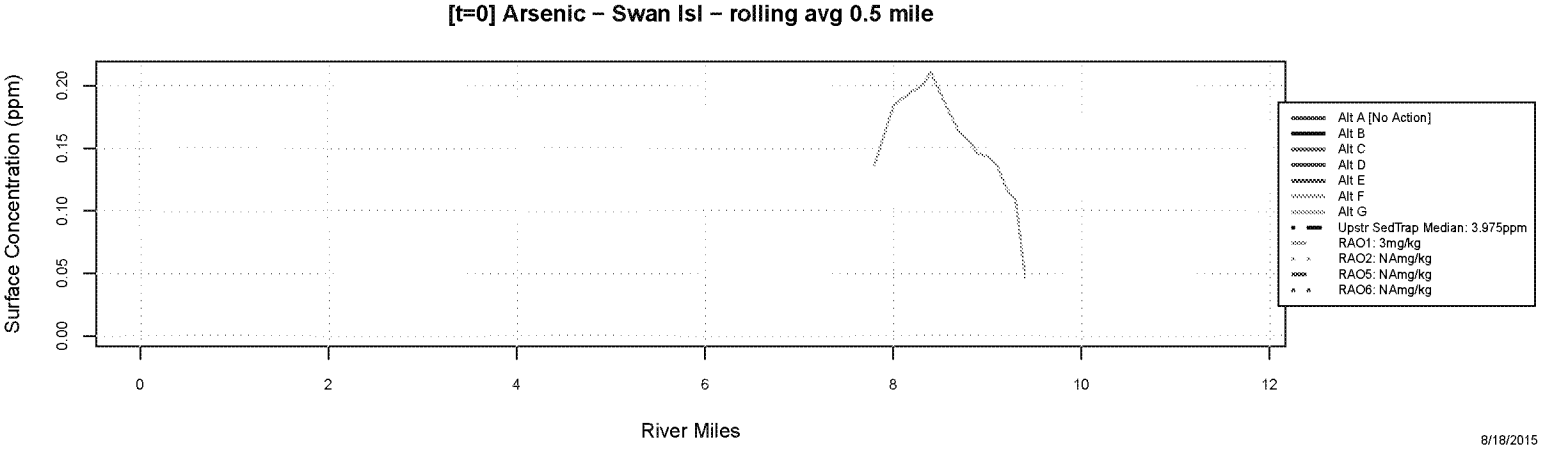
		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
8.3	Swan Isl	324.18	18.63	17.03	11.80	6.47	6.47	2.34	11.80
8.4	Swan Isl	385.51	21.35	19.09	13.03	8.70	8.70	3.54	13.03
8.5	Swan Isl	388.14	18.20	15.29	11.45	9.16	9.16	5.45	11.45
8.6	Swan Isl	359.27	21.05	10.30	7.14	6.12	6.12	5.51	7.14
8.7	Swan Isl	288.09	25.06	8.82	5.66	4.49	4.49	3.91	5.66
8.8	Swan Isl	258.99	26.91	8.34	5.28	3.96	3.96	3.54	5.28
8.9	Swan Isl	309.88	108.46	63.12	40.65	6.27	6.27	4.28	87.76
9	Swan Isl	339.31	131.60	76.02	49.89	7.15	7.15	4.69	109.02
9.1	Swan Isl	325.88	167.56	104.18	68.44	8.88	8.88	5.55	151.36
9.2	Swan Isl	379.46	258.88	169.67	111.36	13.46	13.46	8.08	249.40
9.3	Swan Isl	431.88	369.29	248.47	162.50	19.22	19.22	11.44	366.47
9.4	Swan Isl	63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59

TAB 3



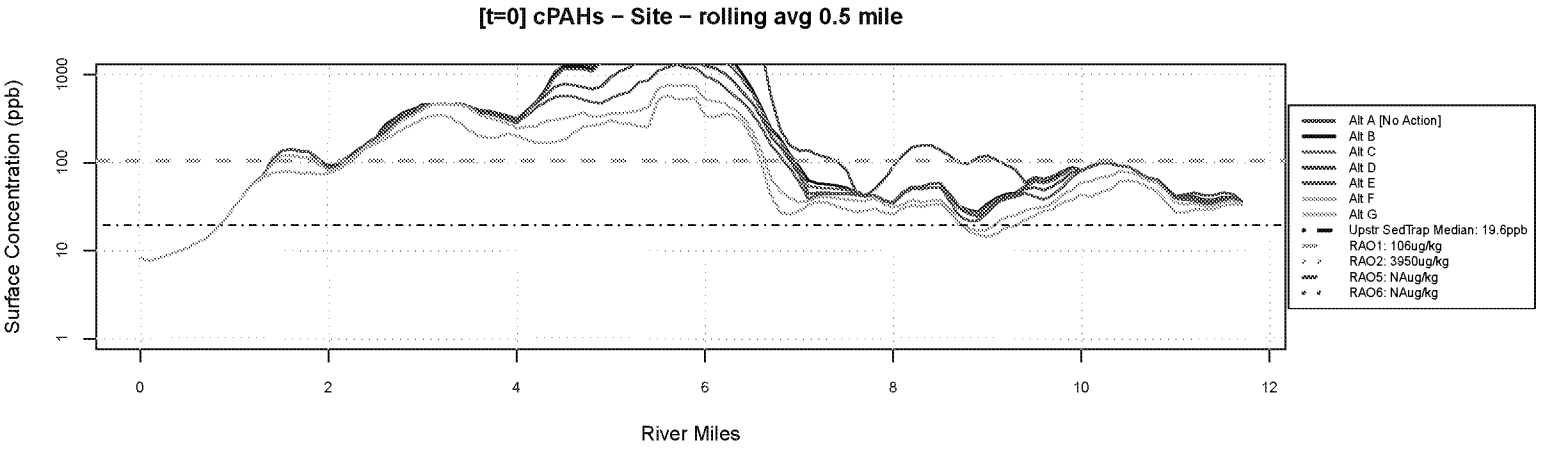


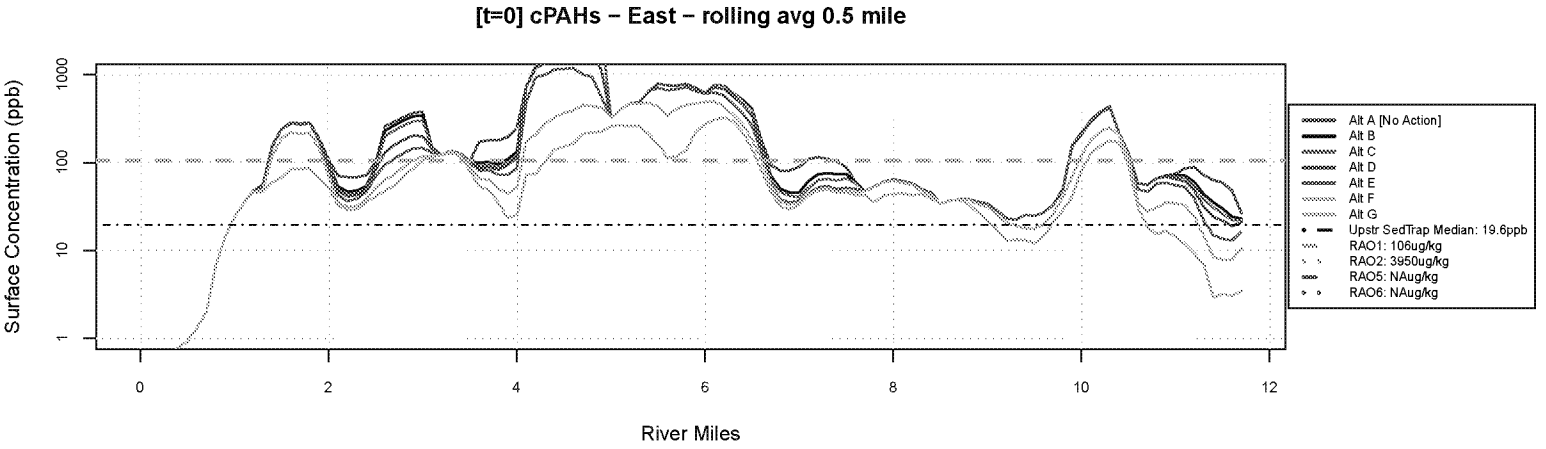


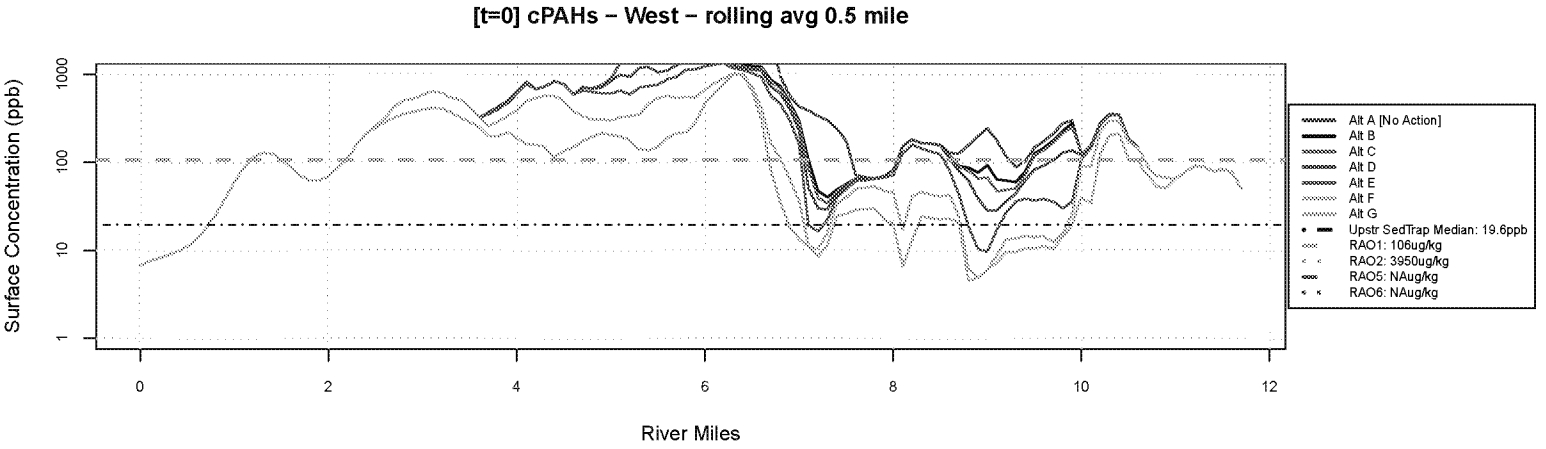


8/18/2015

Figure 4.2-7a. RAO 1 Rolling River Mile (Year 0)- Arsenic







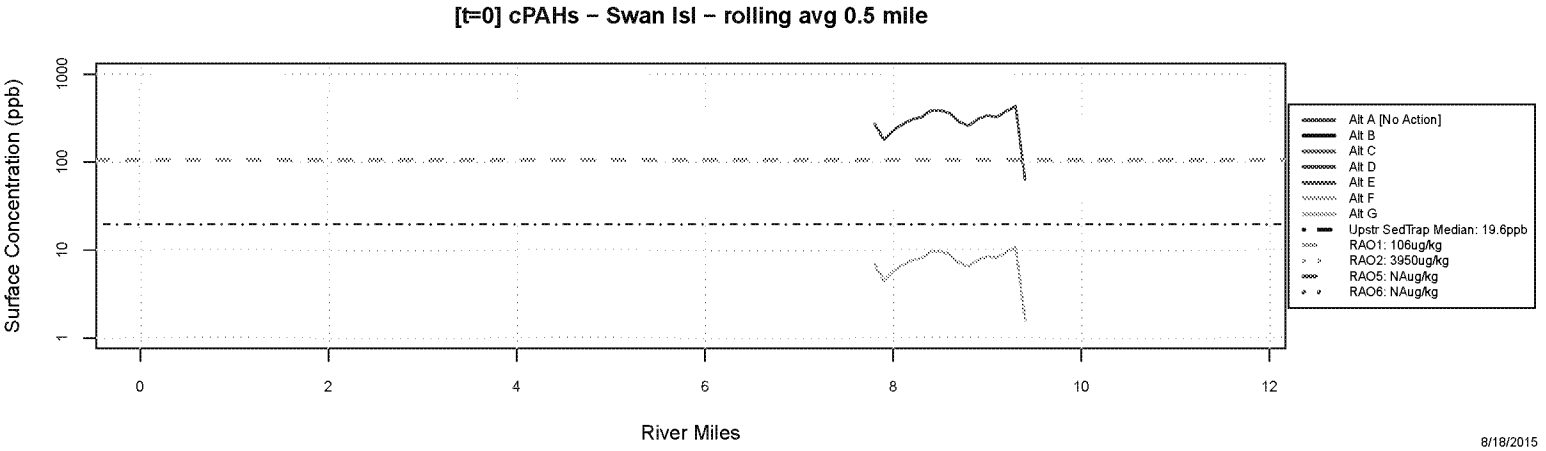
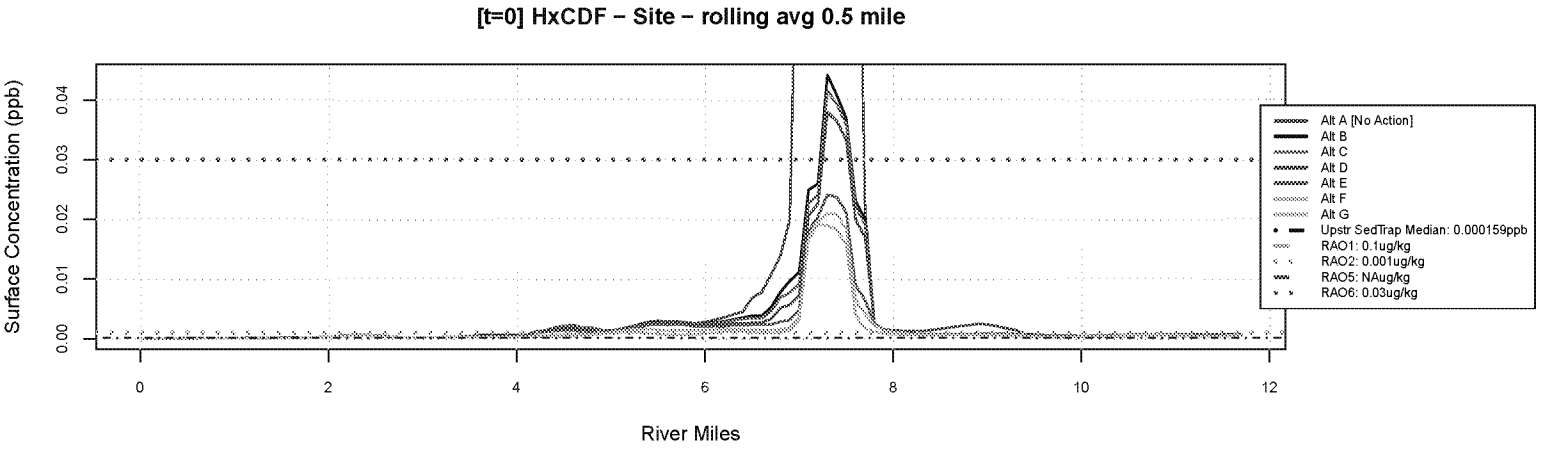
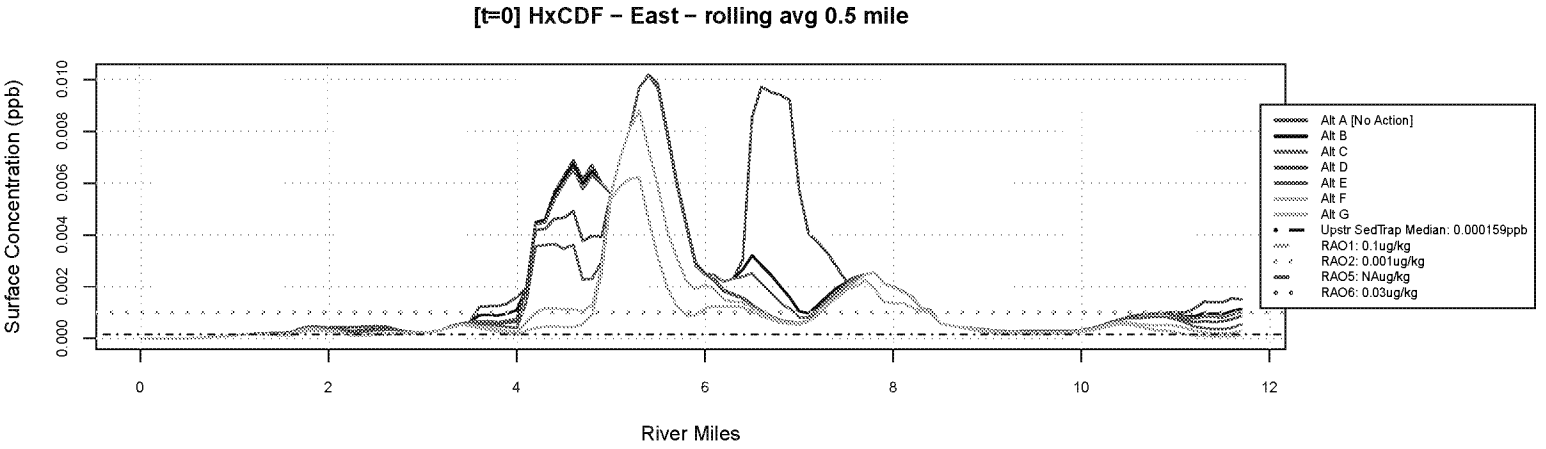
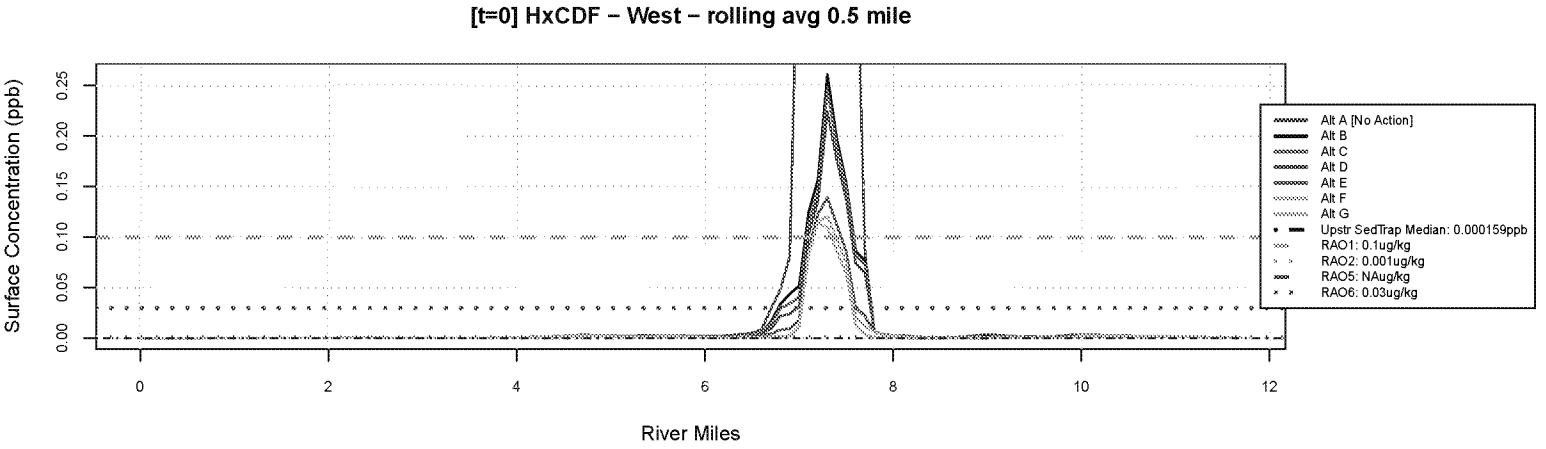


Figure 4.2-7b. RAO 1 Rolling River Mile (Year 0)- cPAHs







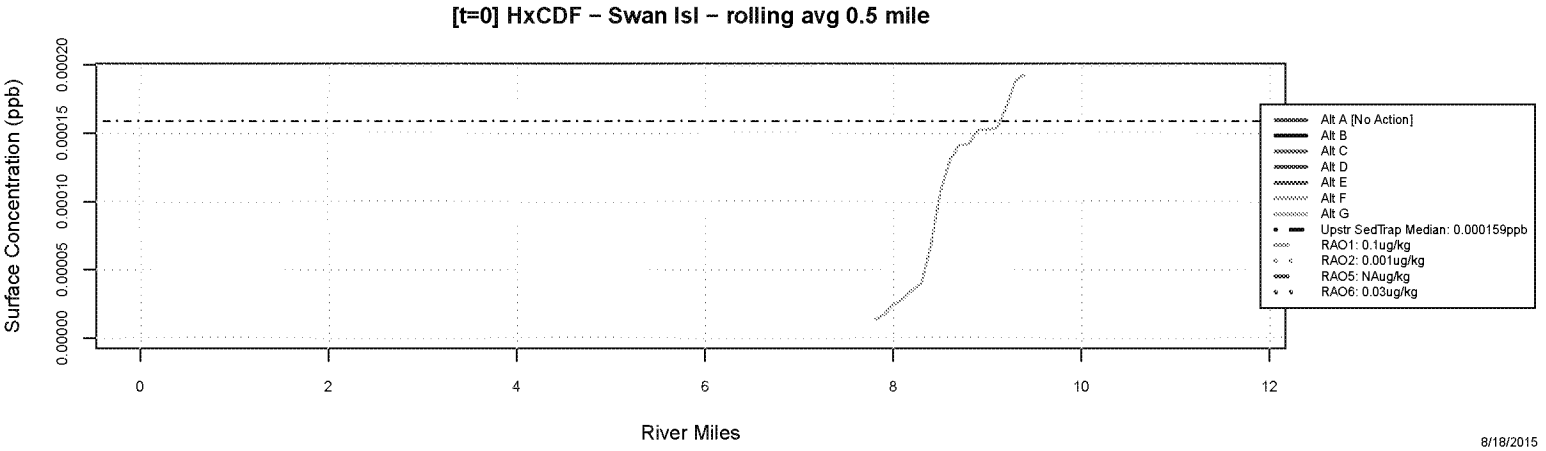
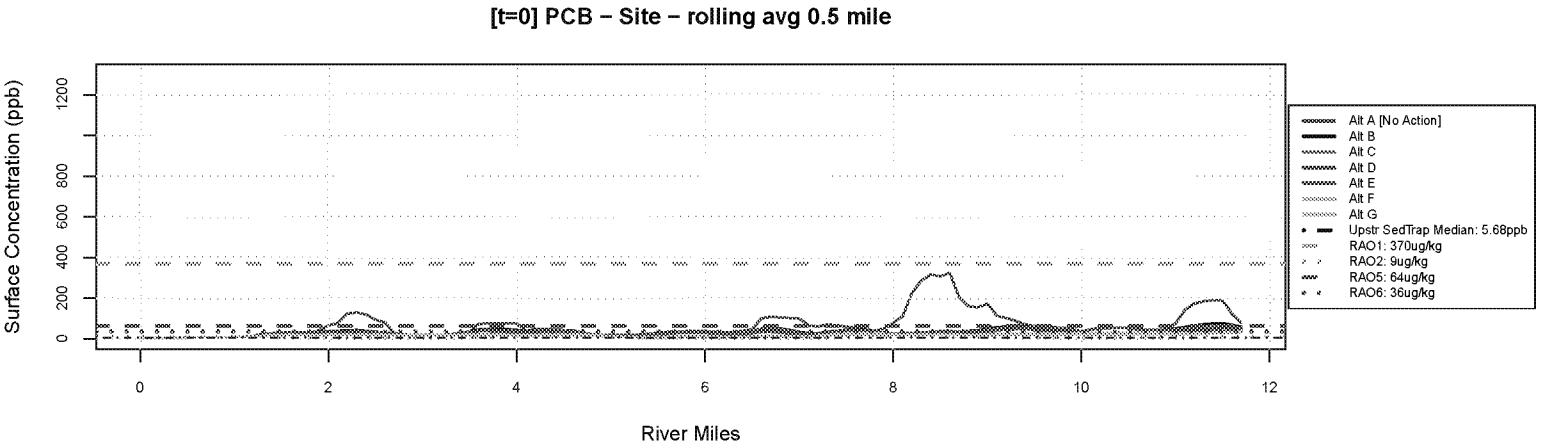
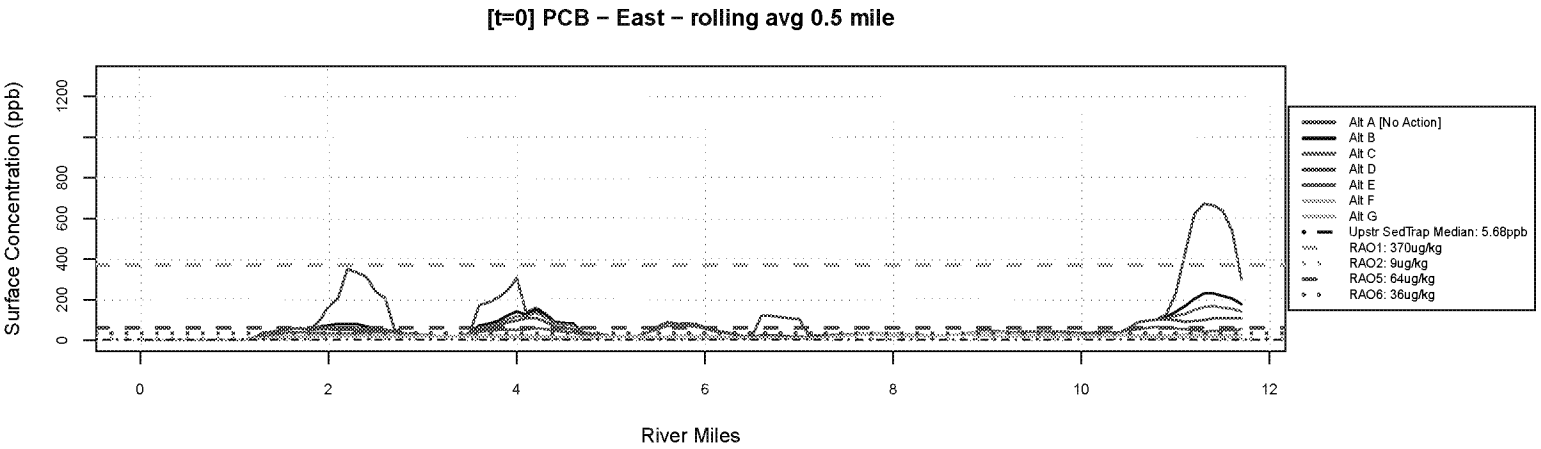
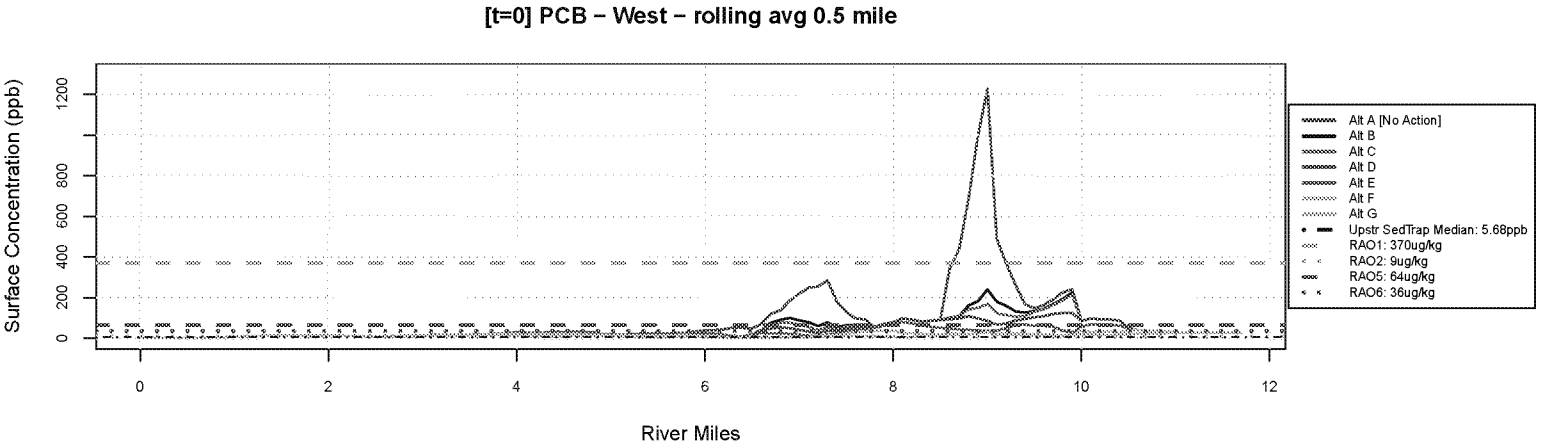


Figure 4.2-7c. RAO 1 Rolling River Mile (Year 0)- HxCDF







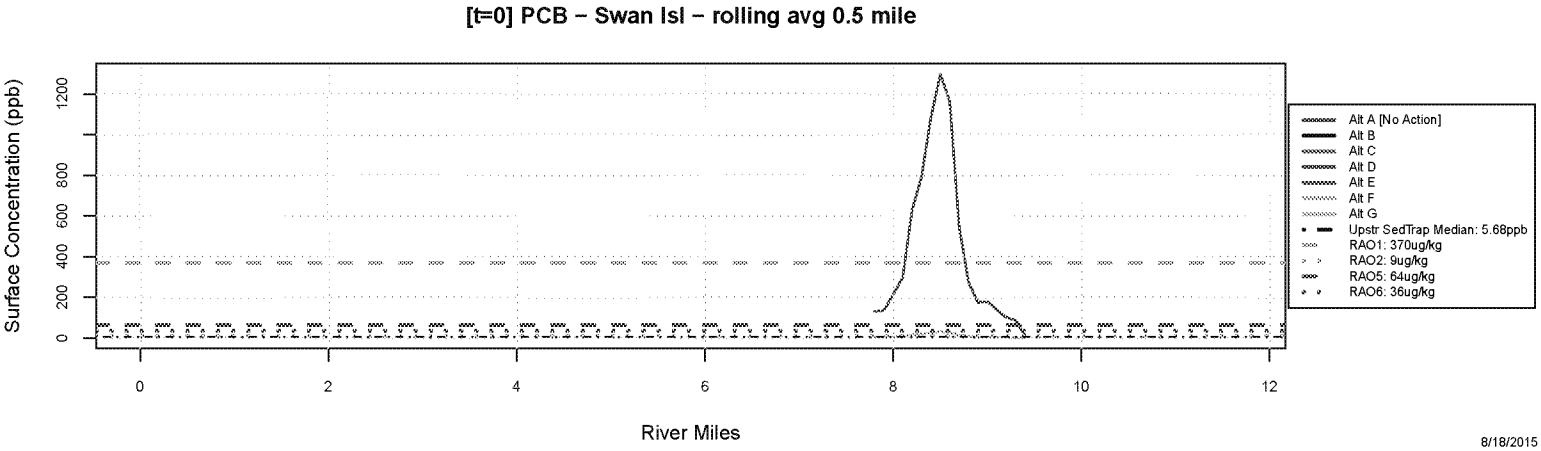
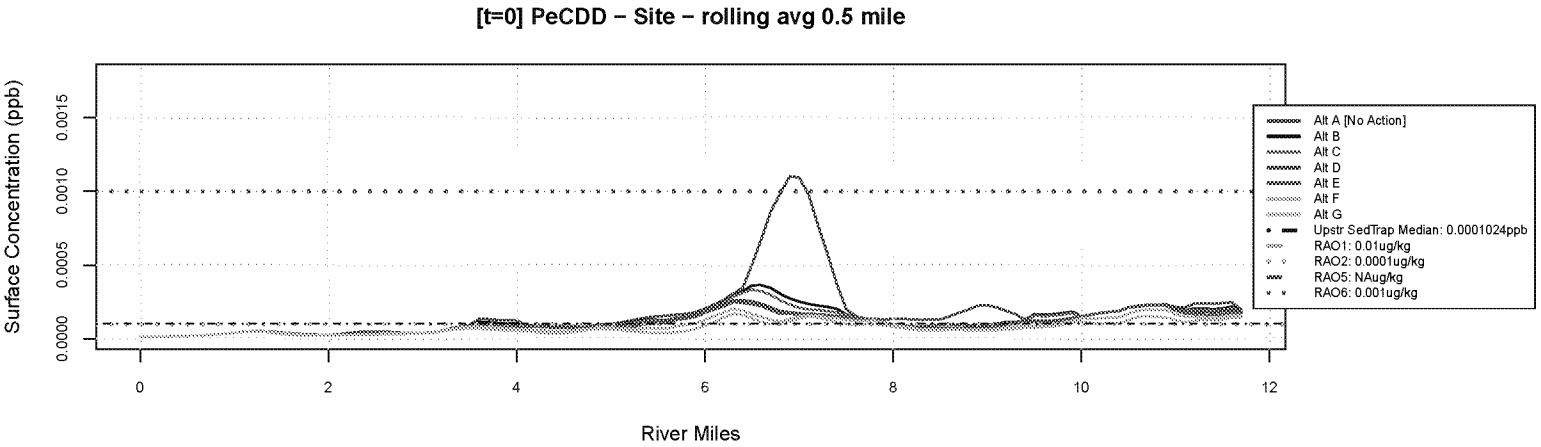
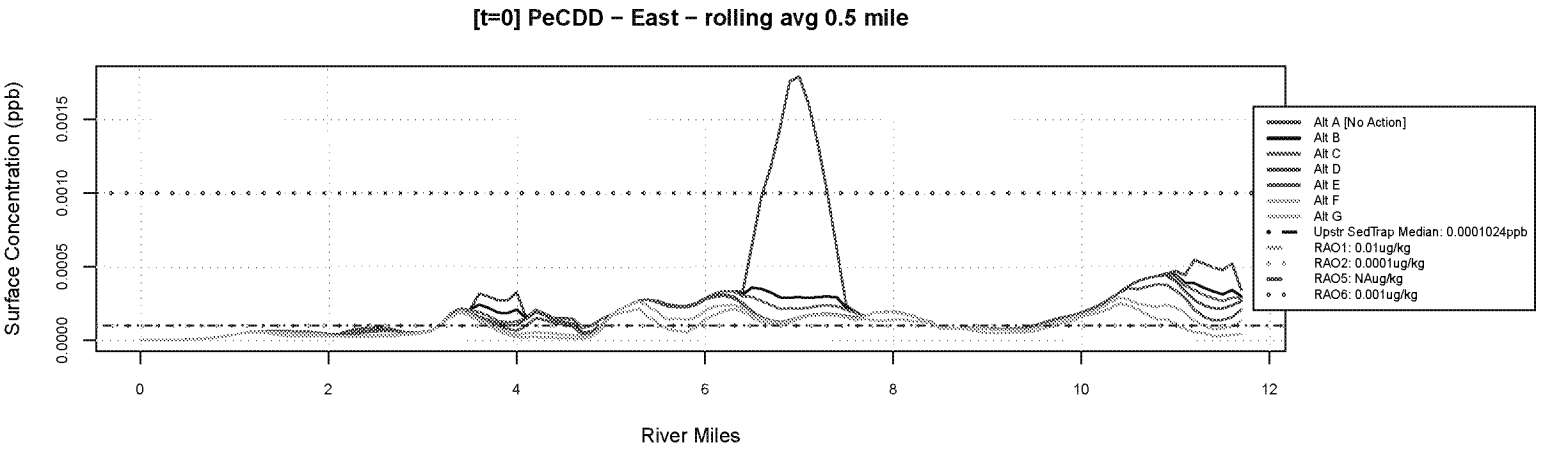
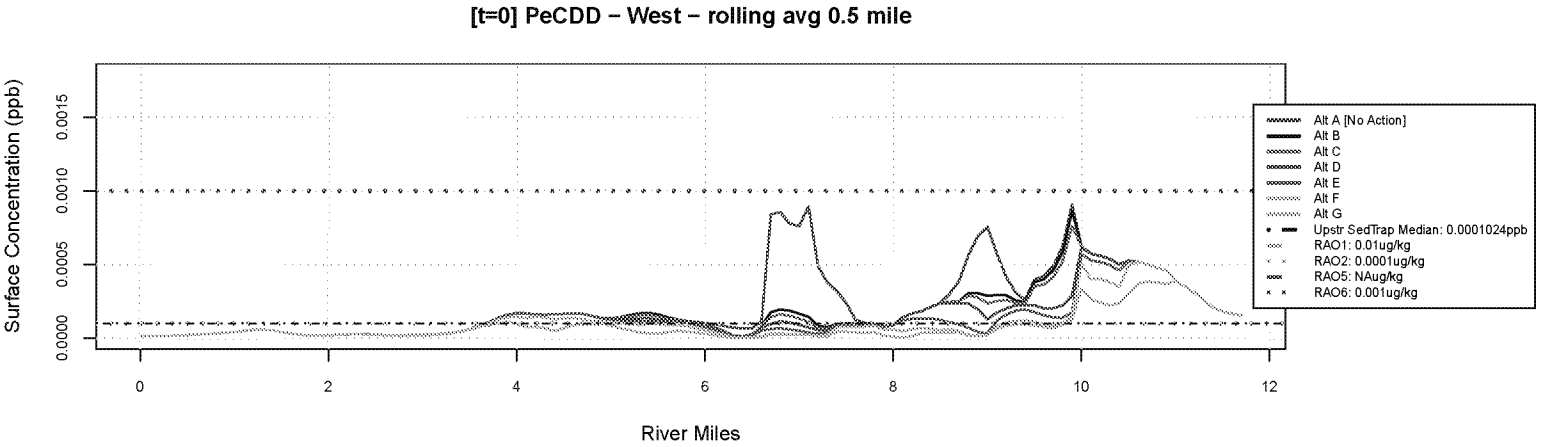


Figure 4.2-7d. RAO 1 Rolling River Mile (Year 0)- PCB







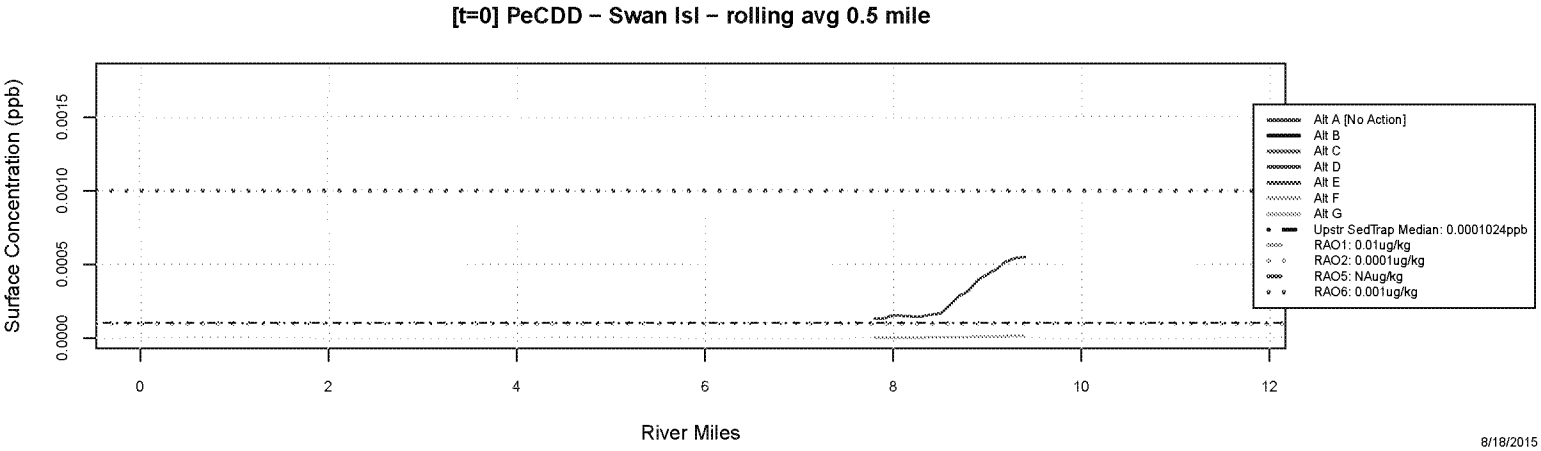
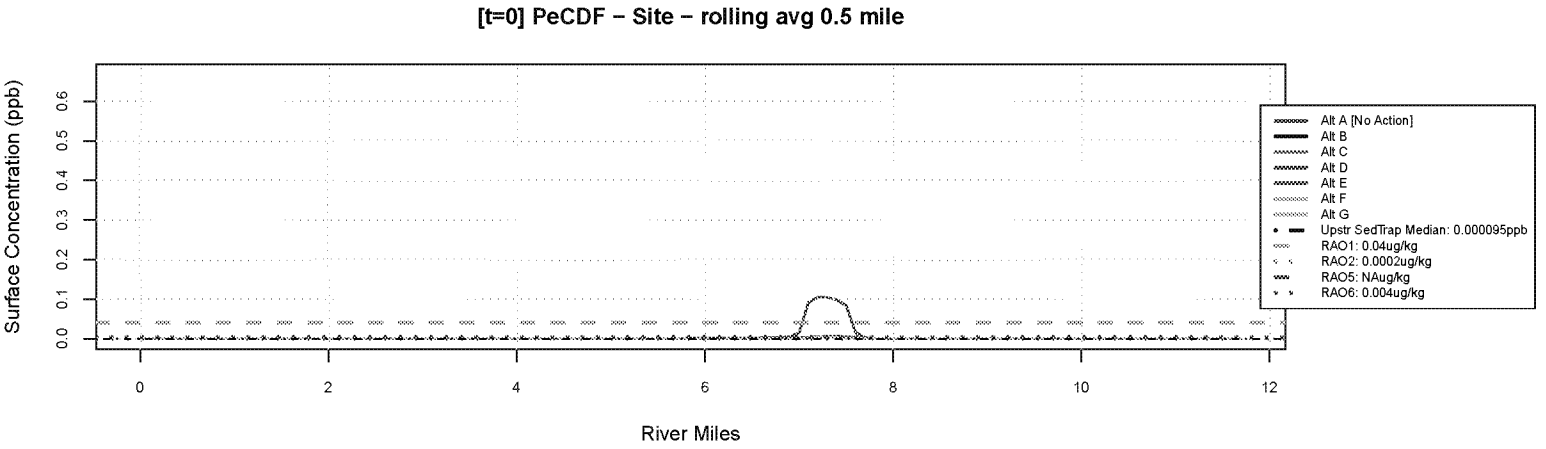
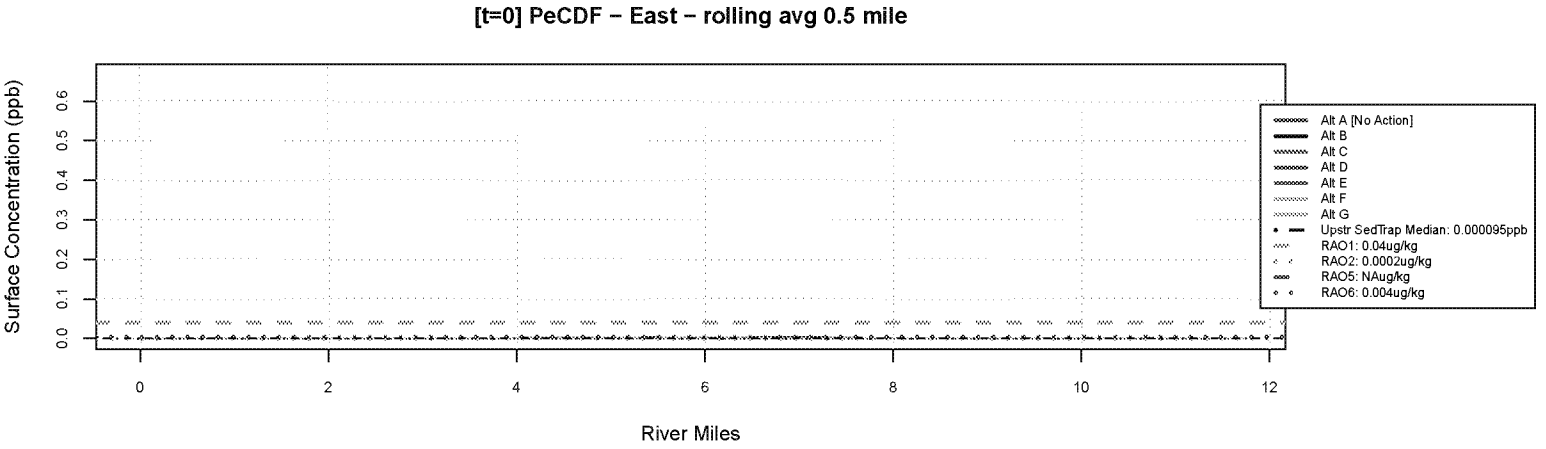
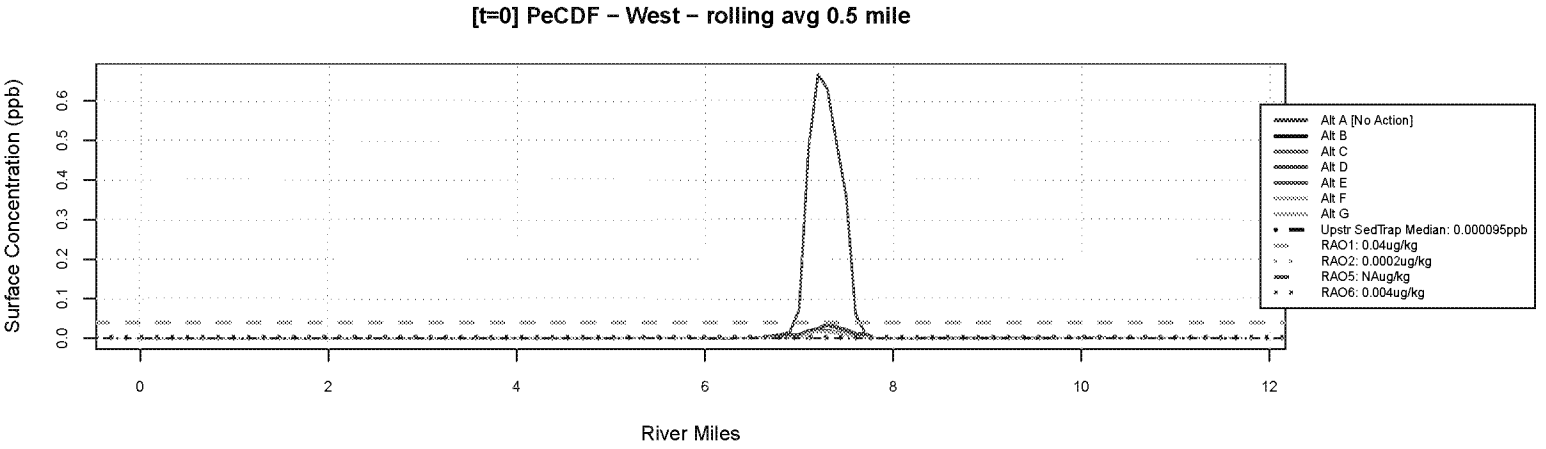


Figure 4.2-7e. RAO 1 Rolling River Mile (Year 0)- PeCDD







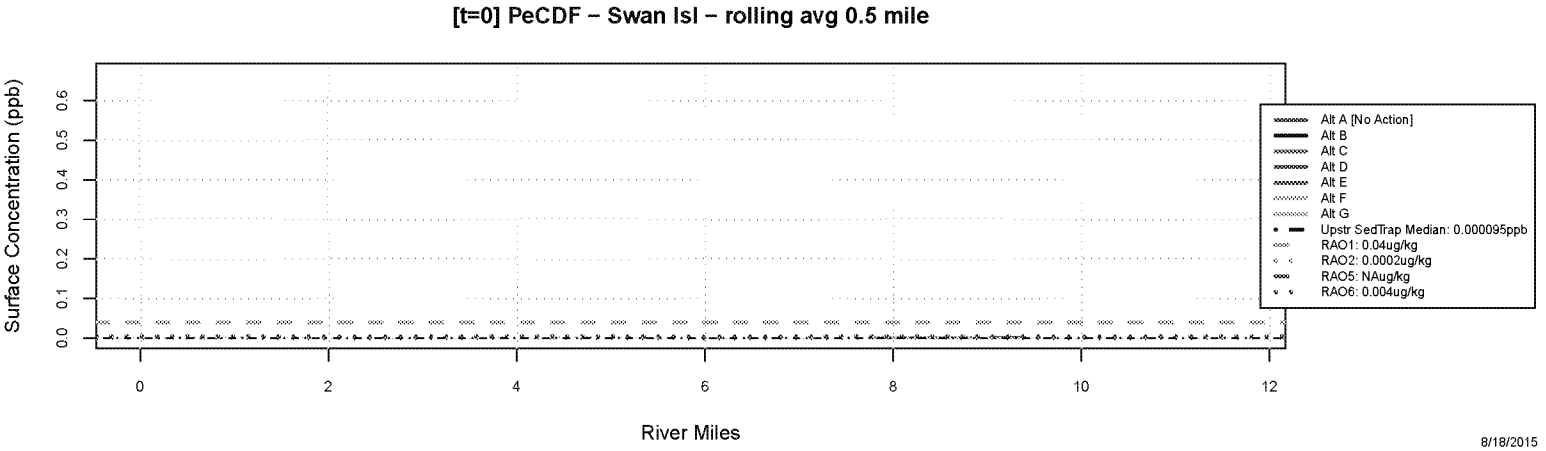
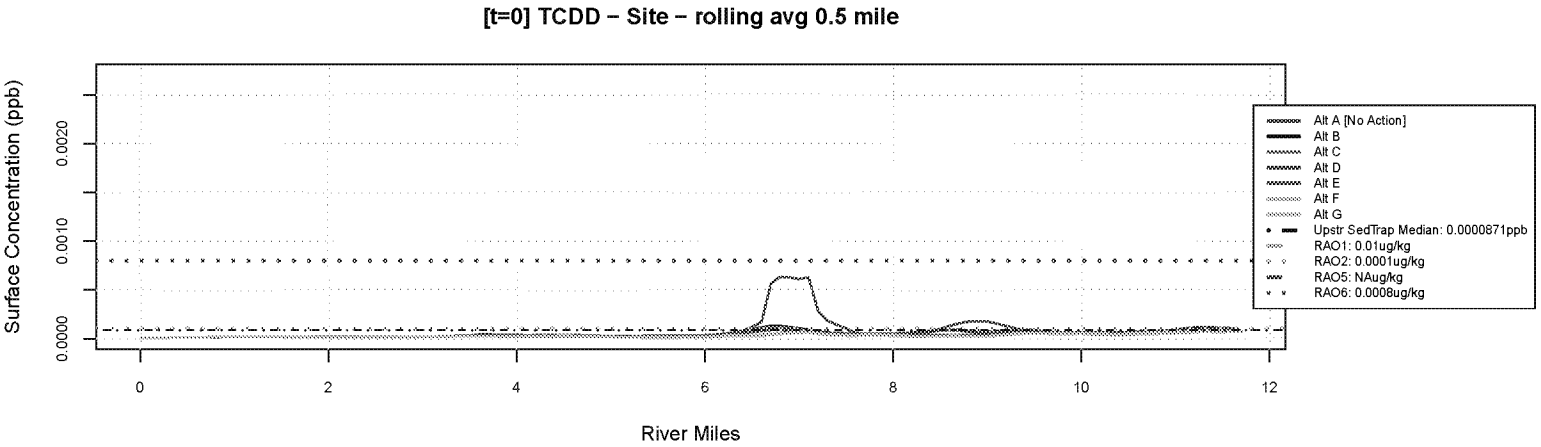
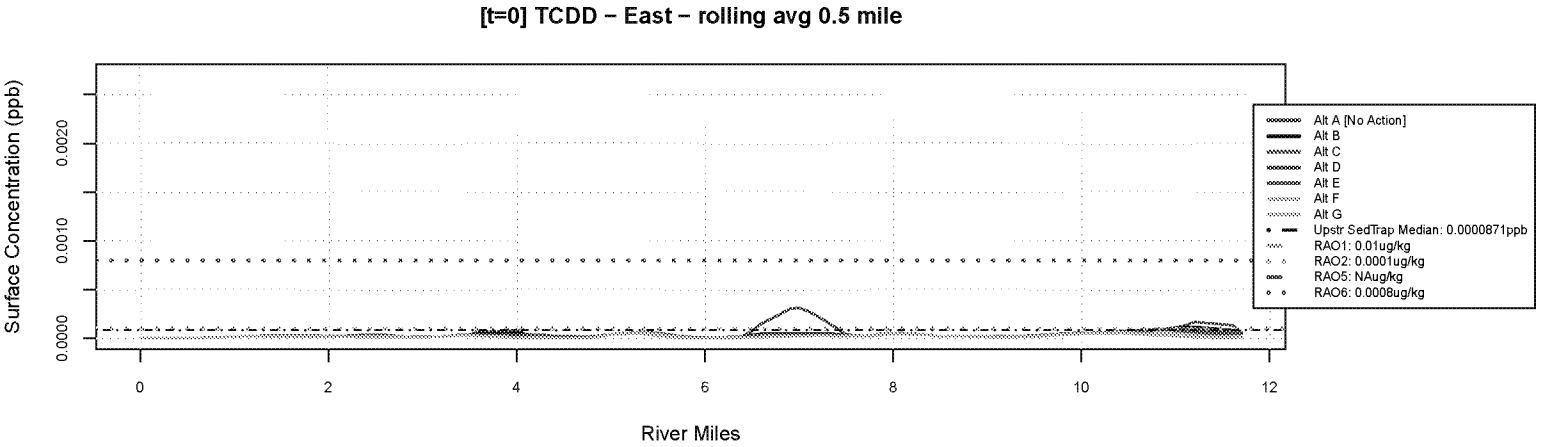
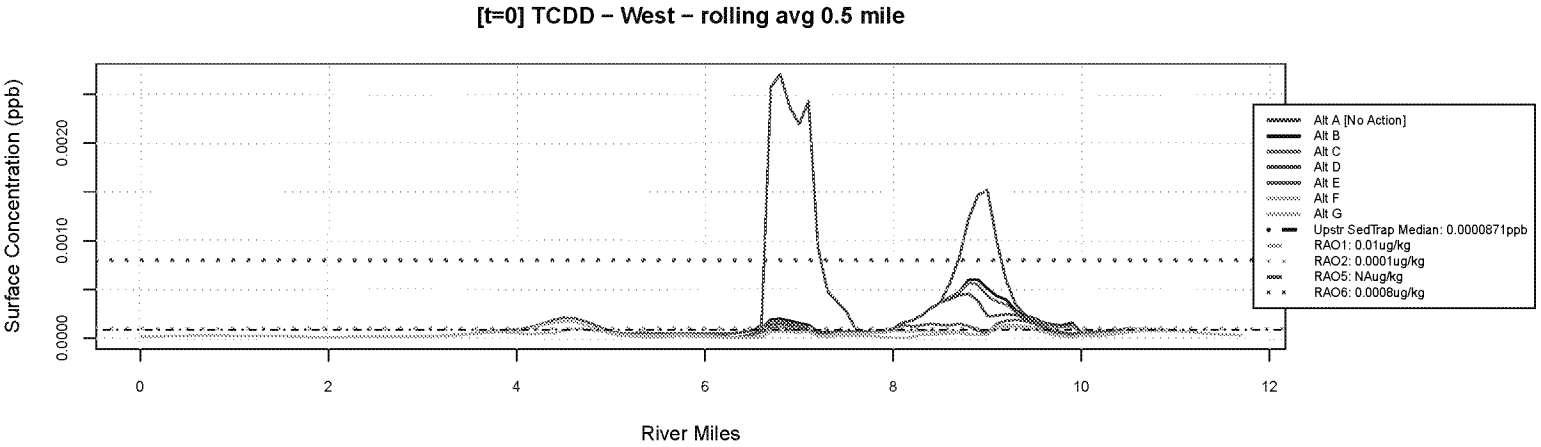


Figure 4.2-7f. RAO 1 Rolling River Mile (Year 0)- PeCDF







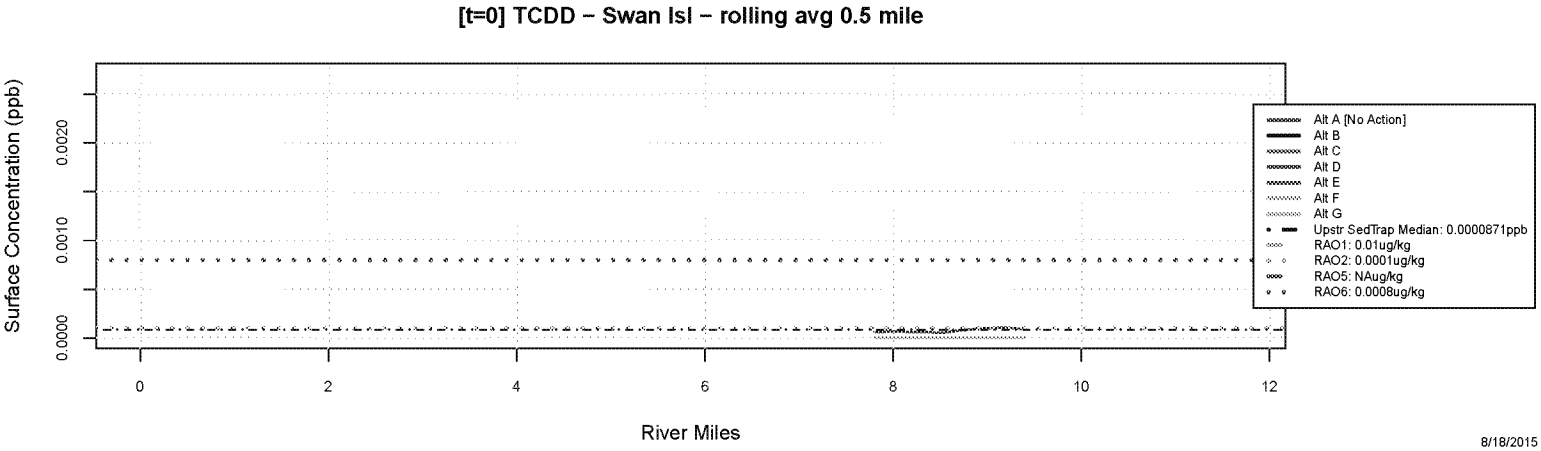
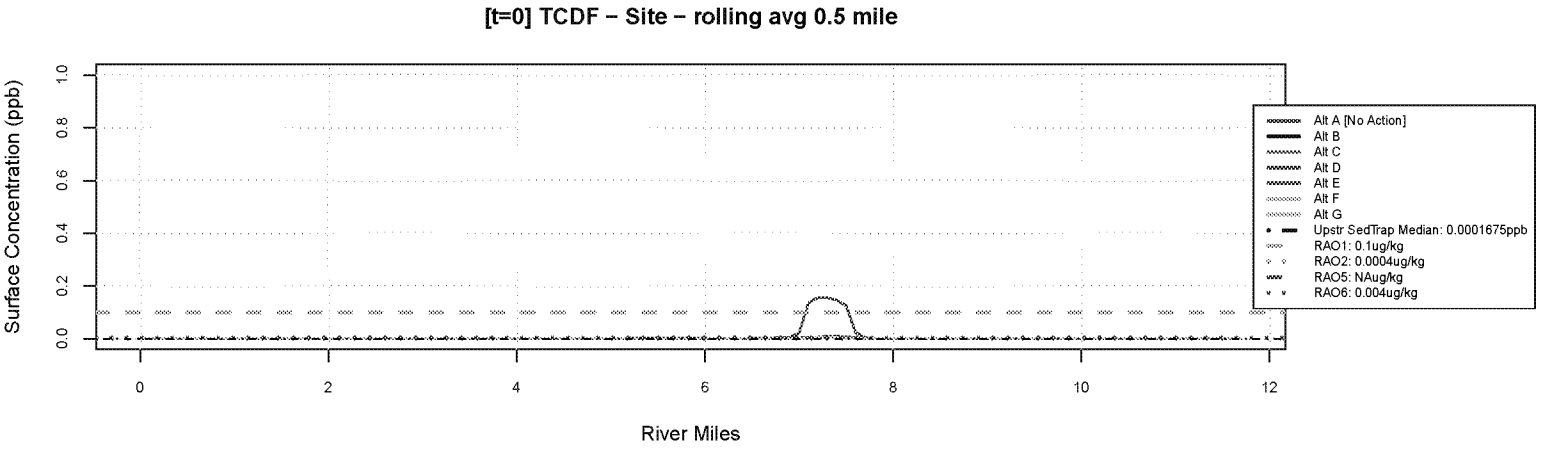
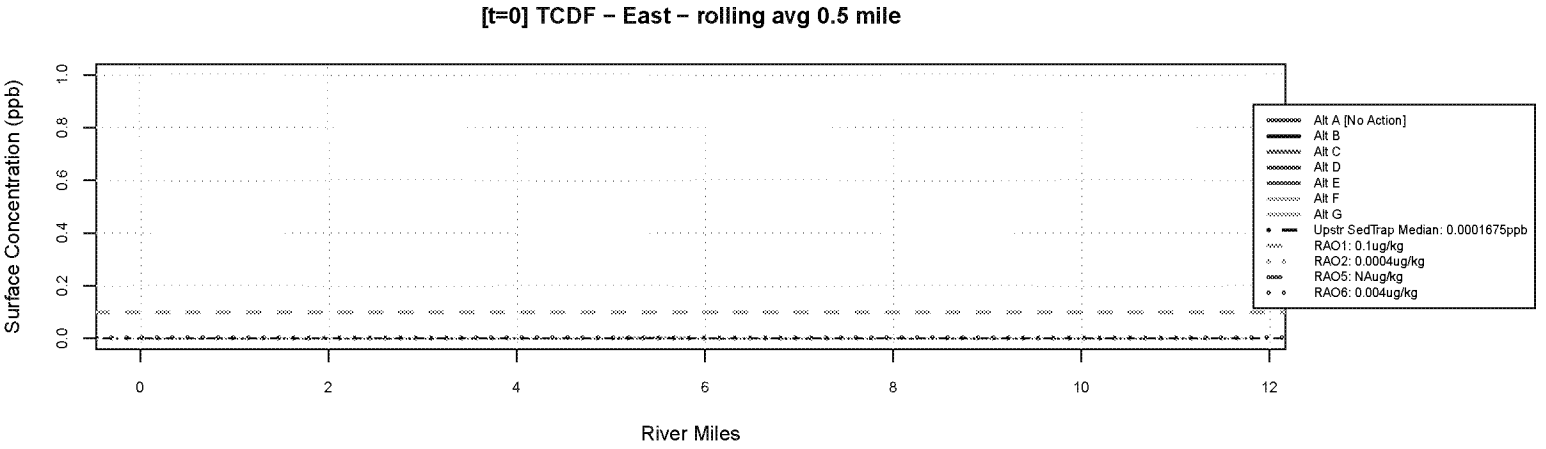
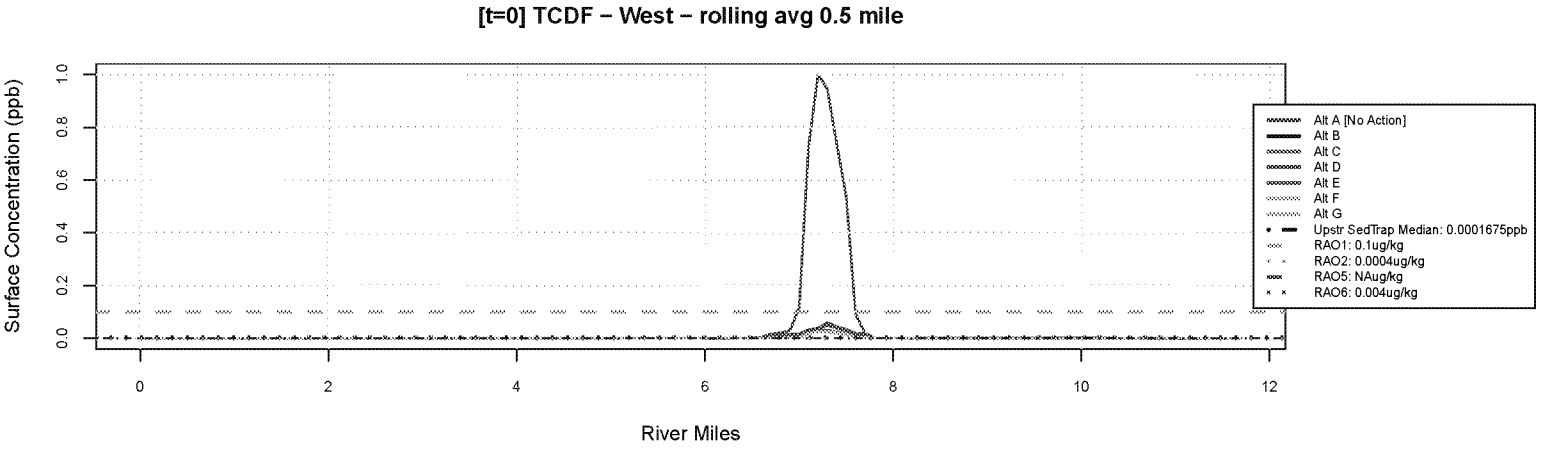


Figure 4.2-7g. RAO 1 Rolling River Mile (Year 0)- TCDD







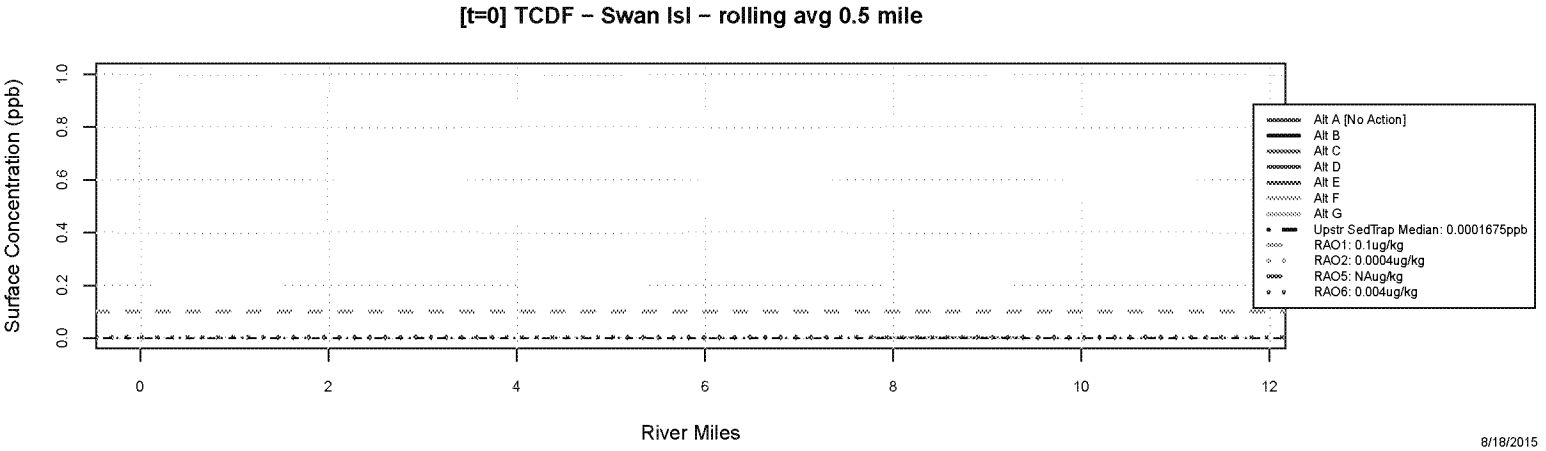


Figure 4.2-7h. RAO 1 Rolling River Mile (Year 0)- TCDF

TAB 4

LWG
LOWER WILLAMETTE GROUP

Chairperson: Bob Wyatt, NW Natural
Treasurer: Frederick Wolf, DBA, Legacy Site Services for Arkema

September 6, 2016

U.S. Environmental Protection Agency, Region 10
ATTN: Harbor Comments
U.S. Environmental Protection Agency
805 SW Broadway, Suite 500
Portland, OR 97205

Re: Lower Willamette Group Comments on Portland Harbor Proposed Plan (Lower Willamette River, Portland Harbor Superfund Site, EPA Docket No: CERCLA-10-2001-0240)

Dear EPA Region 10:

The Lower Willamette Group (LWG) appreciates the opportunity to comment on the U.S. Environmental Protection Agency's (EPA's) June 8, 2016, Proposed Plan and Feasibility Study (FS) for the Portland Harbor Superfund Site (Site).

Introduction

The LWG formed in 2001 as a group of business and government entities who stepped forward to work with EPA to study the risks posed by contamination at the Site and evaluate cleanup alternatives.[1] EPA's common practice at Superfund sites is for the Remedial Investigation (RI) and FS to be developed by potentially responsible parties (PRPs) under EPA oversight.[2] After years of data collection, analysis, and intensive engagement with EPA staff, the LWG presented EPA with a Draft FS in 2012. The LWG continues to stand behind the 2012 LWG Draft FS as a scientifically and legally supported approach to evaluating remediation alternatives for the Site. Over the years that followed, EPA took more active control of the RI/FS and, in the LWG's view, diverged further and further from a scientifically and legally supported approach to cleanup. The LWG expressed significant technical, legal, and policy concerns when EPA produced a Draft FS in 2015. Rather than engage meaningfully with those concerns, EPA formally took over the FS and produced a draft Final FS and Proposed Plan that are even further detached than EPA's 2015 Draft FS from acceptable science and responsible risk characterization and management. In-depth knowledge of the Site and of the technical and legal foundations of its own and EPA's work gives the LWG unique insight and leads the LWG to the conclusion that EPA's selection of Alternative I in the Proposed Plan is incorrect.

[1] Members of the LWG participating in these comments are Arkema Inc., Chevron U.S.A. Inc., Evraz Inc. NA, Gunderson LLC, NW Natural, Phillips 66 Company, Port of Portland, TOC Holdings Co., Union Pacific Railroad Company, Bayer CropScience Inc., BNSF Railway Company and Kinder Morgan.

[2] "The purpose of this memorandum is to reaffirm the EPA's commitment to having potentially responsible parties (PRPs) conduct the remedial investigation/feasibility study (RI/FS) at Superfund sites wherever appropriate." *Promoting Enforcement First for Remedial Investigation/Feasibility Studies at Superfund Sites* (EPA, March 20, 2012).

Executive Summary

The overarching objective of selecting a remedy under the National Contingency Plan (NCP) decision-making process is to identify the cleanup that will be effective and provide "sensible, reliable solutions for identified site problems."[3] Key factors in the decision-making process under the NCP include using a reasonable characterization of risks at the Site (including a consideration of uncertainties) and assessing how well the cleanup will protect people from unacceptable risks and how much it will cost, both in terms of adverse impacts on the community and dollars to be spent. In addition, an important consideration when selecting a remedy is how long it will take before reasonable cleanup goals are achieved.

At this Site, EPA's assessment of risks to human health is based on a series of unrealistic and unsupported assumptions regarding exposure and exposure durations and fails to consider how widely used preparation and cooking methods reduce contaminants in fish tissue. The result is cleanup goals that are not reasonably achievable, because they are based on worst case scenarios, not exposures that are reasonably expected to occur as required by the NCP.

Despite their conservative nature, EPA largely abandoned the Baseline Risk Assessments (BLRAs) in the 2016 draft Final FS by developing preliminary remediation goals (PRGs) inconsistent with the BLRAs, applying remedial action levels (RALs) in areas of the Site where relevant exposures do not occur or where the PRGs are already met, and evaluating the effectiveness of its cleanup alternatives at reducing risk using methodologies that are completely unrelated to the BLRAs. To take but one example of how divorced EPA's remedy selection is from the risk assessments, the EPA approved Baseline Ecological Risk Assessment (BERA) evaluated multiple lines of evidence and concluded that about 4 to 8% of the site presents benthic risk. In 2014 and 2015, EPA and the LWG mapped an approach for applying the BERA in the FS (the Comprehensive Benthic Risk Area [CBRA] approach) that identified approximately 61 acres for the evaluation of active remedies. In the 2016 draft Final FS, however, EPA completely abandoned the BERA and the corresponding EPA/LWG CBRA approach to conclude, without explanation, that benthic risk is present at 1,289 acres, or nearly 60% of the Site. And even with this massive expansion of asserted benthic risk, EPA's preferred remedial alternative fails to address 16% of the 61 acres of benthic risk area identified by the EPA/LWG CBRA approach.

In the face of overwhelming evidence to the contrary, EPA assumed that the complex and dynamic Willamette River is essentially unchanging over time and lacks diversity in its course, assigned prescriptive remediation technologies without accounting for site-specific details, and then incorrectly estimated the probable cost and duration required for implementation of those technologies. As a result, EPA's evaluation of the relative performance of its remedial alternatives is seriously flawed, and its attempt at considering the cost-effectiveness of the alternatives lacks any meaningful foundation.

For example, EPA's evaluation of the protectiveness and "long-term effectiveness" of cleanup alternatives and "cost-effectiveness" is not based on achievement of cleanup goals. Rather, because EPA rejected all methods that might have allowed it to quantify the expected rate of natural recovery of sediments, EPA employs an invented standard—"interim targets" for "risk reduction at construction completion"—to evaluate these criteria and exclude less expensive alternatives from the evaluation for reasons not based on data. EPA rationalizes using these interim targets by stating that protective alternatives would achieve ultimate cleanup goals within a reasonable timeframe (i.e., 30 years) through natural recovery. EPA *assumes* Alternatives E and I will achieve cleanup goals and Applicable or Relevant and Appropriate Requirements (ARARs) in 30 years and *assumes* Alternatives B and D will not. No information in the record supports EPA's assumptions. In the absence of credible information to support its assumptions, EPA has no basis for representing whether alternatives will or will not achieve cleanup goals within a certain time. This critical omission and reliance on assumptions in the long-term effectiveness and cost-effectiveness determinations is arbitrary and capricious. A less expensive alternative that is easier to implement (and therefore quicker to start and finish) may achieve cleanup goals in a comparable or even faster timeframe than a much more complex, disruptive, and expensive alternative.

[3] NCP Preamble, 55 Fed. Reg. 8666, 8700 (March 8, 1990).

The trend shown by the data is decreasing surface sediment and fish tissue concentrations. In 2013, the LWG presented an evaluation of smallmouth bass polychlorinated biphenyl (PCB) tissue measurements made in 2002, 2007, and 2012 that indicate statistically significant declines in tissue concentrations across almost all areas of the Site.[4] Further, 2014 site-wide sediment PCB data[5] show this downward trend in contaminant concentrations in surface sediments due to the effects of natural recovery at the Site. EPA's disregard of recent data in its evaluation of the effectiveness of alternatives undermines the validity of its conclusions.

In addition, EPA's evaluation of cost-effectiveness is superficial and based on inaccurate cost estimates. Cost-effectiveness is not a minor, dispensable factor in the NCP. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that EPA determine that the selected remedy be cost-effective.[6] EPA must compare the cost to effectiveness of each alternative individually and compare the cost and effectiveness of alternatives in relation to one another.[7] Effectiveness means evaluating long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness.

In analyzing an individual alternative, the decision-maker should compare, using best professional judgment, the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness in order to determine that the effectiveness afforded is proportional to the cost. EPA's inadequate analysis of this important criterion in the Proposed Plan is not sufficient.

Further, EPA substantially underestimated the cost for its Preferred Alternative (Alternative I). EPA estimated Alternative I as $1,173 million compared to LWG's estimate of $2,127 million (non-discounted capital costs and annual expenditures over a 30 year period). In addition to using overly optimistic estimates for dredging and capping production rates, EPA's estimate fails to include reasonable estimates for contingencies, oversight, project management, construction management, water quality control structures, mobilization/demobilization, design, and fees for capping on state lands, as well as several other important categories of cost. The LWG's experienced sediment remediation consultant reviewed EPA's cost estimate and believes the cost is underestimated by about $954 million (non-discounted capital costs and annual expenditures over a 30 year period). A more realistic estimate of the cost to perform EPA's Preferred Alternative is well above EPA's margin of error of +50/-30% accuracy for FS cost estimates, rendering the selection of Alternative I invalid.[8]

Portland Harbor was added to the National Priorities List (NPL) in 2000. Sixteen years later, EPA has identified a preferred cleanup alternative that will not be under construction for at least 5 to 7 years. In the opinion of experienced sediment remediation professionals who have reviewed the Proposed Plan, construction will take 14 years or more to complete, given the constraints on performing intrusive work in designated critical habitat for several endangered species of salmon and steelhead and the physical and logistical complexities presented by an active commercial harbor. Completion of the active phase of the cleanup appears to be decades in the future. This is not an acceptable outcome.

As explained in this letter, because EPA is overly conservative in describing the risks at the Site, has not prioritized which areas of the Site pose the highest risk and should be addressed first, has disregarded recent data, and has evaluated cleanup alternatives in a manner that is arbitrary and capricious, EPA's proposed cleanup will not provide meaningful protection within a reasonable timeframe. Unless EPA addresses the issues raised in these comments when it writes the Record of Decision (ROD), this project, after all of these years and well over $100 million spent to date, will not succeed.

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[4] Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis, a presentation file from Anchor QEA provided to EPA on March 18, 2013. A copy of this presentation file is Attachment 1.

[5] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015). (Attachment 2)

[6] 42 U.S.C. § 9621(b).

[7] NCP Preamble, 55 Fed. Reg. 8728.

[8] *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, page 2-10 (EPA October 1988).

EPA can and must do better. In its October 19, 2015, letter to the National Remedy Review Board (NRRB), the LWG provided several recommendations on implementing the cleanup, including focusing on the most significant and pervasive risks, reducing the uncertainty about natural recovery, and maximizing flexibility in remedial design and implementation of the cleanup. Our review of the Proposed Plan has not changed those general recommendations. The risks at the Site do not warrant a cleanup with a completion so far in the future.

Comments

In keeping with the LWG's in-depth and long-term engagement with risk assessment and remedial alternatives evaluation at the Site, the following comments are highly detailed, technical explanations of the key deficiencies in EPA's 2016 draft Final FS and Proposed Plan. The choices and decisions EPA makes in the Portland Harbor ROD must be based in reason and science, and EPA must articulate a rational connection between the facts found and the choices it has made.[9] EPA must consider all important aspects of the problem and explain decisions that run counter to evidence before it.[10] And EPA must not rush through the process, "throw darts," "flip a coin," or make a "sudden, knee-jerk decision."[11] As explained below, EPA's 2016 draft Final FS and Proposed Plan contain major technical errors and draw conclusions that are contrary to the facts and data before EPA and that are, without explanation, inconsistent with the NCP, EPA guidance and even EPA's own prior decisions about the Site.[12]

Our comments identify the incorrect assumptions, inaccurate information and flawed analyses supporting EPA's remedial alternatives evaluation and therefore EPA's Preferred Alternative (Alternative I). EPA's approach diverges from legal requirements for remedy selection, including the nine criteria set out in the NCP, and is inconsistent with EPA guidance and EPA practice at other similar sites. EPA did not consider adequately or ignored completely important information, and the conclusions drawn by EPA are unsupported by, or run counter to, the evidence before EPA. In short, the choices and decisions EPA has made in the Proposed Plan are not supported by reasoned, scientific explanation provided in the FS or elsewhere. As a result, it would be arbitrary and capricious for EPA to select the Preferred Alternative identified in the Proposed Plan as the remedy for Portland Harbor.

The LWG's comments are organized around six categories of deficiencies in EPA's approach:

- **Section I**: EPA departed from the previously approved BLRAs and selected Remedial Action Objectives (RAOs) and PRGs that are not risk-based, risk-managed, or achievable.
- **Section II**: EPA took an unprecedented, inappropriate approach to designating "principal threat waste" (PTW) at the Site, which adds significant costs but does not reduce risk.
- **Section III**: EPA oversimplified the complex, dynamic natural processes occurring within and outside of the Site (the conceptual site model), leading it to inappropriately discount relevant new scientific information and the impact of changes over time to remedy evaluation and selection.
- **Section IV**: EPA did not apply, or misapplied, quantitative analysis to the NCP-required remedy selection criteria of protectiveness, long-term effectiveness, short-term effectiveness, and cost.
- **Section V**: Accurate analysis shows that EPA's remedy is not cost-effective—i.e., it does not meaningfully reduce risks when compared to less time- and resource-intensive remedy alternatives—and that EPA has not conveyed to the public accurate information about risk or risk reduction at the Site.

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[9] *United States v. NCR Corp.*, 911 F. Supp. 2d 767, 773 (E.D. Wis. 2012) *aff'd sub nom.* United States v. P.H. Glatfelter Co., 768 F.3d 662 (7th Cir. 2014); *United States v. Newmont USA Ltd.*, 504 F. Supp. 2d 1077, 1082 (E.D. Wash. 2007).
[10] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43, 103 S. Ct. 2856, 2867 (1983).
[11] *United States v. NCR Corp.*, 911 F. Supp. 2d at 773.
[12] EPA has acknowledged that certain of its FS evaluations were "arbitrary" and that it needs to provide a rationale for its choices. Koch email to McKenna, June 17, 2014. A copy of this email is Attachment 3. As these comments discuss, in many cases, EPA has not met this standard.

- **Section VI:** EPA's remedy selection should include a plan for how cleanup will be implemented through baseline data collection and remedial design and implementation at operable units.

The LWG's comments also provide additional information for the Administrative Record. This information was exchanged between EPA and the LWG during preparation of the RI/FS, provided by the LWG to EPA in the course of the LWG's work on the RI/FS, or previously generated by EPA. The LWG previously recommended that most of these records be placed within the Administrative Record as appendices to relevant LWG deliverables; in most if not all cases, EPA required the LWG to remove the records from the deliverables. We are therefore incorporating these and similar records into our comments on the Proposed Plan for inclusion in the Administrative Record file pursuant to 40 CFR §300.815(b).

I. EPA's Proposed Remedy is Inconsistent with Approved Risk Assessments, is Not Focused on Actual Risk Reduction, and Lacks Any Meaningful Risk Management

In its August 2015 Draft FS, EPA determined that all of the remedial alternatives it evaluated, Alternatives B through G, were protective of human health and the environment and in compliance with ARARs. Yet, EPA indicated to the National Remedy Review Board (NRRB) and Contaminated Sediment Technical Advisory Group (CSTAG) that it favored an alternative that included a relatively high level of mass removal through dredging and upland disposal with an extremely high cost estimate of about $1.5 billion. The LWG commented to the NRRB and EPA that each component of the remedy should be aligned with addressing risks identified in the BLRAs included in the RI and that a remedy tailored to addressing sediment contamination that is actually causing risk would result in a remedy that is protective, effective, implementable, and cost-effective. The primary basis for the LWG's recommendation to ground the remedy in measurable and meaningful risk reduction was EPA's own guidance.

It appears that the LWG's comments caught EPA's attention by demonstrating that EPA was proposing a remedy that was far more expensive with no material increase in risk reduction. However, rather than selecting a remedy in its Proposed Plan more focused on achieving actual risk reduction in a timely and cost-effective manner, EPA without explanation recalculated baseline risk in a manner inconsistent with the EPA-approved BLRAs in order to artificially inflate risk reduction estimates for larger alternatives and claim that now the very same Alternatives B and D that were declared protective in the 2015 Draft FS are no longer protective of the environment.[13]

A. EPA's Declaration that Alternatives B and D May Not Be Protective of the Environment is Arbitrary and Capricious

EPA's Proposed Plan rejects Alternative B and D as not meeting the threshold criteria of protectiveness.[14] EPA has determined that an alternative is protective if it will achieve EPA's PRGs within 30 years.[15] However, because EPA decided that "a long-term model is not available to predict the time to meet the PRGs," EPA assessed protectiveness by "evaluating achievement of interim targets at the end of construction, as well as any additional benefit provided by [institutional controls]."[16] EPA then concludes, "Alternatives B and D may not be protective of the environment because of the timeframe needed to achieve PRGs through MNR and ICs would not provide protection [*sic*] ecological receptors during this time period."[17] As we understand it, EPA reaches this conclusion (which is inconsistent with its conclusion in the 2015 Draft FS that Alternatives B and D *are* protective), based upon its determination in the FS that "post-construction risks are greater than the interim targets thus MNR is unlikely to achieve PRGs within a reasonable time frame due to the uncertainty regarding the effectiveness of MNR with such high remaining contaminant concentration."[18]

EPA's evaluation of interim targets does not address the guidance recommendation that the long-term outcome of remedial alternatives should be assessed quantitatively.[19] EPA's selection of interim targets, generally at 10 times

[13] See, e.g. Proposed Plan, p. 50-51.
[14] Proposed Plan, Table 15.
[15] EPA draft Final FS p. 4-6 ("[A] reasonable time frame... was considered to be 30 years").
[16] EPA draft Final FS p. 4-6.
[17] Proposed Plan, p. 50-51.
[18] EPA draft Final FS p. 4-18. See also EPA draft Final FS p. 4-43.
[19] *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005) (hereafter, the "Sediment Guidance," p. 2-23 and 2-25; *Contaminated Sediments Remediation Guidance* (Interstate Technology and Research Council, 2014) (hereafter, "ITRC") ITRC), p. 61.

the PRGs, is arbitrary and unexplained. In the absence of a quantitative long-term assessment, EPA has no way to determine whether 10 times the PRGs are more likely to be met in 30 years as compared to any other multiplier of the PRG, or any other benchmark based upon, for example, physical properties of the river or chemical properties of a specific contaminant. Despite this arbitrary framework, EPA concludes that only Alternatives B and D "may not be protective of the environment because of the time frame needed to achieve PRGs through MNR." EPA does not explain when it expects Alternatives E and I to achieve the PRGs relative to either Alternatives B and D or its 30 year reasonable timeframe. Nothing in the 2016 draft Final FS or Proposed Plan explains why EPA considers some of the alternatives that meet some ecological risk interim targets protective and others not protective.

EPA acknowledges that concerns about potential risks to human health related to the inability of all of the alternatives to achieve interim targets immediately post-construction can be effectively managed by institutional controls while monitored natural recovery works to attain remedial goals.[20] Ecological exposures, however, cannot be managed through institutional controls. The Proposed Plan concludes that Alternative B does not achieve the RAO 5 (ecological direct toxicity) interim target[21] and that Alternatives, B, D, E, and I may not meet the RAO 6 (ecological bioaccumulation RAO) interim target.[22] The Proposed Plan does not claim that those goals will not be met by the 30-year reasonable timeframe. The actual results of EPA's own analyses indicate that all of these alternatives are in fact protective.

With respect to RAO 5, EPA's 2016 draft Final FS and Proposed Plan approach to benthic risk is entirely inconsistent with the multiple lines of evidence approach used to identify benthic risk areas in the approved BERA and should not be used to conclude that Alternative B is not protective of ecological receptors. Although the BERA concludes (as EPA notes in the Proposed Plan) that "[u]nacceptable risks to benthic invertebrates are located in approximately 4-8 percent of the Site,"[23] the draft Final FS presents benthic risk areas that cover 1,289 acres (or about 59% of the Site).[24]

EPA's large benthic risk areas mapped in the 2016 draft Final FS and Proposed Plan extend into areas shown to lack toxicity based on laboratory toxicity tests and other BERA lines of evidence. EPA and the LWG agree that empirical toxicity testing is one of the most important and direct measures of benthic toxicity available. Figure 1 shows the locations of failing and passing bioassay tests in relationship to "benthic risk" areas mapped on Figure 4.1-1 in the 2016 draft Final FS. EPA identifies broad areas of benthic risk (yellow) in locations that passed bioassay tests (blue dots). Thus, the benthic toxicity that EPA's Proposed Plan assumes exists in these areas in fact does not exist.

EPA determined these broad benthic risk areas by mapping any exceedance of individual benthic PRGs, which are derived from various toxicity models, and by ignoring empirical toxicity data from Portland Harbor. Without explanation, EPA's current approach is exactly the opposite of its own prior instructions to the LWG: "EPA and the LWG recognize that the sediment quality guidelines produced by any model (LRM, FPM or generic SQGs such as PECs or PELs) are intended to be used as a set – not individually."[25] EPA further compounds this error by making numerous errors (or at least unexplained decisions that differ from the EPA-approved BERA) regarding its compilation of the individual benthic PRGs for RAO 5 involving at least PCBs, DDx, and DDT.[26] The overall result of this haphazard approach is that EPA's alternatives require large amounts of active remediation on the basis of RAO 5 while failing to even address all of the EPA/LWG CBRAs previously agreed to as shown in Table 1.

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[20] See Proposed Plan p. 50 (All alternatives other than the no action alternative "in conjunction with MNR and institutional controls, are expected to be protective of human health.").
[21] "Alternative B is the only alternative that does not achieve the interim target of addressing 50 percent of the benthic risk area; all other alternatives achieve the interim target."
[22] "Alternatives B, D, E and I do not achieve the ecological HQ interim target of 10."
[23] BERA, p. 774, Proposed Plan, p. 20.
[24] See, e.g., Table 4.2-7. Pages 11-12 of the Proposed Plan describe the site as 2167 acres.
[25] "Resolution of EPA September 27, 2010 Comments on Benthic Risk Evaluation" in EPA-approved BERA Attachment 1.
[26] See, Windward Environmental's Technical Memorandum *Review of EPA's FS relative to the LWG/EPA agreed comprehensive benthic approach (September 6, 2016)*, Attachment 4.

Figure 1. Comparison of EPA Mapped Areas Above RAO 5 PRGs and Pooled Bioassay Results from the BERA.

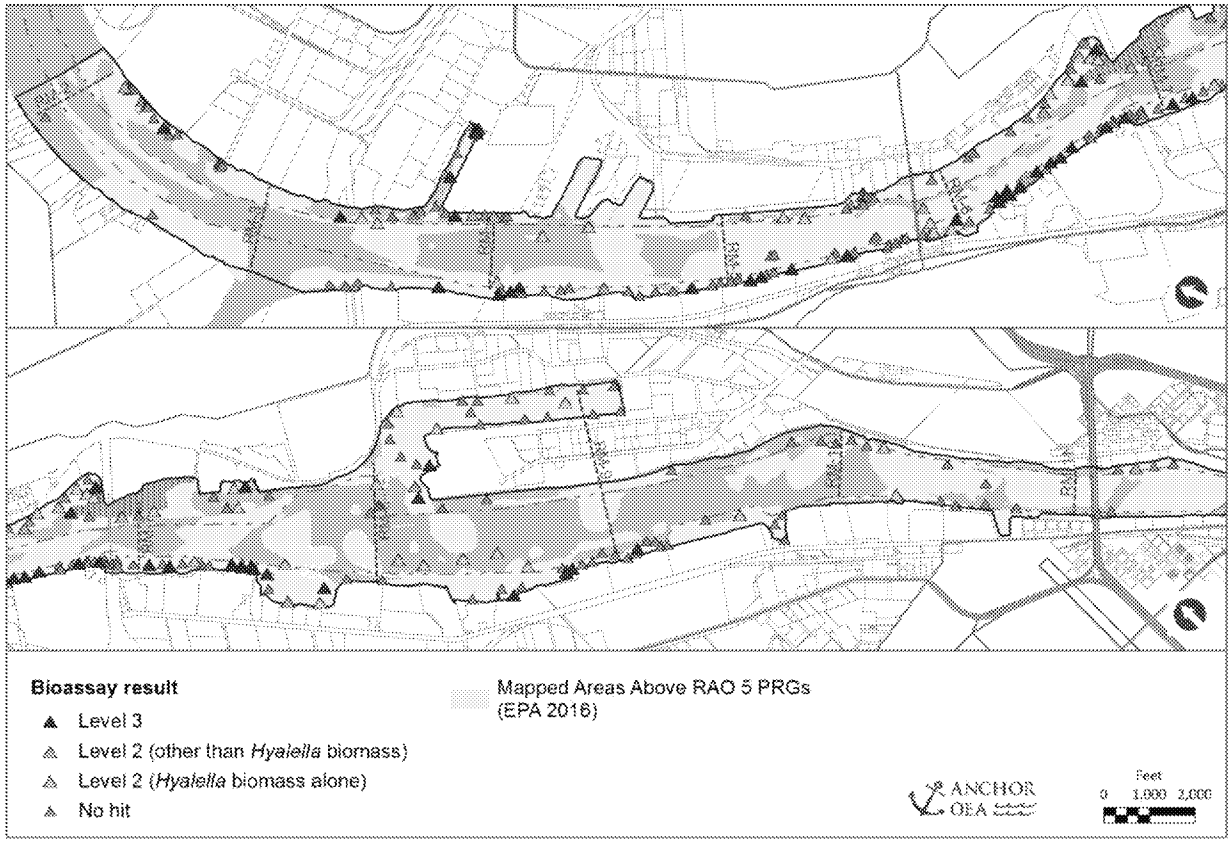

Table 1. Comparison of EPA's 2016 Draft Final FS Alternatives to the CBRAs Directed by EPA in 2014.

EPA Draft Final FS Alternative	Percent of EPA/LWG CBRAs Addressed by EPA Alternative
B	59%
C	66%
D	77%
E	83%
F	89%
G	92%
H	100%
I	84%

The EPA/LWG CBRA approach combines multiple lines of evidence, including bioassay toxicity tests. EPA supported this approach for many years before abruptly abandoning it in the final stages of preparation of the 2015 Draft FS. On April 4, 2014, EPA provided final direction to the LWG on mapping the CBRAs developed for the 2012 LWG Draft FS.[27] On February 2, 2015, EPA advised the Oregon Department of Environmental Quality (DEQ) that it was "not doing something new or different than what was done in the final BERA" and that the revised CBRA layers "are part of the Section 3 development of the alternatives, not Section 2, since they are depiction *[sic]*

[27] Burt Shepard email to John Toll, April 4, 2014, Attachment 5.

remedial action areas and not used for development of PRGs."[28] On February 27, 2015, EPA requested that the LWG submit revised text and maps incorporating its April 4, 2014, direction for the CBRAs; the LWG submitted the requested information on April 3, 2015.[29] The 2015 Draft FS, however, makes no mention of the EPA/LWG CBRAs, and the June 2016 draft Final FS maps benthic risk areas by point-by-point application of PRGs. EPA has never explained its changed approach to benthic risk and the corresponding shift from a remedial approach focused on the most certain areas of benthic risk, which (consistent with the findings of the BERA) encompasses a few percent of the Site to a very large percentage of the Site where significant evidence demonstrates limited or no benthic risk. And yet EPA's alternatives (except Alternative H, which covers the entire Site) do not address even the focused areas of elevated benthic risk.[30] Thus, EPA's distinction that Alternative I is protective of benthic risk, while Alternative B is not protective, is even more arbitrary when readily available and technically appropriate information is considered.

Further, EPA's interim target for RAO 5 is arbitrary based upon EPA's own analyses. EPA very simplistically mapped individual benthic PRG exceedances and used a 10 times exceedance factor to identify interim target benthic risk areas. EPA completed this interim target determination by assuming that an alternative would be protective if it is addressed through active remediation of 50% of the 10 times exceedance area. As discussed above, the 10 times exceedance factor is arbitrary and not supported by any long-term assessment of the alternatives. The 50% requirement is a second arbitrary step that is not tied to any quantitative assessment. EPA provides no explanation of why it picked 50% and not 33 or 67%, or any other value between 1 and 100%. EPA's own 2016 draft Final FS Table 4.2-7 illustrates the arbitrary nature of these decisions. In that table, EPA indicates that Alternative B addresses 48% of the 10 times benthic risk area, while Alternative I addresses 64%. Missing the threshold of 50% by a mere 2% implies a level of certainty to the analysis that is implausible, given the arbitrary nature of the threshold in the first place. Indeed, based on Table 4.2-7, Alternative B would actively remediate about 90 acres based on benthic risk, while the EPA-approved BERA concluded there may be as few as 87 acres of benthic risk.[31] The fact that, as discussed above, none of EPA's final alternatives actually address all benthic risk areas identified by the EPA/LWG CBRA approach just underscores the arbitrariness of EPA's approach in the 2016 draft Final FS.

With respect to RAO 6 (ecological bioaccumulation), as noted above, EPA concluded that "Alternatives B, D, E and I do not achieve the ecological HQ interim target of 10." Putting aside EPA's arbitrary decision to single out only Alternatives B and D as not protective, and ignoring the failure of its Preferred Alternative to meet the same interim target, a cursory review of EPA's own results suggests that all of these alternatives are protective. In the 2016 draft Final FS, EPA refers to Figures 4.2-9 through 4.2-17 and Table 4.2-5 to support its conclusions about RAO 6.[32] Based on this information, there are numerous problems associated with concluding any of these alternatives are not protective:

- As EPA notes on page 4-20 of the 2016 draft Final FS, these figures show that only bis-2-ethyhexyl-phthalate (BEHP) exceeds the 10 times threshold in any river mile or Sediment Decision Unit (SDU) examined and only in Swan Island Lagoon (SIL) or portions of SIL in the case of the rolling river mile analysis.

- On an SDU area basis, Table 4.2-5 shows that the BEHP exceeds the threshold by a factor 11 (slightly above the arbitrary threshold of 10) for Alternative B only.

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[28] Koch email to Jennifer Peterson, February 2, 2015, Attachment 6.
[29] Koch email to Toll, February 27, 2015Attachment 7.
[30] *Appendix P, Comprehensive Benthic Approach, Draft Feasibility Study* (Windward Environmental LLC, March 2015), Attachment 8. The LWG's 2012 draft FS addressed all CBRAs, with the exception of the 3 small additional areas resulting from EPA's April 4, 2014 direction and reflected in these revised text and maps submitted April 3, 2015.
[31] *See,* BERA p. 776. EPA concluded that benthic risk is "projected to extend over between 4 and 8% of the surface sediment area within the Study Area." According to the Proposed Plan, the Site covers approximately 2167 acres; four percent of 2167 acres is just under 87 acres. Proposed Plan, p. 11-12.
[32] See e.g., draft Final FS p. 4-20.

- The BEHP Hazard Quotient (HQ) exceedances highlighted in EPA's 2016 draft Final FS for Alternatives D and I are identical, each with an HQ of 19.[33] EPA cannot legitimately conclude with identical HQs in the same small area that Alternative D is not protective but Alternative I is protective.

- The rolling river mile analysis shows the BEHP exceedances (above threshold of 10) only occur for small fractions of a rolling river mile, around river miles 8 and 9.5 within SIL. This strongly suggests that these "exceedances" are due to one or two individual samples at either end of the SIL area. This reason appears insufficient to declare entire site-wide alternatives as not protective, particularly when any concerns (if real) could be addressed by small modifications to the alternatives in these limited areas either in the FS or in remedial design.

- EPA indicates in the 2016 draft Final FS that "…it is unlikely that ENR in SIL would sufficiently reduce the HQs in the long term due to the remaining concentrations outside the SMA." This appears to be a misstatement of EPA's own approach, because SIL is one of the few places in EPA's alternatives where Enhanced Natural Recovery (ENR) is specifically used outside the Sediment Management Area (SMA) boundaries as defined by the RALs.[34] Under EPA's approach, ENR material would be placed throughout SIL outside the SMAs, which would presumably address the one or two samples with relatively high BEHP concentrations on either end of SIL.[35] There is no quantitative analysis of the long-term outcomes for BEHP concentrations for any of these alternatives. Even a simple calculation of the concentration reduction expected from sand ENR placement in SIL would likely show substantial reductions in the specific BEHP exceedances noted by EPA.

- The HQ exceedances highlighted in EPA's 2016 draft Final FS for Alternative B, D, E, and I range from 34 to 15, with Alternatives D and I both having HQs of 19. EPA does not explain how it decided that an HQ of 34 in a very limited area is not likely to achieve protectiveness in 30 years while an HQ of 19 is protective in one case, but not in the other, over the same period.

Further, all these "exceedances" are based on a BEHP PRG that is questionable. EPA's RAO 6 PRG for BEHP is 135 micrograms per kilogram (ppb) and is based on a bioaccumulation endpoint for smallmouth bass tissue, but the PRG cannot be entirely replicated by the LWG based on the information available in the 2016 draft Final FS. As the LWG previously commented on the EPA 2015 Draft FS, taking into account the low frequency of surface water and tissue Toxicity Reference Value (TRV) exceedances, the conservatism of the fish tissue TRV, the absence of a relationship between site sediment and tissue concentrations, and the absence of evidence of BEHP biomagnification, EPA's selection criteria for contaminants of ecological significance do not support its decision to identify BEHP as a contaminant of ecological significance. It does not warrant an RAO 6 PRG.[36] It is also noteworthy that the BERA did not find widespread risks for BEHP. The BERA found smallmouth bass TRV exceedances in 4 of 31 samples in only 3 river miles.[37] The maximum BEHP exceedance occurred at river mile 3.5, which is many river miles downstream of the SIL area that caused EPA's determination that Alternatives B and D are not protective. Finally, the BERA is clear that the smallmouth bass BEHP TRV is based on one highly uncertain study.[38] Thus, determining a precise but arbitrary threshold of 10 times this highly uncertain PRG, and then rigidly applying that threshold to make a site-wide non-protectiveness determination highlights the absence of any reasonable risk management decision framework for the 2016 draft Final FS and Proposed Plan.

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[33] Draft Final FS, p. 4-42 and 4-80.
[34] Draft Final FS p. 4-20. See also Proposed Plan Figures 10a, b, and c, which indicate application of ENR sand outside SIL RAL boundaries.
[35] As noted elsewhere (in this document) it is problematic that EPA did not include ENR in SIL in the calculations of SWAC reductions. In this case, including ENR in SWAC calculations would likely have changed EPA's determinations in the 2016 FS about BEHP exceedances in SIL. EPA replied on July 20, 2016 to LWG clarification requests that, "The post-construction SWACs in the FS do not reflect the placement of ENR as they also do not include MNR." This reply attempts to equate ENR with MNR, but ENR clearly includes active placement of sand material at the time of construction, which is a form of active remediation as indicated by the word "enhanced" in the term ENR.
[36] *See,* "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240". Letter from LWG to EPA dated June 19, 2014.
[37] BERA Table 7-7.
[38] BERA Table 7-45.

B. <u>If Alternative B Fails to Meet Chemical-specific ARARs, All Alternatives Do, and EPA Should Waive Them Now</u>

EPA's Proposed Plan states that "Alternative B does not achieve chemical-specific ARARs in a reasonable time frame, but will attain the action-specific and location specific ARARs. All other alternatives will attain their respective Federal and State ARARs."[39] The 2016 draft Final FS states, "Alternative B may not comply with all ARARs.... It is unlikely that chemical-specific ARARs would be achieved in a reasonable time frame."[40] As noted above for EPA's long-term protectiveness evaluations, EPA's conclusion about Alternative B not meeting chemical-specific ARARs "in a reasonable timeframe" is entirely arbitrary, because EPA has no quantitative method to assess the long-term outcomes of the alternatives.[41] This ARAR determination for Alternative B is also arbitrary, because it is based on a flawed EPA analysis of surface water data that is inconsistent with Site technical information and any reasonable conceptual site model (CSM).

EPA supports these conclusions with the following statements on page 4-20 of the 2016 draft Final FS: "Exceedances of water quality criteria for protection of human health from contaminated sediment within the Site would continue for PCBs, cPAHs, and 2,3,7,8-TCDD eq at the completion of construction. There is insufficient surface water data to evaluate the effectiveness of this alternative in meeting the aquatic life water quality criteria for BEHP, PAHs and TBT." On page 4-6 of the 2016 draft Final FS, EPA refers to Appendix K as the source of these determinations. The LWG reviewed Appendix K and found it contains numerous flaws that preclude any accurate conclusions regarding surface water concentrations or compliance with surface water ARARs.[42] In summary, EPA's Appendix K analysis errors include the following:

- EPA used flow weights for averaging surface water data that are the opposite of the actual average annual river flow conditions. EPA assumed 240 days of the year were in a high flow condition, when the U.S. Geological Survey Portland river gauge data show that <u>low</u> flows (less than the long-term average of 33,000 cubic feet per second) occur about 250 days out of the year.

- EPA used river mile 11 West and Navigation Channel data to calculate weighted average surface water concentrations (SWACs) for the Site and for concentrations entering the Site. Using these same data to represent both locations on the river results in inaccurate determinations for both locations.

- Although perhaps a typographical error, EPA indicates it subtracted the concentration entering the Site from the average site concentration to obtain concentrations for the "Downtown Reach." As written, such a calculation would produce the contribution from the Site instead.

- EPA assumes that post-construction surface water concentrations will decrease proportional to the percent reduction in sediment surface-weighted average concentrations (SWACs). This simplistic assumption ignores other contributions to surface water, most notably the upstream concentrations entering the Site. As a result, EPA estimates much greater percent reductions for the alternatives than is possible. For example, EPA calculates 92% reduction in Site surface water concentrations for Alternative G, but correctly accounting for upstream inputs would place this estimate at only about a 50% reduction.

- EPA also ignores within-site upland sources such as National Pollutant Discharge Elimination System (NPDES)-permitted stormwater and NPDES-permitted process and cooling water discharges that are beyond the control of sediment remedies.[43] For example, the annual loading summary provided in Table 6.1-11 of the EPA-approved RI shows that nearly 30% of the PCB load to the Site comes from stormwater.

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[39] Proposed Plan, p. 52. See also Proposed Plan Table 15.
[40] EPA draft Final FS, p. 4-20.
[41] EPA rejected the fate and transport model that the LWG developed with EPA encouragement and EPA input over the course of the RI/FS which, if finalized in EPA's draft Final FS, would have provided the means to assess those outcomes.
[42] See the technical memorandum *Further Evaluation of EPA's Flawed Surface Water Analysis in 2016 draft Final FS Appendix K* (Anchor QEA August 8, 2016), Attachment 9.
[43] NPDES-permitted discharges are exempt from CERCLA remedial action requirements under the "federally permitted release" exemption. 42 USC §9607(j).

By ignoring these sources, EPA further and incorrectly inflates the erroneous percent reductions achieved by all alternatives.

These flaws cause EPA to systematically over-estimate the percent reduction in surface water concentrations provided by the alternatives. If EPA applied the same subjective judgments in the 2016 draft Final FS text for Alternative B to corrected (lower) reduction estimates for the other alternatives, EPA would conclude that most of the alternatives (likely including Alternative I) do not meet chemical-specific ARARs. Instead of attempting to correct the Appendix K results, EPA should develop a plausible CSM that recognizes the true role of upstream inputs to the Site and NPDES-permitted discharges.[44] A correct CSM for surface water would demonstrate that it is unreasonable to expect sediment remedies to drive improvements in Site surface water concentrations that are unrelated (e.g., upstream watershed sources) to Site sediment issues.

Such a CSM is fully supported by Site and upstream surface water data. The LWG previously submitted to EPA in the 2012 LWG Draft FS (p. 3-11) analyses demonstrating that "upstream background surface water 95th percentile UPL concentrations of arsenic, total PCBs [polychlorinated biphenyls], total PAHs, dieldrin, 4'4-DDT, sum DDT, and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) entering the Site exceeded the respective fish consumption values for these contaminants." The values being referred to here are various state and federal water quality criteria, which EPA has adopted as PRGs in the 2016 draft Final FS (Tables 2.1-4 and 2.2-1) and Table 11 of the Proposed Plan. EPA subsequently rejected the RI surface water upriver statistics (i.e., the upper confidence limit [UPL]).[45] However, even if EPA had examined just the arithmetic mean of upriver surface water data,[46] EPA would have found the concentrations of aldrin, arsenic, BEHP, DDD, DDE, DDT, hexachlorobenzene, PCBs, several polycyclic aromatic hydrocarbons (PAHs), and 2,3,7,8-TCDD toxic equivalent entering the Site exceed both the state and federal fish consumption water quality ceritifcation (WQC) for these contaminants. It is important to note that this list includes all of the focused RAL chemicals (i.e., PCBs, DDx, dioxin/furans, and PAHs). Therefore, a waiver will be needed for these criteria-based surface water PRGs due to upstream inputs, regardless of the exact statistics used to evaluate those upstream inputs. Consequently, no sediment remedy, even combined with source controls within the Site itself, can technically be expected to attain water concentrations lower than incoming upstream conditions for these chemicals.

Per EPA sediment remediation guidance,[47] "RAOs should reflect objectives that are achievable from the site cleanup." This leads to one of two possible EPA management decisions: 1) EPA should remove surface water RAOs from the 2016 draft Final FS, given that site sediments are not the primary cause of surface water ARAR exceedances and therefore sediment remedies alone cannot achieve all of the most important chemical-specific ARARs in surface water; or 2) EPA should waive water quality ARARs for these same chemicals in the ROD. EPA continues to maintain that, "Currently, EPA does not have a basis for waiving any ARARs. Any ARAR waivers would have to be conducted through the remedy selection process and documented in a ROD amendment."[48] If EPA had correctly estimated alternative surface water concentrations (even using the simplistic approach attempted in Appendix K), or simply compared the upstream concentrations to EPA's proposed surface water PRGs, then it would have an obvious available basis for waiving many of the water quality-related ARARs. Instead EPA maintains that site sediment remedies might somehow achieve site surface water reductions below ARARs despite multiple other sources also contributing to those same ARAR exceedances. EPA supports this ongoing bias by conducting obviously flawed analyses, such as Appendix K, and ignoring upstream data and then contending there is no basis for waiving the surface water ARARs.

Although EPA's guidance contemplates that ARAR waivers can be made either at the time of the ROD or later in a ROD amendment, CERCLA Section 121 strongly suggests that this determination should be made at the time of the ROD ("The President may select a remedial action meeting the requirements of paragraph (1) [protectiveness] that

[44] See Section III, infra.
[45] EPA's rejection of the calculation of upriver statistics was formally disputed by the LWG. See request for Dispute Resolution of EPA's Notice of Decisions on Background Regarding Section 7 of the Remedial Investigation; Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240.
[46] See 2011 draft RI, Table 7.2-5a. EPA removed reference to upstream concentrations statistics from later versions of the RI.
[47] Sediment Guidance, p. 2-15.
[48] 2016 draft Final FS p. 2-6.

does not attain a level or standard of control at least equivalent to [an ARAR] if the President finds that . . . ."). The LWG calls upon EPA to make these decisions at the time of the ROD. EPA has the information it needs now to make the waiver determinations. If EPA does not do so, tens or hundreds of millions of dollars may be wasted striving to meet unachievable surface water ARARs that no sediment remedy can meet.

Similarly, Safe Drinking Water Maximum Contaminant Levels (MCLs) that EPA uses as surface water and groundwater PRGs[49] are likely not achievable throughout the spatial extent of some groundwater plumes along the shoreline or out under the river, and achievement of such criteria is not necessary to design and implement groundwater and sediment remedies that are protective of all reasonable and likely future uses of groundwater. EPA should either determine that MCLs are not applicable, relevant or appropriate because MCLs do not apply to the groundwater in this context, or it should waive these water quality criteria ARARs now. MCLs are not applicable, relevant, or appropriately applied to groundwater here because the Oregon statute designates the Lower Willamette River as a potential public and private water supply only following adequate pretreatment[50] and because the federal Safe Drinking Water Act under which MCLs are developed designate that drinking water is appropriately sampled at the point of distribution.[51]

C. EPA's Risk Evaluations in the 2016 Draft Final FS and Proposed Plan, Individually and Collectively, Present an Inaccurate and Biased Picture of Risk Reduction Attainable through Sediment Cleanup at Portland Harbor

1. EPA's development and application of PRGs for the 2016 draft Final FS and Proposed Plan are inconsistent with the BLRAs

EPA's methods and results throughout the 2016 draft Final FS and the Proposed Plan are often inconsistent with the BLRAs, culminating in both a baseline (i.e., no action) and a post-construction risk assessment that departs significantly from the methods and findings of the BLRAs. EPA should address only those potential risks for contaminants, media, and pathways that were clearly found to pose unacceptable risks in the BLRAs, and EPA should further focus on the subset of unacceptable risks that are required for selecting an effective and protective remedy using all of the FS criteria (i.e., EPA should conduct reasonable risk management). Instead, EPA has departed from the BLRAs and applied virtually none of EPA's 11 Risk Management Principles for "making scientifically sound and nationally consistent risk management decisions at contaminated sediment sites."[52] In short, EPA should use a "risk-based framework" to "select site-specific, project-specific, and sediment specific risk management approaches that will achieve risk-based goals" and "ensure that sediment cleanup levels are clearly tied to risk management goals."[53]

The LWG has previously commented that EPA's PRG development procedures were substantially flawed and should be corrected prior to finalization of the FS.[54] The vast majority of errors previously identified persist in the 2016 draft Final FS and are carried through to the PRGs summarized in Table 11 of the Proposed Plan. EPA continues to propose chemicals of concern (COCs) and PRGs under circumstances that are technically inappropriate, scientifically invalid, and inconsistent with guidance. As noted in prior comments, EPA should instead include in the FS only those COCs and PRGs:

- For contaminant/exposure scenario pairs (ecological or human health) for which the EPA-approved BLRAs identified potentially unacceptable risk from in-river media.

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[49] 2016 FS Tables 2.1-4 and 2.2-1.
[50] OAR 340-041-0340, Table 340A.
[51] 40 CFR Part 141, § 141.23(a).
[52] *Principles for Managing Contaminated Sediment Risk at Hazardous Waste Sites*; February 12 2002. OSWER Directive 9285.6-08. See also Sediment Guidance, Appendix A-1. The relevance of this guidance to risk management steps in the FS is reviewed in detail in Sections 10.1 and 10.2 of the LWG's 2012 draft FS.
[53] Sediment Guidance, page 1-5.
[54] "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)". Letter from LWG to EPA dated June 19, 2014; "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

- That are calculated consistent with EPA-approved BLRA methods.
- Where there is sufficient scientifically valid information to calculate those PRGs.
- That are technically practicable to achieve or, alternatively, for which acceptable risk levels can be reached through sediment remedial action alternatives evaluated in the FS.
- That reflect a reasonable risk management framework including that: 1) the BLRAs indicate a contaminant is significantly contributing to risk' and 2) evaluation of remedial alternatives with respect to a potential COC or PRG is necessary to select a protective remedy.
- That can be attained through sediment remediation, which would exclude any surface water PRGs based on water quality ARARs with substantial contributions from upstream sources or CERCLA-exempt NPDES-permitted discharges. Instead, EPA should waive these ARAR criteria in the ROD, as they are clearly impracticable to meet due to upstream and likely continued upland sources.
- For matrices that can be directly addressed through sediment remediation, which would exclude PRGs for the fish tissue matrix, given that upstream and upland water sources contribute to unacceptable levels in fish tissue. As noted in the past, the LWG agrees with the concept of using fish tissue levels as monitoring tools for a limited number of COCs but not as performance goals or PRGs for sediment remedies.

EPA's designation of large areas in the navigational channel for cleanup based on petroleum contamination is a clear example of the magnitude of errors resulting from EPA's inexplicable severance of the results of the BLRAs from the 2016 draft Final FS and Proposed Plan. The Baseline Human Health Risk Assessment (BHHRA) is clear that fish consumption risks from cPAHs are likely less than 1% of the total cumulative risks for this pathway, with the remainder coming mostly from PCBs and dioxin/furans.[55] EPA has been unable to develop a technically sound cPAH sediment PRG for fish consumption because there is no observable relationship between sediment sources and PAH concentrations in fish tissue.[56] Because it was unable to link cPAHs in sediment to fish consumption risk, and despite the marginal cPAH fish consumption risk, EPA assigned a shellfish consumption PRG to the navigation channel as a surrogate for fish consumption,[57] even though no shellfish harvesting can occur within the navigation channel. EPA cannot simply assume that a PRG based on bioaccumulation in shellfish is representative or appropriate for protection of humans consuming fish.[58] A "rich and comprehensive" body of scientific literature establishes that vertebrate fish and shellfish metabolize PAHs very differently and that there is "very low risk of exposure to PAHs that are a health concern for humans consuming finfish."[59] In the Lower Duwamish Waterway ROD, in fact, EPA concluded that development of a sediment cPAH PRG for the human health seafood

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[55] See Figure 7-3 of the EPA-approved BHHRA.

[56] EPA's own internal reviews indicate this. See EPA memorandum, May 2016 "Evaluation of analyses used to calculate bioaccumulation calculation results Portland Harbor Superfund Site RAC Contract Number EP-W-05-049" to EPA Region 10 Portland harbor RI/FS File from Portland Harbor RI/FS Team (May 2016), Attachment 10. Further, the science is extensive that PAHs do not readily accumulate in vertebrate fish tissue. See Meador et al. 1995, *Reviews of Environmental Contamination and Toxicology* 143:79-164; September 2014 *Toxicological Review of* Benzo(a)pyrene, ORD EPA/635/R-14/312a; Varanasi, et al. 1989, Biotransformation and Disposition of Polycyclic Aromatic Hydrocarbons (PAHs) in Fish: In Varanasi U (ed); Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment, CRC Press; and Metabolism of PAHs in Teleost Fish-Scientific Findings, Memorandum from the Northwest Fisheries Science Center of NMFS, available at http://sero.nmfs.noaa.gov/deepwater_horizon/previous_reopening/index.html, October 22, 2010.

[57] 2016 draft Final FS Appendix B, p. B-35.

[58] In response to LWG comments noting this fact, EPA's explanation for such an assumption was, "EPA calculated a PRG for cPAHs to address unacceptable risks associated with consumption of shellfish, and we anticipate that this PRG will also address the unacceptable risks identified in the BHHRA associated with consumption of fish." How or why EPA believed this to be a scientifically appropriate decision was never explained. Koch email to McKenna and Wyatt (April 10, 2015).

[59] *Metabolism of PAHs in Teleost Fish-Scientific Findings*, Memorandum from the Northwest Fisheries Science Center of NMFS (vertebrate fish enjoy "highly efficient metabolism of PAHs" whereas bivalves such as oysters and clams have a "low capacity to metabolize PAHs"). See also, *Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment*, CRC Press.

consumption pathway was inappropriate, because no observable relationship exists between cPAH sediment and tissue concentrations.[60]

Even if such a PRG were valid, EPA's further decisions to abandon the site use factor used in the BHHRA for the direct contact cPAH PRG,[61] convert that cPAH PRG to a TPAH PRG based upon an irrelevant correlation calculation,[62] and then use this number as a basis for development of TPAH RALs for application in areas of the Site where no direct contact can occur results in a meaningless alternatives analysis. EPA's own immediate post-construction SWAC estimates[63] indicate that Alternative B SWACs in the navigation channel would be below the cPAH shellfish consumption PRG of 3,950 parts per billion (ppb) for every rolling river mile examined (the maximum SWAC at river mile 5.5 was 3,305 ppb within SDU 6Nav). Because Alternative B meets the cPAH shellfish PRG in the navigation channel immediately after construction, even if the shellfish PRG were a valid surrogate for a fish consumption PRG there would be no additional cPAH risk reduction from any of the other larger alternatives (D through I). Alternative RALs much higher than the Alternative B TPAH RAL (170,000 ppb) might provide a more cost-effective balance of active remediation and natural recovery for cPAHs in the navigation channel, but EPA considers no such alternatives. EPA's alternatives evaluation effectively compares only Alternative B against the "no action" Alternative A before selecting an extensive dredging remedy for the navigation channel. The LWG's estimated cost (based upon review of EPA's dredge volumes) of this unnecessary remediation in SDU 6Nav exceeds $62 million, which would classify this SDU, standing alone, as a mega-site. This outcome is manifestly inconsistent with any reasonable risk management approach, especially where fish consumption risks associated with PAHs account for less than 1% of the fish consumption risk identified in the BHHRA, and therefore, no meaningful or measurable human health risk reduction would be attained.[64]

The LWG's prior comments provide many other examples and detail how EPA's deviation from the BLRAs and failure to apply risk management are clearly inconsistent with EPA guidance.[65] Numerous examples of each of these issues are provided in the LWG's prior comments on 2015 Draft FS Section 2. Table 2 provides a summary of COCs and PRGs that EPA should use. Attachment 11 provides additional comments on EPA's COCs and PRGs contained in the 2016 draft Final FS and corrects the numerous issues and EPA errors identified by the LWG in EPA's most recent PRG tables (Proposed Plan Table 11 and 2016 draft Final FS Table 2.2-1).

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[60] Lower Duwamish Waterway Superfund Site Record of Decision, November 2014, p.75.
[61] This issue is detailed in "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)". June 19, 2014. See also, "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.
[62] The LWG previously commented on this issue on page 11 of "List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)" September 8, 2015.
[63] 2016 FS Appendix J Table J2.3-2i.
[64] TPAHs may be a source of benthic risk, but (for the reasons described above) benthic risk is targeted more precisely through application of the multiple lines of evidence used to evaluate benthic risk in the BERA and as applied in the EPA/LWG CBRA approach.
[65] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240", letter from LWG to EPA dated June 19, 2014. "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

Table 2. LWG Proposed Remediation Goals

Contaminant	Sediment - In-Water		Sediment-Beach Human Health Direct Exposure Areas	
	Units	Conc.	Units	Conc.
Arsenic	ppm	4	ppm	3 (or site-specific background)
Cadmium	ppm	Rely on EPA/LWG CBRA instead		
Chlordanes	ppb	Need to derive RAO 2 RG using upstream water values		
DDx	ppb	7.5		
DDD	ppb	Rely on EPA/LWG CBRA instead		
DDE	ppb	Rely on EPA/LWG CBRA instead		
DDT	ppb	Rely on EPA/LWG CBRA instead		
Dieldrin	ppb	Need to derive RAO 2 RG using upstream water values		
Lead	ppm	Rely on EPA/LWG CBRA instead		
Mercury	ppm	Rely on EPA/LWG CBRA instead		
PCBs	ppb	(20 or as determined by additional equilibrium evaluations)		
PAHs	ppb	Rely on EPA/LWG CBRA instead		
cPAHs (BaPEq) - human health direct contact unacceptable risk exposure areas	ppb	424	ppb	12
cPAHs (BaPEq) - areas contributing to clam unacceptable risk consumption exposure based on bioaccumulation	ppb	OC-normalized		
Dioxins/Furans (2,3,7,8-TCDD eq)	ppb	0.04		
1,2,3,4,7,8-HxCDF	ppb	Recalculate based on equilibrium		
1,2,3,7,8-PeCDD	ppb	Recalculate based on equilibrium		
2,3,4,7,8-PeCDF	ppb	Recalculate based on equilibrium		
2,3,7,8-TCDF	ppb	Recalculate based on equilibrium		
2,3,7,8-TCDD	ppb	Recalculate based on equilibrium		
TPH-Diesel	ppb	Rely on EPA/LWG CBRA instead		

As discussed above, the LWG disagrees that there should be any surface water PRGs, because it is not possible to achieve them through sediment remedies (any ARARs related to these PRGs should be waived by EPA in the ROD), and there should be no groundwater and riverbank PRGs. To the extent that EPA chooses to proceed with these types of PRGs, specific ongoing concerns associated with EPA's most recent COCs and PRGs include:

- To the extent that any surface water PRGs are noted as "A" for "ARARs" on Proposed Plan Table 11, these should all be the Oregon water quality standard (WQS) rather than the National Recommended Ambient Water Quality Criteria (NRWQC) (e.g., aldrin, arsenic, copper, DDE, pentachlorophenol, BaP, dibenz(a,h)anthracene).

  > "If a State has promulgated a numerical [water quality standard, or "WQS"] that applies to the contaminant and the designated use of the surface water at a site, the WQS will generally be applicable or relevant and appropriate for determining cleanup levels, rather than [the National Recommended Water Quality Criterion or "NRWQC"]. A WQS represents a determination by the State, based on the [NRWQC], of the level of contaminant which is protective in that surface water body, a determination subject to EPA approval." (Emphasis added.) 53 F.R. 51394, 51442 (Dec. 21, 1988, explanation of revisions to the National Contingency Plan). [66]

  The proposed arsenic surface water PRG is a good example of this. Oregon revised its human health water quality criteria for arsenic to 2.1 micrograms per liter (µg/L) on April 21, 2011. In doing so, Oregon evaluated the NRWQC but set its standard higher than the NRWQC based on state-specific reasons, including its development of state-specific bio-concentration factors. EPA approved these criteria on October 17, 2011, making these revised criteria effective under the Clean Water Act. Thus, any discharge to the Willamette River meets the state water quality standard as long as it does not create a concentration in the river in excess of 2.1 µg/L. However, EPA ignored this Oregon standard in its Proposed Plan and has instead proposed a surface water PRG for arsenic of 0.018 µg/L, based on the NRWQC. This means that EPA will require any discharge to the Portland Harbor (e.g., groundwater or discharges from remedial actions) to be cleaned up as if it had to meet a 0.018 µg/L concentration in the river, even though the State of Oregon has said that a concentration of 2.1 µg/L is fully protective. EPA should not so arbitrarily ignore Oregon's protectiveness determination on this issue—that is, set the stage to require very substantial expenditures so that water discharging to the river is more than 100 times cleaner than the surface water standard itself, a standard that Oregon has determined through its EPA-approved water quality standard process is fully protective.

- To the extent that EPA has set surface water PRGs for a class of chemicals on an ARAR basis where Oregon has chosen not to have a WQS for that class, but instead has WQSs for the individual chemicals in the class, it should be removed. For example, Oregon opted to adopt WQSs for individual PAHs rather than cPAHs as a class. EPA should not set a surface water or groundwater PRGs on an ARAR-basis for cPAHs, because it has already set PRGs for the individual chemicals included in that class consistent with Oregon's WQSs.

- In no case should a groundwater PRG be set on an ARAR-basis using a surface WQS or NRWQC. Instead, EPA should rely on the surface water PRG and indicate that groundwater treatment is required if the groundwater would cause the exceedance of that surface water PRG in the surface water.

- To the extent the WQS or NRWQC that are adopted as PRGs have associated limitations, those need to be carried forward into the final PRGs (e.g., some apply only to a dissolved fraction or to a particular valance state). Similarly, to the extent a PRG is based on a particular exposure scenario (e.g., beach direct contact), it should not be applied to different exposure areas. See Table 2 and Attachment 11.

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[66] *See also* Lori Cora letter of February 2, 2010: "If the State's water quality criteria is promulgated after the most recent NRWQC for that contaminant is published, but adopted a criteria less stringent than the NRWQC due to water body-specific reasons, per Subsection 2(B) (i), EPA may determine that the NRWQC is not relevant and appropriate as long as the remedy will be protective using the State promulgated standard."

- As discussed above, MCLs should not be surface water PRGs or groundwater PRGs; if they are, they should be applied at the theoretical point of distribution after treatment, consistent with Oregon and federal law. [67]

- Tapwater Regional Screening Levels (RSLs) should not be groundwater PRGs, and manganese in particular should not be a PRG for the following reasons:

  - Table 11 of the Proposed Plan proposes a groundwater PRG for manganese of 430 µg/L. The origin of this criterion appears to be an EPA RSL for *tapwater*, based on risk to human health. [68]

  - Table 2.2-2 of the EPA draft Final FS indicates that manganese was not found to pose a risk to human health, so it should not have a PRG set based on a human health criterion.

  - The value is an RSL, not an ARAR.[69]

  - The surface water itself already meets this identified PRG; thus, there is no basis for setting a PRG in groundwater for the purpose of protecting the surface water pursuant to RAO 4.[70] This is because manganese is one of the chemicals subject to changes in concentration based on the geochemistry; specifically, the manganese becomes oxidized as it moves into the surface water, and it precipitates out of solution. Thus, groundwater concentrations are not predictive of surface water concentrations.

  - For RAO 4, which appears to be the basis for the proposed groundwater PRG, human use of surface water from the Willamette River requires pre-treatment as discussed above. Manganese is one of the substances that is most clearly controlled by conventional water pretreatment, which includes hardness adjustment/water softening, filtration, and chlorination. Therefore, manganese levels in groundwater/porewater in no way reflect the manganese concentrations that would be present in water used for potable purposes.

  - The current manganese RSL, which is the basis of the Portland Harbor manganese PRG, is derived from an incorrect and unsubstantiated, un-peer-reviewed evaluation of the manganese EPA IRIS assessment and is not appropriate as a PRG.

- Table 11 of the Proposed Plan lists some substances where there is no PRG (e.g., phenanthrene and pyrene). These should be removed.

The Proposed Plan does not explain how water PRGs will be applied. If EPA chooses not to delete them for reasons discussed above, risk-based surface water PRGs should be applied consistent with the exposure scenario that determined the unacceptable risk. If the PRGs are ARAR-based, they should be applied consistent with state procedures to determine water quality standard exceedances. [71] Further, if EPA keeps groundwater PRGs that are

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[67] OAR 340-041-0340, Table 340A; 40 CFR Part 141, Section 141.23(a).
[68] Note that Table 2.1-1 of EPA draft Final FS incorrectly identifies the source of this PRG as an "EPA Regional Screening Level (RSL) for Groundwater." In fact, the current version of the document that EPA references in that table is called the "Regional Screening Level (RSL) Resident *Tapwater* Table" (May 2016 version). The prior November 2015 version to which EPA cites in FS Table 2.1-1 was called the "Regional Screening Level (RSL) Summary Table," but it clearly indicated that the manganese RSL to which EPA refers of 430 µg/L was for "Tapwater."
[69] Table 2.1-1 of EPA draft Final FS specifically identifies the RSL table from which this was taken as a "To Be Considered" criteria, not an ARAR.
[70] See Attachment 12.
[71] ODEQ rules establish that all aquatic protection water quality standards are applied as a 96-hour average concentration, which may not be exceeded more than once every three years. OAR 340-041-8033, Table 30. Oregon guidance establishes that its human health criteria should be evaluated based on the geometric mean of 24-hour composite samples of high and low flow conditions of the waterbody. ODEQ, *Reasonable Potential Analysis Process for Toxic Pollutants*, Feb 13, 2012, at 34 and 80.

based on surface water ARARs, these need to be as measured in the surface water at the point of groundwater discharge,[72] because that is the beneficial use those ARARs are meant to protect.

Finally, we note that Proposed Plan Table 11 attempts to "summarize" the more detailed PRG tables from the 2016 draft Final FS. Proposed Plan Table 11 combines human health and ecological PRGs by media so that the origin and appropriate application of each PRG is lost. For example, Proposed Plan Table 11 cPAH notes a "riverbank soil/sediment" PRG of 12 ppb; which is an incorrect and misleading summary of that PRG. In fact, this particular PRG only applies to very limited beach areas as more accurately described in 2016 FS Table 2.2-1, and does not apply to the vast majority of the Site. EPA appears to have simply picked the lowest available PRG value from the 2016 draft Final FS PRG tables for each matrix "summarized" in Proposed Plan Table 11 without reference to how or where each particular PRG might be applicable or inapplicable to certain evaluations and decisions in remedy design and implementation. This leaves the reader with the false impression that each of these PRGs applies in all situations, which is clearly not the case and would be inconsistent with both the 2016 draft Final FS and the BLRAs.

In summary, EPA should apply the risk management called for by guidance and, in the ROD, select a refined and narrowed subset of PRGs as Remediation Goals (RGs). As explained above, the LWG believes RGs should be established only for sediments and only for COCs for which the EPA-approved BLRAs found significant unacceptable site-related risk and which can be addressed through a sediment remedy. Those proposed RGs are set forth in Table 2 above. Attachment 11 (specifically Table 11a of that attachment) shows in detailed, red-lined form how and why EPA should narrow its list of sediment PRGs contained in Proposed Plan Table 11 to get to the Table 2 list of proposed RGs. Because concentrations of COCs in fish tissue are highly influenced by upstream and NPDES sources that are not subject to the Portland Harbor remedial action, EPA should not set fish tissue PRGs. The LWG does believe it would be useful, however, to set fish tissue monitoring levels and shows in Attachment 11 (specifically Table 11b to that attachment) how EPA should narrow its list of fish tissue PRGs contained in Proposed Plan Table 11 to a meaningful list of fish tissue monitoring concentrations. For the reasons described above, the LWG does not believe EPA should set either surface water or groundwater RGs in the ROD. If EPA should proceed to use any of these values as RGs or as targets, please note that the LWG has also found errors and inconsistencies with the risk assessments in the PRG values that EPA has proposed. These comments are also provided in Attachment 11. Finally, the LWG reiterates its previous comments on EPA's PRG development.[73] Attachment 11 provides a summary of the LWG's position with respect to each PRG, by matrix and by RAO, narrowed to the list of PRGs set forth in EPA's 2016 draft Final FS.

2. EPA's post-construction risk evaluation is not consistent with the BLRAs

EPA conducts a post-construction risk evaluation in the 2016 draft Final FS for each alternative and uses the resulting post-construction risk estimates to evaluate the effectiveness of the various alternatives immediately after construction. EPA's post-construction risk estimates are inconsistent with the BLRAs in numerous respects. These inconsistencies cause EPA to err regarding the relative effectiveness of the alternatives, which in turn, results in EPA selecting an unnecessarily large and expensive preferred alternative (Alternative I).

a. The post-construction risk evaluation assumes different exposure scenarios and spatial scales than the BLRAs

Just as EPA's PRG selection in the 2016 draft Final and Proposed Plan deviates from the BLRAs in multiple respects to drive potentially unnecessary cleanup, EPA's post-construction risk estimates alter exposure scenarios and spatial scales and use inappropriate PRGs to inflate the perceived benefit of more aggressive actions. We have

[72] Except for 303(d) listed chemicals, this would have to include provision for assumed mixing in the water column, consistent with Oregon's rules for allowed mixing zones.

[73] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240", letter from LWG to EPA dated June 19, 2014; "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text", March 25, 2015.

identified the following discrepancies (which are not comprehensive) between the BLRAs and the 2016 draft Final FS post-construction risk evaluation:

- For RAO 1, continued exclusion of the site use factor from the BHHRA for the benzo(a)pyrene equivalent (BaPEq) FS PRG (106 ppb) results in concluding that not even Alternative G will meet this PRG for many half river miles examined (2016 draft Final FS Table J2.2-1c). However, if the BHHRA site use factor is accurately applied (resulting in a PRG of 424 ppb), Alternative B appears to achieve RAO 1 immediately following construction in all but a few half river miles (e.g., around river miles 4, 5, and 6 East and 3, 4, 5, and 6 West).

- For RAO 2 human health fish consumption risks, EPA generated post-construction SWACs on: 1) a 1-river mile basis longitudinally split into the two shoreline areas and the navigation channel for the recreational fisher scenario; 2) a site-wide basis for the subsistence fisher scenario: and 3) an SDU basis (which represents subareas of various inconsistent sizes and shapes) for the recreational fisher scenario.[74] However, in the EPA-approved BHHRA, risks were evaluated by whole river miles with no longitudinal splitting for recreational fish consumption and without reference to SDUs, which did not exist when the BHHRA was completed.

- For RAO 2, the human health post-construction risks for Alternative A (which should be identical to the BHHRA baseline condition) differ from the risks calculated in the BHHRA, which indicates there are inconsistencies. The baseline highest non-cancer risk for a breastfeeding infant in the BHHRA was a Hazard Index (HI) of 10,000 site-wide (for nursing infants of subsistence fishers). The highest 2016 draft Final FS post-construction risk estimates for the same scenario for Alternative A were 3,333 for site-wide, which is substantially less than the BHHRA result. The highest FS HI estimates for Alternative A (254,000 on a river mile scale and 22,589 on an SDU scale) should be equivalent to the BHHRA recreational fisher infant scenario, because EPA calculated them using an ingestion rate of 49 grams per day. However, the maximum recreational fisher infant river mile HI from the BHHRA is 1,000, which is one to two orders of magnitude less that EPA's Alternative A estimates. The reasons for these differences are unclear.

  In addition to questionable assumptions regarding exposure to resident fish, EPA does not take into consideration several key uncertainties in assessing risk, including food preparation and cooking methods (which can reduce PCB concentrations by up to 87%).[75] EPA's assumptions are not merely conservative but are wholly unrealistic, contrary to the "conservative but within a realistic range of exposure scenarios" recommended by the NCP.[76]

- For RAO 2, there is a significant disconnect between the BHHRA and post-construction risks for dioxins/furans (and other inconsistencies with the BHHRA results also likely exist).

  - For a breastfeeding infant, the highest HQs for dioxin/furan TEQ calculated in the BHHRA are 10 on a site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational reasonable maximum exposure [RME] consumption, river mile 7). Table J2.3-1a in the 2016 draft Final indicates that the site-wide HQ for the same infant scenario from HxCDF alone (not the entire TEQ) is 785 for Alternative A, almost two orders of magnitude higher.

  - For a child, the highest HQs for dioxin/furan TEQ calculated in the BHHRA are also 10 on a site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational RME consumption, river mile 7). Table J2.3-1a in the 2016 draft Final FS shows a site-wide HQ of 23 for just HxCDF.

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[74] 2016 FS, p. 4-10.
[75] BHHRA, p. 89. EPA states that on page 49 of the same document that no adjustments were made to contaminant concentrations in raw fish tissue because of the uncertainties associated with preparation and cooking practices.
[76] NCP Preamble, 55 Fed. Reg. 8710.

- The dioxin/furan Reference Dose has changed since the BHHRA was completed but that appears unlikely to account for the difference between the BHHRA and Alternative A post-construction risks.

- In August 2015, EPA acknowledged the inadequacy of HxCDF data in terms of quality and spatial coverage in written correspondence with the DEQ. At that time, EPA was in charge of finalizing its FS and had the authority to require supplemental scientific investigations to address and resolve these concerns. Instead, it chose to develop PRGs and RALs based on data EPA characterized as inadequate. In doing so, EPA abrogated its duty to produce scientifically sound and supportable risk estimates as well as cleanup criteria in the form of supportable PRGs and RALs.[77]

- Additional issues with EPA's dioxin/furan PRGs and post-construction risk approach are detailed in Attachment 11.[78]

- For RAO 5, ecological direct contact risks, multiple issues with EPA's benthic post-construction risk estimates are discussed above.

- For RAO 6, ecological bioaccumulation risks, 2016 draft Final FS SWACs were generated on a rolling 1-river mile basis with longitudinal splitting and on an SDU scale (p. 4-8). Like other post-construction risk estimates, EPA divides the post-construction SWAC by the PRG for each chemical. Importantly, the PRGs for the various RAO 6 chemicals are based on different ecological receptors evaluated in the BERA. These include smallmouth bass tissue for BEHP, sculpin tissue for DDx, sandpiper dietary assessment for DDE, mink for PCBs, and osprey egg assessment for dioxin/furans. These receptors all have widely divergent exposure parameters (including spatial scales) in the BERA and post-construction risks cannot be estimated by applying a "one size fits all" spatial scale to every PRG. Further, none of the BERA-appropriate spatial scales are consistent with longitudinally split river miles or SDUs. EPA does not recognize in the 2016 draft Final FS that this is even an issue and presents no discussion of why blanket application of split river miles and SDU spatial scales are possibly consistent with the various receptor exposures being evaluated.

  - For example, the DDE PRG is based on the BERA spotted sandpiper dietary assessment that was evaluated on a 2-river mile scale of beach sediment. The BERA evaluation spatial scale differs substantially from EPA's longitudinally split river miles or SDUs. EPA's Dioxin/furan PRG is based on the BERA osprey egg assessment, which was evaluated on a much larger scale than 1 river mile, much less longitudinally split river miles, or SDUs.

  - Also, the LWG has previously commented[79] that almost all of the RAO 6 PRGs, and as a result the post-construction risks calculated, are based on inappropriate or inconsistent determinations as compared to the BERA methods. Attachment 11 contains a summary of the most up-to-date comments from LWG on each of the RAO 6 PRGs.

  - As a result, all of the RAO 6 post-construction risk estimates appear to be unsupported and do not present any accurate accounting of the relative ecological risks or risk reductions achieved by any of the alternatives.

- For RAO 9, EPA considers the number of lineal feet of riverbank soils that are addressed by each alternative as a qualitative measure of human health and ecological risk reductions (EPA draft Final FS p. 4-9). Given that the RI and BLRAs include no riverbank soils (as defined in the RI) data and contain no

[77] See email message E. Allen USEPA to DEQ dated August 20, 2015.
[78] See Technical Memorandum, *Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan*" (S), Section 3 (detailing a comparison of EPA's fish consumption risk estimates to BHHRA and 2012 smallmouth bass estimates). A copy of this memorandum is Attachment 14.
[79] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240," letter from LWG to EPA dated June 19, 2014. "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

> risk assessment of riverbank soils, EPA should not have evaluated these post-construction risks at all. Any "qualitative" assessment is mere conjecture in the absence of actual evaluation of riverbank soils data or baseline risks earlier in the RI/FS process.[80]

Appendix J of the 2016 draft Final FS glosses over many method details; thus, it is not possible to fully comment on EPA's post-construction risk methodology. However, given that it is clear that all of the above aspects are inconsistent with the BLRAs, it is highly likely that other details of the methods, if they were known, would also be inconsistent with the BLRA methods.

b. Inflated SWAC recalculation skews the apparent performance of EPA's alternatives

As noted above, all of EPA's post-construction risk estimates are based on calculating a ratio of the immediate post-construction exposure concentrations in the numerator (SWACs or related tissue concentrations) to the toxicity level (PRGs) in the denominator. EPA presents these ratio results as HQ (non-cancer) or cancer-risk levels for each alternative.[81] As noted above, there are numerous inconsistencies with the BLRAs in EPA's determination and application of the risk-based PRGs in the denominator. This subsection focuses mainly on the numerator (exposure concentration) errors. EPA's FS conclusions rely mainly on post-construction risk estimates for human health fish consumption (RAO 2) and ecological bioaccumulation risks (RAO 6), so discussions here are confined to those scenarios (human health) and receptors (ecological). (In addition, EPA evaluated benthic risk reduction for ecological (RAO 5), and errors associated with this analysis are discussed previously.)

Regarding human health fish consumption (RAO 2), EPA relies on PCB post-construction non-cancer risk estimates for the child[82] (e.g., 2016 draft Final FS Figures 4.2-2 and 4.2-6) and infant scenarios (e.g., 2016 draft Final FS Figure 4.2-4). To simplify the discussion, we focus here on the child scenario errors, but similar errors exist for the infant scenario. EPA presents two types of results: 1) non-cancer HQs and cancer-risk levels;[83] and 2) allowable fish meals, which are calculated through an algebraic rearrangement of the risk equation to solve for the number of meals producing an acceptable risk level under any given post-construction exposure concentration. EPA uses the same flawed exposure concentrations to support both results.

Specifically, EPA graphics (such as 2016 draft Final FS Figures 4.2-2, 4.2-4, and 4.2-6) present baseline (Alternative A) and immediate post-construction risk levels and allowable fish meals for each alternative that depict a sharp decrease in the risk levels between the baseline condition (Alternative A) and the progressively more aggressive alternatives. This steep decrease is caused by EPA's flawed calculation of baseline PCB SWACs for the Site, which EPA newly assumed to be about 208 ppb site-wide.[84] As recently as EPA's 2015 Draft FS and November 2015 NRRB presentation,[85] EPA had been presenting the site-wide SWAC as about 85 to 87 ppb, which is similar to the site-wide SWAC presented in the 2012 LWG Draft FS, the EPA-approved BHHRA and BERA, and essentially all EPA and LWG prior discussions and documents. The 2016 draft Final FS indicates the same FS database was used as the 2015 Draft FS; however, the new SWAC does not involve any new data and is exclusively a reinterpretation of the same data available for many years. In addition, EPA presents a site-wide SWAC of 92 ppb on Figure 3.4-1 (depicting PCB RAL curves) in the 2016 draft Final FS, which is only slightly higher than the

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[80] EPA acknowledges the RI/FS data are insufficient to make an assessment (p. 4-9), but proceeds nonetheless, "A qualitative assessment of protectiveness for river banks is conducted for each alternative as there are no current means to quantitatively assess the effectiveness of the alternative in achieving PRGs in river banks due to uncertainty in contaminant concentrations and locations."

[81] Note that this is a "short cut" method for a residual risk assessment. Typically, such assessments are conducted by calculating post remediation sediment (and other matrices as appropriate) concentrations and then applying those concentrations to forward risk assessment calculations.

[82] EPA's FS and Proposed Plan fail to mention that these risk estimates are for the child scenario, which is more conservative (higher risks) than the adult scenario (e.g., FS Table 4.2-2, Figure 4.2-2, and similar figure titles do not mention whether the risks presented are for adult or child scenarios). EPA typically mentions that "people would be advised to eat no more than 6 fish meals every 10 years" (Proposed Plan p. 58); this makes it unclear which "people" are being evaluated. EPA's widespread use of the child scenario was only discovered through laborious cross checking between EPA's FS main text and appendices and by conducting independent calculations.

[83] EPA focuses on the adult scenario for discussion of cancer risks in the 2016 FS.

[84] This critical information is buried in Draft Final FS, Appendix J, Table J2.3-1a.

[85] "Portland Harbor Remedial Investigation". Presentation to the CSTAG/NRRB, November 18, 2015. Kristine Koch, U.S. EPA, Region 10. Part 2, p. 27.

historical estimates. This SWAC level implies that EPA developed the RAL curves using a different baseline SWAC than the post-construction risk estimates, which is another unexplained inconsistency in EPA's methods.

EPA's new assumed baseline PCB SWAC of about 208 ppb is not mentioned once in the 2016 draft Final FS and Proposed Plan main text, figures, or tables.[86] EPA also does not explain why an upward shift that more than doubles the previously estimated baseline PCB site-wide SWACs is warranted or why this huge inconsistency with the EPA-approved BLRAs is acceptable. EPA generally cites in the FS main text both Appendix I and Appendix J for further information regarding SWAC uncertainties and methods for the post-construction risk assessment. Appendix I of the 2016 draft Final FS presents site-wide PCB SWAC uncertainty analysis results that range from 79 to 205 ppb (p. I-5), and the five methods used produced an average result of 120 ppb (Table I-1). Thus, the 208 ppb SWAC is even above the extreme maximum value from the analyses in Appendix I. Appendix J indicates (p. J-3) that "[s]ite-wide sediment concentrations were calculated for RAO 2 using the post remedial SWACs developed for each SDU and other areas of the river as described in Appendix I. A site-wide average concentration for each COC – represented by the 95 percent upper confidence limit on the mean – was then calculated for each RAO 2 COC using ProUCL." In response to the LWG's questions, this method was later clarified by EPA in an email response: "The figure below was used to develop site-wide SWACs. A SWAC of each area was computed and then put into Pro-UCL to determine the 95th percent UCL on the mean of those SWACs. The SWACs that are used in the FS are provided in Appendix J and K."[87] Despite the confusing and conflicting scattered statements, our current understanding is that the EPA value of 208 ppb derived in Appendix J may be completely separate from the value of 205 ppb described in Appendix I, and they are only coincidentally similar. This remains unclear.

Assuming that this interpretation is correct, the Appendix J method of calculating site-wide SWACs appears fundamentally flawed. EPA is indicating that the Site was cut into 31 subareas, and a SWAC was "computed" (the SWAC method here is unclear) for each subarea. EPA then made the assumption that the SWAC for each subarea was somehow a potentially representative "sample" of the entire Site SWAC, which is clearly an inaccurate and scientifically unsupportable assumption. Empirical data collected over 15 years irrefutably demonstrate that the Site has areas with relatively high and low PCB (and other chemical) concentrations, and the SWAC in any given subarea may have little relationship to the overall surface-weighted average across the entire Site. By selecting the concentration from one subarea to represent all post-construction risk estimates for the entire Site, EPA is deciding that all human health and ecological exposures represented by any particular RAO or scenario occur in that one subarea. In other words, while a given BHHRA scenario may assume a person is catching fish from the entire Site, EPA's FS method reduces this assumption to a person catching fish from just one select subarea for the entire exposure period. And because EPA is using an UPL, this person is assumed to consume only fish from an area with comparatively high concentrations.

A second unstated assumption is that the 31 subareas defined by EPA are a statistically valid way of dividing the Site. EPA clarified that the subareas are based on SDUs, which EPA states were devised to specifically identify the areas of highest COC concentrations on a rolling river mile basis. Obviously, many other methods could be used to define subareas of the Site, each of which would yield different statistics than the one EPA selected. Further, EPA has created an explicitly bimodal distribution of subareas, with some subareas focused on the highest observed concentrations (the SDUs) and remaining subareas focused on the lowest observed concentrations. This method is biased and inherently inaccurate for subsampling Site SWACs, and consequently it is likely that other less biased and more scientifically supportable subsampling methods would produce a lower overall SWAC estimate.

Regardless, it is inappropriate to use any of these new subsampling methods, because they will all create Site SWACs that are inaccurate and inconsistent with those used in the EPA-approved BLRAs, which in turn causes the remedy selection process to diverge from an appropriate focus on reducing risks actually identified in the BLRAs.

EPA's unscientific and artificially inflated new SWACs apply to other COCs as well, as shown in Table 3. An evaluation of EPA's new site-wide SWAC for 2,3,4,7,8-PeCDF clearly illustrates the problems with EPA's new

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[86] Indeed, the 208 ppb PCB SWAC would effectively designate the entire Site as Principal Threat Waste (PTW). *See* 2016 draft Final FS Table 3.2-1 (highly toxic PTW threshold is 200 ppb). Yet 2016 draft Final FS Table 4.2-9 identifies just 172 (out of 2167) acres of the Site as PTW.
[87] Email response number 8 from Kristine Koch on July 20, 2016 regarding LWG's "Request for Clarification."

SWACs. EPA's new site-wide SWAC for 2,3,4,7,8-PeCDF is 0.04 ppb. Out of 374 surface sediment samples analyzed for 2,3,4,7,8-PeCDF, only 10 samples in the entire Site are equal to or greater than 0.04 ppb, and these samples were all collected between river mile 6.7 and 7.3. The LWG calculated SWAC using EPA's 2015 natural neighbor contour surfaces is 0.00588 ppb, which is an order of magnitude less than EPA's new SWAC for this compound. As an additional example, EPA calculates that risk from a single dioxin/furan congener, 1,2,3,4,7,8-Hx CDF, is higher than the total TEQ. This is physically and logically impossible. It was also known to EPA to have been calculated using a flawed characterization and poor data quality.[88] When EPA's own contractor summarized percent contributions to risk from dioxin/furan congeners from actual fish tissue date, the TEQ risk from 1,2,3,4,7,8-Hx CDF was approximately 3 percent.[89]

Table 3. Comparison of EPA's New Site SWACs to Values Estimated by LWG Using EPA's Natural Neighbor Surfaces.

Chemical	Site-Wide SWAC (ppb)	
	Table J2.3-1a (EPA 2016 Draft Final FS)	SWACs Estimated by LWG Using Natural Neighbor Surfaces Provided by EPA
PCBs	208	86
DDx	138	30
1,2,3,7,8-PeCDD	0.0003	0.0002
2,3,4,7,8-PeCDF	0.04	0.006
2,3,7,8-TCDD	0.0003	0.0001

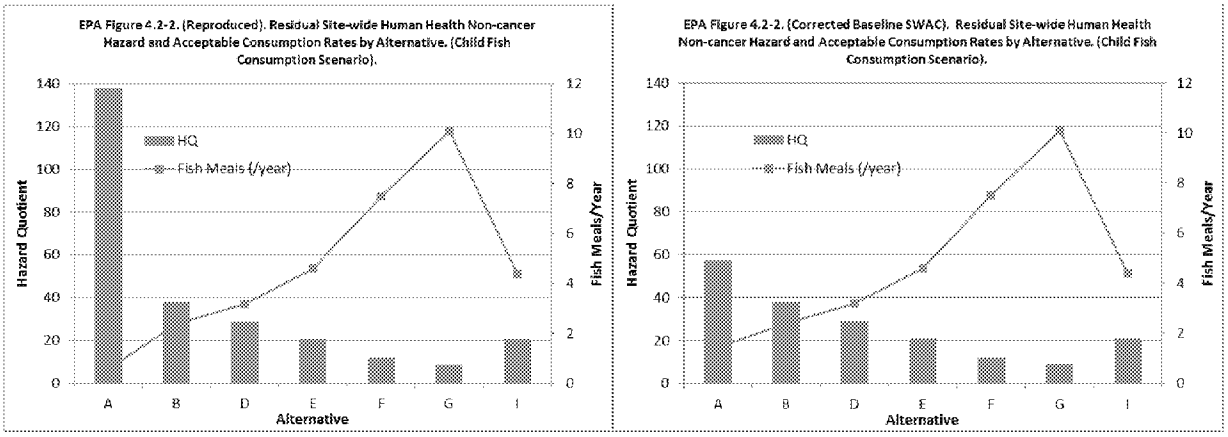
Another issue with EPA's post-construction SWACs is that EPA assumes a "zero" replacement value for areas where active dredging and capping is assumed to take place.[90] That is, the remediated area is assumed to attain a concentration of zero for any evaluated COC immediately after construction is complete. Although this assumption is convenient and simple, it is clearly incorrect for dredge areas, where dredge residuals are known to occur. These residuals can be managed, but it is nearly impossible to reduce post-dredge residual concentrations to zero.[91] The use of zero as a replacement values for dredge areas makes the larger alternatives with more mass removal appear to have greater immediate risk reduction than will actually occur. For example, EPA presents several post-construction SWACs for PCBs that are below EPA's background value of 9 ppb (and the LWG's calculated equilibrium value of 20 ppb). Even if such immediate post-construction concentrations were temporarily achievable, inputs and deposition of sediments from upstream would be expected to quickly return these areas to an equilibrium concentration. Thus, EPA compounds the appearance of steep SWAC declines by simultaneously artificially inflating the baseline SWAC and then over-estimating the SWAC reductions that will occur due to dredging.

The consequences of substantially diverging from the BLRA SWACs at this late date are not considered or discussed anywhere in the 2016 draft Final FS or Proposed Plan. The consequences, combined with other issues like the zero replacement value, are widespread, impacting every post-construction risk estimate presented by EPA and skewing the overall evaluation of the alternatives' effectiveness. Because EPA increases the baseline Alternative A SWACs by a factor of about 2.4, all of EPA's baseline risk estimates are higher than the BHHRA by a

[88] See email message E. Allen USEPA to DEQ dated August 20, 2015.
[89] CDM Smith, "Evaluation of Dioxin/Furan Congeners Against Total Dioxin/Furans, Portland Harbor Superfund Site," December 23, 2014, Table 1 (presenting results by river mile, with the contribution to risk attributed to 1,2,3,4,7,8-Hx CDF by river mile segments ranging from 0 to 20 percent and, once corrected for the fact that the wrong TEF was applied (TEF for 1,2,3,4,7,8-Hx CDF is 0.1, not 0.3, according to https://rais.ornl.gov/documents/dioxin_tef.pdf), averaging approximately 3%).
[90] 2016 draft Final FS p. ES-14.
[91] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; ITRC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA. (Attachment 13)

similar factor.[92] Figure 2 provides an example of how EPA's post-construction risk figures would change if baseline SWACs consistent with BLRAs were used instead. The risk reduction (HQs) from the baseline condition in Alternative A provided by all the alternatives becomes substantially less, and the graph becomes much less compelling visually. Similarly, the number of allowable fish meals provided by Alternative I (for example) goes from 7 times greater than baseline to only 3 times greater than baseline.

Figure 2. Comparison of EPA's FS Risk Estimates to Corrected Values Using a Baseline SWAC Consistent with the BLRAs.

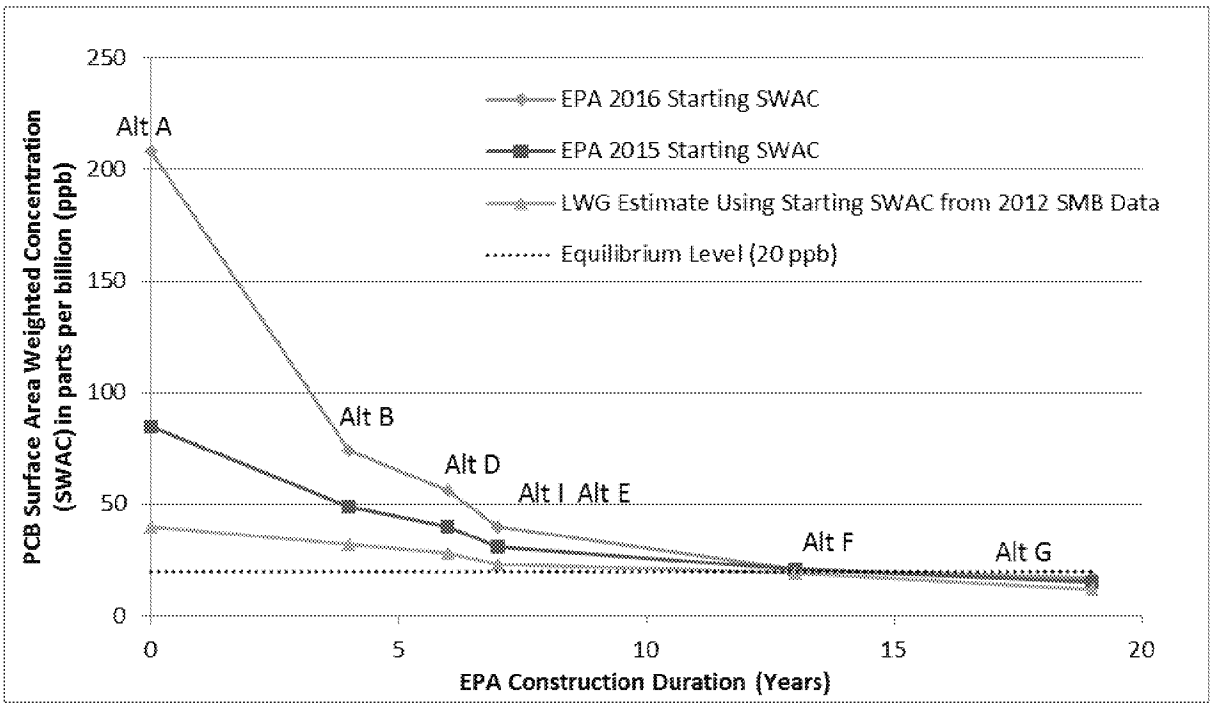


As another example, EPA calculated, using the Food Web Model and the new sediment SWAC of 208 ppb, an average PCB site-wide fish tissue concentration of 521 ppb. The comparable average site-wide fish tissue concentration in the BHHRA, based on actual tissue data collected in 2007 and earlier, is 227 ppb, which equates to a site-wide modeled sediment SWAC of 85 ppb.[93] Using EPA's modeled tissue concentration of 521 ppb, the acceptable consumption rate based on the non-cancer endpoint would be 1.9 fish meals/year for the child scenario; whereas the actual BHHRA tissue concentration of 227 ppb results in an acceptable consumption rate of 4.2 meals/year. The above calculation of 1.9 meals/year for Alternative A (baseline) using EPA's fish tissue concentration is higher than the meals per year shown for Alternative A in EPA's Figure 4.2-2 (reproduced in Figure 2 above), which presents 0.6 fish meal/year for the presumably same scenario. This difference illustrates another error in EPA's calculations that was only discernable through independent calculations. It appears that EPA is using the child scenario but altering the fish meal size from 3.5 ounces to the adult meal size of 8 ounces, which is clearly inconsistent with the BHHRA methods. Putting aside the reasonableness of a child consuming adult meal portions for long periods while still remaining a child, the net result of EPA's poorly explained additional change to the exposure assumptions is to drive allowable fish meals even further down for the baseline condition. Combined with the artificially inflated new SWAC, this meal size change compounds the portrayal of the baseline condition as much worse than the actual BHHRA findings. Again, this further increases the perceived benefit of any SWAC and tissue concentration reductions assumed for the more aggressive alternatives. It should also be noted that even with the change to adult meal size for the child scenario, the LWG could not exactly reproduce EPA's allowable fish meals, which likely indicates other undescribed procedures were employed that create further inconsistencies with the EPA-approved BHHRA.

[92] There may be other differences between some calculations because EPA used additional methods that are also inconsistent with the BLRAs. A factor of 2.4 is accurate to assess the impact of this one variable (i.e., the new SWAC for PCBs).
[93] See Attachment 14. memorandum "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan" detailing a comparison of EPA's fish consumption risk estimates to BHHRA and 2012 smallmouth bass estimates. See also, "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013." (Attachment 1)

Figure 3 illustrates the effect of the choice of the baseline site-wide SWAC on the utility of various alternatives, as represented by construction durations,[94] using a "knee of the curve" analysis. Figure 3 presents the knee of the curve when the baseline PCB SWAC is assumed to be 208, 85, and 40 ppb. These are EPA's artificially inflated 2016 draft Final FS SWAC estimate, the SWAC consistent with the EPA-approved BLRAs that EPA used in the 2015 Draft FS, and the SWAC estimated from the 2012 smallmouth fish tissue sampling, respectively.[95] As the initial SWAC decreases, the incremental benefit in terms of SWAC reduction for each successively longer alternative also decreases. The utility of the alternatives as determined by the knee of the curve shifts away from Alternatives F and G and toward Alternatives B and D. In the case of the lowest initial SWAC (gray line), there is virtually no added benefit in moving from Alternative B to I, while the short-term and other duration associated impacts increase substantially. When a higher value is used for the initial conditions, the most aggressive and resource consuming alternatives erroneously appear to provide more benefit. Also note that due to EPA's zero replacement value assumption, the SWACs for the largest alternatives erroneously appear to achieve levels below equilibrium level (black dotted line in Figure 3).

Figure 3. Immediate Post-construction SWACs and EPA Durations.



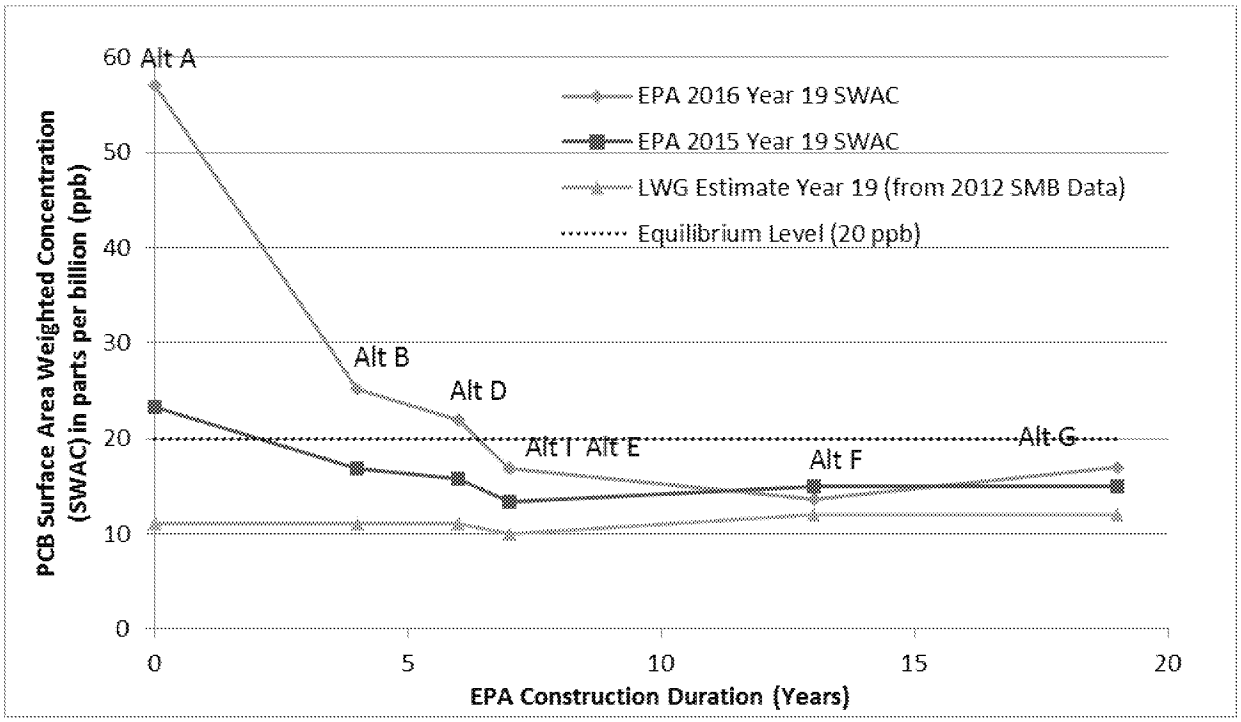
While EPA has increased the perceived benefit of the larger alternatives (such as Alternative I) by artificially increasing the baseline condition by a factor of 2.4 above the approved BLRAs, the 2012 smallmouth bass data strongly suggest the Site has continued to recover below the BLRA SWACs (i.e., the RI and BLRAs use data that were collected mostly between 2002 and 2008). As noted in the LWG's presentations of the 2012 smallmouth bass data to EPA, that data strongly suggest that some parts of the Site that EPA identifies for active remediation are already approaching equilibrium conditions.[96]

[94] As EPA's draft Final FS points out, as the durations of the alternatives rise the short-term impacts to the environment and community, the number of feasibility issues, and costs also rise.
[95] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)
[96] See also Kennedy/Jenks Consultants Memo dated March 6, 2013, that summarizes the data that shows a decline in concentrations. Kennedy Jenks' March 6 memo acknowledges it is comparing 2012 discrete samples to earlier composite samples and bases its comparison on means, maximum, and minimum detected concentrations. (Attachment 15)

c. EPA ignores upstream and other external contributions that limit the risk reduction available through sediment cleanup to system equilibrium values

EPA has previously acknowledged that equilibrium is a useful concept for the Site.[97] The LWG has provided EPA with detailed evaluations demonstrating that, due to upstream sources, the Site is unlikely to ever achieve site-wide PCB SWACs less than 20 ppb.[98] Figure 3 shows immediate post-construction SWACs using EPA's incorrect zero replacement value assumption, but as the Site continues to recover over time, presumed additional decreases in Site SWACs provided by longer and larger alternatives will not actually occur. Figure 4 presents estimated SWACs for all alternatives at 19 years after construction starts,[99] which is EPA's assumed construction duration for Alternative G. Figure 4 shows that any perceived benefits of longer and larger alternatives are unlikely, because EPA's analysis does not consider that concentrations cannot decrease below Site equilibrium conditions. For example, using EPA's 2016 SWAC values, the additional 14 years of estimated construction from Alternative G, or 3 years of construction from EPA's Preferred Alternative. would result in a difference in PCB SWAC of only about 5 ppb from Alternative B.[100]

Figure 4. Estimated SWACs 19 Years after Construction Starts.



The equilibrium concept is a critical consideration in evaluating the long-term effectiveness of remedial alternatives in the FS. EPA guidance provides that sediment remedies "should reflect objectives that are achievable from the site

[97] As recently as April 2015, EPA endorsed the concept of equilibrium as a measure of the most a sediment remedy can accomplish and committed to perform an equilibrium evaluation in Section 4 of the FS. "EPA will conduct an equilibrium evaluation in Section 4 of the FS. The most appropriate means to evaluate whether RAOs or PRGs are achievable by any of the alternatives being developed in Section 3 of the FS is to conduct the detailed evaluation in Section 4 of the FS using the first seven NCP criteria. This information will be considered in developing the final remediation goals/cleanup levels." EPA Response to LWG's March 25, 2015 Comments on the Portland Harbor FS Section 2 (April 10, 2015), p. 2. A copy of EPA's response is Attachment 16.

[98] *Sediment Equilibrium Estimates for the Revised Feasibility Study*, (LWG, August 7, 2014). This Technical Memorandum is Attachment 17. The discussion herein focuses on the expected Site equilibrium for PCBs. As addressed in the LWG's memorandum, equilibrium concentrations for a number of COCs (including background sensitive risk-drivers DDX and dioxins/furans) can be predicted, and the LWG specifically provided that analysis to EPA for PCBs and DDX.

[99] See Section V.C. for a description of methods to estimate long-term SWACs. These methods avoid using computer models that EPA has expressed uncertainty about.

[100] See Table 6, infra.

cleanup."[101] Concentrations below equilibrium cannot be achieved by any alternatives, and any comparisons assuming otherwise are fundamentally flawed. Unlike Portland Harbor, equilibrium has been fully integrated into Proposed Plan decisions at other sites. In the Lower Duwamish Waterway (LDW) Proposed Plan, several datasets representing COC concentrations in suspended sediments entering that site from the upstream Green/Duwamish River system were evaluated because they represent "future COC concentrations in the LDW after implementation of cleanup alternatives."[102] This included the use of deposited sediments in an upper turning basin, because "these data provide an indicator of suspended sediments settling within the upper reach of the LDW."[103] The Grasse River ROD indicates, "The selected remedy will comply with all of the listed ARARs in Tables 13-1 through 13-3 except two chemical-specific ARARs which are not expected to be met due to Site background PCB loading conditions. Therefore, because of technical impracticability, those two ARARs are being waived."[104]

D. EPA's Selection of Its Preferred Alternative is Not Based Upon Meaningful Risk Reduction and Fails to Apply Appropriate Risk Management Principles

According to the EPA-approved BHHRA, consumption of resident fish, such as carp and smallmouth bass, represents the majority of potential human health risk at the Site. Calculated site-wide subsistence fisher risks are orders of magnitude higher than other scenarios,[105] and 93% of this risk comes from PCBs.[106]

EPA's BHHRA evaluated the risks to a subsistence fisher eating 228 resident fish meals/year.[107] EPA calculated such high potential risk to subsistence fishers that EPA has determined that, under current conditions, children and other vulnerable populations should eat only 0.6 resident fish meal/year.[108] According to EPA, healthy adults can currently eat 4.3 meals/year.[109] The most aggressive cleanup alternatives evaluated by EPA would allow vulnerable populations to eat 7.5 to 10 meals/year after construction is complete.[110] Healthy adults could eat 38 meals/year after construction of Alternative F, but because the estimated post-construction PCB SWAC of 21 ppb is approximately the equilibrium value, Alternative G would be unlikely to push additional fish consumption using EPA's risk assumptions much, if at all, above the 38 meals/year estimated for Alternative F. EPA's Preferred Alternative would allow 4.4 meals/year for children and 22 meals/year for adults after construction.

Extensive evidence from other sites suggest that fish tissue PCB concentrations will temporarily increase for a period of 3 to 5 years after dredging of contaminated sediments takes place.[111] The dynamic Food Web Modeling of alternatives in the 2012 LWG Draft FS (Appendix Hb) also projects this reaction in fish tissue concentrations during and after dredging. This evidence all indicates that fish consumption risks will increase significantly during construction and will persist for several years after construction is completed to allow time for the fish tissue to respond to the new sediment conditions. Therefore, and as discussed more fully in Section V.C. below, because the fish consumption risk reduction achievable through a sediment cleanup is limited by sediment equilibrium, cleanup alternatives involving longer and more aggressive construction activities are likely to significantly increase fish consumption risks in the short term while resulting in no greater long-term increase in fish meals. In other words, as

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[101] Sediment Guidance, p. 2-15.
[102] *Proposed Plan Lower Duwamish Waterway Superfund Site*, EPA, Region 10. Seattle Washington. February 28, 2013, pp. 26-27.
[103] *Id.*
[104] *Record of Decision Grasse River Superfund Site (a.k.a. Alcoa Aggregation Site) Massena, St. Lawrence County*, New York. EPA, Region II. New York, New York. April 2013, p. 54.
[105] BHHRA page 101; Figure 7-1.
[106] BHHRA p. 4; Figure 7-3; Table 5-74.
[107] Proposed Plan p. 18.
[108] Proposed Plan p.32.
[109] EPA focused on the child fisher non-cancer scenario in the 2016 FS. Consequently, to compare to OHA adult advisories, the LWG estimated adult allowable fish meals using EPA's methods. See "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan," Attachment 14.
[110] Proposed Plan p. 58. As noted previously, EPA does not state these values are based on the child recreational scenario, but independent calculations suggest that this is the scenario that EPA is presenting in the Proposed Plan.
[111] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; IRTC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.

shown in Table 8 below, Alternative B, which EPA projects would take 4 years to complete, would allow 4.1 meals/year for children 12 years after construction starts, right about the same time that fish tissue levels for Alternative I, which EPA projects would take 7 years to complete, would likely be settling down to EPA's projected post-construction 4.4 meals/year.[112]

The Oregon Health Agency's current fish consumption health advisories are summarized in Table 4. Table 4 compares these advisories to the results of EPA's 2016 draft Final FS allowable fish meal calculations for each alternative. For the adult scenario, Table 4 shows that EPA's Alternative A, representing the existing condition, provides an allowable number of fish meals (4.3 meals/year) that is substantially less than both of the current Oregon Health Agency (OHA) adult advisories. For the vulnerable population or child scenario, Table 4 shows that EPA would allow children to currently eat a little more fish than the OHA advisory, but only because that advisory is already set at zero.

Table 4. Comparison of EPA 2016 Draft Final FS and Oregon Health Agency Allowable Fish Meals (meals/year).

Estimate Source	Healthy Adults[1]	Vulnerable Populations (including children)[2]
OHA Advisories		
PCBs, Portland Harbor	12	0
Mercury, Willamette River[3]	48	12
EPA 2016 Draft Final FS – EPA assumed immediate post-construction consumption per Appendix J		
Alternative A (no action, assumed current condition)	4.3	0.6
EPA recommendation during construction	[4]	0.6
Alternative B	12	2.4
Alternative D	16	3.2
Alternative E	23	4.6
Alternative F	38	7.5
Alternative G	52	10.1
Alternative I	22	4.4

Notes
1 Because the 2016 draft Final FS focuses on child scenario, EPA adult values are estimated by LWG calculations (see attached memorandum "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan.")
2 OHA "vulnerable" populations include children, women of child bearing age, and people with some types of diseases. EPA child values from Figure 4.2-4 in the 2016 draft Final FS.
3 For mainstem Willamette, which includes Portland Harbor.
4 Page 58 of EPA's Proposed Plan states that "people" would be advised no more than 0.6 meals per year during construction. Based upon the calculations in Appendix J, we interpret "people" to mean children and are therefore unable to determine what EPA recommends for adults.

EPA's 2016 draft Final FS concludes that "the existing [OHA] advisories might not be sufficiently effective in protecting human health since the current recommended rate of one meal per month [12 meals/year] for the general population may not be sufficiently protective of consumers."[113] We are not aware that EPA has previously stated that the OHA fish advisory was not protective for adults, even though EPA approved the BHHRA more than 3 years ago. EPA should consider that the conflict between the OHA advisory and EPA's BHHRA indicates EPA's risk estimates may be incorrect. At a minimum, EPA should coordinate with OHA to provide clear, credible, and consistent public health information. EPA should also explain its advisory in light of the U.S. Food and Drug

[112] See Section V.C, *infra*.
[113] 2016 draft Final FS, p. 4-15.

Administration's threshold for PCBs in fish sold in supermarkets of 2 parts per million (ppm), which is more than 1,000 times higher than EPA's cleanup goal of 0.3 ppb in resident fish tissue.[114]

EPA must also recognize that consumption of resident fish in the Willamette River will continue to be limited by mercury fish tissue concentrations that are unrelated to Portland Harbor (e.g., upstream watershed soils, upstream historic gold mining activities, and regional and global combustion sources) and therefore beyond the scope of the Superfund cleanup to address. Mercury, like PCBs, is also a persistent pollutant that will remain in the river after the cleanup is completed. Accordingly, we assume OHA's fish advisory with respect to mercury will remain in place. To a person eating fish from the Site, there is no real world difference between fishing limitations based on PCBs versus mercury. Both chemicals potentially reduce the amount of fish people can consume. The continuing mercury fish advisory is guidance from a credible health agency that provides important context for sediment remediation risk management decisions and determining the most cost-effective sediment remedy.

E. EPA's Establishment of RAO 9 for Source Control Is Arbitrary and Capricious Because There is No Information in the RI or Risk Assessment to Support It

EPA's Proposed Plan includes an RAO 9 for riverbanks. EPA's reason for including this RAO is that, according to vaguely described information it received from DEQ, some contamination remains in some identified riverbank soils at levels that, if erosion were to occur, might result in recontamination of sediments.[115] EPA states in the Proposed Plan that remediation of contaminated river banks is included "if it is determined that it should be conducted in conjunction with the in-river actions." EPA's Proposed Plan provides Figure 6 and Table 5 as the full extent of its evaluation of why and where such remedial action is required. It adds that "[o]ther river banks may be included in the remedial action, if contamination contiguous with the river sediment is found during remedial design sampling."[116]

In February 2001, a Memorandum of Understanding (MOU) related to the Site was executed among EPA, Oregon DEQ, and several state, federal, and Tribal natural resource trustees. That MOU provided that EPA would be the lead agency for investigating and cleaning up contamination in the river sediment and DEQ, using state cleanup authority, was designated as the lead agency for identifying and controlling upland sources adjacent to or near the river. Pursuant to that MOU, the Portland Harbor Joint Source Control Strategy was finalized by EPA and DEQ in December 2005. Since that time, many owners and operators of facilities along the river, including several LWG members, have been actively involved with DEQ, planning and implementing source control measures. DEQ has provided EPA regular updates on its source control efforts. As of March 2016, DEQ reported it is on track to complete its determinations of the need for source control measures at all upland sites within the Portland Harbor and to have needed measures in place prior to implementation of CERCLA in-water remedies, in order to prevent likely future adverse effects on water or sediment quality.[117]

In the 2016 draft Final FS and Proposed Plan, EPA has ignored many of those fully or partially completed actions and identified groundwater and riverbank concerns. Although the FS states that information received from DEQ was the basis of these concerns, that information must not be current or complete. In some instances, the groundwater and riverbank contamination has already been addressed, and in others property owners have agreed with DEQ to implement remedies at or before the time of the adjacent in-water remedy.[118] There is no reason for EPA to now insert RAO 9 into the FS and Proposed Plan, given the ongoing, successful efforts to control upland sources.

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[114] 21 CFR §109.30.
[115] 2016 draft Final FS, page 1-17.
[116] Proposed Plan at 13.
[117] Portland Harbor Upland Source Control Summary Report (DEQ, March 25, 2016 update), at 119.
[118] For example, as of March 2016, DEQ reported that river bank remedial action at the Evraz Rivergate site had been fully implemented and that the pathway was considered controlled. *Id.* at 101. Figure 6 of the Proposed Plan, however, shows this as a river bank requiring remediation.

At no time during the LWG's development of the RI and risk assessments did EPA suggest that riverbank data should be collected sufficient to support the development and evaluation of riverbank remedial alternatives.[119] EPA's last-minute incorporation of riverbanks in the FS, when no upland media were evaluated in the approved RI or risk assessments, is counter to EPA policy and guidance. "The purpose of the remedial investigation (RI) is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating remedial alternatives."[120] Here, EPA provides no data or analysis related to what riverbank-related remedial actions are to be implemented or what specific areas present unacceptable risks. EPA refers to Appendix A as the data source for its riverbank analysis. Appendix A appears to be a random compilation of various data, some of which has nothing to do with riverbanks. A review of the "matrix code" column finds most entries are blank, and many entries are data that are not from riverbank soils. The entries include tissue, water, porewater, groundwater, outfall, stormwater, and surface water. In summary, no care was used to put this database together, and much of the information appears to have little to do with delineating contaminated riverbanks. Appendix A also contains a disclaimer noting that it is taken exactly as-is from third-party sources with no quality assurance or quality control performed by EPA. Section 2.2.2 of the EPA-approved RI states that EPA Order 5360.1 and Office of Solid Waste and Emergency Response (OSWER) Directive 9355.9-01[121] requires that environmental measurements be of known quality, verifiable, and defensible. The Office of the Inspector General concluded in an audit of Region 9 Superfund sites[122] that data used for cleanup decision-making should be validated using EPA functional guidelines.[123]

Despite all of these inadequacies in the data, EPA relies on the data to identify riverbank areas for remediation and then to assess the relative effectiveness of remedial alternatives. This assessment is not grounded in adequate site specific information and therefore is arbitrary and capricious.

EPA should delete RAO 9 and all evaluations of alternatives based on riverbank contamination and rely upon DEQ to adequately address source control as it is required to do under the 2001 MOU and as it is successfully doing.

F. <u>To the Extent the Plan Intends to Prescribe In-river Actions to Address Groundwater Contamination, it is Arbitrary and Capricious Because There is No Information in the RI or Risk Assessment to Support It</u>

EPA's discussion of groundwater in the Proposed Plan is confusing. On the one hand, it appears that the Plan does not prescribe remedies for groundwater and that it is EPA's intent that the ROD will not address it either:

> "It is EPA's expectation that DEQ's upland source control actions will adequately address groundwater contamination. EPA's RAOs above are focused on containing and reducing migration of COCs from groundwater to surface water and biologically active areas of sediment. Should groundwater not be addressed adequately under DEQ's actions, EPA may, at a future time, determine if action is warranted under CERCLA to further address groundwater contamination."[124]

On the other hand, the Proposed Plan states that reactive caps "may" be required when it is predicted that " flow of groundwater or pore water will release contamination through the cap,"[125] and that

> "[i]t is EPA's expectation that the majority of the current identified groundwater plumes will be addressed by DEQ's actions and the alternatives will only need to address the portion of the plumes that extend into the river. Since the extent of these plumes impacting pore water is not currently known, these areas will

[119] For the same reason, EPA has no basis for drawing conclusions about any potential risks to the Columbia River associated with potential transport of chemicals from the Portland Harbor Site. The Columbia River was not investigated or evaluated in any part of the RI, BLRAs, or FS.
[120] 40 CFR §300.430.
[121] *Data quality process for Superfund, Interim final.* EPA-540-G93-071. USEPA, 1993.
[122] Environmental data quality at DOD Superfund sites in Region 9.
http://www.epa.gov/oig/reports/1995/ffqar9rp.htm . Office of Inspector General, USEPA, 1995.
[123] U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA 540/R-99/00801. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, October 1999. And USEPA contract laboratory program national functional guidelines for inorganic data review. EPA 540-R-01-008. Office of Emergency and Remedial Response, USEPA, 2002.
[124] Proposed Plan at 22.
[125] Proposed Plan at 27.

> need to be refined during remedial design and at that point it will be determined which residual groundwater plumes will need to be addressed in the river."[126]

EPA goes so far in the Proposed Plan to identify a single commercial product, "AquaGate+10%PAC," to use in reactive caps where groundwater contamination is present.[127]

If EPA's intent was the former, to leave groundwater remedial actions to DEQ under its source control authority or, at the most, to address groundwater in subsequent ROD amendments, then EPA need not address the remainder of comments in this subsection. For purposes of estimating costs, it may have been reasonable for EPA to include some screening level scoping of groundwater measures to account for the cost of some groundwater-focused actions identified during remedial design as having a potential to recontaminate sediments. However, if this is all EPA intended, in the ROD EPA should: 1) remove the groundwater RAOs; and 2) remove the comparative analysis of alternatives criteria related to groundwater RAOs. Groundwater and the potential for any stranded wedges to affect caps should be considered as part of sediment remedial designs and sediment caps should be appropriately designed to address recontamination or groundwater migration issues.

However, if it is EPA's intent to issue a ROD that prescribes groundwater-focused remedial action as actually described in the Proposed Plan, that would be completely unsupported by the RI and Risk Assessments or by any analysis included in EPA's 2016 draft Final FS and Proposed Plan, and would therefore be arbitrary, capricious, and not in accordance with law, for the following reasons:

- The entire extent of the Proposed Plan's discussion of groundwater remediation consists of three isolated paragraphs, one figure, and one table.[128] As quoted above, EPA admits that it does not know the extent of any groundwater plume, because its RI and risk assessments were not intended to investigate or assess any such plumes. Proposed Plan Table 3 is a summary of contaminants of concern in "porewater and transition zone water" with no explanation of where in the site these samples are or where they present risk.

- Proposed Plan Figure 5 is described only as "multiple areas" that "DEQ has identified...with groundwater contamination," with no data or quantitative assessment. There is nothing in the Proposed Plan that provides data or analysis to support the figure, and it is inconsistent with DEQ documentation, ignoring extensive and successful groundwater source control evaluation and remedial action work by DEQ at many of these sites, including the Arkema, Evraz, Gunderson, NW Natural and Time Oil sites.[129]

- EPA does not have any basis in the Administrative Record before it to conclude as it does in Section 3.4.7.3 of the 2016 draft Final FS and page 27 and Figure 10 of the Proposed Plan (and in its discussions of the various alternatives) with respect to groundwater that reactive caps are necessary at any particular site, or type of site, or to specify a particular type of reactive cap:

  - EPA has not evaluated the risks associated with any particular site or in any way (beyond drawing Proposed Plan Figure 5) defined the technical basis for its assumed extent of groundwater "plumes";

  - Without any analysis of appropriate technologies to treat the COCs driving risk, EPA has no basis to prescribe any particular type of reactive cap;

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[126] Proposed Plan at 60.
[127] Proposed Plan at 65.
[128] Proposed Plan at 13, 27 and 60, Table 3 and Figure 5.
[129] As with the vague references to communications with DEQ regarding riverbanks, this information does not appear to be current or accurate. For example, as of March 2016, DEQ has concluded that no source control measures are needed in groundwater for the Evraz Rivergate site and that the potential for recontamination from groundwater at that site is low. *Portland Harbor Upland Source Control Summary Report* (DEQ, March 25, 2016 update), at 101. Nonetheless, Figure 5 of the Proposed Plan shows a groundwater plume encompassing the entire shoreline of the Evraz site. Similarly, with respect to the Time Oil site, the March 2016 DEQ report states that "a pump and treat system is operating to prevent [the pentachlorophenol plume's] migration to the river." *Id.* at 83. Yet EPA's FS identifies the Time Oil pentachlorophenol plume as one of the "known contaminated groundwater plumes currently or potentially discharging to the river." 2016 draft Final FS pages 1-13 – 1-14.

- EPA has, nonetheless, gone so far as to prescribe one particular commercial product for a reactive cap, AquaGate+10%PAC, apparently based on one presentation that this for-profit commercial business provided to EPA in April 2015, without any performance assessment to determine whether this reactive cap product or any other alternative reactive cap products would address particular COCs driving risk at any particular location;

- EPA has failed to address the implementability of its prescribed reactive caps. Rather than prescribe the use of AquaGate+10%PAC, EPA's ROD should simply state that the need for reactive caps will be evaluated at the design stage for any areas with "stranded" groundwater plumes and that any particular cap material and deployment mechanism will be chosen based on that assessment.

In summary, groundwater should be addressed in the ROD by stating that EPA continues to rely upon DEQ to adequately address source control, as it is required to do under the 2001 MOU and as it is successfully doing. If EPA selects any groundwater-focused "in-river actions," they should be only in those areas where the BLRAs identified known in-water risks from the residual impacts of contaminated groundwater discharge and the extent of the action should be determined in the sediment remedial design. EPA should not prescribe sediment remedies that ignore completed or committed upland source control measures.

II. EPA's Principal Threat Waste Approach Leads to Arbitrary and Capricious Remedial Technology Selections, Inconsistent with both EPA Guidance and Practice as to the Appropriate Consideration of Principal Threat Waste

EPA's Proposed Plan addresses three categories of principal threat waste (PTW), which it describes as "PTW source material," "PTW that cannot be reliably contained," and "highly toxic PTW."[130]

EPA's Proposed Plan incorporates an unprecedented approach in its consideration of PTW that leads to prescriptive remedial technology assignments that are inconsistent with EPA guidance and practice. Perhaps more importantly, EPA's PTW approach is unnecessary to making Portland Harbor remedial technology assignments, because it duplicates other proper risk-based alternatives evaluation considerations already taken into account. In particular, EPA's designation of PTW leads to two aspects of its proposed remedial alternative that should be eliminated as unnecessary:

1. Designation of a set of RALs based on PTW (Table 13 of the Proposed Plan)

2. Prescriptive technology assignments based on the PTW designation (Figures 10a, 10b, and 10c of the Proposed Plan)

Between these two results, EPA adds very material costs to its remedy. For example, EPA requires activated carbon or aquablock/organoclay amendment in caps and residual covers in all areas where PTW (as defined by EPA) exists, even if the PTW is removed by dredging. This assumption adds approximately $52 million to the remedy cost. Additionally, EPA has specific ex situ treatment and disposal requirements for certain PTW that would increase disposal costs by as much as $43 million. Both of these are required by EPA without any evaluation of implementability or effectiveness, let alone cost-effectiveness.

A. EPA's Application of PTW Concepts is Inconsistent with Guidance and Practice

EPA has designated large geographic areas as PTW based on its evaluation of the "high toxicity" criterion as compared to the human health fish consumption PRGs.[131] Its designations are inconsistent with its risk assessment and inconsistent with EPA guidance.

[130] Proposed Plan, p. 14.
[131] Proposed Plan, p. 14.

First, EPA does not accurately assess the presence of greater than 10^{-3} cancer risk at the Site consistent with risk assessments or the intent of EPA guidance.[132] For total PCBs, dioxin/furan TEQ and total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), EPA simply multiplied certain 10^{-6} cancer risk PRGs by 1,000 based on human health fish consumption (high consumption rate, mixed diet, fillet only) to determine concentrations associated with 10^{-3} cancer risk. For BaPEq, EPA followed the same procedure using a sediment direct contact PRG for high frequency fisher.

However, before applying such concentrations for PTW identification, even assuming this is an appropriate pathway to evaluate in this context, the presence of actual risks greater than 10^{-3} needs to be determined. In fact, greater than 10^{-3} risk was not found in the BHHRA for dioxin/furan TEQ, total DDx, or BaPEq for any scenario evaluated. Therefore, the definition of highly toxic as described in EPA PTW guidance[133] is only potentially applicable to total PCBs.

That leads to the question of what pathways are relevant for purposes of defining principal threats. For total PCBs, greater than 10^{-3} cancer risk was found in the BHHRA for three fish consumption scenarios: subsistence (mixed diet, fillet), recreational (mixed diet, fillet), and tribal (whole body and fillet). The PTW guidance states:

> "'Source material" is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or acts as a source for direct exposure." [emphasis added].

The fish consumption risks do not represent direct exposures from source materials, but rather integrate contaminant contributions from sediment, surface water, and diet. As a consequence, the sediments by themselves do not directly pose risks greater than 10^{-3}. In addition, contaminants in fish do not represent a reservoir for migration of contamination to other media in any reasonable sense.

Applying the PTW guidance, only contaminants that were actually found to pose greater than 10^{-3} cancer risk in media that potentially represent a source to other media or of direct exposure should be evaluated for the highly toxic aspect of the PTW definition, and only in those areas where that level of risk was found to occur in the BLRAs. No contaminants meet these conditions at the Site. EPA's definition of PTW in this case is particularly inappropriate given 2012 fish tissue data[134] that show PCB concentrations in fish tissue have declined significantly. If these 2012 concentrations are applied to risk estimates using methods consistent with the BHHRA (using the 95% UCL for the site-wide subsistence consumption scenario, fillet tissue), the resulting human health cancer risk for consumption of smallmouth bass is 4×10^{-4}, substantially lower than 10^{-3}. And the end result of EPA defining PTW by these methods is that EPA has designated material containing PCBs at 200 ppb as PTW; a concentration which is 100 ppb below the sediment cleanup objective of 300 ppb applied in the Hylebos Waterway of Commencement Bay. Thus, EPA is adding nearly $100 million to remedial action costs based on its consideration of a risk level that likely no longer exists and concentrations that are below final cleanup levels established at other Region 10 sites.

Regardless of concentration, EPA should not identify materials that can be reliably contained as principal threat waste. EPA's 2016 draft Final FS states, "'[r]eliably contained' was not used in identifying PTW but rather was used to determine what concentrations of PTW could be reliably contained."[135] This clearly contradicts the guidance, which discusses reliably contained as part of PTW identification.[136]

> "Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. *** No 'threshold level' of toxicity/risk has been established to

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[132] *A Guide to Principal Threat and Low Level Wastes*. Office of Solid Waste and Emergency Response. Superfund Publication 9380.03-06FS. November 1991.
[133] *Id.*
[134] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)
[135] 2016 draft Final FS, page 3-3.
[136] NCP Preamble, 55 Fed. Reg. 8666 at 8703 (March 8, 1990); A Guide to Principal Threat and Low Level Wastes, OSWER Superfund Publication 9380.03-06FS (November 1991).

> equate to 'principal threat.' However, where toxicity and mobility of source material combine to pose a potential risk of 10-3 or greater, generally treatment alternatives should be evaluated. *** Determinations as to whether a source material is a principal or low level threat waste should be based on inherent toxicity as well as consideration of *** the potential mobility of the wastes in the particular environmental setting ***."[137]

The guidance is clear that PTW only exists where the factors of highly toxic or highly mobile *combine* with a condition of not reliably containable. EPA acknowledges (in 2016 draft Final FS Table 3.2-2) that all COCs at the concentrations present in the Site, with just two exceptions (chlorobenzene and naphthalene), *can* be reliably contained.[138] Thus, none of the areas where these contaminants are absent should be designated as PTW. Accordingly, if all PCB, PAH (except naphthalene), and DDx concentrations present at the Site can be reliably contained, then EPA is not required to address them as a PTW. And naphthalene concentrations detected in the RI were not found in the BHHRA to pose a greater than 10^{-3} risk for any media or scenario evaluated and therefore do not constitute PTW.

Similarly, the 2016 draft Final FS and the Proposed Plan provide no discussion or explanation of how material with sediment concentrations above the EPA-identified highly toxic thresholds or the presence of "globules or blebs"[139] of non-aqueous phase liquid (NAPL) pose a risk of migration without any knowledge as to what the globules or blebs consisted of or whether such substances are naturally occurring.[140] EPA's interpretation of any trace evidence of NAPL as PTW is devoid of scientific justification and is inconsistent with situations described in the guidance, such as "pools of NAPLs submerged beneath ground water or in fractured bedrock, NAPLs floating on ground water" or where physical processes are likely to mobilize "source materials" as defined in the guidance.[141] EPA had the responsibility and opportunity to require scientific investigation of globules and blebs as part of the RI or as a supplemental RI. Except at the Gasco Sediment Site (where extensive investigations have defined areas of "substantial product" consistent with the consent order for that site), EPA chose not to do so and to rely entirely on unsupported speculation for its decision making instead. The 2016 draft Final FS interpretation is also inconsistent with the final remedy selected by EPA at the McCormick and Baxter site within Portland Harbor, where sediments containing NAPL were reliably contained using conventional and active capping technologies.[142]

Finally, the 2016 draft Final FS and Proposed Plan state that "All PTW treated ex-situ is assumed to be disposed at a RCRA Subtitle C facility." This assumption is inconsistent with the detailed waste disposal decision and treatment framework identified in the Gasco Sediment Site Statement of Work and FS dataset.[143] A total of 22 toxicity characteristic leaching procedure (TCLP) samples were collected as part of the FS and Gasco Sediments Site investigations to support waste disposal determinations (i.e., Subtitle C versus Subtitle D) and only three samples exhibited concentrations exceeding the TCLP Allowable Limits, all for benzene. Bench-scale testing showed that addition of a minimum 5% Portland cement reduced the benzene concentrations below the TCLP Allowable Limits. Both the 2016 draft Final FS and Proposed Plan assume all PTW is treated ex situ (e.g., with Portland cement);

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[137] Id. at 2.
[138] The LWG disagrees this determination is correct. The LWG 2012 draft FS conducted the same analysis (Appendix Hc) using more appropriate technical procedures and determine that all materials and chemicals at the Site are reliably containable through readily available sediment capping technologies. Importantly, these exceptions were based on preliminary cap modeling that used "representative site conditions" for model input parameters. These "representative" model input parameters do not exist at all sites. For example, they have been demonstrated not to exist at the Gasco site based on site-specific data collection performed under oversight by DEQ and in coordination with EPA. Consistent with the Proposed Plan text, it will be important to perform site-specific cap modeling evaluations during remedial design to determine cap protectiveness. Proposed Plan p. 15.
[139] Draft Final FS, page 3-3.
[140] We also note that EPA's PTW-NRC footprint is mapped inconsistently between the FS and Proposed Plan. EPA provided a later clarification (July 20, 2016 email from Kristine Koch) that one map represents "subsurface NRC" and the other "surface NRC," but the FS and Proposed Plan do not ever use these terms, and it is entirely unclear how these different types of NRC are relevant to EPA's PTW evaluations, if at all.
[141] *A Guide to Principal Threat and Low Level Wastes*, OSWER Superfund Publication 9380.03-06FS (November 1991)
[142] *Third Five-Year Review Report for McCormick & Baxter Creosoting Company Superfund Site*. (Oregon Department of Environmental Quality and U.S. Environmental Protection Agency. September 26, 2011).
[143] Administrative Settlement Agreement and Order on Consent for Removal Action for the Gasco Sediment Site, U.S. EPA Region 10 CERCLA Docket Number 10-2009-0255 (September 9, 2009).

therefore, the Proposed Plan should assume that all ex situ treated PTW material may be disposed of at a Subtitle D facility. Otherwise, the need for treatment of sediments destined for an upland landfill should be based on acceptance criteria of that facility.

B. EPA's Designation of PTW is Unnecessary and Legally Inappropriate Given the Balanced Evaluation of the NCP Evaluation Criteria that is Required

Moreover, even if EPA concludes that any areas of the Site contain PTW, which we believe would be inconsistent with guidance, that does not justify EPA's creation of a distinct PTW RAL set or prescriptive technology assignments based on the presumed presence of PTW. According to EPA's PTW guidance, "the principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement."[144] The NCP itself notes that even duly designated PTW is appropriately contained, rather than removed or treated, when it "poses a relatively low long-term threat or where treatment is impracticable."[145] EPA's Sediment Guidance confirms that this is most often the appropriate, practicable approach at sediment sites: "Based on available technology, treatment is not considered practicable at most sediment sites," and "[i]t should be recognized that in-site containment can also be effective for principal threat wastes, where that approach represents the best balance of the NCP nine remedy selection criteria."[146]

EPA's alternatives evaluation for Portland Harbor demonstrates that virtually all material at the Site can be reliably contained, and where EPA's analysis indicates it may not be contained, the material does not represent a direct 10^{-3} or greater cancer risk. Accordingly, EPA should eliminate the designation of any PTW areas. This outcome would be consistent with EPA's treatment of the same issue at the Lower Duwamish Waterway Superfund site and other similar sediment cleanup sites.[147]

III. EPA's Conceptual Site Model is Inadequate

The purpose of a CSM in environmental remediation is to aid site managers in understanding and directly accounting for contaminant sources, environmental fate and transport processes, and exposure pathways and receptors. "For sediment sites, perhaps even more so than for other types of sites, the CSM can be an important element for evaluating risk and risk reduction approaches…A good CSM can be a valuable tool in evaluating the potential effectiveness of remedial alternatives... [t]he CSM should capture in one place the pathways remedial actions are designed to interdict to reduce exposure of human and ecological receptors to contaminants."[148] "Because of the inherent complexity of these projects, site characteristics (such as source areas, transport mechanisms, background and upstream areas, and key site features) should be clearly identified in a CSM before evaluating and selecting remedial alternatives."[149] Therefore, to be an effective tool in decision-making, a CSM must provide the framework for establishing testable hypotheses related to the behavior of the system and how it will react to any given alternative.

The CSM should be developed iteratively, as more data and site information become available (for example, during the course of the RI).[150] The CSM should reflect the best and most recent understanding of site conditions and dynamics. A more dynamic site will require a more elaborate and detailed CSM. The Lower Willamette River is a highly complex and dynamic system, and the CSM must account for this complexity.

Given the complex and dynamic nature of the Site and the clear need for a robust CSM as recommended by EPA's Sediment Guidance, EPA's reduction of 15 years of data collection and evaluation to two sentences and a one-page

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[144] *Id.* at 2.
[145] 40 CFR §300.430(a) (1) (iii) (B).
[146] Sediment Guidance at p 7-4.
[147] See, *LWG Response to EPA's Principal Threat Waste Approach* (August 7, 2014).
[148] Sediment Guidance, p. 2-7.
[149] ITRC, p. 6.
[150] "As a site CSM is refined, professional judgment must be used to determine the additional data needed for remedy selection." ITRC, p. 4.

sketch[151] is inexplicable by any scientific or technical measure. EPA's sketch compares poorly to the description in guidance of a CSM. "Project managers may find it useful to develop several CSMs that highlight different aspects of the site. At complex sediment sites, often three CSMs are developed: 1) sources, release and media, 2) human health, and 3) ecological receptors. For sites with more than one contaminant that are driving the risks, especially if they behave differently in the environment (e.g., PCBs vs. metals), it is often useful to develop a separate CSM for different contaminants or groups of contaminants."[152] "The first step in the remedial evaluation framework is to review the CSM to understand the relationship between sources, migration pathways, and receptors and to understand the physical conditions and contaminant properties governing exposure and risk at the site. Information presented in the CSM should support identification of the site-specific characteristics needed in the evaluation of remedial technologies."[153]

EPA's CSM sketches some of the site receptors and processes as though the Site exists in a permanent condition of uniformity and steady state, despite the Willamette River being a very dynamic system. EPA errs by considering site processes through the lens of a closed system in which outside sources and forces are largely irrelevant, thereby defeating the very purpose of a CSM.[154] At best, EPA's Portland Harbor CSM is a static snap shot of the Site that offers no explanation of the complex behaviors of the Site. Site-specific hypotheses cannot be deduced from a sketch. The sketch does not allow its users to coherently understand the effects of changes in surface chemistry of the sediments, surface water quality, or tissue concentrations over time. It also cannot adequately address the effects of source control over time, the effects of human activity, or the relative benefits associated with different remedial alternatives.

To formulate and implement effective remedial alternatives at Superfund sites, site-specific conditions must be well characterized and incorporated into a CSM demonstrating that observed conditions can be accurately extrapolated to the system as it may vary physically, biologically, and temporally. NRC guidance appropriately states the importance of conducting risk management decisions "on a site-specific basis…incorporat[ing] all available scientific information" because "[w]ithout a valid conceptual model of the site, it is not possible to define how a management option can successfully meet the risk-reduction goals and objectives."[155] At contaminated sediment sites in particular, "the development of an accurate conceptual site model, which identifies contaminant sources, transport mechanisms, exposure pathways, and receptors at various levels of the food chain" is "especially important...because the interrelationship of soil, surface and groundwater, sediment, and ecological and human receptors is often complex."[156] EPA's Technical *Resource Document on Monitored Natural Recovery* explains that an evaluation of the feasibility of monitored natural recovery (MNR) (and presumably other proposed remedial alternatives) "is best achieved through the development of a CSM that adequately captures the physical, chemical, and biological processes that control contaminant fate, transport, and bioavailability."[157]

Neither the RI nor EPA's FS contains a coherent, complete and accurate CSM that identifies and addresses site-specific context and conditions in sufficient detail to adequately describe the dynamic complexity present at the Site. The result is an inability to rationally develop and evaluate resource intensive and technically challenging remediation alternatives at the Site.

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[151] 2016 draft Final FS p. 1-21, "The CSM integrates the information gathered to date and provides a coherent hypothesis of the contaminant fate and transport at the Site. Figure 1.2-26 provides a simplified visual summary of this hypothesis, including the complete human and ecological exposure pathways."
[152] Sediment Guidance, p. 2-7.
[153] ITRC, p. 19.
[154] "The CSM and site geomorphology help determine the degree of site characterization required to properly evaluate remedial technologies. Understanding the relationship between contaminant sources, transport mechanisms, exposure media, and factors that control contaminant distribution and potential exposure is critical to developing a focused site characterization approach. For example, sediment transport is often controlled by infrequent, high energy events. " ITRC, p. 21.
[155] *A Risk-Management Strategy for PCB-Contaminated Sediments*. (Committee on Remediation of PCB-Contaminated Sediments, Board on Environmental Studies and Toxicology, Division on Life and Earth Studies, National Research Council, May 2001).
[156] Sediment Guidance, p. ii.
[157] *Resource Document on Monitored Natural Recovery* (EPA 2014), Section 1.3.2, p. 6.

A. Errors that Result from the Use of EPA's CSM

There are numerous examples of important dynamic processes that have been overlooked or poorly evaluated in the development of EPA's CSM. Appropriate evaluation of these processes is critical to understanding source dynamics; rate and extent of physical, chemical, and biological transformations; exposure; and how the system will react to any given remedial alternative.

1. Non-steady State Conditions and Aggregation of Data

Due to EPA's nearly non-existent CSM, for many analyses EPA inappropriately aggregates extensive data collected over the course of a decade, which erroneously portrays a highly dynamic system as unchanging and uniform.

There were multiple rounds of data collected at the Site during sampling events over an approximately 10-year period of time, and some data included in the RI/FS database predate this period by another 5 years (back to 1997). It is potentially appropriate for some RI/FS purposes to aggregate these data and plot them on maps and figures, such as portraying the general nature and extent of contamination in relative terms (i.e., to discern relatively high and low concentration areas). However, such simple aggregation is fatally flawed for any evaluations where an appropriately developed CSM would indicate dynamic changes over time (e.g., evaluating potential natural recovery or long-term outcomes of remedial alternatives).

An appropriate CSM would emphasize that Site river sediments have dynamic characteristics and parameters including chemical concentrations that likely increase or decrease over time. By continually aggregating synoptic data without regard to sampling year, any sense of time dependent variation present in these data was lost in EPA's evaluations. There are numerous examples of 2016 draft Final FS statements and conclusions that are incorrect or misleading due to the insufficient CSM that fails to recognize dynamic and changing site conditions. A few examples include:

- Groundwater and riverbank source descriptions (e.g., FS pp. 1-13 through 1-19) and plume maps do not consider source controls implemented at many upland sites in the last five years or so.

- For unexplained reasons, EPA uses only the 2007 and 2012 fish tissue data (and ignores the 2002 tissue data) in its very limited evaluation of tissue contaminant trends (FS pp. 3-34), which essentially halves the available time period that can be evaluated. EPA's discussion is heavily focused on finding any potential evidence of a "zero" trend, which is a bias caused by EPA's simplistic and static CSM.[158]

- EPA's effectiveness evaluations focus almost exclusively on SWACs immediately post-construction (p.3-65, 4-6, 4-10 and elsewhere), and no quantitative estimates of long-term alternative outcomes are included. As described elsewhere in this document,[159] EPA could have easily devised empirically based estimates of long-term outcomes of the alternatives without resorting to complex computer models.

- EPA states that "Sediment trend data do not exist for this Site; insufficient biota and water trend data exist…" (p. 4-4).[160] If EPA had adopted the CSM formulated early in the RI/FS process, any trend data deficiencies now perceived by EPA would have been addressed. In fact, the LWG provided such

[158] EPA provides no details in the 2016 FS of its fish tissue statistical analysis, but a memorandum titled "MNR Evaluation – Fish Contaminant Concentrations," May 2016 is within EPA's Administrative Record for the Site. The LWG found EPA's statistical analysis to be flawed in several respects including that EPA's statistical model lacks power for detecting declines in fish tissue concentrations, is overly simplistic for the task, confounds the analysis by normalizing by non-correlated lipid contents, and ignores 2002 data for poorly explained reasons. See LWG memorandum, *Comments on EPA MNR Evaluation Using Fish Contaminant Concentrations*, (September 6, 2016) (Attachment 18) EPA's results disagree with the LWG's findings as previously provided to EPA in "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis," a presentation file from Anchor QEA provided to EPA on March 18, 2013 (Attachment 1).
[159] See Section V.C.
[160] Note that the LWG disagrees with this statement, and the LWG 2012 draft FS Section 6.2 provides a good example of using the available data to understand Site trends to the maximum extent practicable. The LWG's conclusion, which was later verified by the 2012 smallmouth bass tissue data, was that Site concentrations are declining measurably in just the last 10 years.

> supporting information as far back as the Programmatic Work Plan stage, and when the LWG requested collecting time series surface sediment data to fill part of this data gap, EPA rejected that request.[161]

Probably the least defensible use of the static Site bias portrayed by EPA's insufficient CSM appears a little later on page 4-4 of the 2016 draft Final FS.

> "EPA has concluded that the HST model predictions are inconsistent with the CSM for this Site, as it shows significant concentration reductions occurring within the first 10 years for the No-Action alternative. However, given that the majority of the contamination was released into the river 30-80 years ago and similar reductions have not been observed, the model results appear inconsistent with the empirical data collected during the RI."

We are unaware of chemistry data from 30 to 80 years ago that EPA has compared to data collected during the RI/FS to reach this "empirical" conclusion, and no such data appears in the Administrative Record for the Proposed Plan. However, a significant amount of information collected during the RI demonstrates that river conditions have changed over time. For example, EPA's RI found that, "Concentrations of total PCBs, DDx, total PAHs, hexachlorobenzene, total chlordanes, aldrin and dieldrin, gamma-HCH, lead, and TBT are higher in subsurface than in surface sediments, indicating that historical inputs were likely greater than current inputs."[162]

The dynamics of sediment surface chemistry also have a direct effect on the calculation of RALs and evaluations of natural recovery. When sediment surface chemistry is dynamic over time, the RAL will also vary depending on the time and rate of natural recovery estimated, because RALs define the dividing line between areas that will be actively remediated versus areas that will undergo natural recovery. In turn, these time-dependent RALs and their linkage to natural recovery estimates are one of the key characteristics of the selected remedy (i.e., they define where active remediation will take place).

Yet, EPA devotes about three pages of its FS (starting at p. 3-32) to a discussion of the processes affecting RAL selection and natural recovery. As described in guidance, "Using MNR as a remedy at a contaminated sediment site requires a thorough understanding of the sources, exposure pathways, and receptors in the CSM. Site managers must be able to predict, with some degree of certainty, that contaminant concentrations will decline or be effectively addressed within a specific time frame." Guidance also states that natural recovery evaluations at contaminated sediment sites should be based on multiple lines of evidence.[163] Many of these lines of evidence were collected as part of the Portland Harbor RI/FS process and provide a strong empirical basis for the occurrence of natural recovery in Portland Harbor. Section 6.2.2 of the LWG 2012 Draft FS provides a detailed evaluation of each of these lines of evidence, which were summarized in past LWG FS comments.[164] These important lines of evidence include:

- Sources are being progressively controlled. DEQ's latest source control report indicates DEQ has completed source control evaluations and implemented (or will implement) controls on one or more potential pathways at approximately 149 of 171 sites examined in detail to date.[165]

- The aggregate information from five multi-beam surveys indicates widespread deposition of sediments across many areas of the Site. Although EPA's FS emphasizes the uncertainties of these data, for reasons

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[161] Letter from EPA to LWG dated January 2, 2008, regarding "Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. Round 3B Comprehensive Sediment and Bioassay Field Sampling Plan – Addendum 1: Fate and Transport Modeling – Estimation of Temporal Chemistry Changes in Surface Sediments."
[162] RI, page 10-4.
[163] Sediment Guidance; Magar et al. 2009 (Magar, V., D. Chadwick, T. Bridges, P. Fuchsman, J. Conder, T. Dekker, J. Stevens, K. Gustavson, and M. Mills. 2009. Technical Guide: Monitored Natural Recovery at Contaminated Sediment Sites. Environmental Security Technology Certification Program (ESTCP), Project ER-0622.); ITRC 2014.
[164] Letter to EPA, September 8, 2015, Re: List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240).
[165] Portland Harbor Upland Source Control Summary Report (DEQ, March 25, 2016 update), at 108.

detailed in past comments, the LWG disagrees that these data present substantial uncertainties about deposition.

- Sediment trap and suspended sediment data clearly show that incoming settling sediment has substantially lower contaminant concentrations than most of the site bedded sediment, which will drive bedded sediment concentrations lower over time.

- Radio-isotope coring data, although limited, indicates deposition rates consistent with other measures such as the bathymetry time series.

- Site surface sediment grain sizes are fine-grained across the majority of the Site, strongly indicating a long-term depositional environment exists in these areas.

- Surface to subsurface sediment concentration ratios in most areas of the Site indicate newer surface strata contain lower concentrations than older subsurface strata, which illustrates that surface sediment concentrations are decreasing over time.

- Surface sediment concentrations measured over time (i.e., time series) indicate surface sediments have decreasing contaminant concentrations. The 2012 Draft FS data are somewhat limited, but new PCB data collected in 2014 by other parties provide additional useful information and suggest that PCB sediment concentrations are continuing to decline.[166]

- Smallmouth bass PCB tissue measurements made in 2002, 2007, and 2012 indicate statistically significant declines in tissue concentrations across almost all areas of the Site.[167] Despite uncertainties expressed in EPA's FS, differences in sampling and compositing schemes across the years can be controlled to determine statistically valid results.

- Comparisons of sediment profile images collected in 2001 (by the LWG) and 2013 (by other parties)[168] indicate that much of the Site now has well established Stage 3 benthic communities indicating stable and recovering substrates.

- Simple modeling (such as EPA's SEDCAM modeling, which was never included in EPA's FS) and complex modeling (such as the 2012 Draft FS QEA FATE model and coupled dynamic Food Web Model) all generally indicate recovery of surface sediments over a reasonable timeframe toward a relatively consistent range of potential equilibrium levels.

One of the most important rules of environmental data analysis is the evaluation of time series data to establish the dynamics of site processes (e.g., the rate and extent of changes in physical, chemical, and biological systems). EPA failed to conduct this evaluation, and the assumption of a steady state and uniform Site was mistakenly accepted as valid for the vast majority of the EPA's FS analyses.

2. Role of Surface Water Chemistry and Variation

EPA's CSM fails to consider the non-steady state dynamics of PCBs and DDx in surface water. This causes EPA to ignore the likely effects of water quality on fish tissue concentrations for hydrophobic COCs. Using DDx as an example, the RI demonstrates that variation in Site sediment concentrations explains about 33% of the variation of DDx in resident fish tissue.[169] Obviously, there are other factors that control the remaining 67% of the observed

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[166] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015) (Attachment 2).

[167] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)

[168] *Characterization of the Lower Willamette River with sediment profile imaging: Changes in space & time,* prepared for de maximis, Inc. (Germano & Associates, Inc. June 2014.). (Attachment 19)

[169] Integral 2016 *Review of EPA's Food Web Model* C167-1504. Prepared for Legacy Site Services LLC, Exton, PA. Integral Consulting Inc., Portland, OR. August 30, 2016. (Attachment 20)

variation, which are not addressed by EPA's sketch CSM. This error leads to the unsupportable premise that sediment remediation alone can result in acceptable levels of DDx in tissue, a premise that ignores eight rounds of surface water data that demonstrate significantly higher concentrations of DDx are entering the Site during times of high winter flow than are present during the summer or fall. A similar relationship exists for PCBs. Further, none of the surface water samples for DDx or PCBs taken during either high or low flow conditions entering the Site from upstream obtained during the RI were below EPA's New/Updated CWA 304(a) Human Health Criteria and Oregon's water quality standards. These errors could have been avoided had EPA followed standard practice that "… all sediment sites should include the development of a CSM that identifies watershed inputs and characterizes background conditions."[170]

The CSM also fails to account for the endogenous risk (or risk arising from factors outside the domain of the CSM), including the contribution of upstream chemical inputs to surface water PRG exceedances and ongoing human health fish consumption risks. For example, as discussed in Section I.D and Table 4, the current OHA mercury fish consumption advisory for vulnerable populations on the Lower Willamette River allows only 12 resident fish meals/year. Because this advisory is due to mercury sources upstream of the Site, the advisory is expected to continue after any Portland Harbor sediment remediation is implemented. EPA's FS focuses on (flawed) post-construction risk estimates for the child fish consumption scenario (a vulnerable population). EPA estimates that under the most aggressive alternative (Alternative G), a child will be able to consume 10 fish meals/year, while Alternative B allows 2.4 meals/year. Thus, none of EPA's alternatives result in actual increase in the amount of fish people can consume above the current OHA fish consumption advisory. Similarly, the difference between the smallest and largest alternatives is just a few fish meals per year. Consequently, any perceived benefit to allowable fish consumption from the more aggressive alternatives does not actually exist.

In fact, even if every grain of sediment was removed from the Site and replaced with the cleanest sand available, resident fish tissue would still be adversely impacted by mercury, PCBs, and other contaminants from upstream sources. Contrary to guidance, the CSM sketch fails to address this key relationship between upstream water quality and marginal risk reductions and, as a consequence, the utility of the alternatives.

3. Importance of Non-steady State Chemical Processes

Some of the COCs associated with site sediments are chlorinated organic compounds (e.g., PCBs, DDx, and dioxin/furans). Current scientific literature demonstrates chlorinated compounds can undergo biotic and abiotic changes when present in sediments, surface water, and groundwater. Such processes include aerobic and anaerobic reactions (i.e., in the presence and absence of oxygen). Potentially important biogeochemical recovery pathways observed at other sites are not identified or operationalized in the CSM sketch or discussed elsewhere in EPA's FS. "At a minimum, the CSM should address the following: source(s), nature and extent of contamination, sediment transport pathways and mechanisms, sediment deposition rate; exposure pathways associated with chemical contamination, and the potential for in situ degradation...."[171] Section 2.6 of the LWG 2012 FS provides a good example of such a CSM.

a. Role of Spatial Complexity

Data obtained during the RI demonstrate the Site is complex and varies substantially over space for many parameters relevant to sediment remediation (sediment concentrations, grain size, organic carbon content, deposition rates, erosive forces, varying sources, water movements and currents, etc.). Given there is no CSM that discusses this complexity, particularly with regards to spatial variations in sediment grain size and organic carbon content, EPA erred when it calculated background concentrations for the Site. This error was the subject of a formal dispute by the LWG,[172] where LWG requested retaining the previously calculated RI background values for multiple

[170] ITRC, p. 59.
[171] ITRC, p. 69. [emphasis added]
[172] Request for Dispute Resolution of EPA's Notice of Decisions on Background Regarding Section 7 of the Remedial Investigation; Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240. The LWG requested that, "the full data set with consideration of organic carbon correction be retained as the selected set of background values and applied in the FS. These values are shown in the "all data" columns of Table 7.3-1b (and the related Appendix H Table H-2b) of the RI Section 7 revision agreed to by EPA and the LWG on December 12, 2013."

chemicals including a value of 16 ppb for PCBs. In addition, the LWG submitted a technical memorandum regarding equilibrium conditions,[173] which represent the lowest likely achievable sediment concentrations at the Site due to ongoing upstream inputs of COCs. This memorandum concludes that the appropriate site-wide equilibrium value for PCBs is 20 ppb. Both these documents address issues of sediment spatial variations, particularly for organic carbon content.

EPA rejected the LWG's position that EPA used background data outlier identification methods that are only appropriate for parameters whose latent distribution is normal. Because river sediment grain size and organic carbon content are highly varied over space due to natural processes and concentrations of organic compounds in sediments co-vary with grain size and carbon content, the concentration of compounds (including PCBs and DDx) cannot be normally distributed at the sampling spatial scales associated with the upstream (reference area) data. Thus, EPA's application of outlier methods associated with assumed normal distributions combined with inappropriate data censoring led EPA to artificially low background values (e.g., 9 ppb for PCBs) that are not likely achievable by any sediment remedy. Both an appropriate background analysis and incorporation of equilibrium concepts indicate that EPA should be using a background value more in the 20 ppb range for PCBs. EPA's error could have been avoided had the CSM properly addressed spatial complexity of sediment and other parameters both at the Site and upstream of the Site.

4. Effect of Inadequate CSM on Alternatives Selection

The absence of a coherent and complete CSM results in the selection of the wrong alternative. EPA assumes that time zero (immediate post-construction) SWACs are a good measure of risk reduction for all alternatives measured against arbitrary interim targets, which ignores any reasonable CSM conclusions regarding the dynamic nature (and overall declining concentrations of chemicals) of the system. Thus, EPA assumes that the Preferred Alternative will achieve faster and more cost-effective risk reduction, when in fact smaller, less resource-intensive alternatives will achieve similar risk reduction in a similar time period (and at much lower cost), if the dynamic nature of MNR (both during remedy construction and after) is properly taken into account. See Section V.C of this document for a more detailed discussion on the appropriate alternative selection taking into account expected system changes over the long term.

IV. EPA's Alternatives Evaluation is Incomplete, Misleading, and Almost Entirely Qualitative

An appropriate alternatives evaluation must fairly and carefully weigh the costs[174] against the benefits[175] of the alternatives both individually and relative to one another. "The evaluation should consider both positive effects, such as long-term effectiveness as measured through risk reduction, and negative effects, such as the adverse effects associated with implementation."[176] This evaluation should also demonstrate how the alternatives' dollar costs are proportional to their effectiveness (benefit) in reducing risk. The NCP states, "Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in § 300.430(f)(1)(ii)(A) and (B)…A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." The evaluation should also fully and transparently assess each of the FS criterion contained in the NCP (40 CFR Section 300.430(e)(9)). Unfortunately, EPA's alternatives evaluation has almost no comparison of the overall costs and benefits of the alternatives and fails to fully evaluate many of the FS criterion. Further, where costs (including impacts) or benefits (effectiveness) are discussed independent of each other, EPA:

- Develops alternatives that prescribe technology assignments, which precludes any meaningful comparison of the effectiveness of different technologies.

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[173] *Sediment Equilibrium Estimates for the Revised Feasibility Study*, an LWG Technical Memorandum submitted to EPA on August 7, 2014.
[174] Including the wider sense of the term "costs" such as environmental and community negative impacts due to remedy implementation.
[175] Per the NCP, benefits are measured through effectiveness criteria: "Cost-effectiveness is determined by evaluating the following three of the five balancing criteria noted in § 300.430(f) (1)(i)(B) to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness.
[176] ITRC p. 52.

- Fails to evaluate alternatives consistent with any coherent CSM (as already discussed in Section III).
- Presents flawed post-construction risk estimates to support effectiveness and protectiveness determinations.
- Presents no quantitative or detailed short-term effectiveness evaluation.
- Presents no quantitative or detailed long-term effectiveness evaluation.
- Ignores valuable recent data that would aid in long-term effectiveness evaluations.
- Systematically underestimates the costs and durations of the alternatives.
- Fails to fully consider many implementability challenges.

The result is a defective alternatives evaluation that leads to the ultimate error: selecting the wrong remedial alternative.[177]

A. EPA's Prescriptive Technology Assignments Preclude Meaningful Comparison of the Effectiveness of Different Technologies

EPA's 2016 draft Final FS and Proposed Plan continue to prescriptively assign technologies on the basis of a generic scoring matrix and decision trees without consideration of site-specific factors. EPA's approach prevents meaningful comparison of the performance of various technologies in the FS, because all alternatives employ the same technologies in the same geographic areas.[178] And because the technology assignment is based on FS-level information and screening evaluations, the prescriptive set of evaluation criteria will not appropriately or accurately predict the most appropriate technology assignments or configurations for remedial design based on design-level engineering evaluations and data available at the time of design, including data collected post-ROD. For example, the FS assignments are based on overall general assumptions regarding slopes, presumed erosion and deposition zones, and required depths of removal to reach protective levels. However, real designs implemented throughout the country at other sites (and within Portland Harbor to date) have varied, often substantially, from the FS-assumed criteria and are known to be effective. With respect to riverbank contamination and presumed groundwater contamination, the FS technology assignments are based solely on those general broad designations, without consideration of which COCs are present and conditions of exposure.[179]

EPA's selected remedy should build in the flexibility needed to evaluate the likely performance of technologies against RAOs in the context of the complexities of each particular SDU and within SDUs. EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, and requirements for rigid containment) might be considered or allowed based upon site-specific engineering evaluations and newly developed information.[180]

Attachment 21 provides a decision framework EPA could include in the ROD to specify how technology assignments would be finalized or refined on a site-specific basis. Subject to some general rules (i.e. dredging will typically be required for active remediation in the navigation channel or future maintenance dredge areas and capping will typically be required around permanent structures), dredging or capping at a specific location would be

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[177] Table 15 of the Proposed Plan summarizes EPA's comparison evaluation of alternatives.
[178] 2016 draft Final FS, p. ES-17: "Alternative A is a No Action Alternative, Alternatives B through I that apply the same suite of remedial technologies and process options to varying degrees based on Site-specific characteristics: containment, sediment/soil treatment (in-situ and ex-situ), sediment/soil removal, sediment/soil disposal, MNR/ENR, and institutional controls" (emphasis added).
[179] By contrast, the Corps of Engineers capping guidance document provides design level guidance of modeling and assessment methods to determine the concentration of contaminants of concern that can be safely isolated by capping.
[180] The Lower Duwamish Proposed Plan had an entire subsection that described some of the issues with design implementation and what factors and remedy components would have to be worked out in more detail in design. Proposed Plan, Lower Duwamish Water Superfund Site, https://www3.epa.gov/region10/pdf/sites/ldw/pp/ldw_pp_022513.pdf, §10.1, page 89.

determined by application of demonstration criteria through engineering evaluations during remedial design.[181] Such an approach is consistent with guidance, which clearly indicates both dredging and capping are feasible under a wide range of highly overlapping conditions, and many design options and components exist so that either capping or dredging can be tailored to be highly effective and protective under the same conditions.[182]

B. EPA's FS Presents Flawed Post-construction Risk Estimates

As discussed in Section I.A., EPA fails to maintain consistency with the BERA regarding benthic risk areas, and as a result, all FS estimates of the alternatives' ability to reduce benthic risks are incorrect. As demonstrated in Section I.C.1. EPA uses many PRGs that are inconsistent with the BLRAs and factors in virtually no risk management decisions, resulting in risk estimates that are misaligned with the findings of the BLRAs. As discussed in Section 1.C.2, EPA's incorrect PRGs combined with artificially inflated baseline SWACs create much higher estimates of baseline risks for Alternative A in the FS as compared to the baseline risks in the BLRAs. This approach also creates the appearance of greater risk reductions for the other alternatives than are possible, including unrealistic numbers of increased allowable fish meals as discussed in Section I.D. The overall result of these problems is that EPA repeatedly identifies large areas that are designated for active sediment cleanup where risks are either not present or cannot be meaningfully reduced through a sediment cleanup. A prime example of this is the application of PAH RALs in the navigation channel with no clear benefit as described in Section I.C.1.

Because of EPA's continual and compounding disregard for the methods and findings of the BLRA, all of the risk estimates presented in the 2016 draft Final FS are incorrect and generally portray inflated baseline risks and greater risk reductions than are possible or achievable. EPA cannot use the incorrect risk estimates to determine the relative effectiveness or risk reduction of any of the alternatives. And EPA has no foundation to reasonably decide whether any of its alternatives meet the threshold criteria of protectiveness or compliance with ARARs.

C. No Quantitative or Detailed Short-term Effectiveness Evaluation

As the LWG has previously commented,[183] guidance strongly recommends a comprehensive and quantitative evaluation of dredge release impacts:

- "Generally, the project manager should assess all causes of resuspension and realistically predict likely contaminant releases during a dredging operation."
- "To the extent possible, the project manager should estimate total dredging losses on a site-specific basis and consider them in the comparison of alternatives during the feasibility study."
- "Dredging residuals have been underestimated at some sites, even when obvious complicating factors are not present."
- "Project managers should be aware that most engineering measures implemented to reduce resuspension also reduce dredging efficiency. Estimates of production rates, cost, and project time frame should take these measures into account."

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[181] Attachment 21 builds on a capping demonstration decision tree developed by EPA in late 2015 for the FS but ultimately not included in the final FS.

[182] For example, EPA's Sediment Guidance, page iii states: "When evaluating alternatives with respect to effectiveness and permanence, it is important to remember that each of the three potential remedy approaches may be capable of reaching acceptable levels of effectiveness and permanence…" See also p. 3-2, "However, due to the limited number of approaches that may be available for contaminated sediment, generally project managers should evaluate each approach carefully, including the three major approaches (MNR, in-situ capping, and removal through dredging or excavation) at every sediment site at which they might be appropriate." See also p. 7-5, "Project managers should note that these characteristics are not requirements. It is important to remain flexible when evaluating sediment alternatives and when considering approaches that at first may not appear the most appropriate for a given environment. When an approach is selected for a site that has one or more site characteristics or conditions appearing problematic, additional engineering or ICs may be available to enhance the remedy."

[183] Letter to EPA, September 8, 2015, Re: List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)

- "The strategy for the project manager should be to minimize the resuspension levels generated by any specific dredge type, while also ensuring that the project can be implemented in a reasonable time frame."

EPA provides some discussion of dredge residuals and releases, but no new quantitative evaluations were added since the LWG's comments were submitted on the 2015 Draft FS. The general discussion provided in FS Appendix O and page 3-23 continues to rely on the findings of one project (Hudson River Phase 2) as the basis for its assumption that contaminant releases during dredging in Portland Harbor will be only 1% of the total contaminant mass dredged. This is three times lower than the 3% release rate recommended by the LWG in the 2012 Draft FS based on a review of numerous other recent contaminated sediment dredge projects. EPA further uses this one project to assume that most releases greater than 1% can be eliminated by quickly covering dredge residuals by applying daily clean cover. This assumption will require additional equipment to be available to place these materials or the dredge production rates need to be reduced, which is inconsistent with the 2016 draft Final FS-assumed 24 hours a day, 6 days a week dredging production rate (see Section IV.F). Thus, EPA is establishing a 1% release rate for Portland Harbor based on one project (Hudson River Phase 2) that appears to be one of the lowest release rates documented to date. Further, EPA is applying this optimistic release rate from a site that is entirely different both chemically and physically from Portland Harbor, which includes 10 river miles of highly varying physical and chemical conditions. Regardless of these general discussions, EPA never applies the assumed 1% release rate in any type of quantitative evaluation of dredging releases or the associated increases in fish tissue concentrations as documented on many other projects.[184] These projects document that fish tissue PCB levels typically increase dramatically during contaminated sediment dredging events and stay elevated for 3 to 5 years afterward. None of these likely impacts are quantified or factored into EPA's assumptions about allowable fish meals during and shortly after the construction period.

EPA also states on page 3-24 of the 2016 draft Final FS that residual covers should be applied on a daily basis, a requirement without precedent for a project of this scale. EPA also discusses many other water quality best management practices (BMPs), silt curtains, sheetpile walls, and other dredging water quality controls that are assumed to be employed either all the time or under various conditions. However, contrary to guidance (cited above) the effect of daily covers and this wide array of dredging controls on alternative costs and durations are not quantified or even discussed. The effects of all these controls on alternative cost, duration, and implementability are substantial and are not demonstrated in the 2012 LWG Draft FS to provide additional risk reduction.

For example, EPA assumes sheetpile barrier walls will be used anywhere that trace or greater levels of NAPL is present in water depths up to 50 feet (see 2016 draft Final FS Appendix O). Yet, the 2016 draft Final FS FS fails to incorporate into each alternative's duration the time to install and remove sheetpile walls or factor in the lower dredging production rates that occur in and around the confined space created. The costs of sheetpiles that EPA uses ($2,750 per linear foot) would not be sufficient for water depths approaching 40 to 50 feet; these depths would require a much more expensive cofferdam-type system and require site-specific engineering analyses to determine if they are even feasible. EPA also continues to depict (2016 draft Final FS FS Figure 3.4-33) sheetpiles in greater than 50 feet of actual water depth, which is technically infeasible. Figure 3.4-33 also implies that sheetpiles will be installed in the navigation channel, which would not be permitted by the U.S. Army Corps of Engineers (USACE) or U.S. Coast Guard, because it presents a hazard to navigation in an active vessel traffic lane. Sheetpiles would also impact or prevent ongoing shoreline water dependent operations and nearshore fish migration. EPA also fails to discuss that driving sheetpile walls can transport sediment contamination deeper into clean subsurface sediments or that removal of the sheetpile walls after construction will cause contaminated sediment releases as well. Finally, EPA never quantifies whether the additional cost of sheetpiles (including the impact of slower construction times on costs) is justified by their assumed additional effectiveness.

Other types of construction and short-term impacts could occur with all the alternatives, such as:

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[184] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; ITRC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.

- Potential risks to both construction workers and the general public from sediment removal, transload, transportation, and treatment
- Community impacts from multi-year dredging, capping, and transload operations on the river (e.g., recreational uses, light, and noise)
- Increased greenhouse gas and air pollution discharges
- Impacts to the community and commerce from increased river vessel traffic, community road truck traffic, and potential increased train traffic

EPA only briefly discusses these issues, and when they are discussed, EPA quickly transitions to biased explanations of how these impacts can be avoided or minimized (e.g., FS pages 4-34 through 4-38). Although EPA mentions that short-term impacts will be greater for larger alternatives, the pervasive explanations of minimization measures misleadingly makes these impacts all appear relatively inconsequential.

EPA does not perform any type of quantitative evaluation of dredge releases or other short-term impacts. Almost all of EPA's alternative comparison conclusions rest on simple comparisons of construction durations and the amount of materials handled. We note that EPA made numerous comments on the 2012 LWG Draft FS indicating that document spent too much time discussing durations of the alternatives,[185] even though that document included quantitative estimates of dredge releases, worker risks, community impacts, and air emissions, all of which are important to remedial alternatives evaluation and selection.

In comparison to the 2012 LWG Draft FS, EPA's short-term impact conclusions rely on little more than conjecture about construction durations. For example, EPA notes that "since Alternative I also involves less construction than Alternative E, Alternative I would have less short-term impact on the community, workers, and the environment." However, EPA's Proposed Plan Table 15 shows that Alternatives E and I receive the same overall short-term effectiveness score of "better," as does Alternative D. Alternative B, which has shorter durations and less material transport, recieves a score of "moderate" for unclear reasons. (No alternative receives the "best" score here, which is inconsistent with the other criteria scoring.) Regardless of the approach to evaluating short-term effectiveness, sound policy demands that risk be evaluated holistically and not in baseline and post-construction silos. If the objective is to prevent environmental morbidity and mortality, then the possible tradeoff related to occupational and implementation related injuries, disease, and deaths caused by the cleanup activities themselves must be explicitly taken into consideration in the cost-benefit analysis of the remedial alternatives.

D. <u>No Quantitative or Detailed Long-term Effectiveness Evaluation</u>

As discussed previously, EPA made the determination that no quantitative long-term modeling of the alternatives or natural recovery was possible for the Site. EPA's Sediment Guidance addresses the role of quantitative estimates in making these critical decisions:

> "The time needed until protection is achieved can be difficult to assess at sediment sites, especially where bioaccumulative contaminants are present. Generally, for sites where risk is due to contaminants in the food chain, time to achieve protection can be estimated using models. These models may have significant uncertainty, but may be useful for predicting whether or not there are significant differences between times to achieve protection using different alternatives. When comparing time to achieve protection from MNR to that for active remedies such as capping and dredging, it is generally important to include the time for design and implementation of the active remedies in the analysis."

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[185] "For example, the comparative evaluation of alternatives overemphasizes duration of cleanup in the evaluation of short-term impacts…" and "The FS bases a significant portion of the overall effectiveness evaluation on the duration of the cleanup." Letter from EPA to LWG December 18, 2012 regarding, Portland Harbor Superfund Site, Administrative Order on Consent for Remedial Investigation and Feasibility Study: Docket No. CERCLA-10-2001-0240 EPA Comments on the Portland Harbor RI/FS Draft Feasibility Study (March 30, 2012).

This guidance is particularly relevant for large and complex sites like Portland Harbor where uncertainties are often greater and quantitative estimates help to understand those site uncertainties and better support appropriate remedy decision-making. For example, EPA Region 10 recently completed decision-making using such quantitative approaches for the similarly complex Lower Duwamish Waterway Superfund site.[186]

The absence of quantitative evaluations is the result of rejecting empirical data collection and modeling studies that the LWG conducted in coordination with EPA and under its interim approvals and for the express purpose of informing the RI/FS.[187] EPA's ultimate rejection of LWG's proposed QEAFATE model only came after years of discussion and refinements to that model based on EPA's detailed comments. EPA made little earnest attempt to replace that model with another form of quantitative long-term estimate. For example, EPA rejected its own SEDCAM modeling results and USACE particle tracking models and then failed to consider simple quantification techniques like the half-life estimates discussed in Section V.C.

As a result, and despite the fact that EPA acknowledges that natural recovery is occurring at the Site,[188] EPA is reduced to assuming that:

- Immediate post-construction sediment SWACs are the only available means to quantify the long-term effectiveness of the alternatives, which EPA acknowledges is not an actual long-term measure of the alternatives.

- These immediate post-construction SWACs will remain constant for all alternatives until construction commences, despite EPA identifying the need for multiple years of post-ROD assessment and pre-design data collection and the fact that alternatives that involve more construction will likely take longer to design than alternatives that require less construction.

- SWACs will remain constant during the time of construction even though some areas will not be actively remediated and will obviously undergo natural recovery to the extent that is expected for any given area.

- Immediate post-construction SWACs are static relative to each other even over long periods of time. For example, EPA assumes the estimated post-construction SWACs for Alternative B, with an estimated 4-year construction period, can somehow be compared directly to Alternative I, with an estimated 7-year construction period, or Alternative H, with an estimated 62-year construction period.

These assumptions greatly simplify the alternatives analyses, but they have no basis in reality and are directly contrary to guidance.

The assumption that SWACs remain constant until construction commences is particularly problematic. EPA describes the construction timeframes for all alternatives to be preceded by a "Year 0" condition.[189] This Year 0 is described as including the following work:

- Establishment of initial conditions: "Monitoring (sampling) of sediment, water, biota, and pore water will need to be the first phase, and it will encompass the entire Site to establish a baseline and delineate the SMAs for construction. It is expected that <u>this phase will take 3 to 5 years</u>."

- Construction of an on-site material handling/treatment facility

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[186] Record of Decision. Lower Duwamish Waterway Superfund Site. EPA, Region 10. November 2014.
[187] During this same period, EPA was only able to express ever increasing uncertainty about every empirical data collection effort it approved and oversaw, including one of the most detailed time series bathymetry data sets (showing widespread deposition) ever collected for a sediment Superfund site, high resolution grain size sampling, sediment trap and suspended sediment data, subsurface sediment concentration profiles, radio-isotope cores, disaggregated surface sediment data, time series fish tissue data (including the 2012 smallmouth data collection EPA itself conceived and attempted to execute), and other data.
[188] 2016 draft Final FS p. 3-33.
[189] 2016 draft Final FS p. 3-41 (emphasis added).

- Start-up activities and mobilization, including pre-design investigations
- And the first year of construction: "Year 0 is the first year of construction."

This conceptual timeline does not include any explicit time for completion of the ROD and Consent Decrees. It also does not include time for remedial design, which usually proceeds in at least three EPA review steps (e.g. 30, 70, 100% design). At the most optimistic, the assumptions lead to construction starting no sooner than 5 to 7 years from the ROD. Given EPA assumes that the PRGs will be achieved in 30 years (and as discussed in Section V.C, this equates to a natural recovery half-life of about 10 years), the Site sediment concentrations will have decreased by at least an additional 25% before construction starts. Thus, once initial conditions are set, it will be time to conduct another round of initial condition sampling. More importantly, EPA does not appear to have given any meaningful consideration to pre- or post-construction time periods when evaluating the relative performance of its alternatives. EPA should provide a realistic vision and timeframe for implementation of its alternatives, including the time prior to construction. EPA should clearly identify in its alternatives development and decision trees that sediment management areas and technology assignments and process options will be refined and adjusted through site-specific remedial design and implementation, because the Site is sure to have changed substantially in the time between the ROD and construction.

EPA converted immediate post-construction SWACs to risk estimates by comparing PRGs, many of which are inconsistent with the risk assessments, using spatial scales that are also inconsistent with the risk assessments. EPA also made analogous estimates for fish tissue and surface water that rely on the same immediate post-construction SWACs, and as a result, these estimates are equally useless to assess long-term effectiveness of the alternatives. Some of the problems associated with the tissue estimates are discussed in Section I.C.2.b, and the additional errors involved in EPA's surface water estimates from Appendix K are discussed in Section I.B and are not repeated here.

Rather than actually quantitatively evaluating long-term effectiveness, EPA's new approach for the 2016 draft Final FS uses interim targets, which are basically 10 times its PRGs. EPA then compared immediate post-construction risks to these interim targets for evaluating the "overall protection of human health and the environment" for each alternative. EPA states that if alternatives meet these interim targets, it is reasonable to assume the PRGs will be met through subsequent natural recovery in 30 years.[190] This assumption is justified only by saying that it is "commensurate with the site-specific contaminants and conditions." Particularly in the absence of a coherent CSM, EPA cannot simultaneously claim that it cannot quantitatively estimate MNR and then decide that MNR will work in 30 years. This global assumption also hides a second and equally important and unsupported assumption that EPA's PRGs can eventually be achieved through a sediment remedy. As the equilibrium analyses discussed above demonstrate, many of EPA's PRGs are not achievable even over the very long term. EPA never explains why these assumptions and flawed associated analyses are technically superior to either the LWG's effectiveness evaluations or its own prior evaluations in the 2015 EPA Draft FS.

Even within EPA's interim targets approach to evaluating effectiveness, there are internal inconsistencies. For example, the Preferred Alternative does not meet the interim targets for RAOs 1, 2, and 6 (Proposed Plan pp. 51-52). Likewise, Figure 4.2-4 of the 2016 draft Final FS shows none of the alternatives meet the interim targets (except Alternative G) ,and Figure 4.2-2 shows a similar result (no alternatives except Alternatives F and G meet the interim target). And for most of the other RAOs, there is either "insufficient information" to determine whether Alternative I meets EPA's interim targets, or only qualitative comparisons between alternatives, such as "[p]ost-construction, the estimated contaminated groundwater area addressed by each alternative increases as the footprint of the SMAs increases."

[190] Draft Final FS p. 4-6: "As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions. These interim targets are higher than residual risks once PRGs are achieved, and assume that further reductions will be achieved through MNR."

Ultimately, EPA simply abandons any effort to consider long-term effectiveness beyond its assumed construction durations. EPA notes in the Proposed Plan that Alternatives D, E, and I have roughly the same MNR footprint.[191] However, Alternative D is ranked *low* and Alternatives E and I are ranked *moderate* in Proposed Plan Table 15. To the extent this conclusion is based on EPA's stated goal in the Proposed Plan (page 63) to "maximize permanence through removal of highly contaminated sediment" this conclusion is directly contradictory to guidance, which is clear that mass removal is not an appropriate way to evaluate sediment remediation alternatives; rather the evaluation must address reduction in risk.[192]

Finally, EPA's FS does not quantify or otherwise estimate the performance of enhanced natural recovery (ENR) in SIL SDU either in terms of sediment SWACs or post-construction risks. EPA identified ENR as an applicable technology for SIL in all alternatives considered in the FS, with ENR covering more than 60% of the SDU for Alternative I. ENR is a commonly employed remedial alternative for contaminated sediment sites. It refers to accelerating the natural recovery process by engineering means and includes adding a thin layer of clean sediment and/or additives to enhance contaminant degradation. The 2016 draft Final FS concludes that ENR is expected to meet RAOs in SIL. It provides that the thickness and composition of the ENR layer will be determined during remedial design but that a 12-inch layer is expected to be sufficient.

Despite EPA's conclusions regarding the applicability and effectiveness of ENR in the SIL environment, EPA has arbitrarily ignored the impact of ENR on reducing PCB SWACs and corresponding risks. That is, SWAC and risk calculations reported for the SIL area by EPA in the FS simply do not reflect any benefit expected to be achieved by ENR. EPA's failure to evaluate the impact of ENR on risk results in an incomplete analysis of effectiveness for all alternatives and therefore prevents a meaningful comparison among the alternatives in accordance with the NCP. It is also contrary to EPA's 2015 Draft FS, which explicitly considered the effect of ENR on the SWAC. EPA has failed to provide any reason for its change in position from the 2015 Draft FS. Furthermore, ENR (including the potential for an additive to enhance contaminant degradation or sequestration) contributes significantly to the overall costs of a remedy. Therefore, its effect on risk reduction must be considered when evaluating the cost-effectiveness of remedial alternatives.

E. EPA Ignores Recent Data that Aid in Long-term Effectiveness Evaluations

There is substantial evidence that important chemical characteristics of the Lower Willamette River have changed significantly since the RI.[193] Analyses of the 2012 smallmouth bass data (submitted to EPA) strongly suggest the Site is already approaching equilibrium levels in some areas of the Site. Because that analysis also suggests that the half-life of the process is about 10 years, which is consistent with the recovery rate that EPA must have used as the basis for its assumption that a PCB PRG of 9 ppb can be reached in 30 years,[194] it appears likely that a large proportion of the surface sediments at the Site will be at or near equilibrium levels by the time of remedy implementation, thus eliminating the need for an aggressive cleanup approach such as Alternative I. As noted above, based on a realistic assessment of EPA's timeframe until construction start, Site concentrations are likely to be around 25% lower than the already much lower 2012 estimate. The 2014 PCB sediment data yield similar conclusions.

Because of the relationship between RALs and natural recovery (RALs delineate active construction areas from natural recovery areas), RALs are sensitive to SWAC changes caused by natural recovery. As the Site recovers before construction, the same RALs will delineate ever smaller areas of active construction until equilibrium is reached. Failure to recognize these ongoing processes will cause errors in the selection of the most cost-effective alternative as well as in the assignment of remedial technologies in the absence of flexibility during remedial design to adjust to changing river conditions. Yet, EPA's 2016 draft Final FS and Proposed Plan provide no clear

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[191] Proposed Plan, p. 61.
[192] Sediment Guidance, p.7-1 and p. 7-16.
[193] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis," a presentation file from Anchor QEA provided to EPA on March 18, 2013.
[194] Using Alternative I (the preferred alternative), EPA estimates a post-construction SWAC of 40 ppb at construction completion, which is 7 years after construction started. In order to reach a level of 9 ppb in the 23 years remaining within EPA's 30-year assumption, the site-wide concentration would need to halve every 10 years. This equates to 20 ppb at 17 years after construction started and 10 ppb at 27 years after construction started. Consequently, 9 ppb would be achieved at about 28 years after construction started.

description of how any future design adjustments might impact alternative selection now, what site-specific remedy adjustments will be allowed in the remedial design phase, how those adjustments would be determined, and what procedural steps would be needed (e.g., part of design decisions, Explanation of Significant Difference, or ROD amendments). Instead, the Proposed Plan describes technology assignments based on FS-level screening criteria that apparently will be entirely prescriptive during remedial design regardless of how the Site might evolve over time.

F. EPA Systematically Underestimates Costs and Durations

EPA's estimated costs for performing each of the alternatives continue to omit significant cost elements, including EPA's anticipated "initial conditions" sampling, sufficient pre-remedial engineering design investigations, Oregon Department of State Lands access, lease and easement fees, and agency oversight and participation costs (which alone have amounted to more than 27% of the LWG'S RI/FS costs to date). EPA also dramatically underestimates other cost elements on the basis of unrealistic and, in some cases, impossible assumptions about dredge and cap production rates and volumes, remediation waste processing, engineering design, construction management, BMPs EPA intends to require, and the present value of money (including the cost of financial assurance).

As EPA itself notes, "[c]ost is a central factor in all Superfund remedy selection decisions." Cost estimates are developed at different stages of the Superfund process and are dependent on and have a direct relationship with project definition and design. The cost estimate of the Preferred Alternative is usually transferred from the FS to the Proposed Plan and further included in the ROD, subject to any modifications resulting from the public comment process or the availability of new information.

During the FS phase, cost estimates are developed for the purpose of "comparing remedial alternatives during the remedy selection process...." Cost estimates are prepared during the "development and screening of alternatives" stage, as well as during the "detailed analysis of alternatives" stage. "Screening-level cost estimates are used to screen out disproportionately expensive alternatives in determining what alternatives should be retained for detailed analysis," while estimates generated during the "detailed analysis" stage are "used to compare alternatives and support remedy selection." EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* describes data sources that should be used to generate cost estimates, which include "cost curves, generic unit costs, vendor information, standard cost estimating guides, historical cost data, and estimates for similar projects, as modified for the specific site."

Overall, properly evaluating the cost and cost-effectiveness of each remedial alternative is crucial to ensuring compliance with CERCLA and NCP directives. Regardless of the relevant FS stage, cost estimates "should clearly present" the "expected accuracy range of the cost estimate." The expected accuracy range of cost estimates generated during the "screening of alternatives" phase is -50 to +100%, while the expected accuracy range of cost estimates generated during the "detailed analysis of alternatives" phase is -30 to +50%.

1. Correcting Significant Errors in EPA's Cost Estimates Results in Cost and Duration Projections more than Double EPA's Estimates

An accurate estimate demonstrates that EPA's proposed remedy is more likely to cost close to $1.8 billion (net present value)—more than double EPA's estimate of $811 million (net present value). Attachment 22 presents a side-by-side comparison of EPA's approach to major cost items with LWG's approach.[195] This comparison is summarized in Table 5. The areas of difference most significant to the overall discrepancy between EPA's and the LWG's cost estimates include production rates, volume estimates for capping, use of sheetpile walls, mobilization and demobilization, and design and contingency cost percentages.

EPA's June 2016 cost estimate reduced the publicly announced cost of the remedy without actually changing many significant elements of the remedy. When EPA presented its Preferred Alternative to the NRRB in November 2015, it estimated a cost of $1.5 billion. When EPA proposed virtually the same alternative on June 8, 2016, the cost was

[195] The LWG follows EPA's approach of using a certain cost for each line item. In fact, of course, there is variability and uncertainty in each cost projection. Attachment 23, LWG memorandum on EPA Cost Sensitivity Evaluation (September 6, 2016) evaluates the impacts of these uncertainties.

$811 million—nearly a 50% decrease from what EPA had estimated in November. A couple of material, but isolated, changes to the remedy approach contributed to the decrease (such as the assumed method of PTW ex situ treatment). But without any other significant changes to the key drivers of remedy cost—like significant changes in the volume of material to be dredged and disposed of—it was not clear how the remedy cost estimate decreased by hundreds of millions of dollars.

EPA did choose estimates at the low end of EPA-recommended ranges for many cost assumptions. For contingency assumptions, EPA modified contingency percentages to the low end of the recommended range on the grounds of the remedy's high cost and the detailed technology assignment modeling in the FS. In reality, the size, uncertainty and complexity of Portland Harbor warrants contingency percentages at least in the middle of the range. For remedial design, EPA guidance recommends 6% of capital cost, yet EPA selected 2%. Reasonable estimates for these two factors alone contribute an additional $375 million to the remedy cost estimate.

Table 5. Comparison of EPA and LWG Cost Approach.

Capital Costs			
Item	**EPA**	**LWG**	**Difference**
Direct Costs			
Mobilization/Demobilization	$9,045,000	$42,784,000	$33,700,000
Debris Removal and Disposal	$3,827,000	$3,779,000	$0
Obstruction Removal and Relocation	$15,146,000	$14,955,000	-$200,000
Erosion/Residual Control Measures (Dredge Water Quality Controls)	$25,228,000	$136,546,000	$111,300,000
Dredging of Contaminated Sediments (Open Water)	$38,183,000	$28,889,000	-$9,300,000
Dredging of Contaminated Sediments (Confined)	$2,897,000	$63,343,000	$60,400,000
Excavation of Riverbanks	$533,000	$3,337,000	$2,800,000
Dewatering and Water Treatment for Dredging Operations	$7,261,000	$31,465,000	$24,200,000
Subtitle C/TSCA Disposal	$68,536,000	$81,961,000	$13,400,000
Subtitle D Disposal	$280,706,000	$302,648,000	$21,900,000
Mitigation	$36,408,000	$62,900,000	$26,500,000
DSL Costs	-	$8,616,000	$8,616,000
Sand Placement for Technology Assignments	$20,353,000	$38,678,000	$18,300,000
Beach Mix Placement for Technology Assignments	$3,635,000	$11,425,000	$7,800,000
Armor Placement for Technology Assignments	$5,803,000	$16,473,000	$10,700,000
Reactive/GAC Placement for Technology Assignments	$44,759,000	$94,945,000	$50,200,000
Geofabric for Riverbanks	$303,000	$304,000	$0
Organoclay Mat Placement for Technology Assignments	$1,173,000	$1,159,000	$0
Transload Facility Development	$10,529,000	$37,660,000	$27,100,000
Subtotal	**$574,325,000**	**$981,867,000**	**$407,500,000**
Contingency	$114,865,000	$392,747,000	$277,900,000
Direct Cost Subtotal	**$689,190,000**	**$1,374,614,000**	**$685,400,000**
Indirect Costs			
Remedial Design	$13,784,000	$100,000,000	$86,200,000
Project Management	$13,784,000	-	$36,399,000
Responsible Party Oversight and Project Management	-	$29,432,000	
Agency Oversight and Project Management	-	$16,848,000	
Engineering Support During Construction	-	$9,204,000	
Contractor Project Management	-	$15,375,000	
Construction Management	$20,676,000	-	
Special Insurance and Bonding	-	$68,731,000	$68,731,000

Capital Costs			
Item	**EPA**	**LWG**	**Difference**
Indirect Cost Subtotal	**$48,244,000**	**$239,590,000**	**$191,300,000**
TOTAL CAPITAL COST	**$737,434,000**	**$1,614,204,000**	**$876,800,000**
NPV Cost	**$811,299,000**	**$1,772,629,000**	**$961,300,000**

Estimated Removal Volume (cy)	1,752,000	2,080,000	328,000
Estimated Total Cap Volume (cy)	814,000	1,230,000	416,000
Estimated Duration (Seasons)	7	15	8

Other Capital Costs			
Item	**EPA**	**LWG**	**Notes**
Establish Institutional Controls	$3,726,000	$11,020,000	EPA over construction duration; LWG Year 0
Initial MNR Monitoring	$10,197,000	$10,795,000	EPA/LWG Year 0
Periodic Costs			
Item	**EPA**	**LWG**	**Notes**
Long-term Monitoring and MNR	$38,426,000	$45,137,000	EPA/LWG Years 2, 4, 6, 8, 10, 14, 18, 22, 26, 30
Long-term O&M (Caps) and Institutional Controls	$5,972,000	-	EPA every 5 years
Long-term O&M (Caps)	-	$13,303,000	LWG years 5 and 10 only
Long-term Institutional Controls	-	$650,000	LWG every year after 5 years of construction
Long-term Institutional Controls	-	$50,000	LWG every 5 years
5-year Site Review	$308,000	$341,000	EPA/LWG every 5 years

Notes:
CY - cubic yard
DMM - dredge material management
DSL - Oregon Department of State Lands
EPA - U.S. Environmental Protection Agency
GAC - granular activated carbon
LWG - Lower Willamette Group
MNR - monitored natural recovery
NPV - net present value
O&M - Operations and Maintenance
TSCA - Toxic Substances Control Act

EPA's cost estimates also do not include any specific estimate of the costs for oversight of remedy implementation by EPA, DEQ, and the PRPs performing the remedy. EPA assumed rough total percentages for project management and construction management costs, totaling approximately $34.3 million for Alternative I. Based on historical agency oversight costs charged to the LWG during the RI/FS process, plus costs based on similar projects for responsible party oversight and contractor/construction management, the LWG's estimate for this cost category is double what EPA assumed.

The present value cost of a remedy that takes close to a decade, or more, to construct is heavily influenced by the discount rate. For Portland Harbor, EPA used a 7% discount rate, as suggested by 2000 guidance.[196] In its recent

[196] *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. USEPA 540-R-00-002 OSE 9355.0-75. July 2000.

Lower Duwamish Waterway FS, EPA used the discount rate of 2.3%, taken from the Office of Management and Budget Circular A-94, per EPA guidance.[197] The equivalent treasury rate for 2016 is 1.5%, which is a much more appropriate discount rate at a site where the PRPs include the United States, the State of Oregon, municipalities, public utilities, and many parties whose principal or only source of funding for cleanup are insurance funds outside their investment control. It is also the rate that EPA would presumably use in calculating required financial assurance: "The Agency believes that [financial assurance] based on a 7% discount rate could be insufficient to perform the work because funds called in from FA mechanisms are typically deposited into 'special accounts' or standby trusts, which are unlikely to grow at this annualized real rate."[198] The cost of EPA's typically required financial assurance mechanisms, such as trust funds, letters of credit, and surety bonds, far more accurately reflects actual remediation costs than hypothetical available returns on investment in the financial market. The consequence is to skew present value cost estimates low, particularly for alternatives of long duration, and make highly dredging-intensive remedies appear more cost-effective relative to other alternatives with shorter construction durations. Many other contributing factors are explained in detail in Attachments 22 and 23.

Construction durations are also significantly underestimated in EPA's analysis. Anchor QEA, LLC's review demonstrates that EPA's dredge production volumes, based on assumptions of 24 hours a day, 6 days a week dredging using incorrect dredging technology and less constrained offloading capacity, are significantly higher than what is feasible in Portland Harbor. The LWG assumed 1,600 cubic yards per day of dredging and 104 construction days per season, while EPA assumed 5,100 cubic yards per day of dredging and 122 construction days per season. As a result of these and other assumptions, the LWG assumes that construction durations for each alternative are roughly double what EPA assumed—meaning that Alternative I would take 14 years, not 7 years, to construct.

G. EPA Fails to Fully Consider Many Implementability Challenges

Just as EPA fails to accurately describe short-term impacts and realistic durations associated with the alternatives, it also fails to thoroughly describe and consider parameters associated with the implementability of the remedial alternatives. This includes, but is not limited to:

- Identifying and staging realistic sediment transload and water and sediment treatment facilities
- Evaluating whether dredge production rates included in the EPA 2016 draft Final FS can be maintained over the entire project schedule (e.g., contingencies for weather and equipment maintenance or breakdown and repair)
- Obtaining community acceptance, particularly of short-term impacts such as noise, light, and vehicle traffic
- Placing obstructions to the navigation channel and the requirements to move the dredge and its support vessels and structures to allow for the passage of ship traffic on an ongoing and continuous basis. (An illustration of the impact of passing vessels on dredging can be found at http://dofnw.com/animation/)
- Potentially treating large quantities of sediment

V. EPA Has Failed to Perform Even a Perfunctory Cost-effectiveness Analysis

CERCLA requires that remedies be cost-effective. In the Proposed Plan, EPA failed to perform even a perfunctory cost-effectiveness analysis and only purported to compare Alternatives E and I. A factually supported, quantitative analysis of cost-effectiveness, based on measures of effectiveness that are consistent with the NCP, reveals that the increased cost of dredging-intensive remedies, including Alternatives E and I, is not proportional to increased effectiveness when compared with less costly alternatives. EPA's has failed to demonstrate that Alternative I is cost-effective.

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[197] Final Feasibility Study, Lower Duwamish Waterway Group (October 31, 2012), Appendix I, page I-5.
[198] *Guidance on Financial Assurance in Superfund Settlement Agreements and Unilateral Administrative Orders* (EPA, April 6, 2015).

A. CERCLA, the NCP, and EPA Guidance Require that Remedies Be Cost-effective

Cost plays an integral role in the Superfund remedy selection process, as demonstrated by CERCLA, the NCP, and EPA's own guidance.[199] CERCLA requires EPA to choose a remedy "that is protective of human health and the environment, *that is cost-effective*, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable."[200]

To that end, the NCP places emphasis on cost-effectiveness at various stages throughout the remediation process. The NCP preamble explains, "[i]n analyzing an individual alternative, the decision-maker should compare...the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness."[201] Furthermore, "if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist," and "[t]he more expensive remedy may not be cost-effective."[202]

With respect to the development and screening of remedial alternatives during the FS, the NCP allows for the elimination of alternatives that are not cost-effective. Specifically, the NCP provides: "[t]he costs of construction and any long-term costs to operate and maintain the alternatives shall be considered. Costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated."[203]

Cost-effectiveness is also emphasized during the detailed analysis of alternatives stage of the FS, with cost being listed as one of the nine criteria required to be evaluated for each alternative.[204] With respect to the selection of a remedy, the NCP requires that "[e]ach remedial action selected *shall* be cost-effective," so long as the threshold criteria of protectiveness and compliance with ARARs are met.[205] "Cost-effectiveness is determined by evaluating the following three of the five balancing criteria… to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective."[206] "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness."[207]

EPA guidance reinforces the need to weigh remedial alternative cost against incremental risk reduction, stating that "[t]he evaluation of an alternative's cost-effectiveness is usually concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs when compared to other available options."[208] A "[c]areful evaluation of site risks…help[s] to prevent implementation of costly remediation programs that may not be warranted."[209]

B. EPA Failed to Perform Even a Perfunctory Cost-effectiveness Analysis in the Proposed Plan

The Proposed Plan presents a "Rationale for Selecting the Preferred Alternative," which would be the appropriate section to compare and contrast the cost-effectiveness of the remedial alternatives. However, EPA fails to perform

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[199] EPA, *The Role of Cost in the Superfund Remedy Selection Process*, Publication 9200.3-23FS, 1 (Sept. 1996).
[200] 42 U.S.C. § 9621(b)(1) (emphasis added).
[201] 55 Fed. Reg. 8728.
[202] *Id.*
[203] 40 CFR § 300.430(e)(7)(iii). As the LWG previously commented, EPA's screening out of Alternative C in 2015 Draft FS Section 3 is inconsistent with guidance. Alternative C provides moderately better risk reduction than Alternative B at moderately additional cost. See Section 3 and 4 comments submitted by LWG to EPA on October 9, 2015.
[204] 40 CFR § 300.430(e)(9)(ii).
[205] 40 CFR 300.430(f)(1)(ii)(D) (emphasis added); *see also U.S. v. Am. Cyanamid Co.*, 786 F.Supp. 152 (D.R.I. 1992) ("The NCP directs EPA to prospectively choose a remedial action that EPA believes will clean-up the site for the least cost.").
[206] 40 CFR Section 300.430(f)(1)(ii)(D).
[207] *Id.*
[208] EPA, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, OSWER 9355.0-85, 7-3 (Dec. 2005).
[209] EPA, *The Role of Cost in the Superfund Remedy Selection Process*, Publication 9200.3-23FS, 2 (Sept. 1996).

this required exercise. EPA Region 10 has previously stated that the correct place for cost-effectiveness evaluations, per the NCP, is after the FS (e.g., in the Proposed Plan).[210]

The Proposed Plan only compares Alternatives E and I. It does not measure, graph, evaluate, or compare the cost-effectiveness between or among any of the other alternatives. Alternatives B, D, F, and G are dismissed in two cursory sentences. Alternatives B and D because they "may not be [sic] meet the first threshold criteria,"[211] and Alternatives F and G because they "involve a significantly greater amount of construction area, time, impact to the environment and the community and cost more." [212] EPA's Proposed Plan ignores the NCP and guidance requirements that EPA compare all alternatives' "incremental cost differences in relation to incremental differences in effectiveness,"[213] and thereby fails to satisfy CERCLA's requirement that the selected remedy be cost-effective.

Even as to the very similar Alternatives E and I, EPA's limited reference to cost-effectiveness is insufficient to comply with CERCLA and the NCP's requirements that the selected remedy be cost-effective. The Proposed Plan devotes less than a page to the comparison between Alternatives E and I, summarily concluding that "Alternative I… is a more cost-effective alternative because it involves approximately 40 fewer acres of dredging in the navigation channel… and is approximately $58M less than Alternative E while achieving the same risk reduction."[214]

As demonstrated below, if EPA had performed a cost-effectiveness analysis among the alternatives, it would be apparent that Alternative I is not cost-effective relative to lower cost alternatives that achieve the same levels of effectiveness.

C. Major Deficiencies in EPA's Effectiveness Analysis Must Be Corrected to Rationally Evaluate Cost-effectiveness

To perform the NCP-required analysis of incremental cost differences in relation to incremental differences in effectiveness, EPA must have a valid analysis of short- and long-term effectiveness, which are two of the three balancing criteria used to determine overall effectiveness. Overall effectiveness is compared to cost to ensure that the remedy is cost-effective.[215]

EPA scarcely addresses these required elements of overall effectiveness, as discussed in Section IV. Instead, EPA's effectiveness analysis is limited to comparing SWACs (and resulting expected fish tissue concentrations) immediately after construction. The Proposed Plan provides that "[t]he effectiveness of each remedial alternative is evaluated in part by comparing each alternative's post-construction [SWAC] to the PRGs for each RAO in the SDUs."[216] This comparison is intended to "provide [] an assessment of how the different alternatives reduce sediment contaminant concentrations, which can then be used to calculate reductions in contaminant concentrations in fish tissue."[217]

It is inappropriate for EPA to evaluate overall effectiveness based only on SWACs immediately after construction, because EPA fails to consider the post-construction natural recovery and ENR that EPA suggests will meet PRGs in the long term. As discussed in Section IV.D, to analyze relative long-term effectiveness, EPA abandons quantitative estimates based on a calibrated and validated long-term model, and then replaces those estimates with the assumption that the Site will recover in 30 years, which is an assumption for which EPA does not provide a rationale.

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[210] Kristine Koch of EPA provided this answer in response to questions during EPA and LWG FS rollout meetings on August 3, 2015 about the absence of cost-effectiveness discussions in the 2016 FS.
[211] We disagree. See Section I.A, supra.
[212] Proposed Plan at 66.
[213] 55 Fed. Reg. 8728.
[214] Proposed Plan at 67.
[215] 40 CFR § 300.430(f)(1)(ii)(D).
[216] Proposed Plan at 49.
[217] Proposed Plan at 49.

Setting aside questions about the validity of predictive long-term models, the analysis below provides long-term SWAC estimates that are consistent with EPA's assumption that Alternative I would meet PRGs in 30 years. This analysis was accomplished by calculating the PCB half-life in Site sediments that would achieve EPA's PCB PRG of 9 ppb[218] in 30 years for Alternative I, which works out to a half-life of about 10 years.[219] This half-life was then applied to each alternative for comparative purposes. In addition to being derived from EPA's conclusion, this estimated rate of natural recovery is supported by empirical data from smallmouth bass fish tissue collected in 2002, 2007, and 2012.[220] Recent 2014 PCB sediment data appear to confirm the validity of this half-life estimate.[221] So, although EPA does not provide any explicit rationale for the 30-year recovery assumption in the Proposed Plan, that assumption appears consistent with valid estimates of the Site recovery rate based on empirical data that do not rely on predictive models.

Table 6 depicts SWAC estimates using this method, from the completion of construction of each alternative (according to EPA's estimates) to Year 30. Table 6 uses EPA's very optimistic construction durations (based on continuous dredging) and conservative initial condition SWAC of 208 ppb for PCBs (EPA 2016 SWAC), which is much higher than the SWAC of 85 ppb used in the EPA 2015 Draft FS (EPA 2015 SWAC). As discussed in Section I.C.2.b, the EPA 2016 SWAC results in risks that are inconsistent with the BLRAs and actual initial conditions are likely much lower. Table 6 also factors in the LWG's estimated Site PCB equilibrium of 20 ppb, which is the lowest likely achievable Site concentration based on the LWG's analysis of upstream PCB inputs to the Site.[222]

Table 6 demonstrates that Alternatives B and D reach a SWAC within 20% of EPA's post-construction SWAC estimate for Alternatives E and I (40 ppb) by Years 11-13—just 4 to 6 years after EPA estimates construction of Alternatives E and I would be complete. (EPA's accepted analytical accuracy for most organic compounds is at least 20%, and it is higher for most PCB measurements.[223]) Further, as noted by the green highlighted cells in Table 6, Alternatives E and I would be within the Site equilibrium range (20 to 24 ppb) as little as 1 year sooner than Alternative D and as little as 3 years sooner than Alternative B.

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[218] Note that the LWG disagrees that a long-term concentration of 9 ppb PCBs is actually achievable. The analysis below also considers that the long-term PCB equilibrium for the Site is likely to be no lower than 20 ppb (as supported by the analysis in "Sediment Equilibrium Estimates for the Revised Feasibility Study" (LWG, August 7, 2014.)

[219] Using Alternative 1 (the preferred alternative), EPA estimates a post-construction SWAC of 40 ppb at construction completion, which is 7 years after construction started. In order to reach a level of 9 ppb in the 23 years remaining within EPA's 30-year assumption, the site-wide concentration would need to halve every 10 years. This equates to 20 ppb at 17 years after construction started and 10 ppb at 27 years after construction started. Consequently, 9 ppb would be achieved at about 28 years after construction started.

[220] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)

[221] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015). (Attachment 2)

[222] *Sediment Equilibrium Estimates for the Revised Feasibility Study* (LWG, August 7, 2014).

[223] Kennedy/Jenks and Integral, 2005. Portland Harbor RI/FS Round 2 Surface Sediment PCB Congeners Sample Selection Memo. Prepared for the Lower Willamette Group, Portland, OR. June 10, 2005; USEPA 2008. USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. OSWER 9240.1-48; USEPA-540-R-08-01.]

Table 6. PCB SWACs (ppb) Comparison Using EPA's 24 hour/day Assumption for Alternative Durations (using EPA's 2016 initial SWAC of 208 ppb).

EPA Alternatives	Years																													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A (no action)	208	194	180	168	156	145	135	126	117	109	101	94	88	82	76	71	66	61	57	53	49	46	43	40	37	35	32	30	28	26
B				74	69	64	60	56	52	48	45	42	39	36	34	31	29	27	25	23	22	20	20	20	20	20	20	20	20	20
D						56	52	49	45	42	39	36	34	32	29	27	25	24	22	20	20	20	20	20	20	20	20	20	20	20
E/I							40	37	35	32	30	28	26	24	23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20
F													23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
G																			20	20	20	20	20	20	20	20	20	20	20	20

Notes

	Duration of alternative construction
XX	Year construction is completed and EPA estimated SWAC at that time.
XX	Using an estimated natural recovery rate, the years that the alternative achieves a concentration approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds). This equates to a concentration range of 20 to 24 ppb (i.e., 24 ppb is plus 20% of the equilibrium value of 20 ppb).

Measures of effectiveness over time depend significantly on the accuracy of construction duration estimates. As discussed in Section V.F, the LWG concludes that construction of EPA's alternatives is likely to take twice as long as EPA estimates. Table 7 uses the same methodology described above but assumes construction durations twice as long as EPA's, such that Alternatives E and I would be complete in Year 14. In addition, Table 7 initial SWACs are based on the EPA 2015 FS initial SWAC of 85 ppb, which is consistent with the BLRAs.

Table 7 demonstrates that Alternatives B and D reach a SWAC within 20% of EPA's post-construction SWAC estimate (from EPA's 2015 Draft FS) for Alternatives E and I (31 ppb) by approximately the same time that Alternatives E and I complete construction. Further, Alternatives B, D, E, and I all enter the equilibrium range (green range from 20 to 24 ppb) at about the same time (as does the no action Alternative A). This indicates that, when uncertainties associated with construction duration are accounted for, Alternatives B and D are equally effective as Alternative I, while including far less active remediation and construction.

Taking into account EPA's own 30-year recovery assumption and acknowledging the uncertainties associated with construction duration, Alternative I is highly unlikely to achieve measurably lower SWACs meaningfully sooner than other, less costly alternatives.

Further, the real world consequences of these differences in SWACs are minimal. Table 8 depicts the fish meals per month that children could safely consume (non-cancer risk) at various years after the start of remedy construction.[224] Table 8 uses EPA's starting SWAC of 208 ppb and assumed construction durations based on work proceeding 24 hours per day. Similar to the SWAC analyses above, Alternatives E and I would attain 4.3 fish meals per year immediately after construction by Year 7, and Alternative B and D would achieve the same level of fish consumption in just a few years later (by Years 11 to 13).[225]

However, Alternatives E and I would require much lower fish consumption levels[226] during an additional 3 years of construction as compared to Alternative B. Factoring in fish meals during construction, the <u>average</u> fish meals per year allowed under each alternative over the entire 30-year period shown in Table 8 would be:

- Alternative A – 2.7 fish meals/year
- Alternative B – 5.6 fish meals/year
- Alternative D – 5.9 fish meals/year
- Alternatives E and I – 6.6 fish meals/year
- Alternative F – 5.7 fish meals/year
- Alternative G – 4.1 fish meals/year

[224] As noted previously, EPA focuses many of the 2016 draft Final FS and Proposed Plan discussions on allowable fish meals for "people" based on a non-cancer endpoint, but in fact, these estimates are based on the child scenario, not the adult scenario.
[225] And, as noted in Section IV.C above, fish tissue concentrations are likely to remain elevated for 3-5 years following construction, minimizing the window of differential allowable fish consumption between the alternatives even further.
[226] EPA Proposed Plan page 58 indicates EPA assumed only 0.6 fish meals per year could be consumed during construction.

Table 7. PCB SWACs (ppb) Comparison Using LWG's 12 hour/day Assumption for Alternative Durations (using EPA's 2015 Initial SWAC of 85 ppb).

EPA Alternatives	Years																																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**
A (no action)	85	79	74	69	64	59	55	51	48	45	41	39	36	33	31	29	27	25	23	22	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
B								49	46	42	40	37	34	32	30	28	26	24	22	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
D												40	37	35	32	30	28	26	24	23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
E/I														31	29	27	25	23	22	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
F																										21	20	20	20	20	20	20	20	20	20	20	20
G																																				15	20

Notes

Duration of alternative construction

XX Year construction is completed and EPA estimated SWAC at that time.

XX Using an estimated natural recovery rate, the years that the alternative achieves a concentration approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds). This equates to a concentration range of 20 to 24 ppb (i.e., 24 ppb is plus 20% of the equilibrium value of 20 ppb).

* Half-life set to rate that would achieve background PCB PRG of 9 ppb in 30 years (without applying the equilibrium asymptote at 20 ppb, which is consistent with EPA's approach). Based on EPA's text on page 4-6: "As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions." This assumption is similar to the estimated natural recovery rate based on average smallmouth bass fish tissue half-lives using 2002, 2007, and 2012 data. Also, recent 2014 PCB sediment data appear to be approximately equivalent to this half-life.

Table 8. Fish Meals per Year (Non-cancer Child) Comparison Using EPA's 24 hour/day Assumption for Alternative Durations (using EPA's 2016 initial SWAC of 208 ppb).

EPA Alternatives	Years																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A (no action)	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.4	3.7	4.0	4.3	4.7	5.1	5.5	5.9	6.4	7.0
Alt B	0.6	0.6	0.6	2.2	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.1	4.4	4.8	5.2	5.6	6.1	6.6	7.2	7.8	8.4	9.1	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt D	0.6	0.6	0.6	0.6	0.6	2.9	3.2	3.5	3.7	4.1	4.4	4.8	5.2	5.6	6.1	6.6	7.1	7.7	8.3	9.0	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alts E/I	0.6	0.6	0.6	0.6	0.6	0.6	4.3	4.6	5.0	5.5	5.9	6.4	6.9	7.5	8.1	8.8	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt F	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	8.0	8.6	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt G	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3

Notes

Duration of alternative construction (EPA Proposed Plan p. 58 indicates EPA will allow 0.6 fish meals per year during construction phase).

XX Year construction is completed and EPA estimated allowable fish meals per year at that time.

XX Using an estimated natural recovery rate, the years that the alternative achieves a number of fish meals approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds).

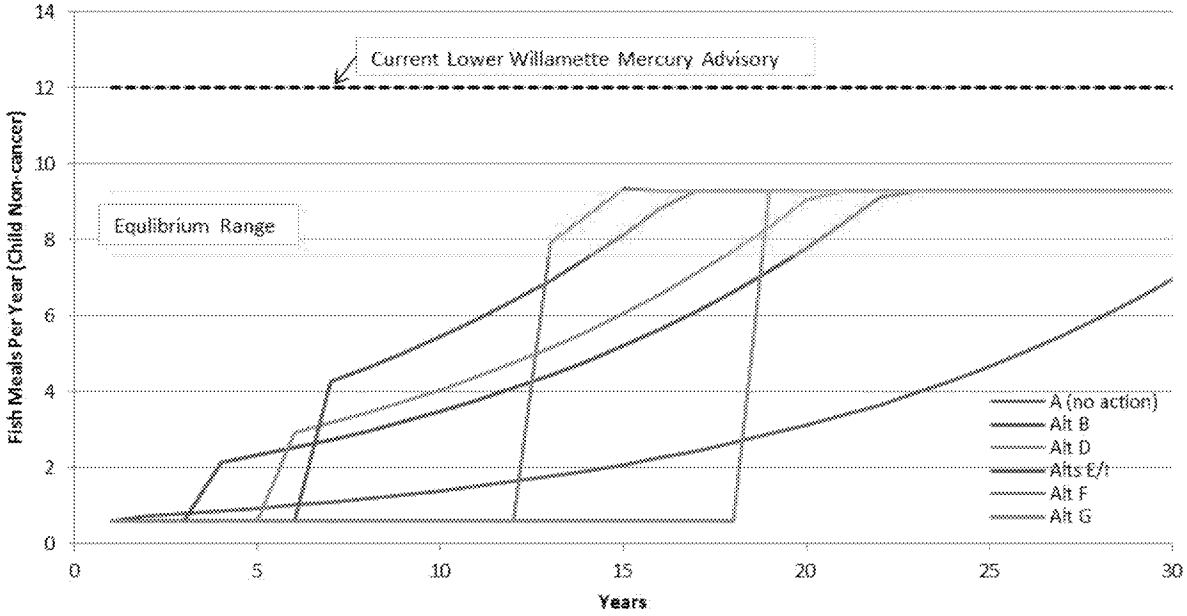
Following EPA's assumptions, EPA's Alternative I would only allow an average of one additional fish meal per year over the entire 30-year period as compared to Alternative B, but with substantially greater and longer environmental and community impacts from construction. Further, this analysis does not account for the fact that fish consumption would likely need to be lower during construction than EPA assumes, because EPA did not quantify that dredging releases typically cause elevated fish tissue concentrations during and a few years after construction.[227] Thus, the real difference between Alternatives B and I's average fish meals per year over 30 years would be less than one additional fish meal per year.

Finally, EPA acknowledges but fails to quantify or evaluate that "Estimating the number of acceptable fish meals at the end of construction is not a precise calculation, but rather is a prediction that has some degree of uncertainty."[228] Thus, the uncertainty around the calculated SWACs and related numbers of fish meals provided by various alternatives means that the results are likely to be highly overlapping. Just accounting for the different estimates in construction durations results in no difference in the SWACs achieved over time by the alternatives as demonstrated in Tables 6 and 7. For example, in Table 6 (24 hour/day construction) Alternative B reaches the equilibrium range of 20 to 24 ppb by Year 20, while Alternative I reaches the same range by Year 14, but in Table 7 (12 hour/day construction) Alternative B and Alternative I both reach the same concentration range by Year 18. Calculating fish meals is an additional highly uncertain step beyond the SWAC uncertainty, and as a result, there is no real or measurable difference between any of the alternatives in terms of the number of fish people will be able to consume over the 30-year evaluation period proposed by EPA. EPA should compare real world outcomes of different alternatives (e.g., average additional fish meals per year), quantify the uncertainties in those outcomes, and provide some estimate of the time it takes different alternatives to achieve them.

Figure 6 shows fish meals per year that can be consumed by adults for each remedy, over time, in the context of the current Portland Harbor mercury fish advisory and the estimated equilibrium range.

[227] See discussion in Sections I.C. and IV.C; LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; IRTC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.
[228] Proposed Plan p. 58.

Figure 6. Fish Meals/Year (child non-cancer scenario) for 2016 Draft Final FS Alternatives using EPA's Initial SWACs and Construction Durations. ("Years" represent years from construction start.)



As Figure 6 shows, all alternatives are likely to attain the equilibrium range (gray zone) supported number of fish meals within about the same 6-year period, which will still be less than the current mercury advisory for the same population (i.e., child/vulnerable). Given the uncertainties in this calculation, the actual real world outcomes in terms of fish meals per year for these alternatives is likely to be highly overlapping.

The cost-effectiveness analysis that follows uses these rational and accurate analyses, primarily of long-term effectiveness, to display what the cost-effectiveness analysis missing from EPA's Proposed Plan would show.

D. Alternatives E and I are Not Cost-effective

The following figures demonstrate that if EPA had performed an appropriate cost-effectiveness analysis, it would be apparent that Alternatives E and I are not cost-effective relative to other alternatives.

Figure 7 shows the relative additional effectiveness (as represented by SWACs) of each successively larger alternative, as compared to incremental increases in the costs of those alternatives. (Cost estimates are based on EPA's FS, which as noted in Section IV.F, significantly underestimate the true costs of the alternatives.) The red line is based solely on SWACs immediately after construction, the right most part of the line begins with EPA's unrealistically high initial condition SWAC of 208 ppb for Alternative A.

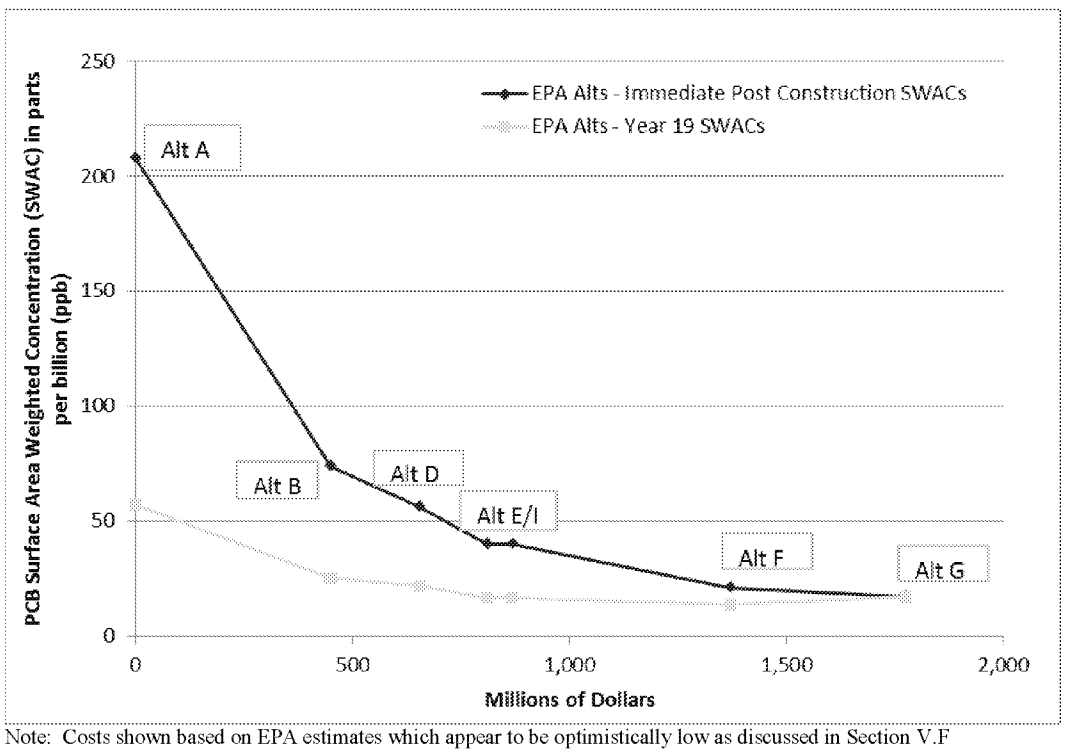
EPA focuses solely on the red line that implies relatively steep reductions in SWACs across the range of alternatives' costs. With this focus, EPA ignores the criterion of long-term effectiveness in evaluating overall effectiveness of the alternatives. A more appropriate way to evaluate cost-effectiveness among alternatives is to also evaluate the SWACs several years after construction.

The yellow line on Figure 7 shows the same alternatives evaluated 19 years after the construction of any alternative is started, given that Alternative G is estimated by EPA to be complete by Year 19 based on an optimistic 24 hour per day construction assumption. (The SWACs shown on the yellow line are the same as those presented in Table 6 above for Year 19 using the methods described there.) Clearly, the yellow (Year 19) line is much less steep than the red (immediate post construction) line, indicating that relatively little additional long-term SWAC reduction is achieved with each successively more costly alternative. Examining Year 19 SWACs, EPA's alternatives are at or near an asymptote of virtually no additional SWAC reduction by about the end of construction of Alternative D, if

not Alternative B. It is worth comparing the weaker cost-effectiveness performance of EPA's alternatives as compared with the integrated alternatives from the 2012 LWG Draft FS. The integrated alternatives were designed to reduce risk faster, at lower cost. Figure 8 adds the LWG alternatives to compare with EPA's alternatives.[229] Examining Year 19 (yellow and blue lines), both EPA and the LWG's alternatives are at or near an asymptote of virtually no additional SWAC reduction by about Alternative D, if not Alternative B. The 2012 LWG Draft FS integrated alternatives perform better than EPA's alternatives by using both immediate post-construction SWACs (green line) and Year 19 SWACs (blue line), because lower SWACs are achieved at substantially lower costs. Figure 9 depicts the same information using the cost estimates developed by the LWG and summarized in Table 5.

Figure 10 shows the same relationship between SWAC reductions and costs, as measured by dividing the alternative's total cost by the PCB SWAC reduction achieved (i.e., cost in millions of dollars to achieve each incremental ppb reduction in the SWAC). Because this measure is very sensitive to the amount of SWAC reduction, Figure 10 uses an initial SWAC (Alternative A) of 85 ppb (instead of EPA's inflated 208 ppb) to compare EPA and the LWG's alternatives. (As noted elsewhere, EPA's 2015 Draft FS used 85 ppb and up to that time EPA and the LWG were in agreement for many years that the baseline SWAC for the Site was about 85 ppb.) As expected, EPA's Preferred Alternative (red and yellow bars) achieves each increment of SWAC reduction for a higher unit cost than EPA's Alternative B (red and yellow bars) either on an immediate post-construction or Year 19 basis. Similarly, all of EPA's alternatives are equally or less cost-effective (all red and yellow bars) as compared to similar LWG integrated alternatives (all blue and green bars). Unit cost measures are consistent with the NCP and show that EPA's larger alternatives (all alternatives from Alternative E upward) have substantially higher costs per unit of effectiveness as measured by SWAC reductions.[230] As noted above, EPA's costs appear to be optimistically low. Consequently, EPA's alternatives would all be even less cost-effective if more realistic (higher) alternative costs were used in any of these figures.

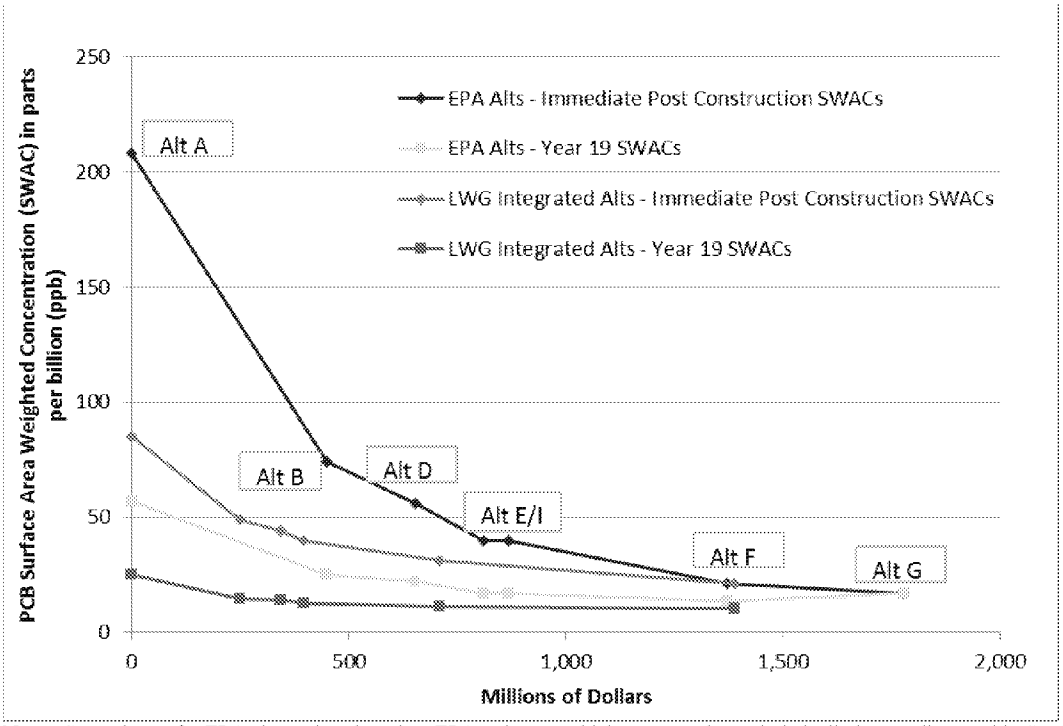
Figure 7. Comparison of EPA Alternative SWACs and Costs, Immediate Post Construction and 19 Years After Construction Start.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

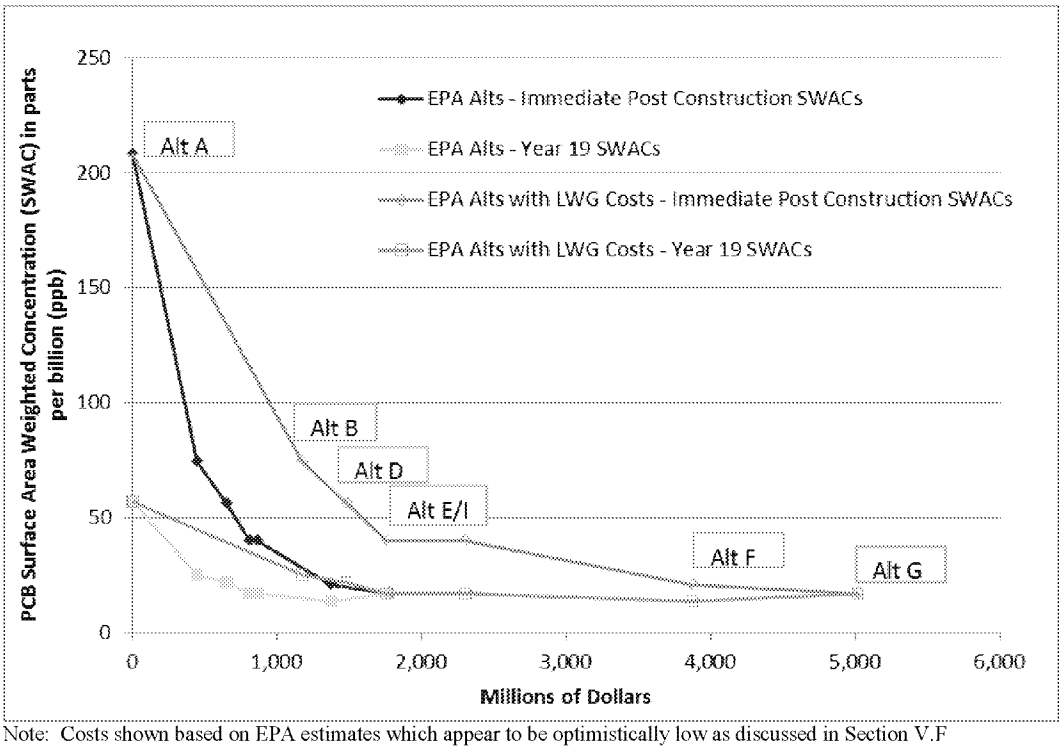
[229] The SWAC for LWG Alternative A is 85 ppb consistent with the LWG 2012 Draft FS and EPA 2015 FS as noted elsewhere.
[230] 55 Fed. Reg. 8728 ("if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist," and "[t]he more expensive remedy may not be cost-effective").

Figure 8. Comparison of EPA and LWG Integrated Alternative SWACs and Costs, Immediate Post Construction and 19 Years after Construction Start.



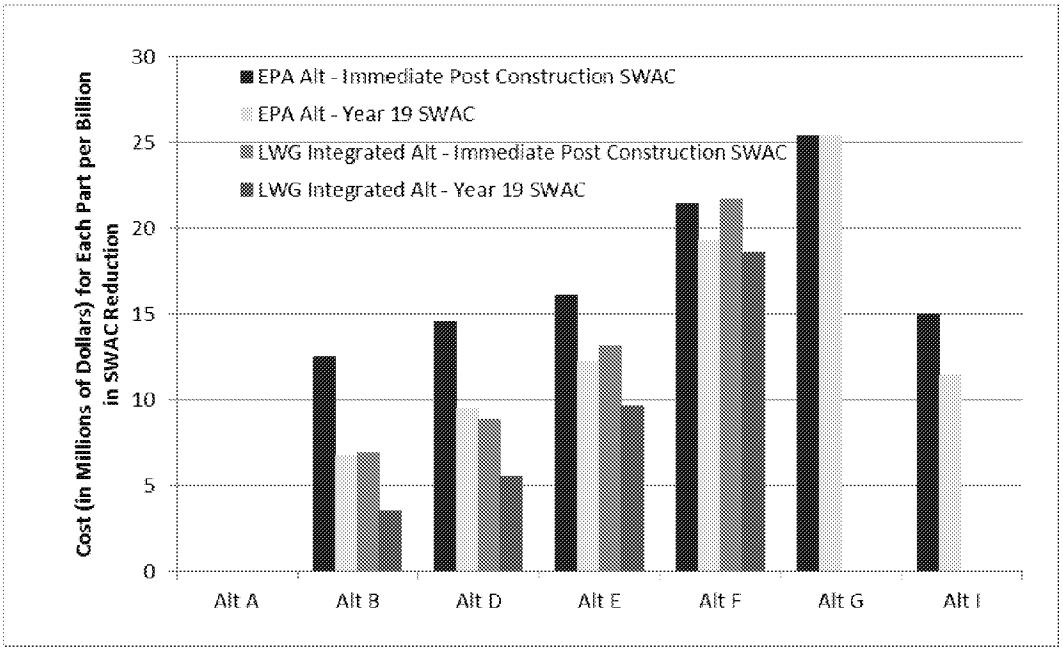
Note: Costs shown for EPA alternatives based on EPA estimates which appear to be optimistically low as discussed in Section V.F

Figure 9. Comparison of EPA and LWG Integrated Alternative SWACs and Costs, Immediate Post Construction and 19 Years after Construction Start. LWG Estimated Costs for EPA's Alternatives Shown.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

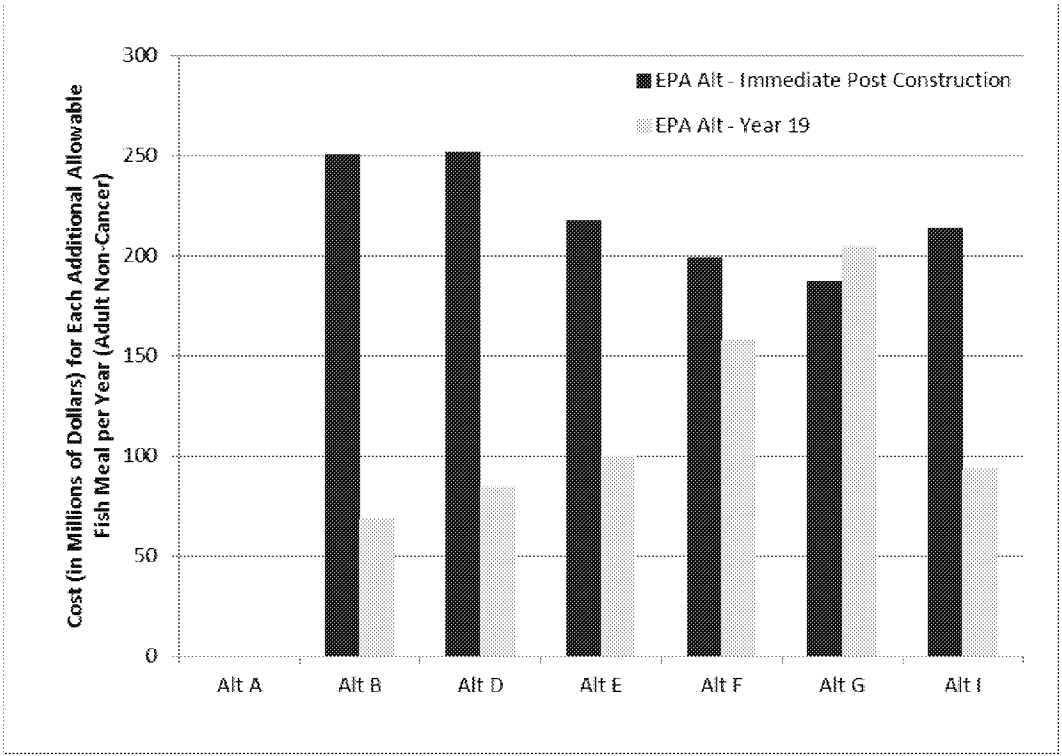
Figure 10. Cost for Each Part per Billion in PCB SWAC Reduction for EPA and LWG Alternatives.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

By way of further analysis in terms of cost versus risk reduction, Figure 11 reflects the unit costs of the alternatives for each additional allowable fish meal per year (beyond that provided by baseline conditions) for adult non-cancer risks consistent with the fish meal calculation assumptions in Table 8. Based on Year 19 allowable consumption rates (yellow bars), Figure 11 demonstrates that the larger alternatives have relatively higher unit costs for each additional fish meal allowed per year, and EPA's Preferred Alternative has a higher unit cost than Alternative B. Figure 11 also illustrates the dangers of EPA's sole focus on immediate post-construction conditions (red bars). The red bars imply lower unit costs for additional allowable fish meals with the larger alternatives, but this is only true if ongoing natural recovery after the construction period is ignored. Similar to effectiveness measured by SWAC reduction, effectiveness measured by additional allowable fish meals over the long term shows that Alternative I is equally or less effective than the much less costly Alternatives B and D. Also, as noted above, if EPA's entire 30-year period is examined (the period EPA assumes it will take until attainment of the PRGs), the average allowable annual fish meals for Alternative I (average of 31 fish meals/year) is only three more meals than for Alternative B (average of 28 fish meals/year).

Figure 11. Cost for Each Additional Allowable Fish Meal per Year for EPA Alternatives, Immediate Post Construction and at Year 19 after Construction Start.

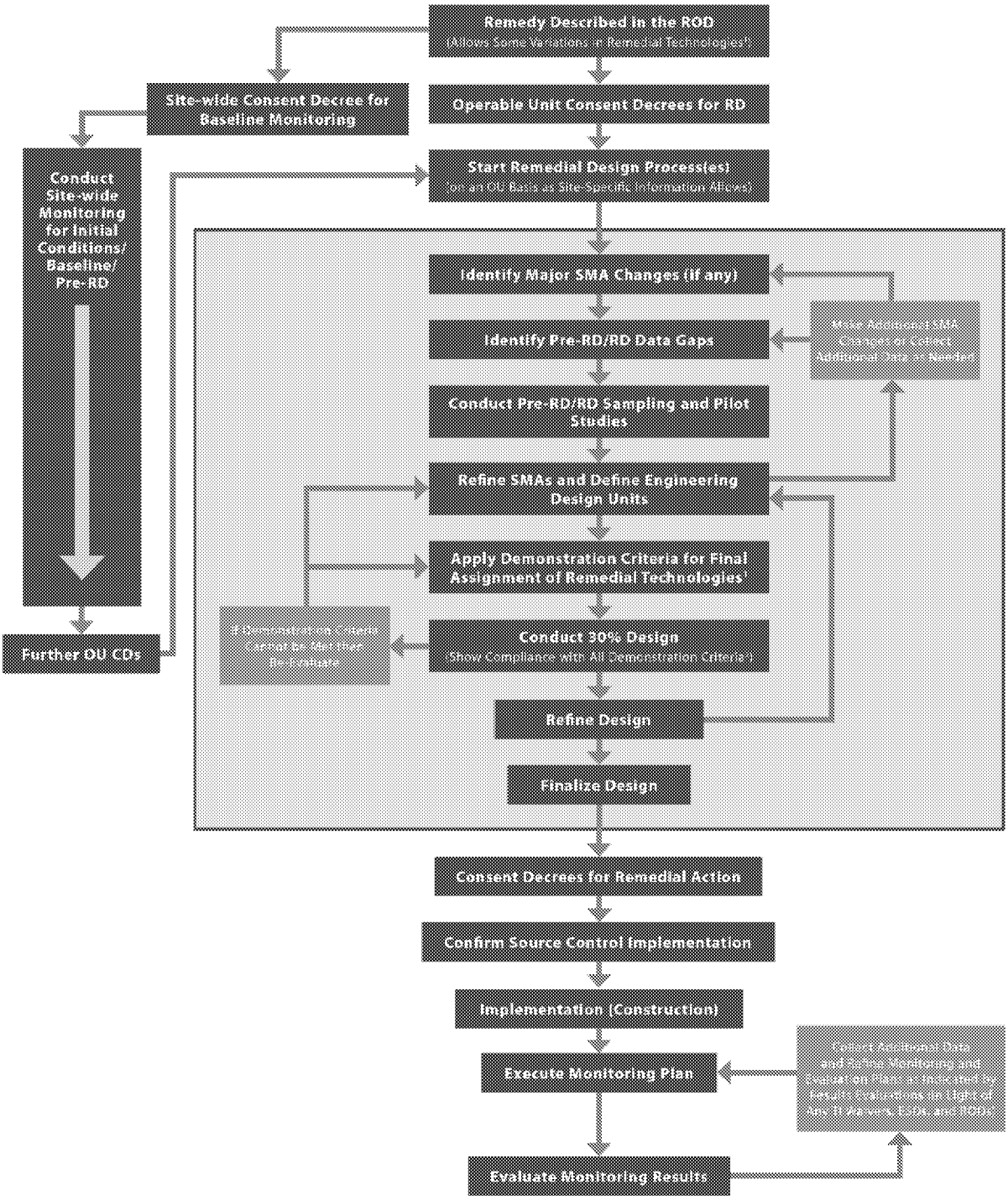


Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

VI. EPA's Remedy Selection Should include a Plan for How Cleanup will be Implemented Through Baseline Data Collection and Remedial Design and Implementation at Operable Units

Notably missing from EPA's Proposed Plan is a procedural and technical implementation roadmap of how cleanup of Portland Harbor will be accomplished. Having a clear understanding of that roadmap is critical to timely and successful cleanup. The LWG recommends that the ROD define a procedural process similar to Figure 12.

Figure 12. LWG Recommended Iterative Remedial Design/Remedial Action Approach



EPA should manage implementation of cleanup through the identification of operable units. After appropriate data needs are filled and pre-remedial engineering design studies are completed, some operable units may be ready to move into remedial design sooner than others. Remediation in operable units is a key CERCLA program management principle supporting EPA's "bias for action."

The National Contingency Plan provides:

> (ii) *Program management principles.* EPA generally shall consider the following general principles of program management during the remedial process:
>
> (A) Sites should generally be remediated in operable units when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup.[231]

Contemporaneous initiation of cleanup at some operable units while others undergo additional assessment is entirely consistent with the NCP:

> While the bias for action promotes multiple actions of limited scale, the program's ultimate goal continues to be to implement final remedies at sites. The scoping section of today's rule has been amended to make clear that the lead agency shall conduct strategic planning to identify the optimal set and sequence of actions necessary to address the site problems. Such actions may include, as appropriate, removal actions, interim actions and other types of operable units. Site management planning is a dynamic, ongoing, and informal strategic planning effort that generally starts as soon as sites are proposed for inclusion on the NPL and continues through the RI/FS and remedy selection process and the remedial design and remedial action phases, to deletion from the NPL.[232]

EPA's Sediment Guidance recommends exactly this approach: "Project managers may also consider separating the management of source areas from other, less concentrated areas by establishing separate operable units (OUs) for the site."[233]

---

[231] 40 CFR §300.430(a)(1)(ii). The preamble to the 1990 revisions to the NCP explains,

> A bias for action is consistent with EPA's long-standing policy of responding by distinct operable units at sites as appropriate, rather than waiting to take one consolidated response action. The 1985 NCP originally codified this policy that remedial actions may be staged through the use of operable units.
>
> ***
>
> Consistent with the bias for action principle in today's rule, EPA will implement remedial actions in phases as appropriate using operable units to effectively manage site problems or expedite the reduction of risk posed by the site.
>
> ***
>
> EPA supports the operable unit concept as an efficient method of achieving safer and cleaner sites more quickly while striving to implement total site cleanups. Although the selection of each operable unit must be supported with sufficient site data and alternatives analyses, EPA allows the ROD for the operable unit to use data and analyses collected from any RI/FS performed for the site.

55 Fed. Reg. 8666, 8704-05.

[232] 55 Fed. Reg. at 8706. See also, 53 Fed. Reg. at 51423: "Where problems are reasonably severable, phased responses implemented through a sequence of operable units may promote more rapid risk reduction."

[233] EPA, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, p. 2-22. EPA's decision to approach other large and diverse Superfund sites as a monolithic whole has been criticized by the scientific community. A 2005 report by the National Academies of Science reviewing EPA's work in the Coeur d'Alene River Basin concluded that EPA's decision to treat a large and diverse area as a single operable unit resulted in a slower, less effective and more uncertain cleanup:

> By combining these different problems into one OU and subjecting them to the process established in the NCP, EPA must attempt to answer all the questions for all the problems before it can attempt to remedy any of them. As a result, the agency must delay action on addressing the more tractable problems until it has all the information it needs to decide what to do about those that are less easily addressed, or, alternatively, it must propose remedies for some of the problems with inadequate information.
>
> ***
>
> As an area increases in complexity, the certainty of cost, volume, and remedial efficacy estimates decreases as does the certainty that selected decisions will be conducted. In reality, these large geographically complex sites like the Coeur d'Alene River basin cannot be

Breaking up the site into operable units would allow EPA to get cleanup started in areas where more information exists while less well-defined areas or areas of lower risk proceed on a parallel path through collection of baseline or "initial conditions" assessment. Figure 12 depicts our recommended programmatic approach to remedial design and implementation at Portland Harbor, which could allow different areas of the Site to move at different rates based upon site-specific information and information to be developed after the ROD.

VII. The Administrative Record, As Supplemented by These Comments, Demonstrates that EPA's Selection of its Preferred Alternative Would Be Arbitrary and Capricious

Appendix A provides additional information for the Administrative Record. This information was exchanged between EPA and the LWG during preparation of the RI/FS, provided by the LWG to EPA in the course of the LWG's work on the RI/FS or previously generated by EPA. The LWG previously recommended that most of these records be placed within the Administrative Record as appendices to relevant LWG deliverables; in most, if not all, cases, EPA required the LWG to remove the records from the deliverables. We are therefore incorporating these and similar records into our comments on the Proposed Plan for inclusion in the Administrative Record file pursuant to 40 CFR §300.815(b). The LWG and its members submitted Freedom of Information Act requests to EPA on March 9, 2016 (as clarified April 4, 2016) and August 11, 2016. EPA has not completed its responses to these requests. The LWG and its members may request that the Administrative Record be supplemented by information EPA provides after the public comment period closes.

Conclusion

EPA has departed so significantly from the baseline risk assessments that it cannot accurately describe the risk reduction attained by each of its alternatives. The unrealistic assumptions EPA has made about the practical and engineering details of its alternatives, together with the simplifying assumptions it has made about the physical, chemical, and temporal properties of the Site, limit EPA to subjective and conclusory evaluations of the performance of those alternatives at attaining its inaccurate risk reduction estimates, and they prevent a meaningful assessment of the impacts of those alternatives on the community and the environment. These errors, compounded with EPA's incomplete and imprecise cost estimating, make it impossible for EPA to shine any real light on why it is making the decision it proposes to make, or how that decision is more than throwing darts at the wall, flipping a coin, or making a sudden knee-jerk decision. A thoughtful review of the evidence before EPA leads instead to the conclusion that less aggressive, shorter duration alternatives, based on site-specific information and current data, are protective, would be as effective at reducing risks identified in the baseline risk assessments, would result in less short-term risk to people and the environment, and would attain the amount of risk reduction achievable through sediment remedies in about the same amount of time and at far less cost than EPA's Preferred Alternative.

In its October 19, 2015, letter to the NRRB, the LWG provided several recommendations on implementing the cleanup, including focusing on the most significant and pervasive risks, selecting cleanup goals that are aligned with the risk assessments and are achievable, treating principal threat waste only where it is more cost-effective than other disposal options, reducing the uncertainty about natural recovery, and maximizing flexibility in remedial design and implementation of the cleanup. Our review of the Proposed Plan has not changed those general recommendations:

- Reasonable PRGs based on appropriate risk management.
- RALs that are appropriately applied to surface sediments consistent with the methods and results of the BLRAs and that focus on active remediation of the highest contaminant concentrations:
  - PCB RAL of 1,000 ppb

---

remediated in a short time frame, and efforts to describe the entirety of the problem and chart a path to completion (as attempted in the Superfund process) become less realistic with increasing complexity of the site.

National Academy of Science, *Superfund and Mining Megasites: Lessons Learned from the C'oeur d'Alene River Basin* (2005), pp. 420-21.

  - DDE RAL of 1,000 ppb
  - cPAH (as BaPEq) RAL of 20,000 ppb
  - Designated CBRAs consistent with the multiple lines of evidence evaluation of benthic toxicity in the BERA

- Flexible technology assignments assigned to SMAs or operable units, with an appropriate balance of removal and in-place technologies at the harbor-wide scale (e.g., capping, in situ treatment, and EMNR). We anticipate this will equate to approximately 50% dredging and 50% in-place technologies (by site-wide acreage). Technology assignment must take into account that the longer it takes to implement the remedy, the longer the impact to the river and the fish, and the longer it takes the system to recover.

- No identified PTW. Substantial product at the Gasco Sediment Site will be managed consistent with the 2009 Gasco Consent Order.

- Appropriate application of in situ and ex situ treatment of a significant volume of materials at the Site through application of the above appropriate RALs and technology assignments.

- Use of operable units to manage the Site based on localized chemical and physical characteristics.

- Exclude riverbank soils remedies (leaving those to be designed and implemented through either DEQ upland source control program or future sediment remedial designs).

- Refinement of technology assignment and process options in remedial design (e.g., types of dredging and dredge BMPs types of treatment, and habitat and flood mitigation methods).

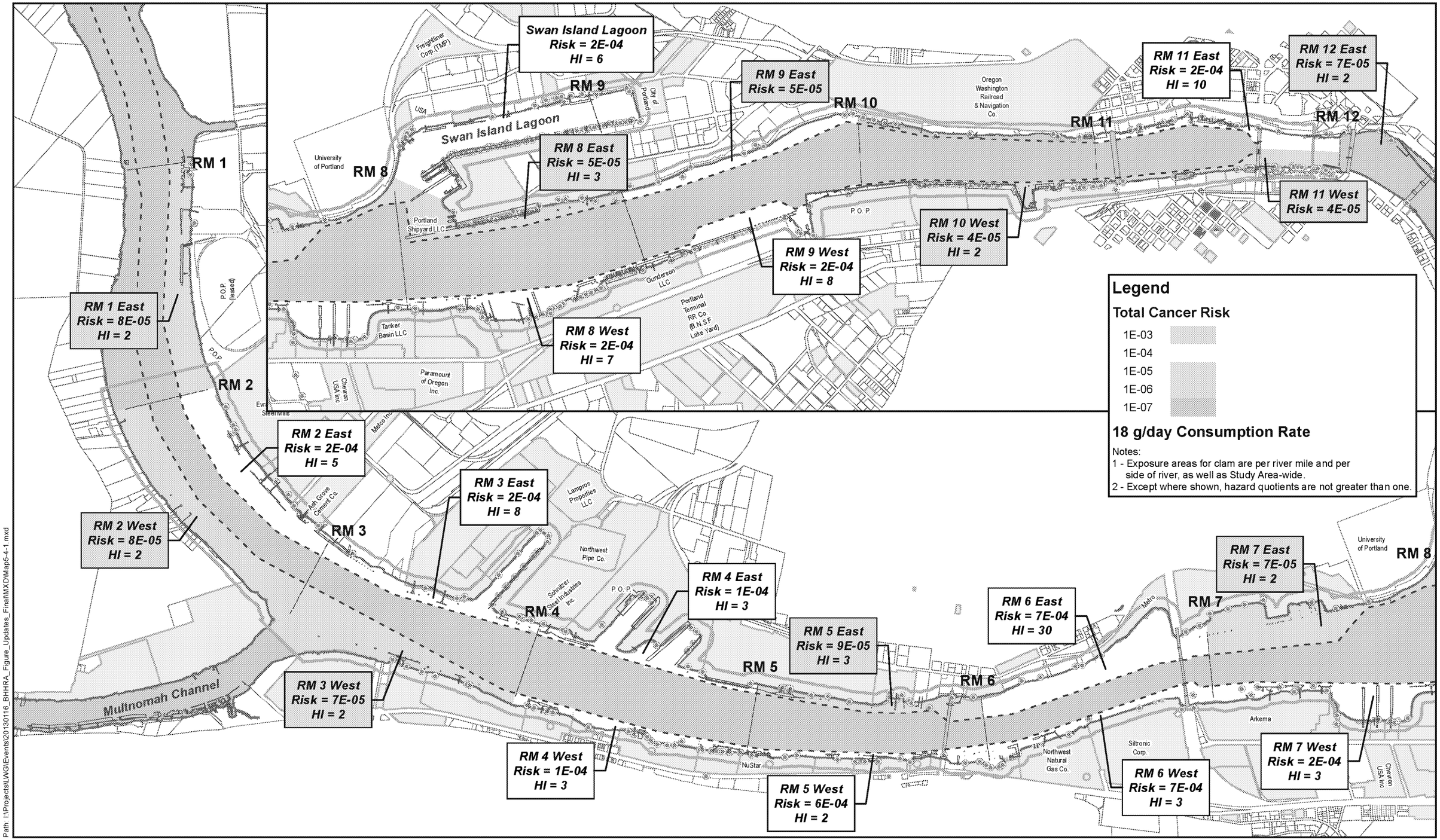
As discussed in these comments, such an alternative would be protective and compliant with ARARs and would be a cost-effective, implementable remedy. The areal extent of SMAs developed under this alternative would be defined based upon evaluation of data collected through additional baseline sampling and during remedial design, and the general balance of technology assignments would be refined or modified during remedial design as appropriate based upon site-specific engineering evaluations and design data. The LWG believes this remedy could be implemented through settlement within a reasonable timeframe following the ROD.

Sincerely,

The Lower Willamette Group

cc: Kristine Koch, US. Environmental Protection Agency, Region 10
Sean Sheldrake, U.S. Environmental Protection Agency, Region 10
Confederated Tribes and Bands of the Yakama Nation
Confederated Tribes of the Grand Ronde Community of Oregon
Confederated Tribes of Siletz Indians of Oregon
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Warm Springs Reservation of Oregon
Nez Perce Tribe
Oregon Department of Fish & Wildlife
United States Fish & Wildlife
Oregon Department of Environmental Quality

TAB 5



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Kennedy/Jenks Consultants
Engineers & Scientists

LWG
Lower Willamette Group

FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS.
Channel & River Miles: US Army Corps of Engineers.
Bathymetric Information: David Evans and Associates, Inc.

0 1,000 2,000 Feet

Map Features

- River Miles
- Navigation Channel
- River Edge +13 ft NAVD
- Study Area

Outfalls

- Outfall
- Dock Drain
- Roof Drain

- Bridges
- Docks and Structures
- Waterfront Taxlots
- Upland ECSI Sites (2008)

Map 5-4-1
Portland Harbor RI/FS
Final Remedial Investigation Report
Appendix F: BHHRA
March 28, 2013

Risks from Clam Consumption, RME

TAB 6

DHS
Oregon Department of Human Services

FAX COVER SHEET

Oregon State Public Health
Environmental & Occupational Epidemiology
503-731-4025
Fax: 503-872-5398

Date: 6/13/07	**Sender:** Julie Early
To: Cindy	**Office Name:**
Office Name:	**Address:** 800 NE Oregon St., #827
Address:	**City:** Portland
State: **Zip:**	**State:** OR **Zip:** 97232
Phone No.:	**Phone No.:** 503-731-4025
Fax No.: 503-295-4901	**Fax No.:** 503-872-5398
	Total Pages:

Re: Linntn Comm. Center Report – Portland Harbor

☐ **Urgent** ☐ **For review** ☐ **Please comment** ☐ **Please reply** ☐ **Please recycle**

Let me know if you have any ?'s.

Confidentiality Notice: The information contained in this facsimile may be confidential and legally privileged. It is intended **only** for use of the individual named. If you are not the intended recipient, you are hereby notified that the disclosure, copying, distribution, or taking of any action in regards to the contents of this fax – except its direct delivery to the intended recipient – is strictly prohibited. If you have received this fax in error, please notify the sender immediately and destroy this cover sheet along with its contents, and delete from your system, if applicable.

1 [redacted] : Living in camp trailer and an old car. Came from Texas a few months ago. Move around every few days. Park on vacant industrial land and old roads and parks located between Willbridge and St. Helens. Fish in superfund area in Multnomah Channel and in the Willamette . Their estimated age is about forty or fifty. Found parked on road off Marina Way. Don't know how long they will stay in area. They had been catching crawdads and sturgeon wanted to know the best fishing places. Mostly cook in frying pan on cook stove or boil. Make "fish head soup". (soup made with the boiled heads of any kind of fish. They catch the fishermen before they discard the fishheads and ask for the heads. The heads are boiled and seasoned in a milky broth , eyeballs and all.) They say it's really good.

2 [redacted]e: Live in a car. Move around up and down the river. Early teens late twenties. Fish for trout, sturgeon, steelhead bass squawfish. Catch squawfish for money. Bathe with river water. Do not drink river water. Park in abandoned industrial lots, sides of old roads. Move around every night. If park in same place every night police come. Don't know how long will stay in area but probably for summer. The "state" buys the squawfish for money. They pull in with a van at Diddlers Beach by the airport that has ice chests. If the squawfish are over 9" long they pay $6.00. If you have over 100 they pay $10. Cook fish over campfires on a grill or in a frying pan.

3 [redacted]. fishes off the shore for sturgeon, steelhead, salmon, bass crawdads whatever he can catch. Lives "up there" (off Skyline in Forest Park?). Would not disclose exact location where he camps. Fishing at beach in Linnton. "Lives in woods." " Don't always live in woods". Bathes and swims in river. Drinks creek water sometimes and buys water. Eats whatever he catches. Cooks the fish however he can. Sometimes buys bricquets and lighter fuel when its raining and too hard to start a fire. Puts net out for crawdads, pulls net up to the top of the water for a couple of days to let the clean water run through them for a couple of days before he eats them. "Otherwise they taste like mud" He boils them "like lobster".

4 [redacted] on trail off Newberry Rd. Catches catfish to sell to Vietnamese. Eats bass salmon and sturgeon. Fishes in Linnton area. bathes in creek. Just moved camp. Temporarily staying in Forest Park. Bathes in river when camped by river.

5 [redacted] stays in his boat at Freds Marina. Takes people fishing for money. Eats all fish, crawfish. Bathes in river, buys water. Eats "whatevers running". Cooks on a stove in his boat. Mostly fries his catch. Does not eat "junk fish".

6 [redacted] approximately fifty years old Lives in camp off Marina Way. Blue tarps are visible from road. Digs in trash at 7-11 for bottles for money. Friends give him fish or he eats fish with friends at their camps. Does not fish himself. Very uncommunicative. Very reclusive. Lives under tarps at side of Marina Way for years. Rides bike. Took 5 pamphlets to give to his friends"vietnam vets that live in the woods" " wont tell nothing else about them."

7 [redacted] stays in forest Park above Newberry. Fishes with John on Willamette and Multnomah Channel. Squawfish to sell. Eats sturgeon, bass catfish, "whatever is biting". Bathes in river. Gets $6 to $7 apiece for squawfish, Shad.

8 [redacted] lives in Forest Park when he is homeless or can't find friends to live with. Probably spends winters in houses when he can. Uses drugs. Fishes for bass whatever he can catch. Lives in tent on river bank when no one will let him stay at their house.

9 [redacted] would not disclose exact location of camp but live up trail on west side of the St. Johns Bridge in big canyon in Forest Park. There is a set of stairs and then a trail Each has own shelter behind the police impound lot. Fish for whatever they can catch. Wont eat squawfish, carp or suckers. Suckers are too bony. Drinks from creeks. Wont eat shad.

10 [redacted], just passing through. Stays in trees north of power poles Catches anything he can. Eats anything edible. Clams, carp, shad, suckers bathes in river. Throws out three of four lines pulls in with hands.

11 [redacted]. lives off river and in Forest Park. Catches whatever he can. Throws back carp suckers. Uses crawdads and clams for bait. Does not drink river water. Drinks from little creeks running into the Willamette.

12 [redacted] " a little nuts" fishes camps out on river bathes in river. Lives by power poles in camp most of the time. " Does not handle society well." Eats clams crawdads bass anything he can beg or catch. Drinks from creeks.

13 [redacted] lives in tree house "fort" above Linnton. Bathes in creek. "Fishes every once in awhile" Mostly catfish. Drinks from creeks bathes in creeks. Occassionally catches bass. Sometimes eats clams because easy to find and hungry.

14 [redacted]: Fishes in Linnton. Camps in St. Johns. Uncommunicative. Met on railroad tracks.

15 [redacted]: Lived in school bus, ambulance and several cars across from steel yard on Front Ave. in Linnton. Have lived in the area of the steel yard off Front Avenue in Linnton for years off and on.. Kept several cars running and would move them around to keep police at bay. . Have ten children aged two to 22 that lived with them in the vehicles. The state has towed their vehicles several times. Somehow they get them or others back. The state have taken the children away and put them in foster care. For some reason the teenage boys are back. The older girl is still with them and never left. One boy is about 18 and the other is 15. The 15 year old says he lives in a foster home but is always in Linnton. The community center pays the 15 year old for several hours on Sunday evenings to mop the gym floor and clean the bathrooms. . The state towed the bus and most of the vehicles away again about in February. The [redacted] then began living in the back of a small white pickup with tarps and a makeshift camper. They still

park down on Front by the steel yard. The parents do not work. They do not fish. They eat fish when it is given to them by fishermen.. The steel yard is by a beach on the Willamette that is frequently used by fishermen. They cooked it and all their food in pans on a stove they had set up by the school bus. I do not know how they cook now, but probably set their stove up by the pickup.

16 [redacted] stays in his boat. He moves it up and down the river and channel. He bathes in the river. He usually cooks on a small camp stove.

17 [redacted] stays in a friends garage. He fishes on the east side of the river by the power poles. He uses a camp stove and frying pan. He eats whatever he catches. Does not eat suckers.

18 Two women met on railroad tracks by Linnton. Temporarily camped near Willbridge. Came to Portland to get married. Asked about good fishing spots.

19 Fat Man and girlfriend. Fish for everything. Whatever is biting. Currently camping at power poles. Always leave a big mess when they move camp. Have been around for years. Eat anything. Don't eat "junk fish" carp, squawfish or suckers. Haul water in plastic containers from gas station. Bathe in river. Usually fry fish. Sometimes barbecue depending on weather. Sometimes use wood, sometimes briquets. Fatman is approximately 50. His girlfriend is about 30.

20 [redacted] stays in van behind Texaco station. Fishes at power poles. Can't drive van due to DUI. Fishes for bass, catfish, squawfish for money. Uses a little fishing pole. Cooks on little campstove.

21 [redacted] move camps up and down river all the way from St. Helens to Willbridge. Fish for sturgeon, catfish, bass, croppie, squawfish for money.

22 [redacted] lives on beach below steel yard. He has a camp made of tarps. He cooks on fires. Bathes in river. Fishes for edible fish only. No suckers or carp. Sometimes drinks from river but heats the water good. .

23 [redacted] a black man about 50 years old has lived by the power poles in tarp and cardboard camp for 6 or 7 years. The "cops" tore his camp down last winter. Lived with girlfriend. When they tore his camp down he moved his camp to a cove by the railroad bridge. He uses a rope to get to his camp. Sometimes works as a pipefitter. Has money. He "just loves camping by river". "Doesn't like to be part of society." Relies on river for food. Does not eat "junk fish". Uses crawdads for bait.

Amanda Guay
Dept. of Human Services
800 NE Oregon Street
Portland, Oregon 97232-2162

Pat Wagner
Linnton Community Center
10614 NW St. Helens Rd.
Portland, Oregon 97231

JUN 1 8 2004

June 6, 2004

Dear Amanda Guay,

This project was done in the winter and spring months. In the beginning I attempted to carry the project out myself with the help of [redacted] a man that has lived and been homeless off and on in the Linnton area for years. [redacted] has a severe problem with alcohol. [redacted] lived in a camp on the river last summer and is as well acquainted with the transient population and their habits as a person can be. This approach did not work very well. People avoided me and would not talk. I sometimes felt afraid because the few I was involved with were not friendly or interested in talking with me.

After we realized this was not working [redacted] and I evaluated and changed our approach to the camp visits.. [redacted] made the visits by himself because the people would not communicate with me around. Ben enjoys their company. [redacted] had to spend time visiting them, drinking with them and fishing with them to get some of them to talk. Sometimes he spent the night with them around their campfires. . Even with this approach many did not want to answer many questions. [redacted] spent countless hours hiking the back trails and abandoned roads and railroad tracks where he had seen homeless people fishing and camping. [redacted] would just head out with his pockets full of beer and his fishing pole and would run into some that he has known for quite some time or strike up conversations with new people. He could not take notes during the conversations. [redacted] wrote notes in a notebook he kept in his pocket after he parted ways with the people. This project occurred between February and June.

[redacted] carried pamphlets in his pockets and would convey the information in the pamphlets about safe fish consumption when the time was appropriate and when he was most likely to get a positive reception. He tried to question them on their habits as best he could without pushing too hard and having them pull away and becoming uncommunicative. He gave each of these people pamphlets and sometimes extras for their friends. [redacted] said most seemed receptive to the information.

This population is mostly very transient. This project would have best been carried out during the summer months as that is when the population of homeless increases

In response to the questions provided by David Stone Ph.D

Most homeless people spoke to reported not seeing homeless children.

The following businesses have reported to me about homeless children.
Frank Berg, Plant Leader from OWENS CORNING 11910 NW St. Helens Rd. Portland, Oregon Phone: 273-1465, an industry with lots of riverfront property in the Superfund area reports having to tear down a camp with parents and a little girl about three or four years of age a couple of times. He eventually fenced his property to keep them off because it "broke his heart" when the little girl said" Do we have to move again Daddy."

RK Storage, a steel industry on NW Front Avenue, employees, Eric and others have reported the [redacted] family for garbage and not taking care of their children to the police multiple times. At one point all ten of their children lived with them in vehicles parked by the steel yard. . The men in the steel yard were always afraid they were going to run over one of the children with their lift machines and trucks.

Enclosed is a newspaper article about one homeless family. Kuney Construction workers observed this man and his child hiking back up into the woods many times. As with most homeless families they were very secretive and elusive.

The police from North Precinct that covers the Linnton area will tell you that there are a very few homeless children living along the river or in Forest Park on occasion. They say that the parents hide their children during the day and only let them out at night. Speak to Sgt. Karl McDade of North precinct about this.

Crawfish, Crayfish and Crawdads are just different names for the same thing.

2000 copies of printed brochures were divided among the ARCO store, Seven Eleven, Freds Marina store, Linnton Feed Store and the Texaco in the Linnton area. . These are the places people buy bait and snacks for fishing trips. Brochures were posted in the windows and on some doors of these businesses. Store employees agreed to give the brochures to people purchasing bait.

Pat Wagner

Pat Wagner

ADDENDUM

As this project progressed in the spring we remembered from past summers groups of Hispanic men that migrate to work on Sauvie Island in the farmers fields during the spring and summer months. One large group of these men reside communally in a large house near the Sauvie Island Bridge every summer. When we went to Krugers Farm we observed about five or six Mexican men in the back of a pickup truck just returning from a fishing trip. They did not speak English well enough to communicate effectively with us but indicated they had been fishing in the river nearby.

We did our best to have our brochure translated to the Spanish language and are currently making 1000 copies to be distributed to the farmers, markets and stores on Sauvie Island. There are more brochures than currently needed, however, this population is transient and the brochures should last throughout the summer.

TAB 7

PB97-963148
EPA/541/R-97/165
January 1998

EPA Superfund Explanation of Significant Difference for the Record of Decision:

Salem Acres
Salem, MA
4/11/1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

EXPLANATION OF SIGNIFICANT DIFFERENCE
SALEM ACRES SUPERFUND SITE
SALEM, MASSACHUSETTS

Site Name: Salem Acres Superfund Site

Location: Salem, Massachusetts

Lead Agency: U.S. Environmental Protection Agency

Support Agency: Massachusetts Department of Environmental Protection

Under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and promulgated in 40 C.F.R. Sections 300.435(c)(2)(I) and 300.825(a)(2), if the United States Environmental Protection Agency (EPA) determines that the remedial action at the Site differs significantly in scope, performance or cost from the Record of Decision (ROD) for the Site, EPA shall publish an explanation of significant difference between the remedial action being undertaken and the remedial action set forth in the ROD and the reasons such changes are being made.

This Explanation of Significant Difference (ESD) contains a brief history of the Salem Acres Site, a description of the remedy selected in the ROD signed on March 25, 1993, and a description of and rationale for the change to the ROD.

This ESD and other supporting documents can be found in the Administrative Record located at EPA's Region I office at 90 Canal Street, Boston, Massachusetts, open Monday - Friday 8 a.m. - 1 p.m. and 2 p.m. - 5 p.m., and at the Salem Public Library, 370 Essex Street, Salem, Massachusetts, 01970.

I. Site History

Salem Acres Superfund Site (the Site) is a 234 acre parcel of land located in the cities of Salem and Peabody, MA. The contaminated portion of the Site comprises an area of approximately thirteen (13) acres located in the southerly portion of the parcel, and is entirely in Salem. The contamination on the thirteen acres consists of an old landfill, three debris piles, a fly ash pile and a series of sludge lagoons. There are three potentially responsible parties (PRPs) associated with the Site, the owner, DiBiase Salem Realty Trust, and two generators, the Massachusetts Electric Company and the South Essex Sewerage District. Each of the PRPs settled with EPA and DEP and each signed consent decrees to remediate a portion of the Site.

The landfill, debris piles and the fly ash pile were substantially remediated in 1995 and 1996 by DiBiase Salem Realty Trust and Massachusetts Electric Company, respectively. The South Essex Sewerage

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Printed with Soy/Canola Ink on paper that contains at least 75% recycled fiber

District is currently remediating the sludge lagoons which is scheduled to be complete in late spring of 1997.

II. Summary of Remedy

The selected remedy consists of treatment of certain contaminants in-place and excavation and disposal of all contaminated materials off-site at permitted off-site landfills. On-site wastes and soils are to be remediated to the cleanup levels specified in the ROD.

The soil cleanup levels established in the ROD for specified contaminants were based on calculations performed as part of the 1992 Health Risk Assessment (HRA) which utilized toxicity data in effect at that time. This risk assessment was performed as part of the Remedial Investigation for the Site. The cleanup criteria established in the ROD has allowed for unrestricted future use of the property once the cleanup is complete.

III. Explanation of Significant Difference

As mentioned above; the cleanup levels established in the ROD for on-site wastes and soils were calculated as part of the 1992 Health Risk Assessment, conducted as part of the Remedial Investigation for the Site. The calculated levels were based on toxicity criteria in effect at that time or on background concentrations available for the site. This ESD will establish soil cleanup levels for six carcinogenic polyaromatic hydrocarbons (cPAHs), revise the cleanup level for one cPAH and revise the background concentration and thus the soil cleanup level for beryllium.

A. With regard to the cPAHs, the risk evaluation was based on toxicity data which was available for only one of the cPAHS - benzo(a)pyrene, which had an oral potency slope factor value of 12 $(mg/kg/day)^{-1}$ when the ROD was signed. The oral slope factor is EPA's terminology for describing how potent a compound may be in causing cancer, based on studies conducted in animals and human studies when available. The risk evaluation and the cleanup value specified in the ROD for all cPAHs [1.2 parts per million (ppm)] were based on the assumption that all cPAHs were of equal potency as benzo(a)pyrene.

Since that time, EPA has revised the oral potency factor for benzo(a)pyrene to its current value of 7.3 $(mg/kg/day)^{-1}$ (EPA 1997) rendering benzo(a)pyrene less potent than it was believed when the ROD was written. EPA has also published (EPA 1993) an interim recommendation for addressing the carcinogenic potential of the other six cPAHs. This is known as the relative potency factor approach. Using the relative potency factor approach, the oral slope factor for benzo(a)pyrene can be multiplied by a relative potency factor for each of the six cPAHs to derive relative oral slope factors for each cPAH. Five of the six cPAHs identified have resulting oral cancer slope factors one to three orders of magnitude less than the oral slope factor for benzo(a)pyrene. Through this ESD, EPA will be establishing cleanup levels for each of the seven cPAHs based on the availability of a new oral slope factor for benzo(a)pyrene and the adoption of the relative potency factor approach for cPAHs.

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Please note, however, that the original acceptable risk level of 6.7×10^{-6} which was used to determine a cleanup level in the ROD for the combined effects of cPAHs *remains unchanged* (as do all assumptions regarding the nature and intensity of exposure). The incremental cancer risk level assigned to each of the seven cPAHs in this ESD is 9.5×10^{-7} or one-seventh of 6.7×10^{-6}. The resulting soil cleanup levels are presented in the following table.

COMPOUND	SOIL CLEANUP LEVEL, ppm		CANCER RISK
Benzo(a)anthracene	2.7		9.5×10^{-7}
Chrysene	266.7		9.5×10^{-7}
Benzo(b)fluoranthene	2.7		9.5×10^{-7}
Benzo(k)fluoranthene	26.7		9.5×10^{-7}
Benzo(a)pyrene	0.3		9.5×10^{-7}
Indeno(1,2,3-cd)pyrene	2.7		9.5×10^{-7}
Dibenz(a,h)anthracene	0.3		9.5×10^{-7}
		Total cPAH risk =	6.7×10^{-6}

In summary, the only thing that has changed is the associated cleanup concentrations of the cPAHS. The risk-based protectiveness of 6.7×10^{-6} established in the ROD remains the same. The result of cleaning up cPAHS to these new concentrations will allow for the same protectiveness that was sought as a remedial action goal under the ROD. The Site, once cleaned, will allow for unrestricted future use.

In addition to the ESD, EPA is taking this opportunity to articulate how compliance with all cleanup levels identified for soils at the Salem Acres Superfund Site will be determined. Consistent with Risk Assessment Guidance for Superfund (RAGS), Part A (EPA 1989) which calls for assessment of the reasonable maximum exposure, and Supplemental Guidance to RAGS: Calculating the Concentration Term (EPA 1992) which articulates that a 95% upper confidence limit on the arithmetic mean of contaminant concentrations is to be used when computing exposure, EPA Region I will use the 95% upper confidence limit on the arithmetic mean concentration of each compound of concern in soils at the Site and compare it to the appropriate cleanup level specified in the ROD as amended today by this ESD.

EPA recognizes that data obtained from sampling and analysis are never fully representative of actual human exposure. To account for the uncertainty in the data, EPA Region I has opted to use the 95 percent upper confidence limit for Superfund Sites (RAGS, EPA 1989) as embodied in the Supplemental Guidance to RAGS (EPA 1992). The 95% UCL provides reasonable confidence that the true site average of concentrations of compounds remaining in the soils are less than the cleanup levels established for the Site.

If the 95% upper confidence limit on the arithmetic mean concentration for any compound exceeds the cleanup limit, the Site is still considered above the cleanup level for the compound. On the other hand, if the 95% upper confidence limit on the arithmetic mean concentration for any compound is below the cleanup level, the Site is considered below the cleanup level for that particular compound (i.e., no further

excavation will be necessary based on that compound of concern).

B. With regard to beryllium, the soil cleanup level established in the ROD was based on a very limited (two samples) characterization of site background. The lower of the two background concentrations (0.42 ppm of beryllium) was used as the cleanup level.

In an effort to better characterize naturally occurring levels of beryllium, twelve representative background samples were taken at various depths from undisturbed areas in close proximity to the site. The results show that beryllium is naturally present in the soils in concentrations that range from 0.50 ppm to 1.50 ppm, with an average concentration of 0.83 ppm (Memorandum dated April 4, 1997). The 95% upper confidence limit calculated for the arithmetic mean of 0.83 ppm is 1 ppm.

Given the variability in the data set, it is consistent with EPA practices to use the 95% upper confidence limit on the arithmetic mean (1 ppm) as representative of naturally occurring (background) beryllium concentrations. Thus through this ESD, EPA is redefining the background concentration of beryllium in soils as 1 ppm. EPA is replacing the former cleanup level for beryllium of 0.42 ppm with 1 ppm for compliance purposes. The excess lifetime cancer risk resulting from exposure to 1 ppm beryllium in soils given the exposure scenario and assumptions specified in the HRA is 2×10^{-6} which is consistent with EPA's goal for remedial actions (clean up to within the acceptable risk range of 1×10^{-4} to 1×10^{-6}).

As a consequence of this change, there may be a potential estimated cost savings of approximately $680,000 in remedial costs.

IV. Support Agency Comments

The Massachusetts Department of Environmental Protection has reviewed this ESD and has concurred with EPA in its issuance.

V. Affirmation of Statutory Determinations

Considering the new toxicity information for cPAHs that has been developed and the continued use of the original risk based cleanup goal of 6.7×10^{-6} for cPAHs, and the revision to the background value for beryllium based on more extensive data than was previously available, EPA believes the remedy as amended by this ESD remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, this remedy reflects EPA's commitment to utilize the most up-to-date scientific information and methodology available.

VI. Public Participation Activities

This ESD and supporting information are available for public review at the locations and times identified in the Introduction to this document. In addition, a notice of availability and brief description of the ESD will be provided to a local newspaper of general circulation, the Salem Evening News.

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VII. Declaration

For the foregoing reasons, by my signature, EPA is issuing this Explanation of Significant Difference for the Salem Acres Superfund Site in Salem, Massachusetts.

April 11, 1997
Date

Frank Cianciulli
for
Linda M. Murphy, Director
Office of Remediation and Restoration

ED_002671A_00012956-00213

References

U.S. EPA 1989. Risk Assessment Guidance for Superfund. Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002.

U.S. EPA 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response, Washington, D.C. Publication 9285.7-08I, May 1992.

U.S. EPA 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Office of Research and Development, Washington, D.C. EPA/600/R-93/089.

U.S. EPA 1997. Integrated Risk Information System (IRIS). Online database. National Center for Exposure Assessment, Cincinnati, OH.

Memorandum from Dharmarajan Iyer, URS Greiner, Inc. to Elaine Stanley, EPA dated April 4, 1997

ED_002671A_00012956-00214

TAB 8

SF File Number
98

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

EXPLANATION OF SIGNIFICANT DIFFERENCES

Burlington Northern (Somers Plant) Site
Somers, Flathead County, Montana

United States Environmental Protection Agency
July 1998

I. INTRODUCTION

This Explanation of Significant Differences (ESD) is being issued by the U.S. Environmental Protection Agency (EPA) to modify certain remediation criteria established in the Record of Decision (ROD) issued by EPA on September 27, 1989 and modified by the previous ESD issued on June 26, 1992 for the Burlington Northern (Somers Plant) Site (hereby referred to as "Somers Plant" or the "Site") and identifies the documents that serve as the basis for the determination.

EPA, in consultation with the Montana Department of Environmental Quality (MDEQ), and after consideration of documents prepared pursuant to the first Five-Year Review of the Somers Plant and other documents in the Administrative Record, has determined that modifications to the remediation levels established in the 1989 ROD are required to incorporate criteria developed since the ROD was issued.

The modifications to the remedy described in this ESD do not fundamentally alter the overall approach of the remedy selected in the ROD. However, the modifications to the remediation goals at the site significantly change the scope and performance of the selected remedy. Therefore this ESD is required by the NCP and EPA guidance.

In accordance with Sections 117(c) and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund), as amended, 42 U.S.C. Section 9601, et seq. ("CERCLA"), and the regulations at 40 C.F.R. Section 300.435(c)(2)(i), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), this ESD has been prepared for the following reasons:

- to provide the public with an explanation of the nature of the changes to the remedy;
- to summarize the circumstances that led to the changes to the remedy; and
- to affirm that the revised remedy complies with all statutory requirements.

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MDEQ (formerly the Montana Department of Health and Environmental Sciences, MDHES) concurred on the ROD issued on September 27, 1989, and has participated in the review of information leading to this ESD, including the Five-Year Review Report which includes the Protectiveness Evaluation and the Five-Year Review Site Visit (Roy F. Weston, Inc., 1995a and 1995b). MDEQ has reviewed and concurred on this final ESD.

This document presents a summary of the changes to the selected remedy and a synopsis of information on the Site. The Administrative Record, which contains this ESD and the complete documentation supporting the revisions selected herein, is available for public review at the locations indicated at the end of this report.

II. SITE HISTORY AND BACKGROUND

The Burlington Northern (Somers Plant) Site is located in northwestern Montana in the unincorporated town of Somers, Flathead County. The Somers Plant was operated by Burlington Northern Railroad (BNRR) between 1901 and 1986, and covers approximately 80 acres. The plant treated railroad ties and other miscellaneous lumber products to protect the materials from weathering and insects. Treatment fluids used by BNRR included zinc chloride, chromated zinc chloride and creosote/petroleum preservative mixtures. The treatment process generated wastewater primarily consisting of steam condensate containing zinc chloride or creosote. Floor and shop washing, drippage from treated ties pulled from the retort onto the drip track and storage of treated ties on the property were other sources of process-generated wastewater. Prior to 1971, BNRR discharged wastewater into a lagoon (the "CERCLA Lagoon") located immediately south of the retort building. Overflow from this lagoon flowed in an open ditch from the facility into a swamp on the shore of Flathead Lake. Sometime prior to 1946, a pond formed in the swamp area (the "swamp pond") adjacent to Flathead Lake and waste material discharged through the open ditch accumulated there.

BNRR abandoned the CERCLA Lagoon and ditch in 1971 when the company constructed two new wastewater holding impoundments [the Resource Conservation and Recovery Act (RCRA) impoundments]. In 1984 BN implemented a recycling system and stopped all wastewater discharges.

In February 1984, the Montana Department of Health and Environmental Sciences (MDHES) sampled the soils at the Somers Plant. Based on the results of this investigation, the Site was proposed for inclusion on the Superfund National Priorities List (NPL) in 49 CFR 40320, October 15, 1984. The proposed listing cited potential adverse effects on Flathead Lake and the water supply for the town of Somers, which drew water from the lake.

In May 1985, EPA, BNRR and Sliters Corporation (a corporation which owns a portion of the site) signed an Administrative Order on Consent (AOC) (Docket No. CERCLA-VIII-85-02) providing for an Emergency Removal Action in the area of the swamp pond adjacent to Flathead Lake. The area was determined to pose an imminent and substantial hazard to Flathead Lake because of the presence of creosote contamination in water and soil located within two (2) feet of the shoreline. Pursuant to the 1985 AOC, BNRR removed

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contaminated soil and surface water from the swamp pond area and the drainage ditch. The soils were temporarily placed in the lined RCRA impoundments and eventually hauled to the BN RCRA-regulated facility in Paradise, Montana for treatment. The water was processed at the plant. The excavated areas were backfilled with clean soil and riprap was placed along the lakeshore.

In October 1985, EPA, BNRR, and Sliters Corporation signed another AOC (Docket No. CERCLA-VIII-85-07) for a Remedial Investigation and Feasibility Study (RI/FS). The purpose of the RI/FS was to determine the nature and extent of contamination at the Site, to evaluate the impacts of contamination on public health and the environment, and to formulate alternatives for remedial action. The field work to support the RI was performed from the Fall of 1985 to Fall 1988. An RI/FS Report (Remediation Technologies, Inc., 1989) was submitted to EPA in the spring of 1989.

The RCRA impoundments were closed in 1988 under the MDEQ Hazardous Waste Permitting Program. Subsequent to the closure, a groundwater monitoring well located adjacent to the impoundment indicated that groundwater was contaminated; therefore, groundwater corrective action was required.

After completion of the RI/FS, a ROD was signed on September 27, 1989 (EPA 1989a). The ROD selected a remedy and a contingency remedy for remediation of soil, groundwater and sediments, which were determined to pose a potential threat to human health and the environment. The selected remedy addressed the principal threats by removing the potential for direct contact with soils, by reducing the impact of the soils and sediments on groundwater and surface water and by treating the groundwater. The contingency remedy was to be implemented if the selected remedy was not determined to be effective. On December 20, 1991, the EPA entered into a Consent Decree (Civil Action No. CV-91-32-M-CCL) with BNRR and Burlington Northern, Inc. for Remedial Design/Remedial Action (RD/RA) of the selected remedy at the Site. The Consent Decree required performance of a Pilot Study to demonstrate the "practicability" of the innovative bioremediation component of the selected groundwater remedy. The Consent Decree required that the Pilot Study be conducted prior to any soil application on the Land Treatment Unit (LTU).

EPA issued an ESD in June 1992 (EPA, 1992) that modified the elements of the selected remedy, based on the "practicability" determination required in the ROD. The results of the Pilot Study were presented in the Remedial Design Investigation Report for the Former Somers Tie Plant (Remediation Technologies, Inc., 1991). The study was conducted to more accurately define and quantify the conditions under which the groundwater could be successfully remediated.

Operation of the 14.4 acre LTU commenced in 1994 following removal of soil from the CERCLA Lagoon to a 15 foot depth (22,300 cubic yards), Swamp Pond Area to a 12 foot depth (19,030 cubic yards), and the Drip Track/Retort Building (10,000 cubic yards). After the first year of LTU operation, the ROD remediation levels for soils were achieved. The second year of operation of the LTU produced a 19% reduction in carcinogenic Polycyclic Aromatic Hydrocarbons (cPAH) concentrations (RETEC 1995a). The cPAH reduction

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allowed BN to apply a second lift of soil to the LTU in the fall of 1995 in accordance with the 1989 ROD requirements.

The groundwater remedy consisting of five (5) extraction and ten (10) injection wells and a granular activated carbon (GAC) water treatment plant was put into operation at the end of April 1994 to capture and treat contaminants at the CERCLA Lagoon and downgradient of the CERCLA Lagoon. The system is designed to hydraulically contain Polycyclic Aromatic Hydrocarbons (PAH) contaminated groundwater within the boundary of the influence of the well fields. Extracted water is chemically and mechanically treated for free product, dissolved organics and iron at the site Water Treatment Plant prior to reinjection. Groundwater contamination at the site consists of Dense Non Aqueous Phase Liquids (DNAPL) within and adjacent to the CERCLA Lagoon and dissolved components downgradient from the lagoon.

Excavation activity in the swamp pond and slough areas resulted in the determination of the need for mitigation of damage to wetland environments. The Fish and Wildlife Service delineated and determined functional values of the wetland ai ea in July 1993 (USFWS, 1994), which are described in the Wetlands Compensation Determination (EPA, 1994c). BNRR reconstructed the swamp pond in accordance with the plan and conducts semi-annual water quality sampling and assessment of vegetation recovery for the area.

A Five-Year Review of the Remedial Action at the Somers Plant was performed in April 1996. The objectives of the Five-Year Review were: (1) to verify that the remedy is operating and functioning as designed and, (2) to evaluate whether the remedial action selected for the site remains protective of human health and the environment. The Five-Year Review conducted for the Somers site was performed in accordance with the Office of Solid Waste and Emergency Response (OSWER) Directives 9355.7-02 entitled "Structure and Components of Five-Year Reviews", (EPA 1991) and 9355.7-02A, entitled "Supplemental Five-Year Review Guidance", (EPA 1994a).

The Five-Year Review of the Somers site was triggered by the initiation of a portion of the remedy by the responsible party, Burlington Northern Railroad, in 1991. The Five-Year Review includes recommendations for the evaluation of remediation levels for the site to ensure that the remedy is protective of human health and the environment and that the remediation levels are current and consistent with CERCLA Section 121, and EPA and State policy and guidance.

III. SUMMARY OF THE 1989 RECORD OF DECISION

The objectives of the remedy selected in the 1989 ROD are to reduce human exposure to soil, sediment and groundwater contaminants of concern. The components of the remedy are excavation and biological treatment of soils within an onsite LTU, and *in situ* biological treatment of contaminated groundwater within the water table aquifer, supplemented by extraction and treatment of contaminated water through a mechanical and chemical treatment process to remove free product, metals and particulates, and dissolved organics

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through oil/water separation, equalization, oxidation, particulate settling and granulated activated carbon filtration.

A list of the components of the original remedy selected for the site can be found on pages 40 through 46 of the 1989 ROD (EPA, 1989a). The remedy was modified by the 1992 ESD (EPA, 1992) based on the Pilot Study for ground water contaminants of concern. A brief summary of the original and modified remedy is provided below. The ROD remediation levels for contaminated soil and ground water are presented in Table 1.

- The soil remedy involved excavation of creosote and zinc contaminated soils in the CERCLA lagoon, drip track, drainage ditch, beneath the retort building and in the slough and beach areas. Some soil left below the water table in the CERCLA lagoon and swamp would be treated as part of the groundwater component of the remedy. The ROD included provisions for groundwater monitoring and post-closure care for up to 30 years or deed restrictions placed if hazardous constituents remained. Due to RCRA land disposal restrictions, a demonstration of no-migration of hazardous constituents was conducted to satisfy requirements.

- The original feasibility study alternative was modified for the selected remedy to exclude the excavation of the beach sediments. The sediments were not excavated due to a determination that the ecological risks to Flathead Lake from beach excavation outweighed the benefits of removing the contaminated sediments.

- Excavated areas were required to be backfilled with clean borrow soils and revegetated. The remedy also included replacement or restoration of wetlands lost during the remedial action.

- The ROD identified groundwater remedy involved the evaluation of the applicability of innovative technology, either hot water flushing of contaminated groundwater, ozone/UV or peroxide/UV treatment at the surface and *in situ* biological treatment of residual contamination.

  The 1991 Consent Decree required that a pilot test of the hot water flushing and *in situ* biological treatment technologies be conducted to evaluate their "practicability" in the low permeability hydrogeologic conditions at the Site. Implementation of the soil remedy was restricted until after the pilot test was conducted, as the contingency remedy involved deep excavation and incineration of soils. The remedy involved the installation of injection and recovery wells in the CERCLA Lagoon and the swamp pond area. Recovered groundwater would be treated in a chemical reactor in order to reduce contaminant levels.

- Identification and implementation of institutional controls to restrict use of groundwater downgradient of the contaminated areas was required.

- Monitoring activities required to assess the performance of the components of the remedy would be conducted throughout the life of the remedial activities. Activities

ED_002671A_00012956-00220

involve monitoring of groundwater wells and semi-annual monitoring of the Somers municipal supply well until cleanup concentrations are achieved.

- The Site conditions will be reviewed no less than every five years after initiation of the remedial action to ensure that the remedy remains protective of human health and the environment.

In 1992, EPA modified the remedy selected for the site through an ESD. The ESD presented the "practicability" determination for the innovative bioremediation technology for the groundwater component. The significant differences between the remedy described in the 1989 ROD and the 1992 ESD are listed below:

1. Excavation of additional soils in the CERCLA Lagoon and the Swamp Pond Areas increasing the total excavated materials from 11,700 cubic yards to 41,000 cubic yards. Additional excavation was conducted to aid the remediation process.

2. Increase the size of the Land Treatment Facility from 10 acres to 14 acres to decrease the time required to meet remedial objectives and cleanup remediation levels. Procedure for completion of land treatment described in the ROD (p. 42) was not modified.

3. Elimination of the hot water flushing option of the groundwater remedy due to the low permeability of the aquifer materials. Excavation of additional soil in the CERCLA Lagoon would remove more source material and aid the remediation process.

4. Change in soil and groundwater cleanup times. Decrease the time to achieve soil remediation levels to 4 to 6 years rather than 10 years. Increase the estimate to achieve groundwater remediation levels from 10 to 15 years to 50 years.

IV. SUMMARY OF SIGNIFICANT DIFFERENCES TO THE REMEDY

The significant differences between the remedy selected in the 1989 ROD and the 1992 ESD and in this ESD are:

1. The soil remediation level for carcinogenic polycyclic aromatic hydrocarbon (cPAH) is revised from 36 to 57 milligrams per kilogram (mg/kg) calculated as benzo(a)pyrene (B(a)P) equivalents using the revised B(a)P cancer slope factor.

2. The limitations established in the 1989 ROD for pyrene, naphthalene and phenanthrene in soils are removed. EPA cites in part the rationale provided by field data, toxicological assessment and the language within the No-

ED_002671A_00012956-00221

Migration Petition as reasons for removing these requirements. Further discussion is provided below.

3. The soil remediation level for total non-carcinogenic PAH is revised from 1875 mg/kg to 1500 mg/kg based on the revisions to the Reference Dose (RfD) for naphthalene equivalents which has been revised from 0.005 to 0.004 mg/kg-day.

4. The groundwater remediation level for total non-carcinogenic PAH is revised from 0.3 μg/L to 40 μg/L based on the current procedure of not considering co-carcinogenicity and the change in the Reference Dose (RfD) equivalent to naphthalene noted in item 3. above.

5. The groundwater remediation level for total phenolics is revised from 15,000 μg/L to 6000 μg/L calculated, based on revisions in the RfD for Phenol and RfD values for other phenolic compounds.

Only those changes in Section IV paragraphs 1 through 5 above are being made to the remedy selected in the 1989 ROD and 1992 ESD. All other aspects of the selected remedy documented in 1989 ROD and 1992 ESD remain the same. A detailed rationale and background for the changes in this ESD follows.

Risk-Based Remedial Goals

Risk-based cleanup remediation levels established in the ROD for contaminated soils and groundwater were reviewed to determine the impact of changes in the toxicological assessment of contaminants of concern (COCs) including total PAHs, cPAHs and phenolic compounds using current EPA toxicological information and updated relative potency factor (RPF) and Toxicity Equivalency Factor (TEF) guidance (EPA, 1989b, EPA 1994b, EPA 1993). This review effort was performed to assess the degree of protectiveness afforded by the current risk-based remediation levels documented in the 1989 ROD for Somers.

The residential exposure scenarios were used as the basis for 1989 cleanup levels presented in the ROD for groundwater and soil. The site-specific exposure parameters established in the human health evaluation for these scenarios were used in the calculation of chemical concentrations for specific target risk levels. In the absence of site-specific information, standard default exposure parameters were used in the calculations. Risk-based remediation levels were also prepared for contaminants with MCLs for comparison purposes only (EPA, 1994e).

A summary of the results of the risk-based cleanup goal review effort is presented in Table 1.0. Details regarding the methods and input parameters used to develop the 1998 risk-based remediation levels presented in these tables are provided in the Supplemental Remedy Protectiveness Evaluation (Roy F. Weston, 1995b).

ED_002671A_00012956-00222

Soils Remediation Levels

The 1989 risk-based remediation levels for total carcinogenic and non-carcinogenic PAHs in soils differ from the 1998 risk-based remediation levels. The differences are based on revisions in the slope factor for B(a)P and the establishment of new RfD's for non-carcinogenic PAHs. Table 3 provides a summary of the slope factor and RfD revisions.

Total cPAH

The 1989 risk-based remedial remediation levels for total carcinogenic PAHs for soils, established using residential exposure scenarios differ from the 1998 risk-based remediation levels. The difference is due to revisions in the slope factor for B(a)P from 11.5 to 7.3 $(mg/kg\text{-}d)^{-1}$. Also, the 1989 remediation levels were applied to the sum of all cPAHs with the assumption that each cPAH was equal in carcinogenic potency to B(a)P. However, since promulgation of the ROD, cPAHs have been assigned RPFs which are used to convert individual cPAHs to B(a)P equivalent concentrations, thus resulting in less potent classification and having an effect of decreasing the estimated risk from cPAHs. The determination of compliance to the revised remediation levels for soils can be accomplished using EPA Region VIII Superfund Technical Guidance, Development of Toxicity Values for PAHs (EPA, 1994b).

Using the updated slope factor for B(a)P results in a change of the soil treatment cPAH limitation from 36 mg/kg to 57 mg/kg.

Total non-carcinogenic PAH

In 1989 non-carcinogenic effects of total PAHs were based upon the assumption that all PAHs were as toxic as naphthalene with an RfD of 0.005 mg/kg-d. Since promulgation of the ROD, the RfD for naphthalene has been revised from 0.005 to 0.004 mg/kg-d. Additionally, RfDs for other PAHs have been derived. As with the groundwater, those PAHs that have no RfD are conservatively evaluated as equal to most potent known RfD (naphthalene).

Application of the revised RfD produces a soil cleanup level for non-carcinogenic PAHs of 1500 mg/kg to replace the 1875 mg/kg level found in the 1989 ROD.

Naphthalene, Pyrene and Phenanthrene

EPA and MDHES established soil cleanup levels in the 1989 ROD that were based on both risk assessment results and proposed (Best Demonstrated Available Treatment) BDAT requirements for land disposal of the wastes found at the Site. These remediation levels include.

Contaminant(s)	Cleanup Goal	Source
Total cPAH	36.0 mg/kg	Risk Assessment

ED_002671A_00012956-00223

Total PAH	1,875 mg/kg	Risk Assessment
Naphthalene	8.0 mg/kg	BDAT Requirements
Phenanthrene	8.0 mg/kg	BDAT Requirements
Pyrene	7.3 mg/kg	BDAT Requirements

The remediation levels listed above that are based on BDAT requirements were incorporated within the 1988 ROD due to the land disposal restrictions (LDRs) that applied to the remedy (a land treatment unit) proposed for the wastes found in soils at the Site. The BDAT limitations were included in the ROD due to the lack of other numerical standards that applied to the contaminated soils. The BDAT limitations were derived from a demonstration using an incineration technology not a bioremediation technology as was selected for implementation at the Somers site.

It was recognized by both Burlington Northern and EPA at the time of the ROD that achievement of the pyrene level by land treatment would likely prove most difficult because the BDAT limitations were based on incineration as the applicable treatment technology. The No-Migration Petition for the Somers site was submitted by ReTec, Inc., as Appendix D of the Remedial Design investigation Report (December 1991). The petition evaluated migration potential for all contaminants of concern at the Site, including pyrene, naphthalene and phenanthrene. The petition was reviewed by EPA and MDEQ and commented on extensively by EPA. EPA approved the final No-Migration Petition with the issuance of the 1992 ESD on June 26, 1992. The study demonstrated that no migration of contaminants and no adverse impact to human health or the environment would occur during operation and closure of the LTU. 40 C.F.R. Section 268.6 allows EPA to approve a waiver of the Land Disposal Restrictions BDAT standard based on a successful No Migration Demonstration and Petition.

Removing the BDAT requirement for pyrene will not compromise the overall protectiveness of the selected remedy. Pyrene is now included in the list of total PAH compounds (no longer considered by EPA to be carcinogenic) whose sum total concentration must be remediated below the risk-based cleanup goal of 1,875 (modified to 1,500 by this ESD). By remediating the total PAHs below this level, EPA has determined that the residual concentrations of PAHs (including pyrene) will be protective of human health and the environment.

Field data available in BNRR's *LTU Annual Operations Reports* also indicate that BDAT requirements for both naphthalene and phenanthrene are achievable with the selected soils remedy. During operation of the Site LTU, remediation levels for these compounds are achieved prior to achievement of remediation levels for total carcinogenic PAHs. Thus, the standard set for total carcinogenic PAHs would ultimately govern the total time required to fully remediate a soil lift within the LTU.

ED_002671A_00012956-00224

With a potential for expediting the time required to remediate the contaminated soils at the Site while still maintaining the degree of protectiveness for human health and the environment, and EPA's approval of the No-Migration Petition, EPA is removing the soil treatment levels for pyrene, naphthalene and phenanthrene. As explained above, the degree of protectiveness for human health and the environment will be maintained by remediating the total PAH compounds to 1,875 mg/kg and the carcinogenic PAH compounds to the new risk-based goal of 57 mg/kg. All other requirements for remediating the contaminated soils within the LTU (as listed above) will remain in effect.

Only the initial treatment levels are being changed by this ESD. The ROD requirement for additional treatment of soils, after attaining the new initial treatment levels, until the annual reduction in cPAH is less than 20 percent, remains unchanged. The additional ROD requirement that health risks posed by direct contact with site soils be reduced to at least 1x10-5 also remains unchanged.

Groundwater Remediation Levels

Total non-carcinogenic PAHs

In 1989, the Risk Assessment for the BN Somers site identified a concentration for total PAHs of 50 μg/L as being protective against noncancer health effects. This level was calculated based on the assumption that all PAHs had an RfD equivalent to naphthalene (0.005 mg/kg-d). However, this risk-based value was not selected for incorporation in the ROD due to concerns at the time over carcinogenic promotion or co-carcinogenicity of noncarcinogenic PAHs. Therefore, a cleanup level for total PAHs of 0.300 μg/L was set, using a value one order of magnitude greater than the risk-based cleanup level for carcinogenic PAHs (0.03μg/L).

Currently, carcinogenic promotion by noncarcinogenic PAHs is not considered in estimating potential carcinogenic effects from exposure to PAHs (EPA, 1994c) and a health-based level using RfDs for noncarcinogenic effects is appropriate. As noted above, since issuance of the ROD in 1989, the RfD for naphthalene has been revised from 0.005 to 0.004 mg/kg-d, and many of the PAHs have been assigned individual RfDs. Those PAHs for which no RfD has been assigned have been assumed to be equal to the most potent known RfD (naphthalene = 0.004 mg/kg-d).

The recalculation of the health based clean-up goal is 40 μg/L. To determine compliance levels, exposure point concentrations (EPCs) for individual PAHs are recalculated based on the revised RfDs and converted to naphthalene equivalent concentrations using RfD ratios. These naphthalene equivalent concentrations are then summed to represent total PAHs present in groundwater for comparison to the revised clean-up level.

There is no change in the exposure risk to the public due to this revision in the remediation level for non-carcinogenic PAHs.

ED_002671A_00012956-00225

Total phenolics

For total phenolic compounds, the RfD for phenol has been revised to 0.6 mg/kg-d, resulting in a revised clean-up goal of 6000 μg/L which replaces the 1989 ROD level of 15,000. As with the cPAHs and PAHs, RfD values for other phenolic chemicals of concern have been derived (phenol, 2,4-dimethylphenol, 2-methylphenol, 4-methyphenol). Again, EPCs for individual phenolic compounds are converted to phenol equivalent concentrations using ratios of RfDs, which are summed to represent total phenolics present at the site for comparison to the revised clean-up level.

There is no change in the exposure risk to the public due to this change in the remediation level for total phenolics.

Carcinogenic PAHs

Although federal MCLs for cPAHs have been promulgated since the ROD was issued, no change is made to the ROD at this time because: (1) MDEQ is currently revising the Montana WQB-7 standards for these compounds and (2) BNSF will prepare a Technical Impracticability (TI) waiver application relative to groundwater cleanup at the Site. Updated groundwater standards will be addressed as part of the TI waiver analysis and application.

V. SUMMARY OF STATE COMMENTS AND AVAILABILITY OF ADMINISTRATIVE RECORD

As stated above, MDEQ has reviewed the documents that serve as the basis for this determination and has provided comments to EPA on the documents and on this ESD. All of the MDEQ comments were incorporated into the final reports. MDEQ has been provided with the opportunity to review and comment on this ESD and all of their comments have been incorporated.

Documents referenced within this ESD are part of the Administrative Record for the Somers Site. The administrative record will also contain any written public comments that may be received regarding this ESD. The complete administrative record for the Site is available for public review at the following location:

U.S. EPA Montana Office	Flathead County Public Library
Federal Building, Room 192	247 1st Avenue East
301 South Park, Box 10096	Kalispell, Montana 59901
Helena, Montana 59626-0096	
(406) 441-1150	(406) 756-5690
Mon-Fri, 8:00 a.m. to 5:00 p.m.	Mon-Fri, 8:00 a.m. to 4:00 p.m.

ED_002671A_00012956-00226

VI. AFFIRMATION OF STATUTORY REQUIREMENTS

Considering the new information that has been developed and the changes that have been made to the selected remedy, EPA, in consultation with MDEQ, believes that the remedy remains protective of human health and the environment, complies with Federal and State requirements that both applicable or relevant and appropriate to this remedial action or involves appropriate waivers of these requirements, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Site.

VII. APPROVAL

Mark A. Simonich

7/13/98

Mark A. Simonich, Director
Montana Department of Environmental Quality

Date

Max H. Dodson

7/21/98

Max H. Dodson, ARA
Office of Ecosystems Protection and Remediation
U.S. Environmental Protection Agency

Date

ED_002671A_00012956-00227

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ED_002671A_00012956-00228

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ED_002671A_00012956-00229

TABLE 1.0
COMPARISON OF 1989 AND 1995 RISK-BASED REMEDIATION LEVELS FOR BN-SOMERS [a,e]

Contaminants of Concern	Groundwater		Soil	
	1989 Risk Based Goal[d] (μg/L)	Risk-Based 1995 Target Clean-up Concentration (μg/L)	1989 Risk Based Goal (mg/kg)	Risk-Based 1995 Target Clean-up Concentration (mg/kg)
Total Carcinogenic PAHS [b]	0.030 μg/L	0.047 μg/L	36 mg/kg	57 mg/kg
Total PAHs - NonCancer Effects	0.300 μg/L Based on concern over possible co-carcinogenicity	40 μg/L Based on noncancer health effects calculated using naphthalene equivalent concentrations	1,875[c]	1,500
Phenol	—	6000	—	45,000
Total Phenolics	15,000	6000	3,000[c]	45,000

(a) Calculated using toxicity values shown in Table 2.0.
(b) Benzo(g,h,i)perylene assessed as a potential carcinogen in 1989; not classifiable as to human carcinogenicity and assessed as a noncarcinogen in 1995.
(c) Value cited as an excavation concentration.
(d) Values obtained from 1989 ROD for BN-Somers.
(e) Methods for comparing site concentrations to risk-based remediation levels have been revised since 1989. See text for further detail.
— Risk-based value not used as goal in 1989 ROD.

ED_002671A_00012956-00230

TABLE 2.0
COMPARISON OF TOXICITY VALUES USED FOR RISK CHARACTERIZATION AT BN-SOMERS 1989 AND 1998 VALUES

Contaminant of Concern	1989 Values[a] RfD (mg/kg-d)	1989 Values[a] oSF (mg/kg-d)$^{-1}$	1998 Values[c] RfD (mg/kg-d)	1998 Values[c] oSF (mg/kg-d)$^{-1}$ [b]
PAHs:				
Naphthalene	0.05 to 0.005[d]		0.004	
Acenaphthylene	0.03		NA	
Acenaphthene	0.20		0.06	
Fluorene	0.07*		0.04	
Phenanthrene	0.07*		NA	
Fluoranthene	0.07*		0.04	
Pyrene	0.06		0.03	
Benzo(a)anthracene	0.07*	11.5	NA	0.73
Chrysene	0.07*	11.5	NA	0.0073
Benzo(b)fluoranthene	0.07*	11.5	NA	0.73
Benzo(k)fluoranthene	0.07*	11.5	NA	0.073
Benzo(a)pyrene	0.07*	11.5	NA	7.3
Indeno(1,2,3-c,d)pyrene	0.07*	11.5	NA	0.73
Dibenzo(a,h)anthracene	0.07*	11.5	NA	7.3
Benzo(g,h,i)perylene[e]	0.07*	11.5	NA	--
2,4-dimethylphenol	NA		0.02	
2-methylphenol	NA		0.05	
4-methylphenol	NA		NA	
Phenol	0.04		0.6	
Zinc	0.21		0.3	

(a) Values from Table 2 of the 1989 ROD
(b) PAH specific Slope Factors calculated from B(a)P by multiplying by RPF (see text)
(c) Values obtained through reviews of IRIS, HEAST and Safe Drinking Water Guidance (EPA, 1995, 1994d, 1994e)
(d) Provided range of RfDs for Naphthalene, however used most stringent (0.005) in calculations
(e) Assessed as a potential carcinogen in 1989; not classifiable as to human carcinogenicity and assessed as a non carcinogen in 1998
* Value assumed equal to average RfD for other noncarcinogenic PAHs
NA Not Available

ED_002671A_00012956-00231

TAB 9

PB98-963149
EPA 541-R98-175
March 1999

EPA Superfund
Explanation of Significant Difference for the Record of Decision:

Petrochem Recycling Corp./ Ekotek Plant
Salt Lake City, UT
12/9/1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

EXPLANATION OF SIGNIFICANT DIFFERENCES

Petrochem Recycling Corp./Ekotek, Inc., Superfund Site
Salt Lake County, Salt Lake City, Utah

December 1997

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ED_002671A_00012956-00234

PETROCHEM RECYCLING CORP./EKOTEK, INC., SUPERFUND SITE
EXPLANATION OF SIGNIFICANT DIFFERENCES
DECEMBER 1997

I. INTRODUCTION

This Explanation of Significant Differences (ESD) is being issued by the U.S. Environmental Protection Agency (EPA) to modify certain remediation criteria established in the Record of Decision signed by EPA on September 27, 1996 (ROD), and certain other components of the ROD, as described herein, which will be implemented at the Petrochem Recycling Corp./Ekotek, Inc., Superfund Site, located in Salt Lake City, Utah (Petrochem Site or Site).

The changes to the ROD have been made as a result of new information that EPA received subsequent to the issuance of the ROD. These changes do not fundamentally alter the site-wide remedy presented in the ROD. The site-wide remedy for the Petrochem Site remains protective of human health and the environment. This ESD is issued by EPA, the lead agency at the Site, after consultation with the Utah Department of Environmental Quality (UDEQ), the support agency at the Site.

The modifications to the remedy described in this ESD do not alter the selected remedy in any fundamental aspect regarding scope, cost, or performance. In accordance with Sections 117(c) and 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund), as amended, 42 U.S.C. Section 9601, et seq. ("CERCLA"), and the regulations at 40 C.F.R. Section 300.435(c)(2)(I), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), this ESD has been prepared for the following reasons:

- to provide the public with an explanation of the nature of the changes to the remedy;
- to summarize the circumstances that led to the changes to the remedy; and
- to affirm that the revised remedy complies with all statutory requirements.

This document presents a summary of the changes to the selected remedy and a synopsis of information on the Site. The Administrative Record, which contains the ESD and this documentation supporting the revisions, is available for public review at the locations indicated at the end of this report.

II. SITE HISTORY AND BACKGROUND

a. Location

The Petrochem/Ekotek Site (the Site) is located in Township 1 North, Range 1 West, Section 23, and occupies approximately seven acres in an industrial corridor in the northern section of Salt Lake City, Utah.

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b. Operational History

The Site was originally owned and operated as an oil refinery by O. C. Allen Oil Company, from 1953 to 1968. In 1968, Flinco, Inc. purchased the facility and operated the refinery until 1978. During that time Flinco changed its name to Bonus International Corp. In 1978 Axel Johnson, Inc., acquired the facility and operated it through its Delaware-based subsidiary, Ekotek, Inc. At this time, Ekotek, Inc. converted the Site into a hazardous waste storage and treatment, and petroleum recycling facility. Steven Self and Steve Miller purchased the site from Axel Johnson, Inc. in 1981 and reincorporated as Ekotek Incorporated, a Utah corporation. From 1980 to 1987, the facility operated under Resource Conservation and Recovery Act (RCRA) interim status, and received a hazardous waste storage permit in July 1987 for a limited number of these activities. Ekotek, Inc. declared bankruptcy in November of 1987. Petrochem Recycling Corp. leased the facility in 1987 from Ekotek, Inc. and continued operations until February 1988. The Ekotek bankruptcy estate released the property (Parcel Numbers 0823407001 and 0823407002) pursuant to state statute, Utah Code Annotated Section 59-2-1336. Delinquent County taxes attributed to the property have not been paid. Ownership of the Site is uncertain at present following the bankruptcy proceedings of Ekotek Incorporated, the owner of the Site in 1989. A transfer of title to the property to either the county or a potential purchaser may occur as a result of a final tax sale. The tax sale must be initiated within four and a half years after the initial date of the delinquent taxes.

c. History of Site Investigations

In 1980, Ekotek, Inc., filed a RCRA Part A permit application and achieved Interim Status. A RCRA Part B permit was issued in 1987 to Ekotek, Inc. Site operations were shut down in February 1988, after the issuance to Petrochem Recycling Corporation of a Notice of Violation by the Utah Bureau of Solid and Hazardous Waste and by the Bureau of Air Quality. In November 1988, Region VIII EPA Emergency Response Branch initiated a removal action at the site.

Sources of contamination at the Site included approximately 60 aboveground tanks, 1200 drums and 1500 smaller containers, three surface impoundments, an underground drain field, numerous piles and pits of waste material, underground tanks, incineration furnaces, and contaminated soils. Contaminants associated with on-site sources include a wide range of organic substances such as chlorinated solvents and other volatile organic compounds, polynuclear aromatic hydrocarbons, phthalates, pesticides, Aroclor 1260, dioxin and furans. Heavy metals are also present in on-site sources.

On August, 2, 1989, an Administrative Order on Consent (AOC) for Emergency Surface Removal (Docket CERCLA-VIII-89-25) was issued to 27 Potentially Responsible Parties (PRPs) to undertake actions to clean up the Site. These PRPs operated as members of a voluntary association termed the Ekotek Site Remediation Committee (ESRC). As part of the emergency response, the ESRC removed surface and underground storage tanks, containers, contaminated sludges, pooled liquids, and processing equipment from the Site.

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ED_002671A_00012956-00236

EPA began site assessment field operations in November 1989, at which time all contaminant sources discussed above were present on-site. Pursuant to section 105 of CERCLA, 42 U.S.C. Section 9605, EPA proposed the Site for listing on the National Priorities List (NPL), set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on July 29, 1991; and listed the Site on the NPL promulgated on October 14, 1992; 57 Fed. Reg. 47180, 47200 (October 14, 1992). Only one operable unit has been designated for the Site.

An Administrative Order on Consent (AOC) for the performance of the Remedial Investigation/Feasibility Study (RI/FS) was signed in July 1992 (Docket No. CERCLA (106) VIII-92-21). Members of the ESRC were Respondents for the RI/FS AOC. The Phase I field investigation was undertaken from December 1992 to March 1993 and Phase II investigations were conducted from August to October 1993. A final RI report was issued in July 1994 and the final FS report was issued in January 1995. Two addenda to the FS were submitted on February 24, 1995 and April 7, 1995.

The hazardous substances present at the site and the data or information documenting a release or threatened release of a hazardous substance at or in connection with the Site is described in the Administrative Record for the Site, including but not limited to the RI Report. The release migration, including present and potential future pathways, possible or known routes of exposure of the hazardous substances, population at risk, and threats to human health and the environment are described in the Administrative Record for the Site, including but not limited to the Baseline Risk Assessment for the Site.

Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the FS and of the proposed plan for remedial action on July 19, 1995, in two major local newspaper of general circulation. EPA provided extensive opportunity for written and oral comments from the public on the proposed plan for remedial action. A copy of the transcript of the public meeting is available to the public as part of the administrative record upon which the Ecosystems Protection and Remediation Assistant Regional Administrator based the selection of the response action.

The decision by EPA on the remedial action to be implemented at the Site is embodied in a final Record of Decision (ROD) executed on September 27, 1996. The State had a reasonable opportunity to review and comment on the remedial action and the ROD. The ROD includes EPA's explanation for any significant differences between the final plan and the proposed plan as well as a responsiveness summary to the public comments received. Notice of the final plan was published in accordance with Section 117(b) of CERCLA, 42 U.S.C. § 9617(b). The ROD is supported by an administrative record that contains the documents and information upon which EPA based the selection of the response action.

Since February, 1997, EPA and the ESRC representatives have been in negotiations for an agreement to implement the remedy selected in the ROD. This agreement, in the form of a consent decree for remedial design and remedial action (RD/RA), if agreed upon, will be filed in the U.S. District Court for Utah. Since the time of the ROD, EPA has obtained new information which has resulted in the need for this ESD. The consent decree would provide for implementation of the remedy selected in the ROD including the modifications of this ESD.

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III. DESCRIPTION OF THE ROD

The purpose of the remedy is to eliminate the pathway of direct exposure to soils of an industrial worker through excavation and offsite disposal of hot spot soils; containment onsite of low-level contaminated soils under 42-inch soil cap; eliminate partitioning of LNAPL to the ground water through removal and treatment of LNAPL; and eliminate the potential future ingestion of contaminated drinking water through intrinsic remediation/attenuation of the ground water.

The components of the selected remedy include: Remove/Dispose Hot Spot Soils; Consolidate/Cap Soils that Exceed Soil Performance Standards; Partial Removal/Disposal of Soil and Buried Debris and Cap Remaining Debris; Remove/Treat 100% LNAPL; Intrinsic Remediation of Ground Water; and Access and Land Use Restrictions for the Petrochem/Ekotek Site.

The changes documented in this ESD are based on new information that EPA received subsequent to the issuance of the ROD. EPA determined that the information supports the need to correct and/or clarify certain aspects of the remedy described in the ROD. These changes do not fundamentally alter the overall approach of the site-wide remedy or any individual component of the site-wide remedy. The changes to the performance standards in this ESD may alter the amount of soil which exceeds the Hot Spot performance standards and which must be sent for offsite disposal as well as alter the amount of soil consolidated and contained onsite under the 42 inch cap. The volumes specified in the ROD were estimates. The actual volumes will be determined during the implementation of the remedy.

IV. SIGNIFICANT DIFFERENCES TO THE REMEDY

The significant differences between the remedy described in the 1996 ROD and in this ESD are:

1. The Soil Performance Standard for 2,3,7,8,-TCDD(TEF) will be revised from 1.86E-06 mg/kg to 3.7E-05 mg/kg for cancer risk of 1E-06 (site wide) and the Soil Hot Spot Performance Standard will be revised from 0.186 ug/kg to 3.7 ug/kg for cancer risk of 1E-04 (hot spot);

2. The Soil Performance Standard for PCBs will be revised from 0.15 mg/kg to 2.7 mg/kg (ppm);

3. The Soil <u>Hot Spots</u> Performance Standard for PCBs will be revised from 10 mg/kg to 25 mg/kg (ppm); and

4. The <u>Contingency Measures</u> section of the ROD will be revised to permit, as an alternative to discharge to the POTW, the discharge of ground water to re-injection wells or to a surface water/storm drain via the substantive requirements of a UPDES permit.

Only those changes described in Section IV, Paragraphs 1 through 4 above are being made to the selected remedy described in the 1996 ROD. All other aspects of the selected remedy documented

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in the 1996 ROD remain the same. A more detailed description of the revised components to the remedy follows.

V. DETAILED DESCRIPTION OF CHANGES TO THE ROD

1. Soil Performance Standard for 2,3,7,8,-TCDD(TEF).

The algorithms, exposure assumptions, and toxicity values used in the calculation of the remediation levels for 2,3,7,8,-TCDD(TEF) [dioxin] were re-examined. It was determined that a numerical entry error occurred during the original calculation of the dioxin performance standard. New values, 0.037 ug/kg (3.7E-05 mg/kg) for cancer risk of 1E-06 (site wide) and 3.7 ug/kg (3.7E-03 mg/kg) for cancer risk of 1E-04 (hot spots) were calculated based upon the same equations and assumptions in the August 2, 1994 Baseline Human Health Risk Assessment for the Petrochem Site for the commercial and industrial worker for exposure to soil via ingestion and dermal absorption, but with the correct numerical entries.

The revised Soil Performance Standard (SPS) for TCDD is derived based upon the following formula:

$$SPS = \frac{TR*BW*AT*365\ days/year}{EF*ED*[(SF_0*1\text{-}06*IR) + (SF_0*0.9*1E\text{-}06*SA*AF*ABS)]}$$

TR (target risk) 1E-06
BW (body weight) 70 kg
AT (averaging time) 70 years
EF (exposure frequency) 250 days/year
ED (exposure duration) 25 years
SF_0 (slope factor oral) 1.5E+05 mg/kg-day^{-1}
1E-06 kg/mg (conversion factor)
IR (ingestion rate for soil) 50 mg/day
0.9 (adjustment factor for conversion from administered to absorbed dose for TCDD)
SA (Skin surface area) 3100 cm^2
AF (Soil to skin adherence factor) 0.016 mg/cm^2
ABS (absorption factor) 0.03

The SPS formula augments the risk based concentration (RBC) formula utilized in the risk assessment by incorporating an adjustment factor to convert administered to absorbed dose . Additionally, a default value of 0.87 was utilized in the risk assessment for ABS (fractional absorption factor). The default value was updated to 0.03 as per Dermal Exposure Guidance, (EPA/600/8-91/011E, January 1992). Lastly, based upon a recent update to the Exposure Factors Handbook (EPA/600/P-95/002Ba, August 1996) the AF (Soil to skin adherence factor) was updated from 1 to 0.016 mg/cm^2-day.

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2. Soil Performance Standard for PCBs.

EPA relies upon the Agency's Integrated Risk Information System (IRIS) for calculation of risk-based cleanup concentrations. IRIS, an electronic data base containing EPA's information on human health effects, was revised for polychlorinated biphenyls (PCBs) on June 1, 1997. Specifically, the slope factor for PCBs was revised subsequent to the release of the ROD, and several new slope factors (including those for the central tendency exposure condition) of PCBs became available. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per mg/kg/day. EPA recommends the use of a new slope factor of 2.0 per mg/kg-day, updated from 7.7 mg/kg-day, for the reasonable maximum exposure condition for PCBs in soil that are high risk and persistent. This slope factor is appropriate for deriving Soil Performance Standards for Aroclors 1260 and 1254 (PCB types found at Site) at the Site because these chemicals are high risk and persistent and the medium of exposure is in soil. The revised Soil Performance Standard of 2.7 mg/kg is based upon the same equations and assumptions in the August 2, 1994 Baseline Human Health Risk Assessment for the Petrochem Site for the commercial and industrial worker for exposure to soil via ingestion and dermal absorption, but utilizing in those equations the new slope factor and the updated AF (Soil to skin adherence factor) detailed in Section V.1..

3. Soil Hot Spot Performance Standard for PCBs

EPA carefully reviewed its *Guidance on Remedial Actions for Superfund Sites with PCBs Contamination,* OSWER Directive 9355.4-01, before making its decision to change PCB cleanup levels at the Petrochem Site. The *Guidance* describes how to develop remedial alternatives that are consistent with PCB-related Applicable or Relevant and Appropriate Requirements (ARARs) and "to-be-considered" criteria.

The guidance states that, for sites in *industrial* areas, cleanup actions should be considered when PCB levels range from 10 to 25 parts per million (ppm). Among the reasons for choosing 25 ppm are:

- there is less access in industrial areas than in other areas and, therefore, less frequency of exposure and less risk posed by the PCBs; and
- a 42-inch cap that covers PCB-containing soils further reduces access to the contaminants.

This cleanup level is consistent with the PCB Spill Policy, which recommends a cleanup level of 25 to 50 ppm for sites in *industrial* or other *reduced access* areas." The cleanup level is also consistent with the PCB guidance document. At the Petrochem Site, the PCB level remaining on site will not exceed 25 ppm.

4. Groundwater Contingency Measures: Discharge of Ground Water.

At the time of the ROD it was assumed that the POTW would be able to accept treated ground water

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generated from either the containment and/or the arsenic remediation contingency plans, if invoked. Based upon potential capacity issues at the POTW, an additional alternative may be considered permitting treated ground water to also be discharged to the underlying aquifer via re-injection wells or to a surface water/storm drain. These alternative measures for disposal of treated ground water would be evaluated at the time EPA determines they are needed, depending on whether either or both of the groundwater contingency measures (for containment and for arsenic) are invoked and if, in fact, capacity issues do exist at the POTW for the amounts of ground water being disposed. Discharge to a surface water/storm drain would comply with the requirements of a UPDES permit.

These additional components must also comply with all applicable and relevant and appropriate requirements (ARARs), pursuant to Section 121 of CERCLA. In addition to the ARARs set forth in the ROD, these revised activities must comply with Section 3020 of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901, et seq., which bans the injection of contaminated materials into drinking water formations unless specified conditions are met, designated by EPA as a relevant and appropriate requirement; and the Underground Injection Control program regulations at 40 C.F.R. Parts 144-147, which establish standards for construction and operation of injection wells and provide for the protection of underground sources of drinking water by ensuring that injected waters meet MCLs and risk based concentrations. The UIC regulations are designated by EPA as applicable to the activity described above.

VI. SUMMARY OF STATE COMMENTS AND AVAILABILITY OF ADMINISTRATIVE RECORD

UDEQ has been provided with the opportunity to review and comment on this ESD and the documents that serve as the basis for this ESD. UDEQ commented to EPA on these documents, and supports the changes to the Soil Performance Standard for 2,3,7,8-TCDD(TEF) and the Soil Performance Standard for PCBs. UDEQ, however, does not support the change to the Soil Hot Spot Performance Standard for PCBs based, in part, on its interpretation of EPA's PCB Spill Cleanup Policy. Finally, UDEQ supports the ground water contingency measure change. UDEQ's comments, dated October 30, 1997, can be found in the Administrative Record for the Site.

Documents referenced within this ESD are part of the Administrative Record for the Petrochem/Ekotek Inc. Site. The complete administrative record for the Site is available for public review at the following locations:

EPA Superfund Records Center
999 18th Street, Fifth Floor
Denver, Colorado 80202
Hours: Monday-Friday 8:00am - 4:30pm
Telephone: (303) 312-6473

Mr. Walter Jones
Marriott Library
Western Americana and Special Collections
University of Utah
Salt Lake City, UT 84122
Telephone: (801) 581-8863

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VII. AFFIRMATION OF STATUTORY REQUIREMENTS

Considering the new information that has been developed and the changes that have been made to the selected remedy, EPA, in consultation with UDEQ, believes that the remedy remains protective of human health and the environment, complies with Federal and State requirements that are both applicable or relevant and appropriate to this remedial action or involves appropriate waivers of these requirements, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Site.

VIII. APPROVAL

Max H. Dodson, Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

12/9/97
Date

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TAB 10

CONFIDENTIAL

6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
503.670.1108

ANCHOR QEA

Memorandum

August 2, 2017

To: Bob Wyatt, NW Natural

From: Amy Nelson and Taku Fuji, Anchor QEA, LLC

cc: Patty Dost, Pearl Legal Group

Ryan Barth, Carl Stivers, and Ben Hung, Anchor QEA, LLC

Re: USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor

Introduction

This memorandum summarizes the January 2017 U.S. Environmental Protection Agency (USEPA) updates to the human health toxicity values for benzo(a)pyrene (BaP) and their potential impacts on cleanup levels and remedial action levels (RALs) identified in the January 3, 2017 Record of Decision (ROD; USEPA 2017a) at the Portland Harbor Superfund Site (Site). USEPA's January 19, 2017 updates to *Toxicological Review of Benzo(a)pyrene (CASRN 50-32-8): Executive Summary. Integrated Risk Information System (IRIS)* (USEPA 2017b) include the following toxicity value changes:

- The oral cancer slope factor (CSF) decreased from 7.3 per milligram per kilogram-day (per mg/kg-day) to 1 per mg/kg-day. In general, the use of a lower BaP CSF results in lower BaP and carcinogenic polycyclic aromatic hydrocarbon (cPAH) risk estimates.
- A non-cancer oral reference dose (RfD) of 0.0003 per mg/kg-day was added; previously, USEPA did not identify an RfD for BaP in IRIS. Thus, BaP non-cancer risks had not been previously estimated.

Cleanup Levels

USEPA calculated preliminary remediation goals (PRGs) in the *Portland Harbor Feasibility Study* (FS; USEPA 2016) for each remedial action objective (RAO). In the ROD, USEPA set cleanup levels by media using the PRGs from the FS. Sediment and riverbank soil cPAH cleanup levels (expressed as BaP equivalents) presented in the ROD are based on PRGs developed using the 1987 BaP CSF (representing $1x10^{-6}$ risk level), rather than the 2017 BaP CSF.

This technical memorandum recalculates the cPAH PRGs presented in the FS and ROD using the new BaP CSF.[1] We have not modified any other variable or USEPA's equations themselves.

[1] USEPA cleanup levels (and RALs) incorporate rounding in one or more steps in the calculation, so recalculated concentrations are approximate.

Nearshore Sediment Cleanup Levels

The "riverbank soil/sediment" nearshore sediment cleanup level for cPAH of 12 micrograms per kilogram (µg/kg), as presented in Table 17 of the ROD (USEPA 2017a), is the minimum amount of cPAH PRGs by media developed in the FS and represents the human health sediment direct contact pathway specific to beaches. The USEPA FS also includes a separate RAO 1 cPAH PRG of 106 µg/kg for the sediment direct contact exposure evaluated in the Baseline Human Health Risk Assessment (BHHRA) for nearshore areas (i.e., outside the channel and not at beaches; identified in the FS as "in-water" PRGs). Although ROD Table 17 does not include that in-water value and defaults to the lower 12-µg/kg value based on beach exposures, the 106-µg/kg PRG is used to define "highly toxic" principal threat waste (PTW) concentrations in the ROD and to evaluate risk reduction for USEPA's selected remedy (USEPA 2017a, Table 6 and Appendix IV, Table J.2.2-1c).

If the updated BaP CSF was applied, the cleanup level based on the RAO 1 direct contact PRG applicable to beaches would increase from 12 µg/kg to approximately 85 µg/kg. The risk-based PRG for beach contact (recreational beach user) presented in the ROD is a cancer-based goal that happens to be the same number as the background value (a value USEPA estimated using a total polycyclic aromatic hydrocarbon [TPAH] to cPAH regression equation). Therefore, the updated BaP cleanup level of 85 µg/kg would lead to the risk-based goal being greater than USEPA's background value.

Using the updated BaP CSF, the cPAH RAO 1 in-water sediment direct contact PRG (based on cancer risks for the tribal fisher and applicable to nearshore sediments outside beach areas) would increase from 106 µg/kg to approximately 773 µg/kg.

Navigation Channel Sediment Cleanup Levels

Per USEPA's ROD Table 17 footnote (USEPA 2017a), the cPAH cleanup level of 3,950 µg/kg for navigation channel sediment is based on the RAO 2 sediment PRG protective of clam consumption by humans. Applying the updated BaP CSF to USEPA's cPAH clam PRG equation (USEPA FS Appendix D, as updated in the ROD), the resulting sediment cleanup level would increase from 3,950 µg/kg to approximately 108,000 µg/kg. Due to the log-log biota-sediment accumulation regression equation used in developing this PRG, the increase is not directly 7.3-fold as it is for the sediment direct contact PRGs applied for nearshore sediments.

Surface Water Cleanup Levels

Surface water cleanup levels in the ROD were selected based on the lower of RAO 3 and 7 PRGs from the FS (USEPA 2016). The ROD surface water cleanup level for cPAH (0.00012 µg/L) is equivalent to the RAO 3 PRG, which is based on federal human health water quality criteria protective of fish consumption. This value is lower than the RAO 7 ecological-based value for BaP (0.014 µg/L).

Application of USEPA's updated CSF would affect both the Oregon and federal human health water quality BaP criteria. The updated BaP CSF would increase the federal criteria and therefore, the ROD surface water cleanup level for BaP from 0.00012 µg/L to approximately 0.0009 µg/L. Similarly, the Oregon criteria would increase from 0.0013 µg/L to 0.0095 µg/L. Per the current ambient water quality criteria document for BaP (USEPA 2015), USEPA planned to update the human health criteria for BaP following the finalization of the IRIS update.

USEPA's No Action site-wide average surface water cPAH concentration (approximately 0.0008 µg/L, per ROD Appendix IV Figure 4.2-8b provided in the ROD [USEPA 2017a]) is less than the revised surface water cleanup level of 0.0009 µg/L. Following USEPA's FS evaluation methods, this would mean that the site already achieves the revised cleanup level.

Non-cancer PRGs

Prior to the BaP toxicity value update, a USEPA-approved non-cancer RfD did not exist for BaP and, as such, non-cancer hazards were not quantified in the Site human health risk assessment for BaP (Kennedy/Jenks Consultants 2013). However, USEPA apparently used this new toxicity value[2] to develop non-cancer RAO 1 PRGs for cPAH (FS Table B3-4; USEPA 2017a). These PRGs were not summarized in USEPA FS Section 2 and do not appear to be used in the FS or ROD evaluations. Because cPAH is a chemical sum made up of specific carcinogenic PAHs, it is unclear whether USEPA intended these PRGs to be applied to cPAH or only to BaP. However, the non-cancer cPAH RAO 1 PRGs in Table B3-4 of the USEPA FS are orders of magnitude higher than the cancer-based RAO 1 PRGs (i.e., the minimum non-cancer cPAH PRG is 91,470 µg/kg).

Remedial Action Levels and Principal Threat Waste Highly Toxic Threshold

The selected remedy identified in the ROD (USEPA 2017a) includes RALs and PTW highly toxic sediment concentrations, above which USEPA's remedy requires active remediation. PAH RALs for sediment identified in USEPA's ROD are TPAH concentrations determined by USEPA using RAL curves, the cPAH to TPAH correlation regression analysis, and USEPA's professional judgment regarding the acceptability of surface-weighted average concentrations (SWACs) achieved relative to various PRGs. Therefore, revised RALs cannot be directly recalculated using the updated BaP CSF. Nonetheless, USEPA's RAL determination methods can be mimicked using the updated PRGs through two approaches: 1) a proportional adjustment approach; and 2) a risk-reduction approach.

For the first approach, we used USEPA's correlation relationship between cPAH PRGs and TPAH RALs to estimate revised RALs. For the second approach, we also used post-construction SWACs associated with various RALs and compared them to the revised PRGs to see if higher RALs would

[2] Though USEPA cites the RfD as a 2004 number, it did not exist at that time, and it was not used in the baseline human health risk assessment.

still meet USEPA's interim target risk levels, similar to USEPA's FS methods for post-construction risk estimation. Each of these approaches are detailed below.

Nearshore Sediment RAL

The selected remedy identified in the ROD includes a TPAH RAL of 13,000 µg/kg applicable to nearshore sediments. The ROD cleanup levels associated with the nearshore sediment direct contact include 23,000 µg /kg TPAH (RAO 5 benthic risk PRG) and 12 µg/kg cPAH (RAO 1 beach direct contact PRG). As noted above, USEPA identifies the sediment direct contact PRG for beach sediments as the cleanup level for RAO 1, which is inconsistent with the RAO 1 exposure scenario evaluated in the BHHRA for nearshore sediments outside of beach areas. However, USEPA developed the TPAH RALs based upon the 106-µg/kg cPAH PRG (USEPA 2016, Figure 3.4-2). Further, USEPA's updated calculation of residual and post construction risks (USEPA 2017a, Appendix IV, Appendix J) evaluates achievement of RAO 1 in nearshore sediments for each alternative, including the selected alternative, using the in-water sediment RAO 1 cPAH PRG of 106 µg/kg. Consequently, we used the same PRG for our revised RAL estimates.

Proportional Adjustment Approach

The ROD TPAH RAL of 13,000 µg/kg converts to 1,500 µg/kg cPAH using USEPA's cPAH to TPAH regression, which is approximately 14 times the USEPA's RAO 1 in-water sediment cPAH PRG of 106 µg/kg. Proportionally adjusting USEPA's RAL by applying a 14-fold increase to the revised RAO 1 in-water cPAH PRG (773 µg/kg) results in an estimated revised RAL for the nearshore of 92,000 µg/kg TPAH (converted from 10,800 µg/kg cPAH using the regression and rounding to two significant figures, consistent with USEPA's RALs).[3] Figure 1 shows the sediment management areas (SMAs) associated with an alternative where the only modification to the selected remedy is revision of the nearshore TPAH RAL from 13,000 µg/kg to 92,000 µg/kg. Total SMA acreage (areas exceeding all RALs plus all PTW) decreases from 355 acres for the selected remedy (red area) to 326 acres (yellow plus green areas). Though the proportionally adjusted nearshore TPAH RAL results in only an approximately eight percent decrease in total SMAs, the revised RAL primarily reduces the SMA extents upstream and downstream of Gasco (only in the nearshore area, which is where the revised RAL would be applied).

[3] TPAH RAL for the nearshore sediments is 125 times the USEPA's RAO 1 beach PRG. Proportional adjustment results in a revised cPAH RAL of 10,600 µg/kg (approximately 91,000 µg/kg TPAH).

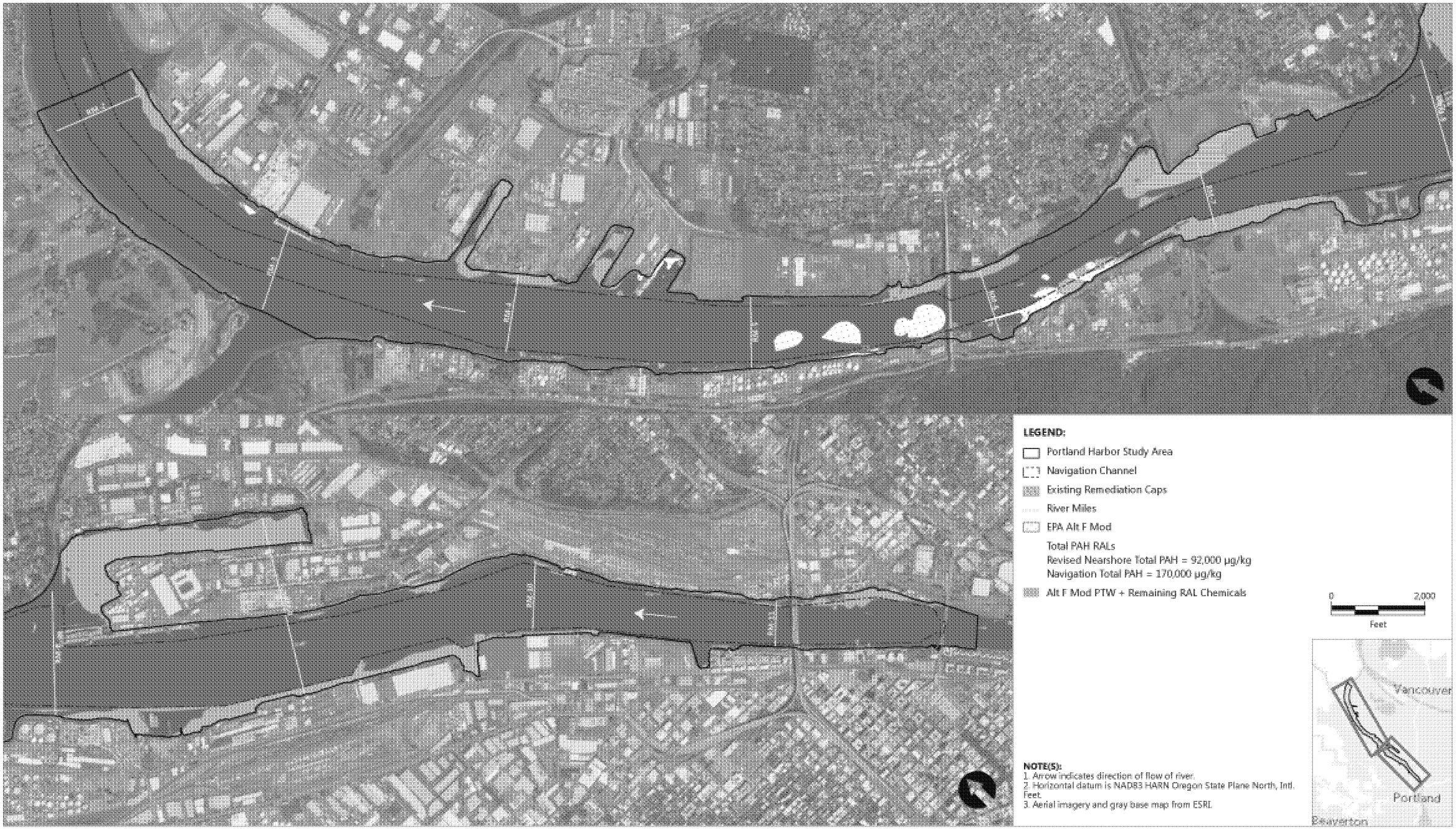

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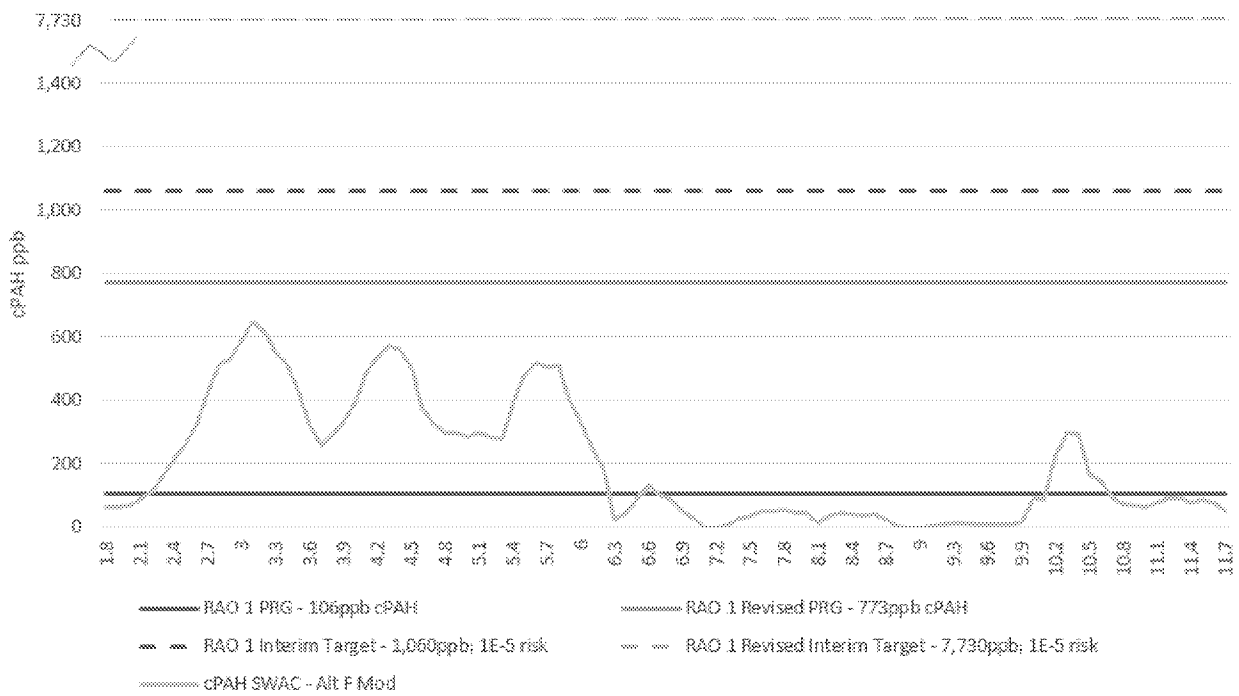
Figure 1
Sediment Management Areas (SMAs) Using Revised Nearshore TPAH RAL
Portland Harbor Record of Decision Review
Gasco Sediments Cleanup Action

Risk Reduction Approach

PRGs were developed at a $1x10^{-6}$ level (USEPA 2016). USEPA set interim targets for risks to evaluate the potential for achievement of PRGs in a "reasonable time frame." For RAO 1, USEPA set the interim target at $1x10^{-5}$ cumulative risk (i.e., the total risk of the contaminants of concern evaluated in USEPA's FS). Therefore, risk reduction from cPAHs for river miles (RMs) where cPAHs compose most of the cumulative risk can be used to develop a revised TPAH RAL, and an interim target-based concentration was estimated from the revised cPAH PRG. These evaluations are discussed below, with a focus in this example on the west side of the river where, according to USEPA's ROD, cPAHs compose most of the cumulative risk in select RMs.

USEPA's selected remedy (Alternative F Modified) in the ROD contains several RM SWACs (as reported in the USEPA FS Appendix J tables provided in the ROD) that exceed USEPA's RAO 1 in-water direct contact cPAH PRG (Figure 2) but meet the interim target at a cancer risk level of $1x10^{-5}$. When the revised PRG is used, all RM SWACs associated with USEPA's selected remedy are less than the revised PRG and much less than the revised $1x10^{-5}$ interim target level.

Figure 2
USEPA-selected Remedy Post-construction cPAH SWACs Using USEPA App J 0.5 RM SWACs – West

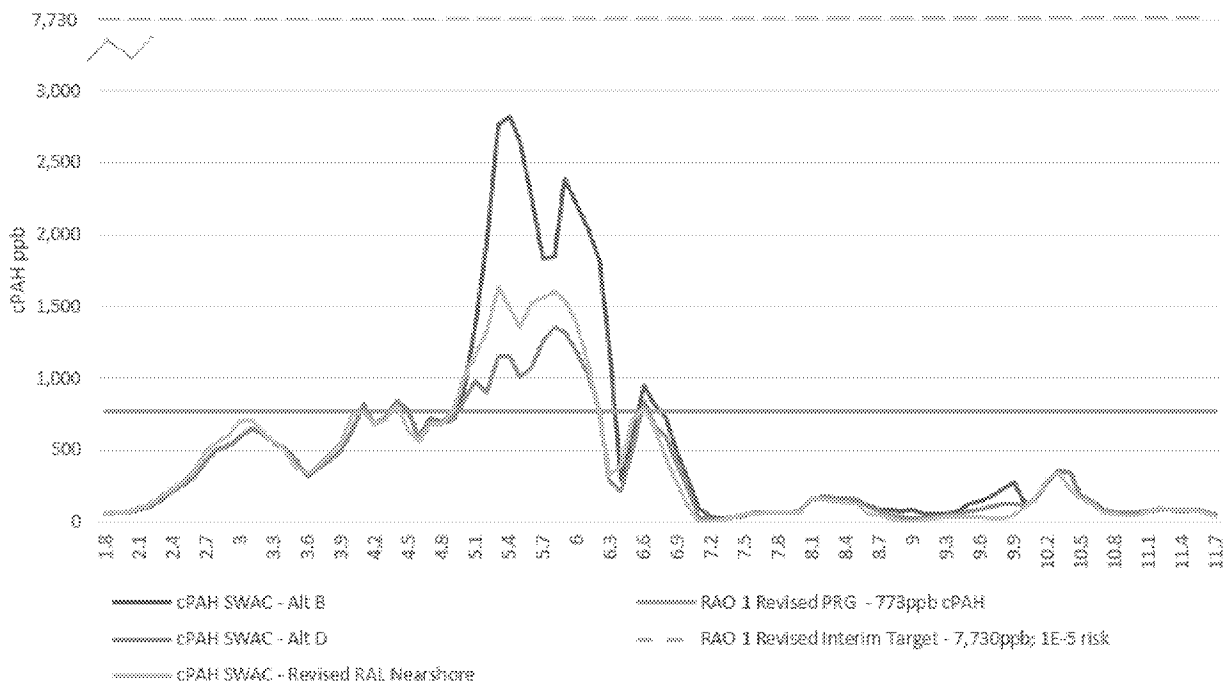


To identify which RAL could be applied and still meet USEPA's interim targets, post-construction SWACs were compared to the revised PRG and interim target level using USEPA's Appendix J SWACs (based on rolling 0.5 RM segments) for Alternatives B and D and Anchor QEA-estimated SWACs for the estimated RAL based on proportional adjustment

As shown in Figure 3, USEPA's Alternative B (RAL of 170,000 µg/kg) meets the revised PRG in most RMs. Similar to USEPA's Alternative D, revision of the nearshore TPAH RAL from 13,000 µg/kg to 92,000 µg/kg results in estimated post-construction SWACs that achieve the revised PRG at more RMs than for Alternative B. All SWACs in Figure 3 are well below the revised interim target.

Based on these SWACs and the revised RAO 1 in-water direct contact cPAH PRG applicable to nearshore sediments (773 µg/kg), a revised TPAH RAL for nearshore sediment that would likely meet USEPA's objectives for risk reduction could increase from 13,000 µg/kg to a range of 92,000 µg/kg to 170,000 µg/kg, a 7- to 13-fold increase.

Figure 3
Post-construction cPAH SWACs Using USEPA App J 0.5 RM SWACs Revised RAL – West



Navigation Channel Sediment RAL

USEPA's selected remedy in the ROD includes a TPAH RAL of 170,000 µg/kg applicable to navigation channel sediments. The cleanup levels associated with the navigation channel include 23,000 µg/kg TPAH (RAO 5 benthic risk PRG) and 3,950 µg/kg cPAH (RAO 2 PRG). As described above, the RAO 2

cPAH cleanup level increases to 108,000 µg/kg using the revised CSF. Potential impacts to the navigation channel TPAH RAL from application of the revised RAO 2 cPAH cleanup level are summarized below.

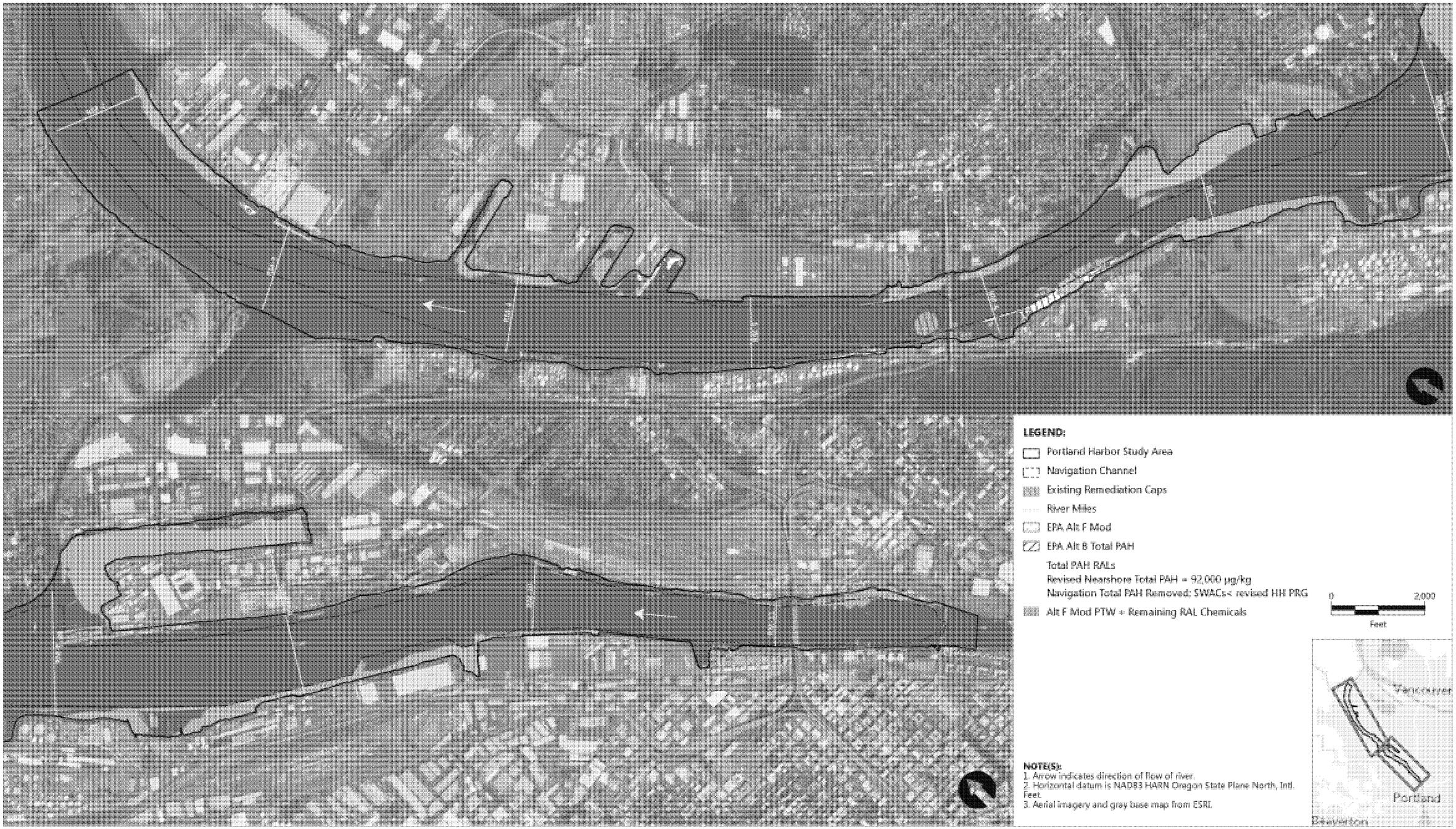
Proportional Adjustment Approach

The ROD TPAH RAL of 170,000 µg/kg converts to approximately 20,000 µg/kg cPAH using USEPA's cPAH to TPAH regression, which is approximately five times the ROD RAO 2 cPAH cleanup level. Proportionally adjusting USEPA's RAL by applying a five-fold increase to the revised RAO 2 cPAH cleanup level (108,000 µg/kg) results in an estimated revised RAL for the navigation channel of 540,000 µg/kg cPAH (more than 4,000,000 µg/kg TPAH).

Risk Reduction Approach

The revised RAO 2 cPAH cleanup level (108,000 µg/kg) exceeds the ROD cPAH PTW highly toxic threshold (106,000 µg/kg). USEPA's No Action SWACs for all RMs in the navigation channel (per the USEPA ROD, Appendix IV, Appendix J tables) already achieve the revised RAO 2 cPAH cleanup level. Therefore, a TPAH RAL would no longer be needed to be protective of the revised PAH human health cleanup level.

Revised SMAs associated with applying a revised nearshore TPAH RAL of 92,000 µg/kg and eliminating a navigation channel TPAH RAL are shown in Figure 4 as compared to the SMAs associated with USEPA's selected remedy. The RAL revisions eliminate nearly all SMAs in the navigation channel; those remaining are associated with elevated PCB concentrations (green areas). Total SMA extents decreases by approximately 14 percent from 355 acres associated with USEPA's selected remedy to 304 acres through revising nearshore and navigation channel TPAH RALs. The TPAH areas associated with Alternative B (blue areas) are included for comparison with the TPAH areas associated with the revised nearshore and navigation channel RALs (yellow areas).



Publish Date: 2017/08/01, 11:03 AM | User: everson
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Figure 4
Sediment Management Areas (SMAs) Using Revised Nearshore and Navigation Channel TPAH RALs
Portland Harbor Record of Decision Review
Gasco Sediments Cleanup Action

Principal Threat Waste

PTW highly toxic is a risk-based action level based on the RAO 1 in-water direct contact cPAH PRG; therefore, a revised threshold can be calculated following USEPA's methods using the revised BaP CSF. The PTW highly toxic cPAH concentration increases from 106,000 µg/kg to 773,000 µg/kg when applying the new BaP CSF. USEPA's No Action sediment concentrations are less than this revised PTW highly toxic threshold; therefore, no PTW highly toxic areas would exist at the Site for cPAHs.

References

Anchor QEA, LLC, 2016. Technical memorandum to: NW Natural. Regarding: Critique of EPA PRGs and RALs. Portland Harbor Feasibility Study. Attachment 2 of NW Natural September 6, 2016 Comments on EPA's June 8, 2016 Proposed Plan and Draft Final Feasibility Study for the Portland Harbor Superfund Site. September 6, 2016.

USEPA (U.S. Environmental Protection Agency), 2015. *Update of Human Health Ambient Water Quality Criteria: Benzo(a)pyrene 50-32-8. Office of Science and Technology*. Office of Water. USEPA/820/R-15/012. June 2015.

USEPA, 2016. *Portland Harbor Feasibility Study*. USEPA Region 10. Seattle, Washington. June 2016.

USEPA, 2017a. *Record of Decision. Portland Harbor Superfund Site*. Portland, Oregon. USEPA Region 10. Seattle, Washington. January 2017.

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Kennedy/Jenks Consultants, 2013. *Portland Harbor RI/FS: Baseline Human Health Risk Assessment, Appendix F*. Final. Prepared for the Lower Willamette Group and USEPA. March 28, 2013.

Appendix A5

TCT Meeting Materials, January 11, 2018

DRAFT

Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 11, 2018

CONFIDENTIAL WORKING DRAFT –
FOR DELIBERATIVE PURPOSES

ED_002671A_00012956-00255

Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- Requires evaluation of potential RAL changes related to cPAH direct contact and clam consumption risk
  - Must also consider impact of potential RAL change on RAOs 3 and 5

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Proposed cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 12 µg/kg to 85 µg/kg
  - Updated in-water sediment CUL: 106 µg/kg to 774 µg/kg
  - Updated clam consumption CUL: 3950 µg/kg to 107,600 µg/kg
  - Updated highly toxic PTW threshold: 106,000 µg/kg to 774,000 µg/kg
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

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Proposed Nearshore* Total PAH RAL Change

- EPA proposes that the current total PAH nearshore * RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - EPA conducted an analysis that showed that a total PAH RAL of 30,000 µg/kg addresses all areas with cPAH exceeding 774 µg/kg on a rolling river mile SWAC basis (½ mile increments)
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon)

*Outside the Navigation Channel

Proposed Navigation Channel Total PAH RAL

- EPA proposes that the current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading to surface water has been observed downstream of RM 6.3
  - Increasing the total PAH RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data and may not achieve the ROD specified protectiveness standards for RAOs 3 and 5

CUL, PTW and RAL Change Summary

Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL (RAO 1)	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL (RAO 1)	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level (RAO 2)	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL (RAO 2)	Site-Wide	3,950 µg/kg	107,600 µg/kg
Benthic Risk total PAH Sediment CUL (RAO 5)	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

* No Change Proposed

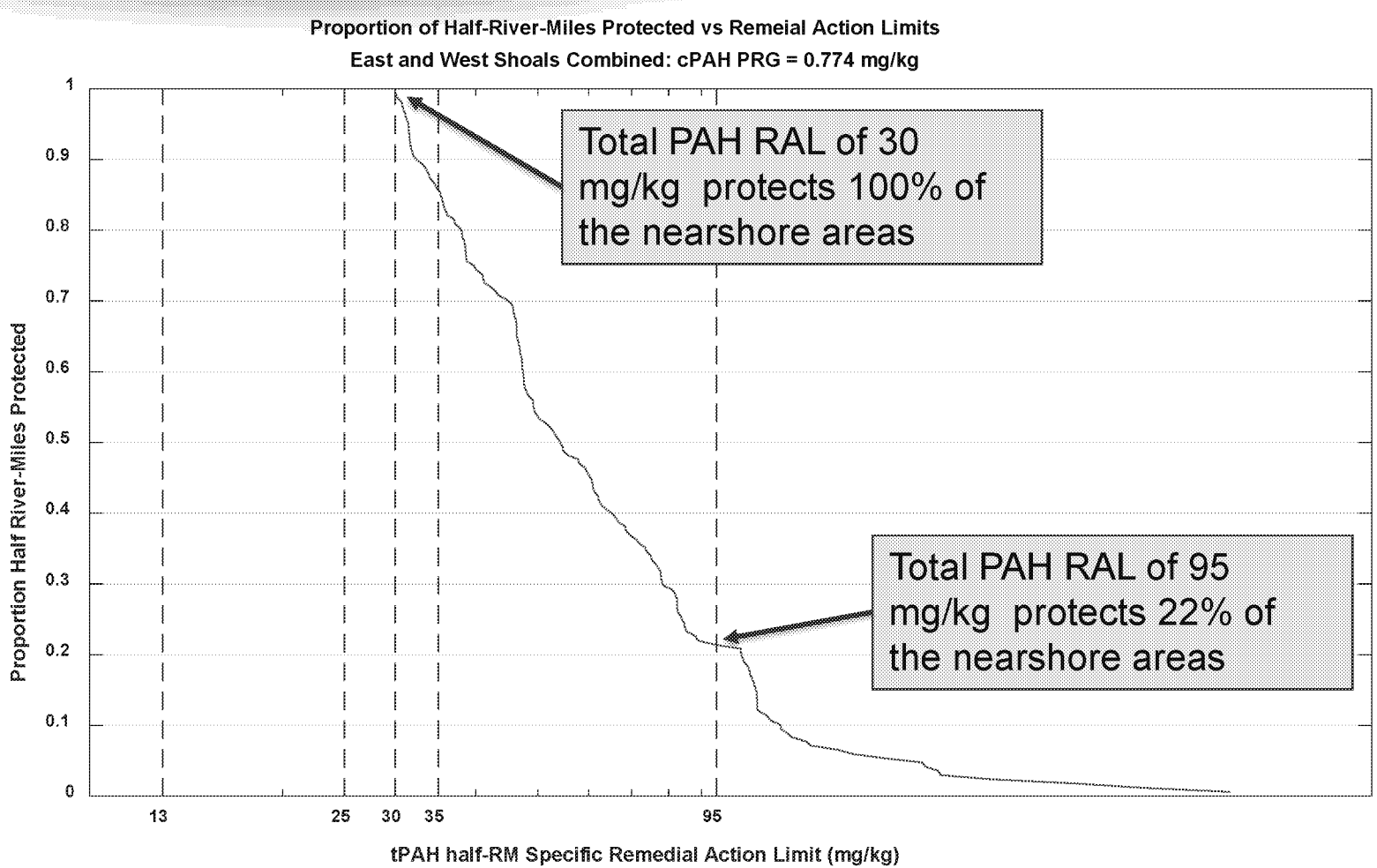
ED_002671A_00012956-00260

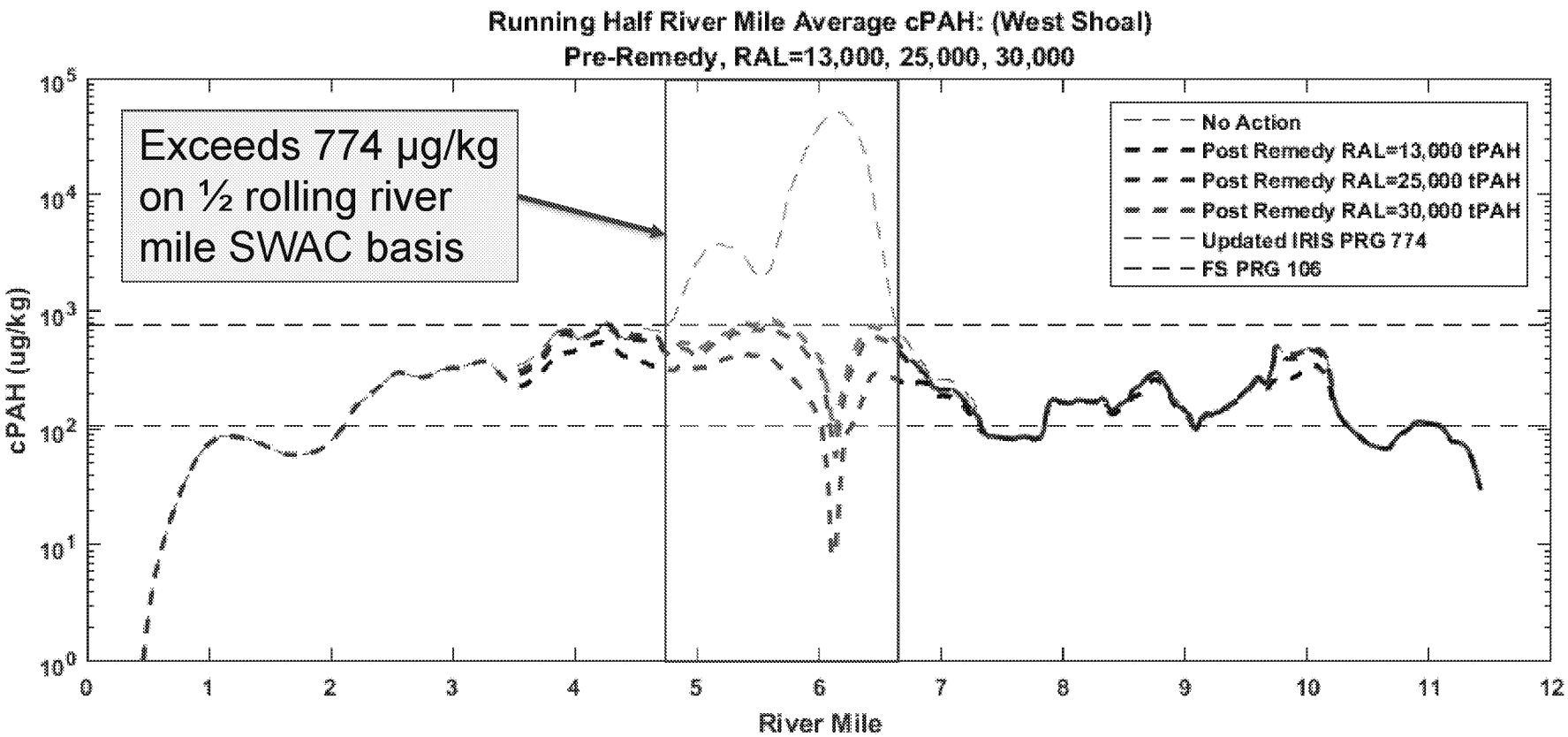
RAL Change Evaluation Summary

Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (230,000 µg/kg)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
State Acceptance	No	Yes	Yes	No

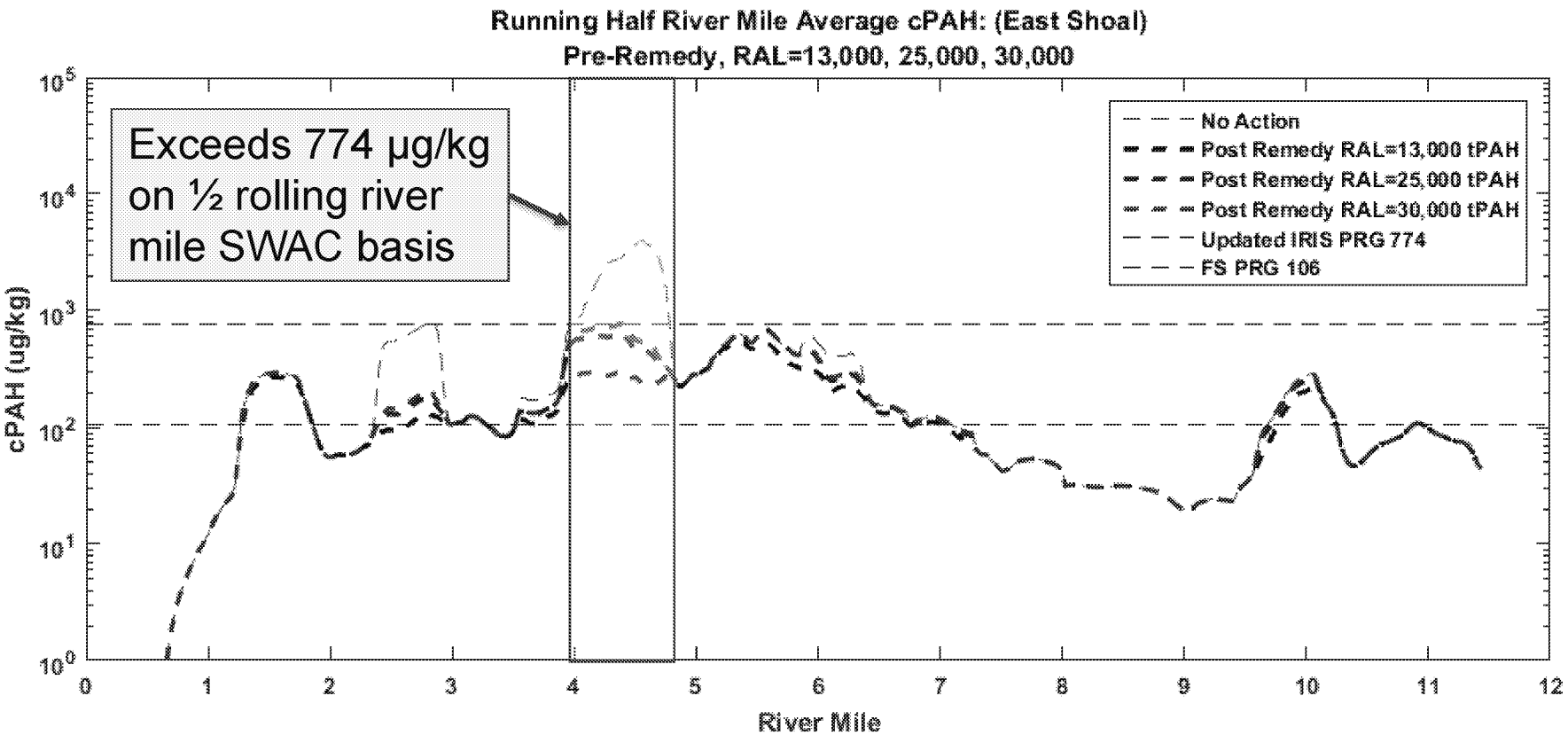
ED_002671A_00012956-00261

Backup Slides for Discussion

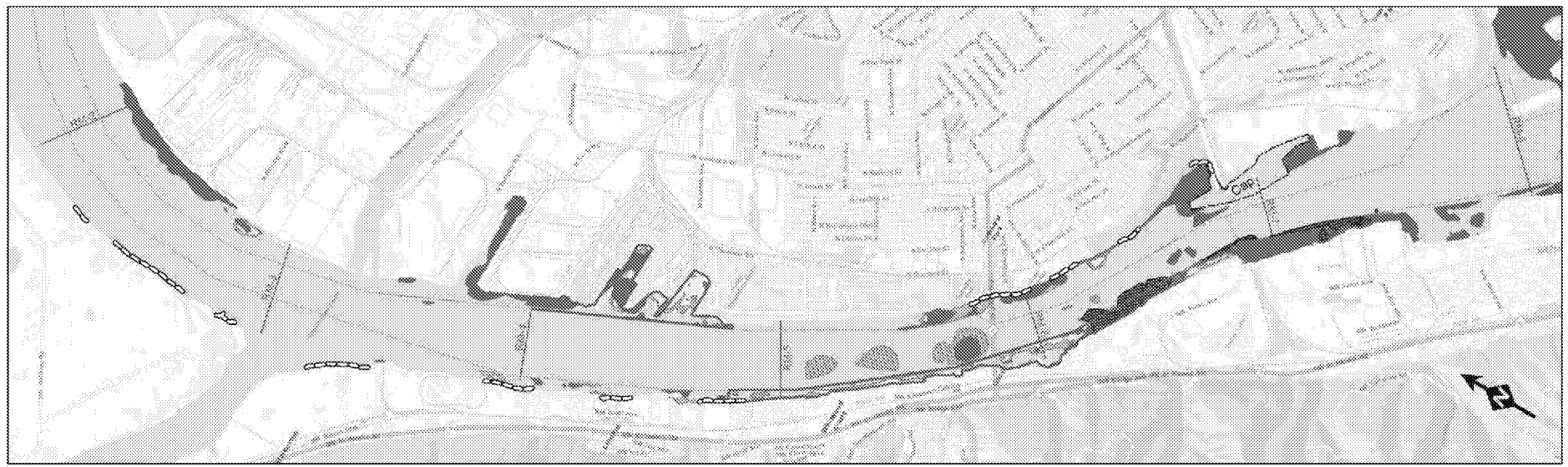

Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)
Total PAH RAL of 30 mg/kg protects 100% of the nearshore areas
Total PAH RAL of 95 mg/kg protects 22% of the nearshore areas

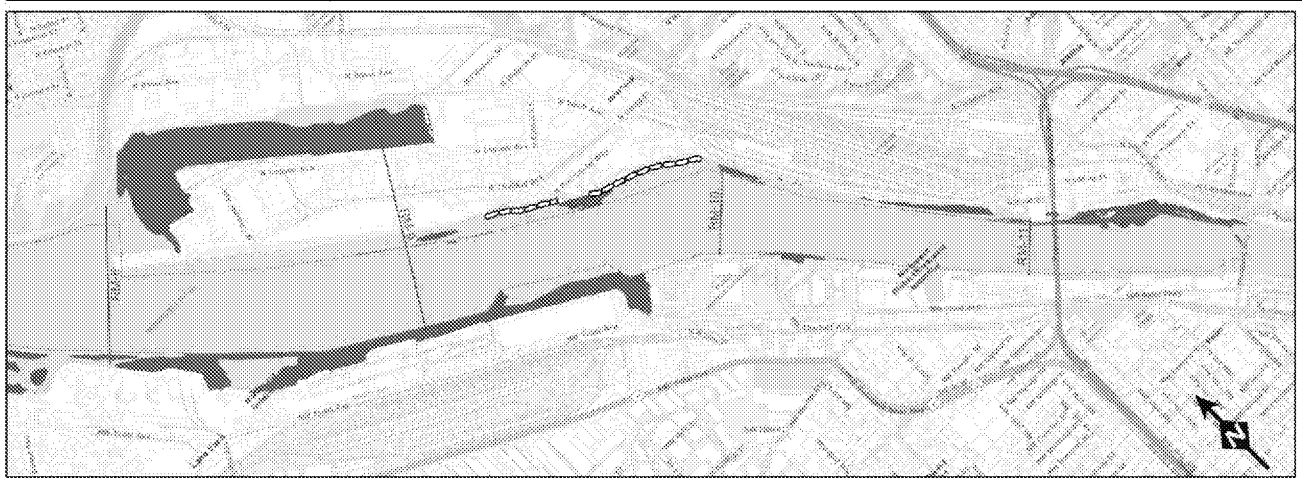


Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario



Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario

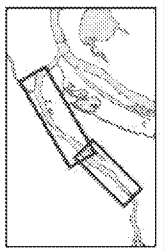




Legend

- Beach areas with cancer risk greater than 1x10-6 for child recreational beach users
- CPAHs that exceed 774 ug/kg in nearshore areas on a rolling river mile SWAC basis
- Remedial Footprint for focused COCs other than PAHs (including PTW)
- Remedial Footprint for PAHs in Nearshore Area – 30 ppm RAL
- Remedial Footprint for PAHs in Nearshore Area – 13 ppm RAL
- Remedial Footprint for PAHs in Navigation Channel – 170 ppm RAL
- PTW (NRC/NAPL)
- Navigation Channel

0 1,000 2,000 3,000 4,000
Feet



Source Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User

Figure X-X. Selected Remedy Footprint comparison

Path: E:\Projects\Portland Harbor\GIS\Map\Documents\Post ROD Phase\PAH analysis\Fig X_SWAC based on PAHs 30ppm.mxd

Date: 1/2/2018

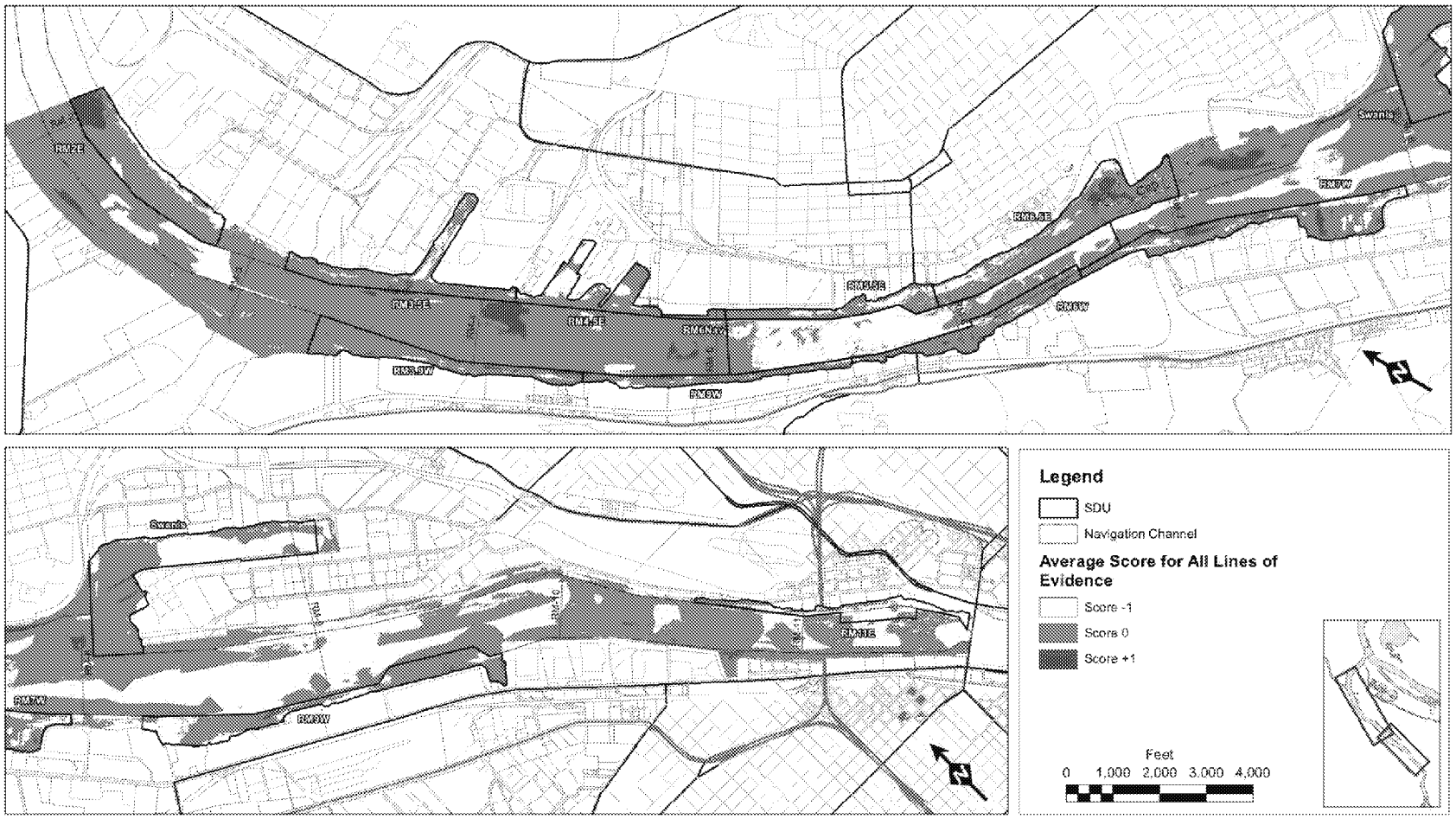


Figure D8-7. Average Score for Six Lines of Evidence

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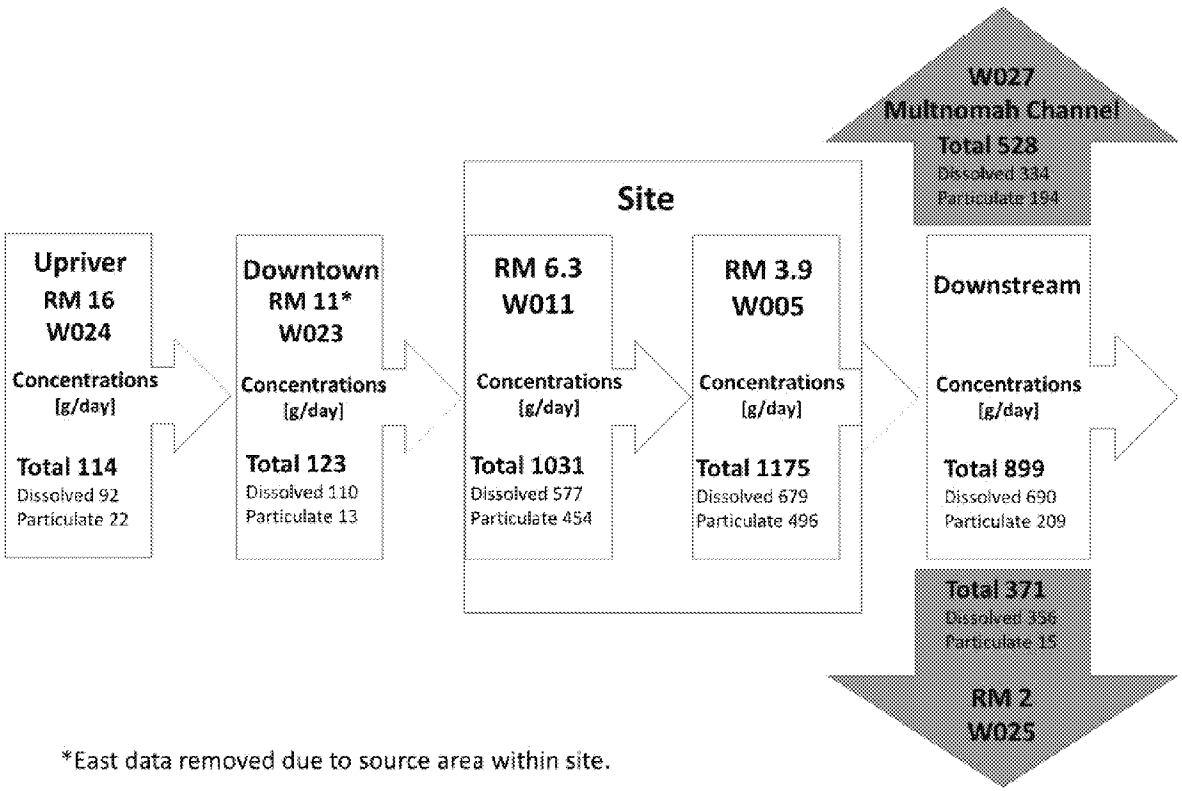
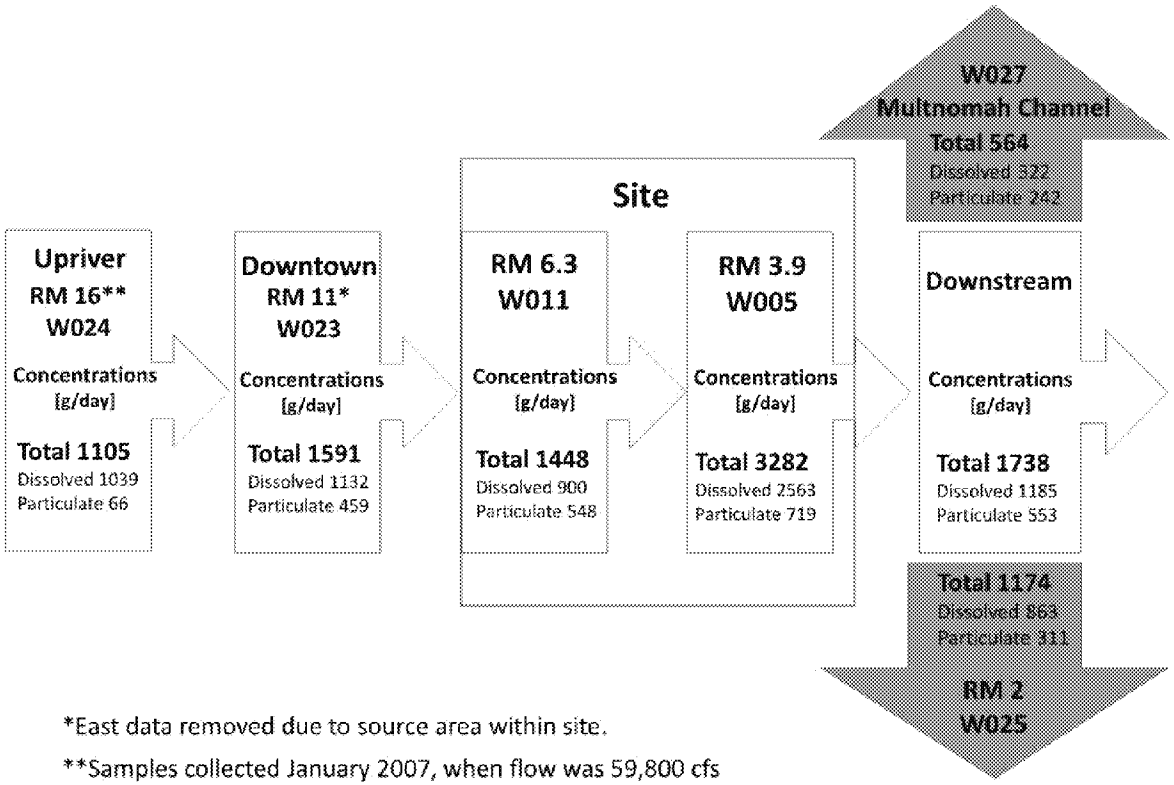


Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs

Remedial Footprint Area Summary

Scenario	Remedial Footprint (Acres)			Notes
	Current Remedy	Nearshore Total PAH RAL Change from 13 to 30 ppm	Remedial Footprint Change	
Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint

Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136).

Human Health Risk:

Within the navigation channel, the current cleanup level is 3,950 ppb CPAHs and is based on the clam consumption exposure pathway. Direct contact with contaminated sediment is not considered a complete exposure pathway in the navigation channel. Surface water exposure pathways (ingestion, inhalation and dermal contact) are complete within the navigation channel. Although it is known that contaminated sediments contribute to surface water COCs, there is not a sediment cleanup levels associated with the protection of drinking water. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling ½ river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

PAH contaminated sediments within the Navigation Channel also pose risks to ecological receptors. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg, a value which is already 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." The areas that exceed the Navigation Channel RAL within the for PAHs are isolated to areas between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may further limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. Sediments within the navigation channel are significantly elevated in cPAH concentration and are likely contribute to cPAH exceedances of the human health and ecological AWQCs. As shown in Figures 3 and 4, taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that the high levels of PAH contamination within the Navigation Channel between RM 5 and 6.6are contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, RAOs 3, 5, and 7 are not affected by the IRIS change. Due to the exceedances of the benthic cleanup levels in the navigation channel between RM 5 and 7, the limited effectiveness of MNR in that area, and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor is not warranted in the navigation channel area.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

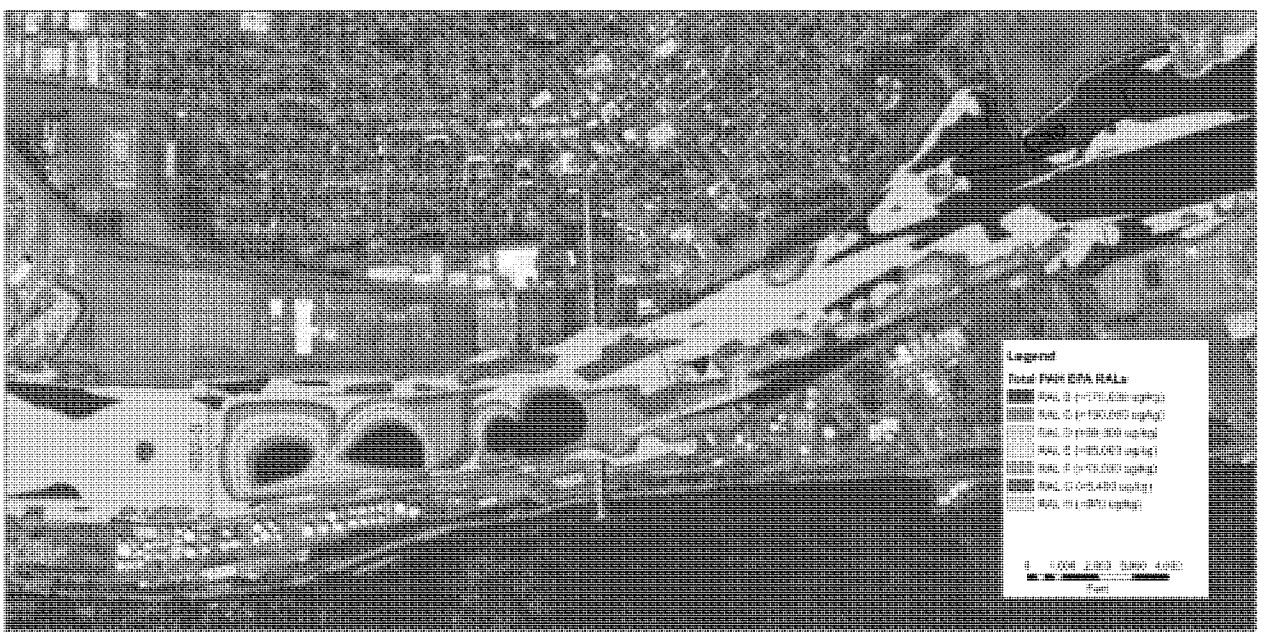


Figure 2 – MNR Average Score for Six Lines of Evidence

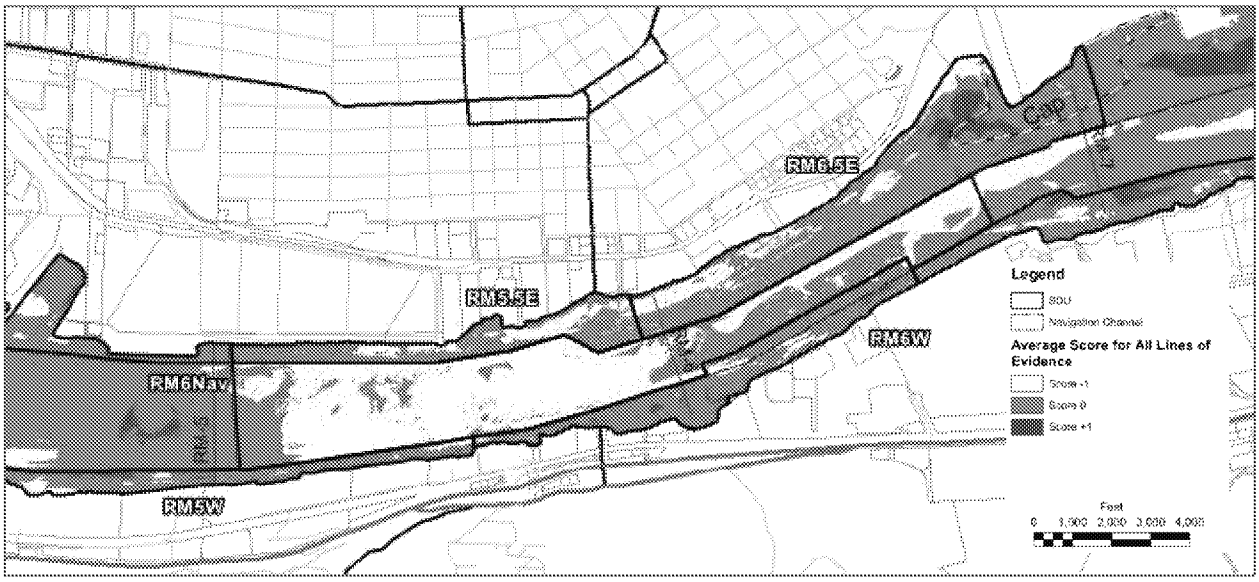


Figure 3 – PAH Loading under Low Flow Conditions

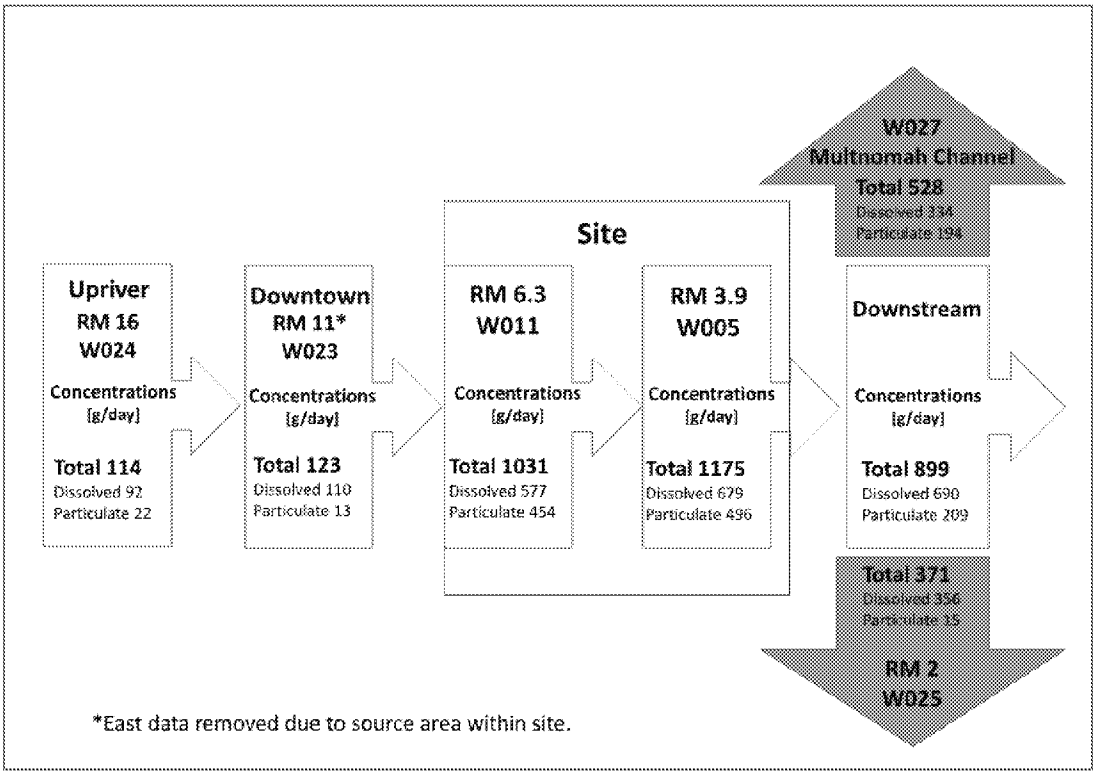
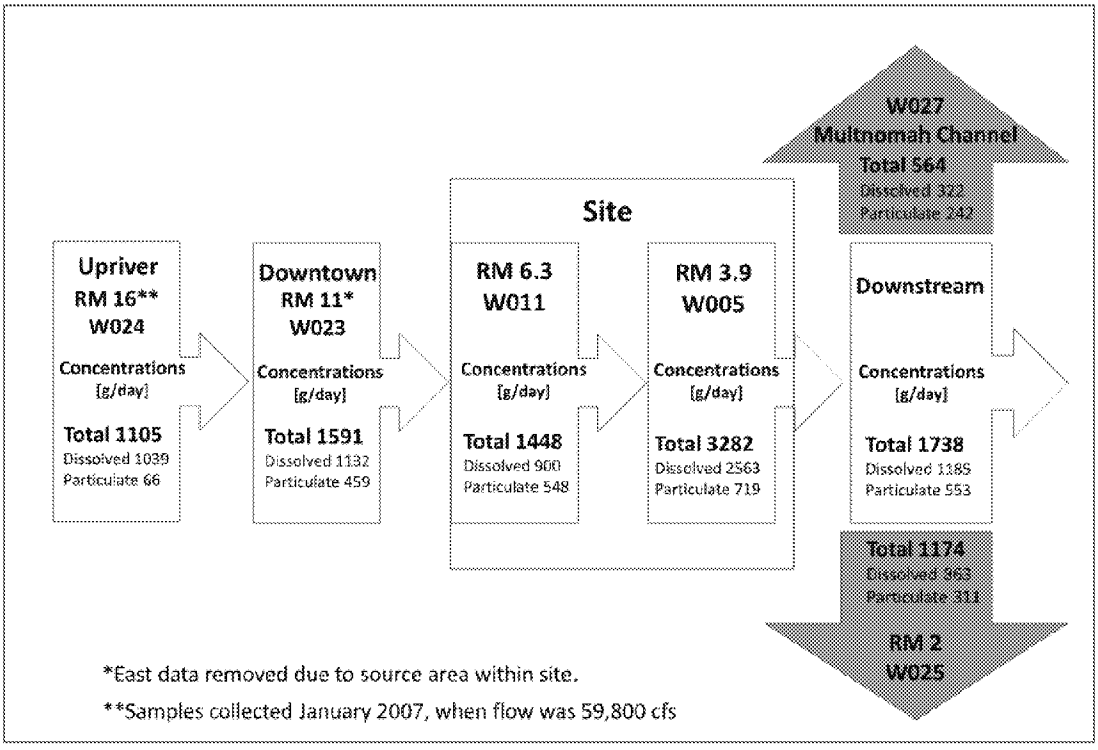


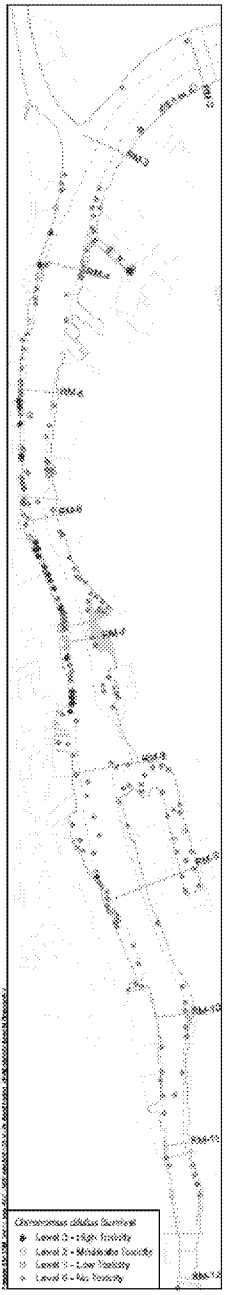
Figure 4 – PAH Loading under High Flow Conditions



Appendix A6

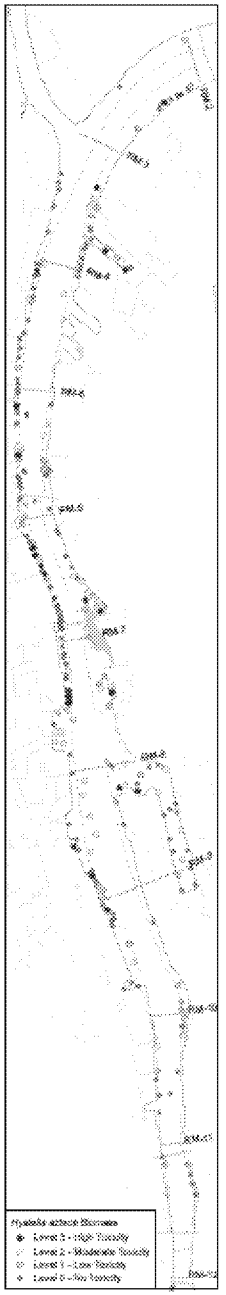
9-7-17 Email from Kevin Parrett (DEQ), Subject: PH Benthic Risk - 8-23-17.pptx

DRAFT

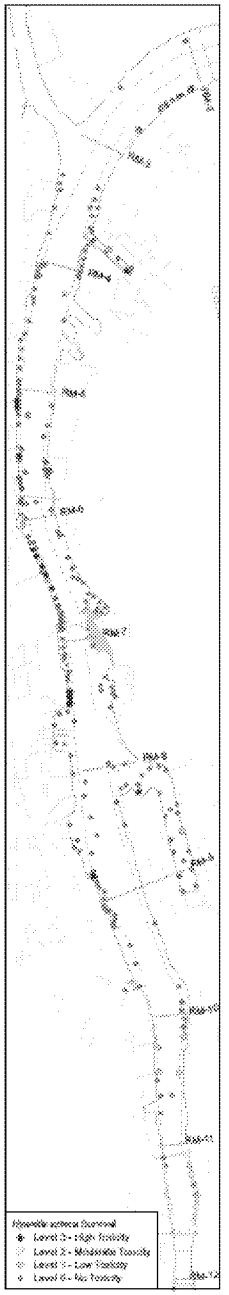


Map 8-2
Chironomus dilutus Survival
Biotoxicity Results

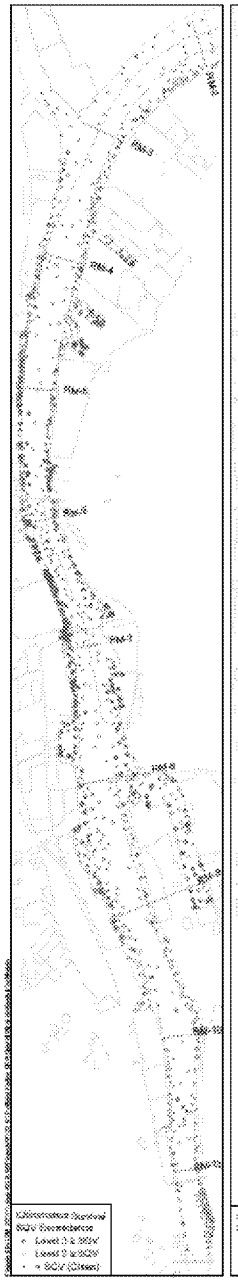
Map 8-3
Chironomus dilutus Biomass
Biotoxicity Results



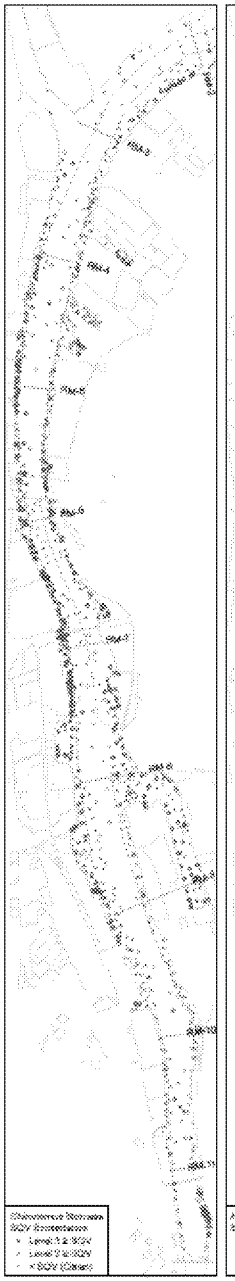
Map 8-4
Hyalella azteca Biomass
Biotoxicity Results



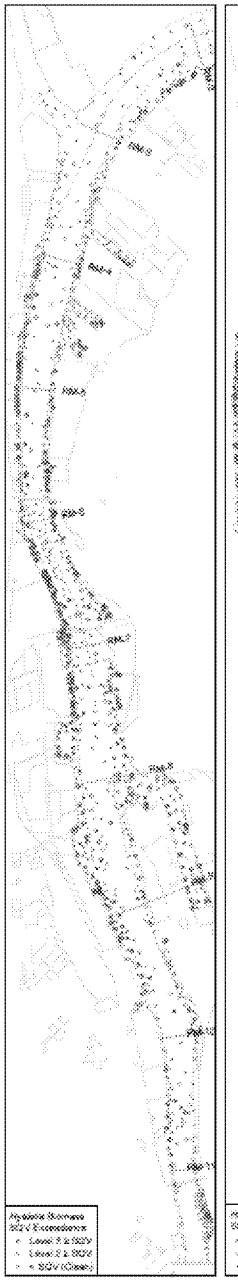
Map 8-5
Hyalella azteca Survival
Biotoxicity Results



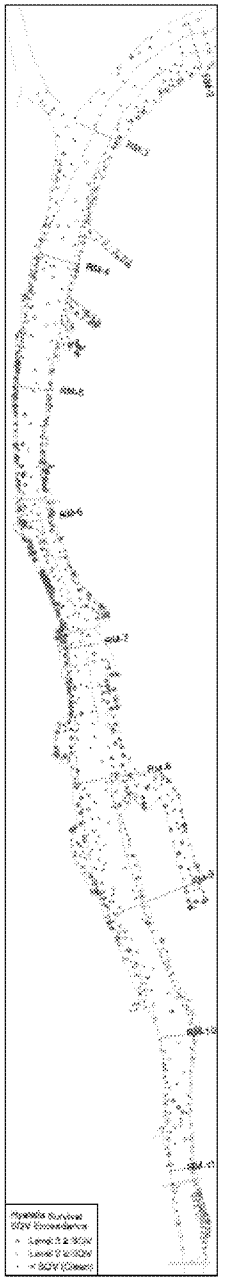
Map 8-7
Exceedance of Site-Specific PRM SQVs
based on Chironomus dilutus Survival



Map 8-8
Exceedance of Site-Specific PRM SQVs
based on Chironomus dilutus Biomass

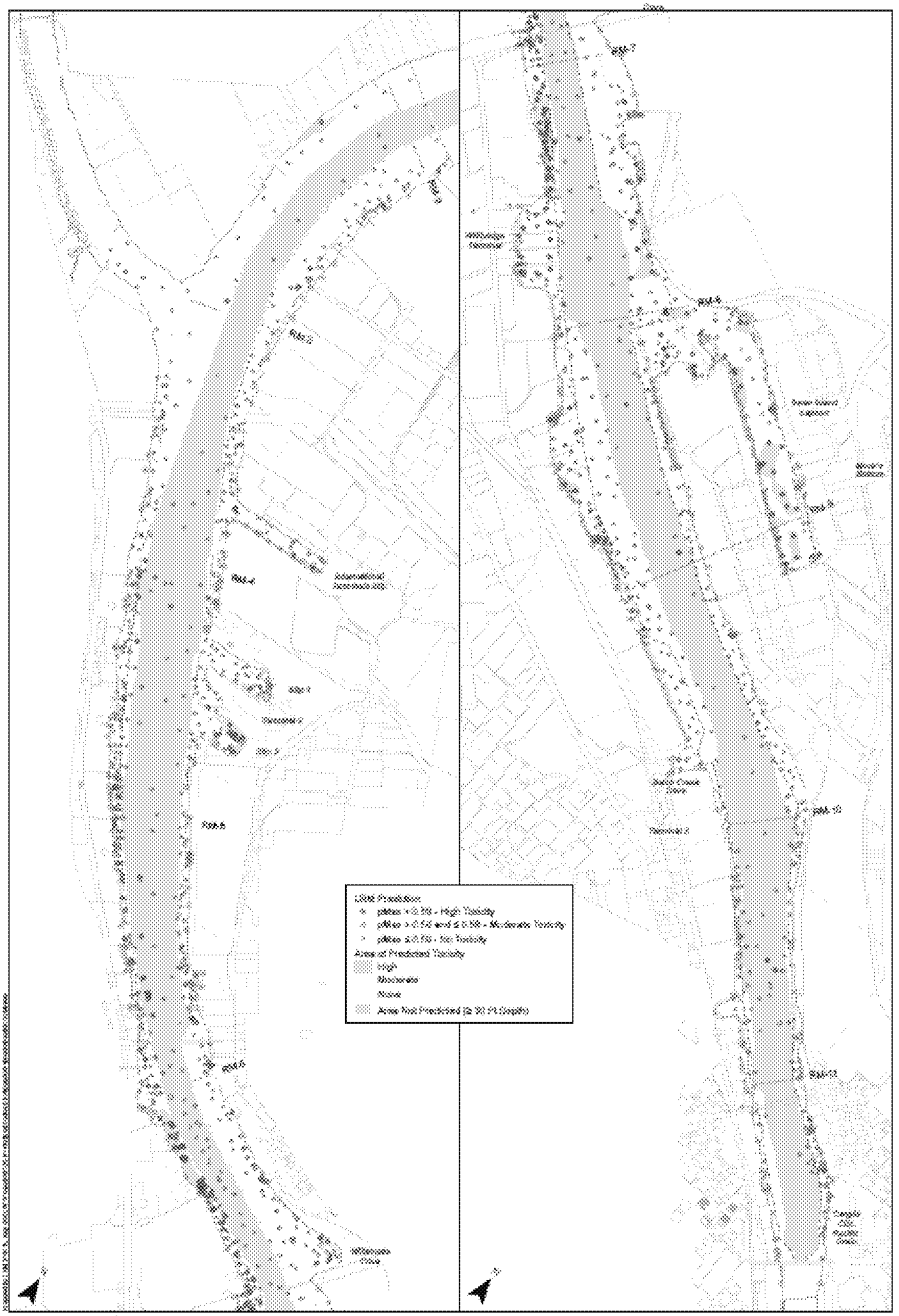


Map 8-9
Exceedance of Site-Specific PRM SQVs
based on Hyalella azteca Biomass

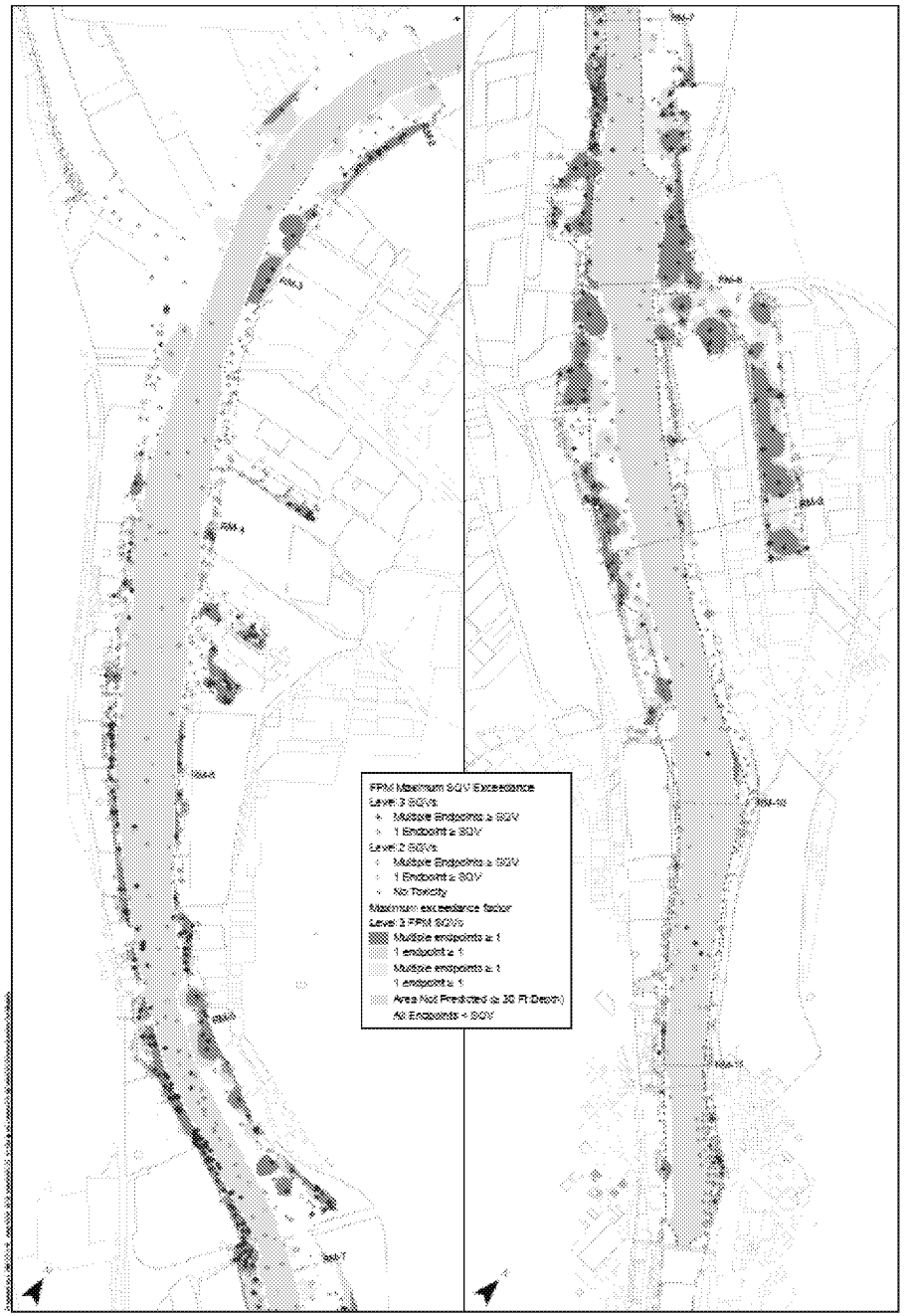


Map 8-10
Exceedance of Site-Specific PRM SQVs
based on Hyalella azteca Survival

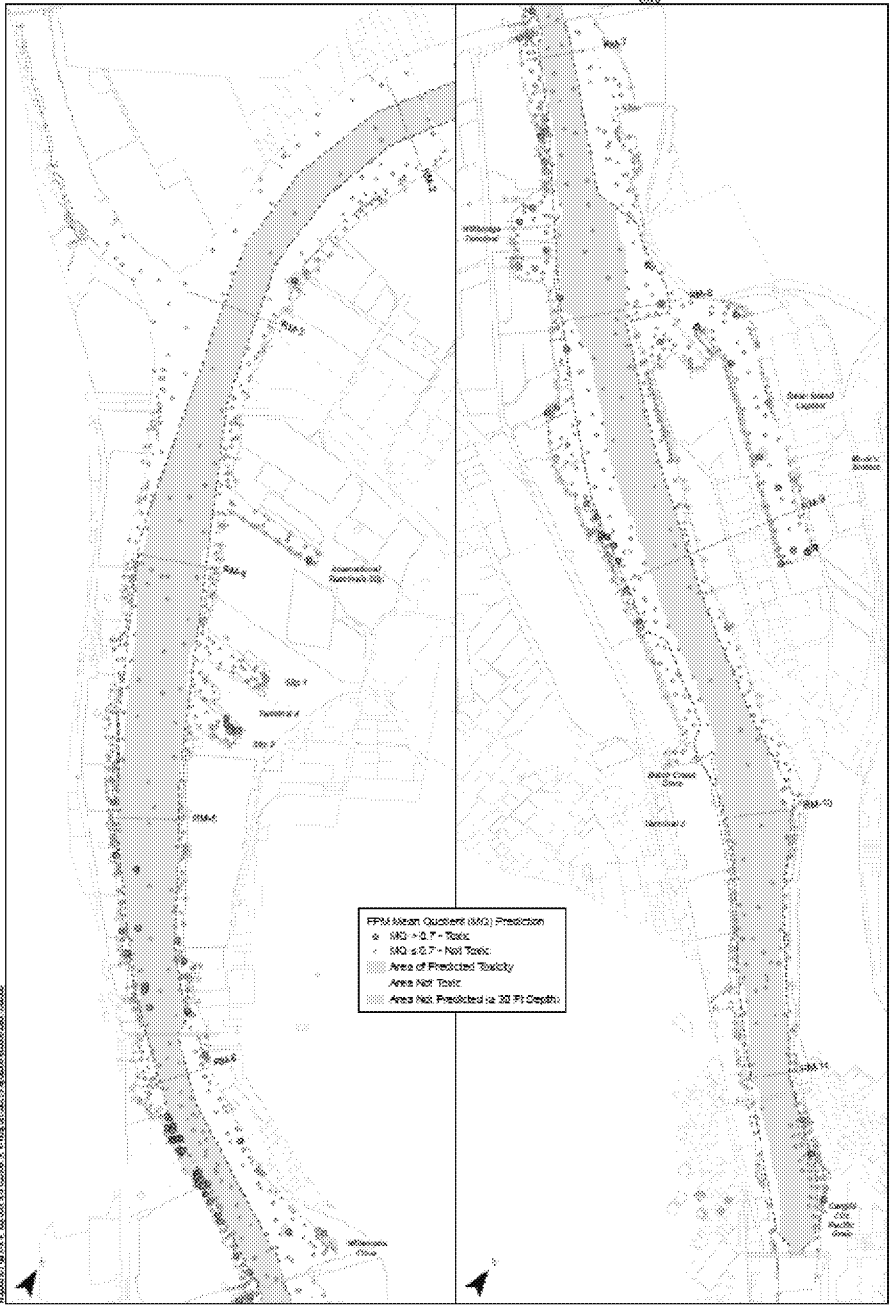
Portland Harbor RI/FS
Baseline Ecological Risk Assessment



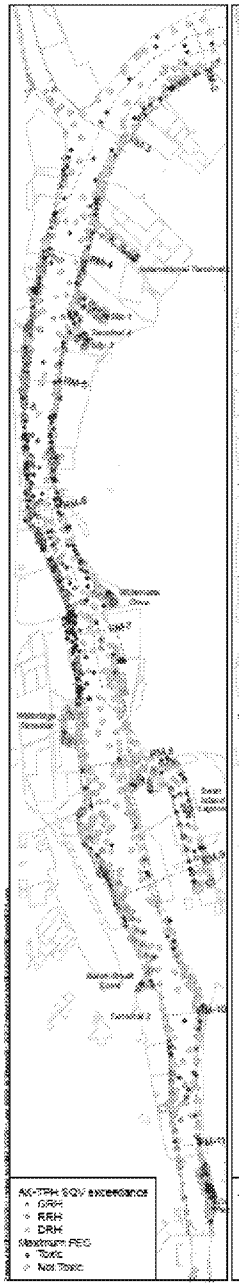
Map 6-11
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Toxicity Predicted from
Site-Specific LRM pMean



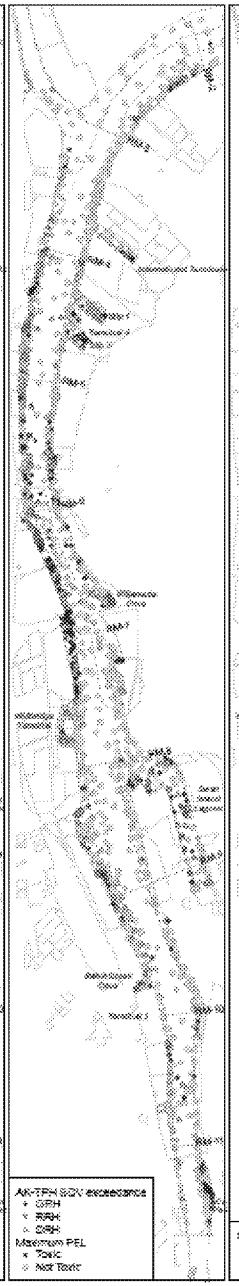
Map 6-12
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Number of Endpoints Exceeding FPM SQVs
Based on Maximum Exceedance



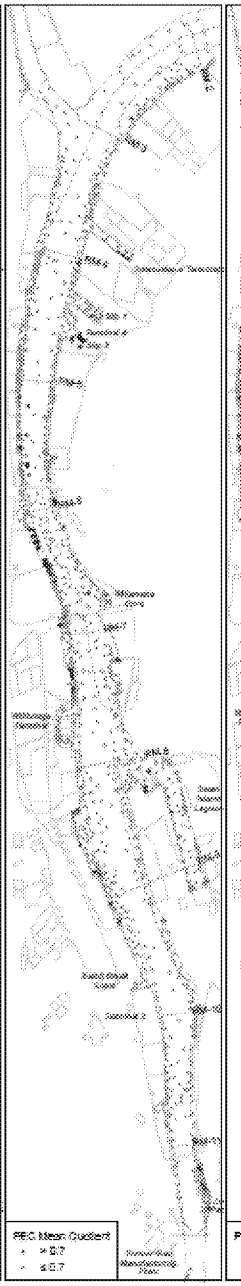
Map 6-17
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Toxicity Predicted from
FPM Mean Quotients



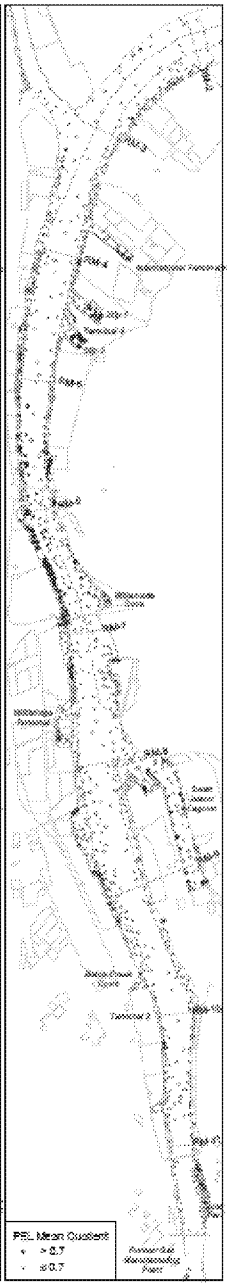
Map 6-18
Maximum Exceedance and No/Low
Toxicity Based on PEC



Map 6-19
Maximum Exceedance and No/Low
Toxicity Based on PEL

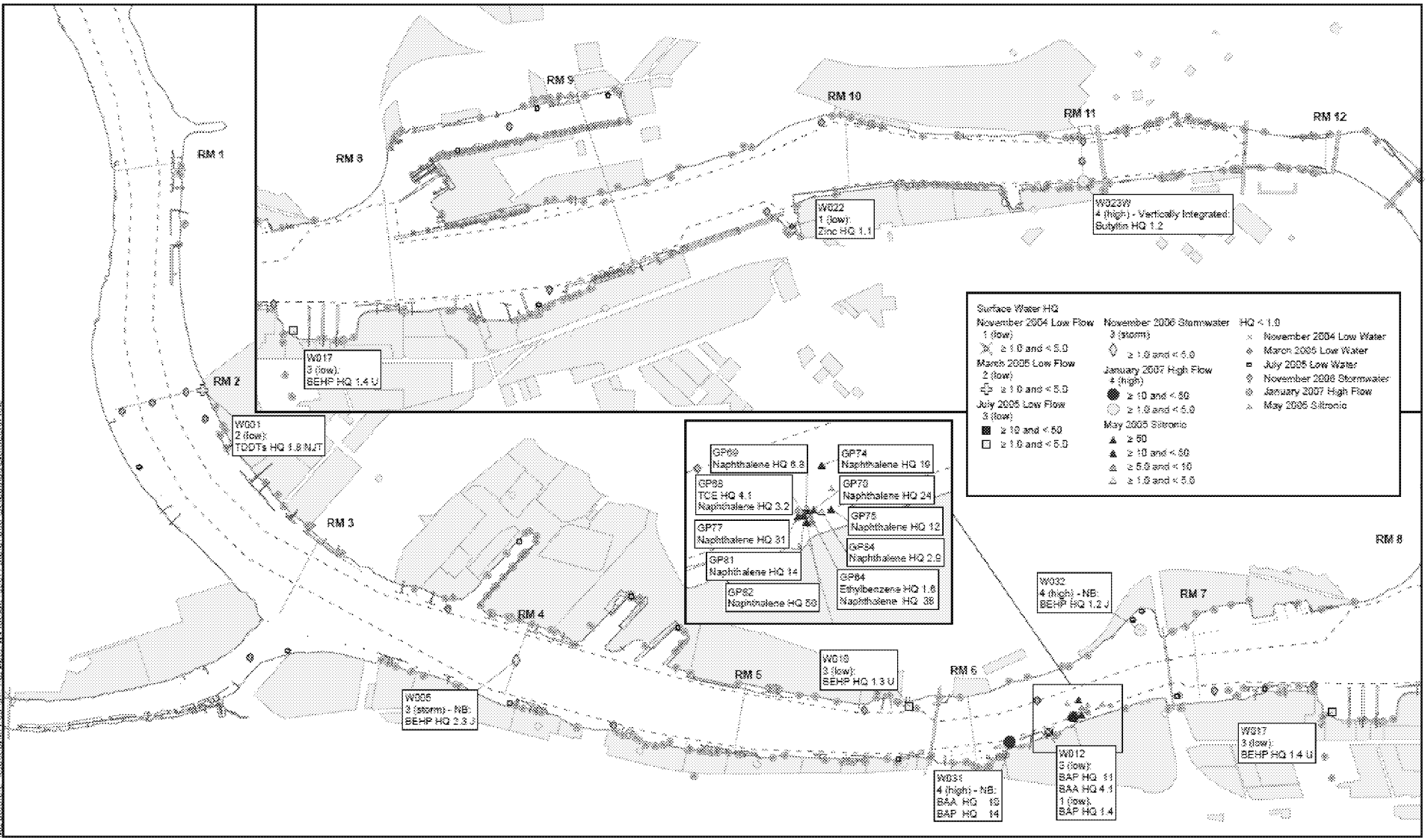


Map 6-20
Exceedance Based on
PEC Mean Quotient



Map 6-21
Exceedance Based on
PEL Mean Quotient

Portland Harbor RI/FS
Baseline Ecological Risk Assessment

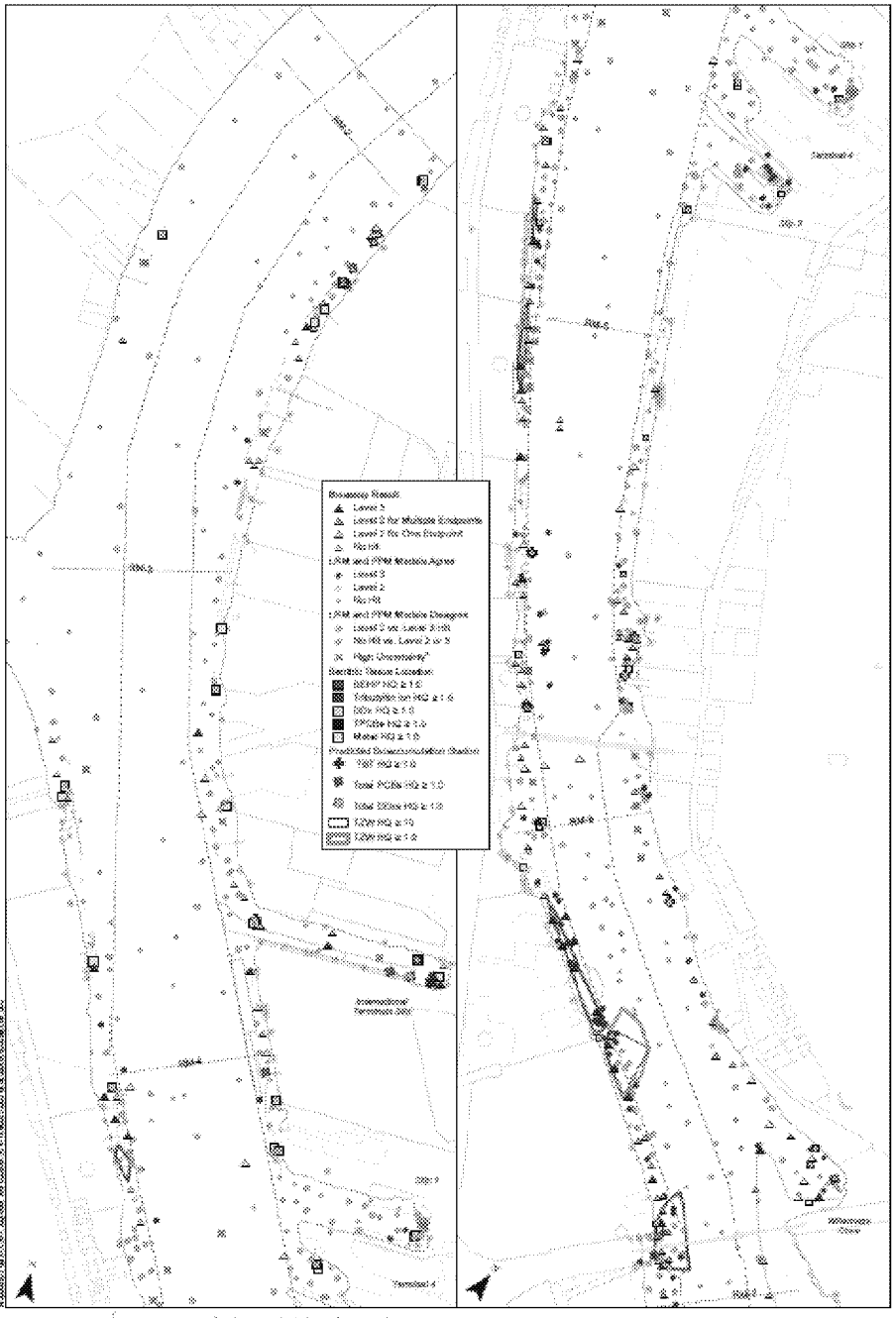


Windward LLC
LWG
LOWER WILLAMETTE GROUP

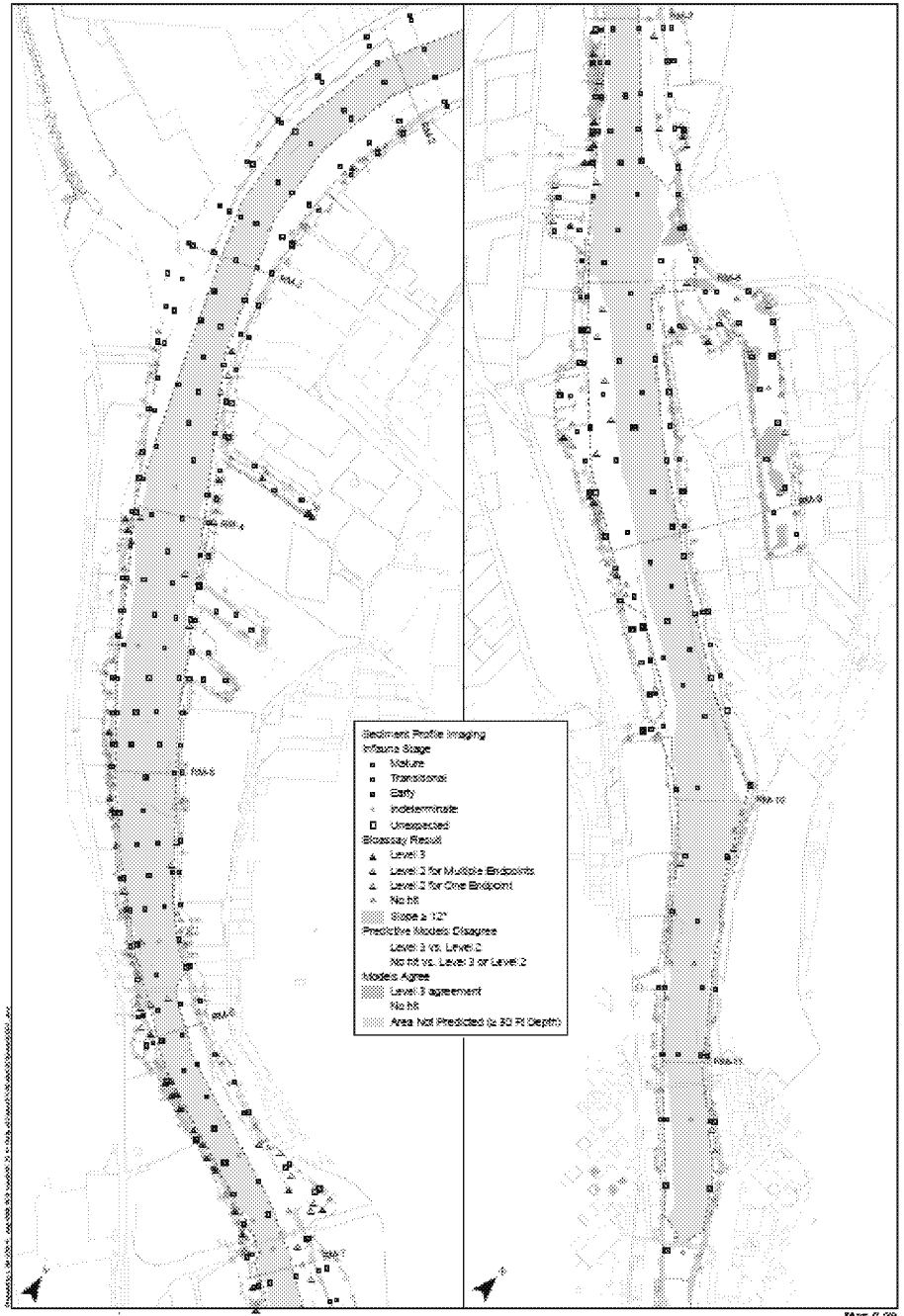
0 1,000 2,000 3,000 4,000 5,000 Feet

Map Features
Outfalls
Outfall
Dock Drain
Roof Drain
Bridges
Docks and Structures
Upland ECSI Sites (2008)
River Miles
Navigation Channel
River Edge +13 ft NAVD

Map 6-27
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Surface Water HQs for Sampling Locations
in the Portland Harbor Study Area



Map 6-28a
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Weight of Evidence in
RM 1.3 to RM 7



Map 6-29
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Infaunal Stages and
Empirical and Modeled Toxicity

Appendix A7

9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx

DRAFT

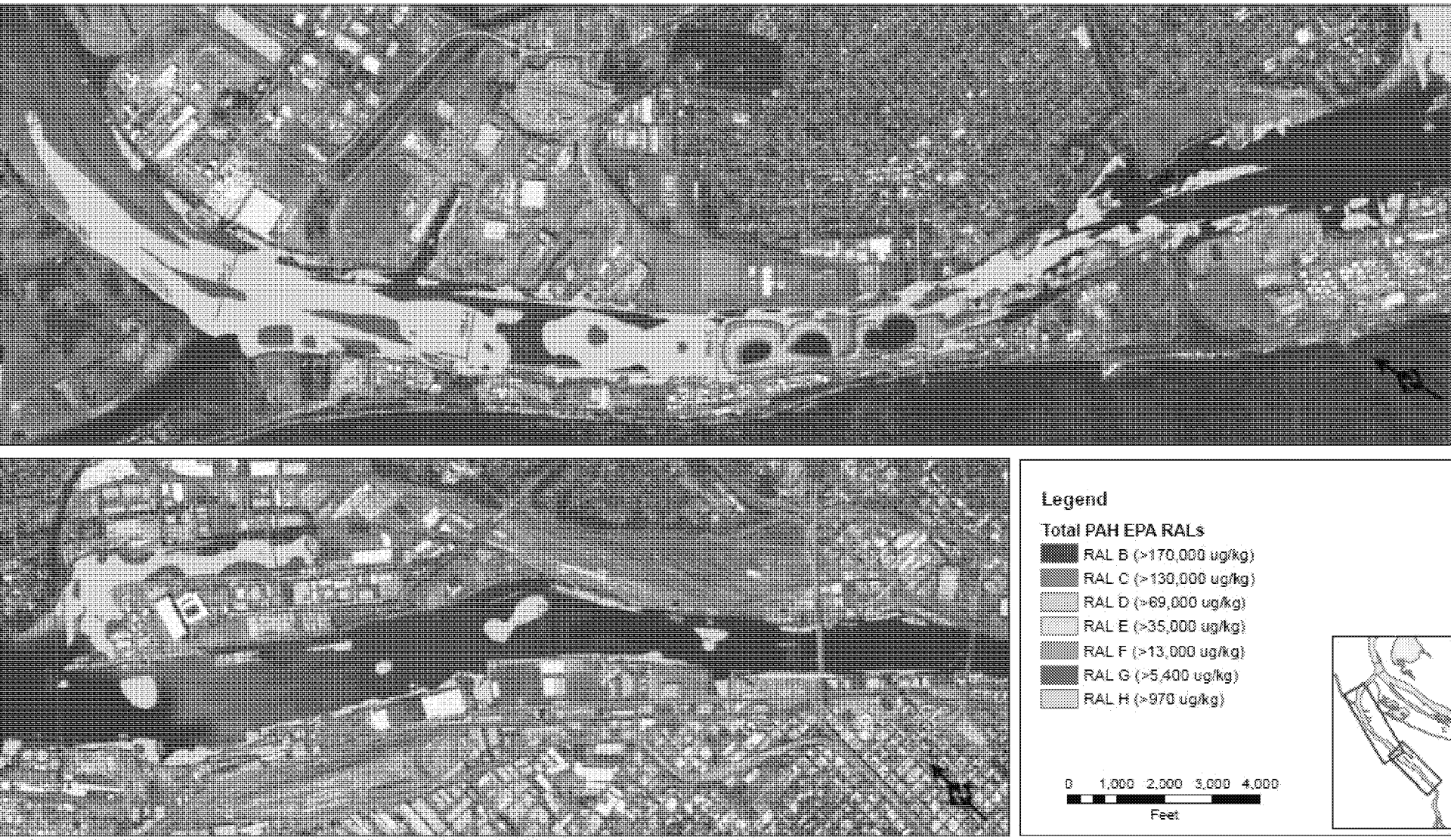


Figure 3.4-8. Total PAH RAL Contours

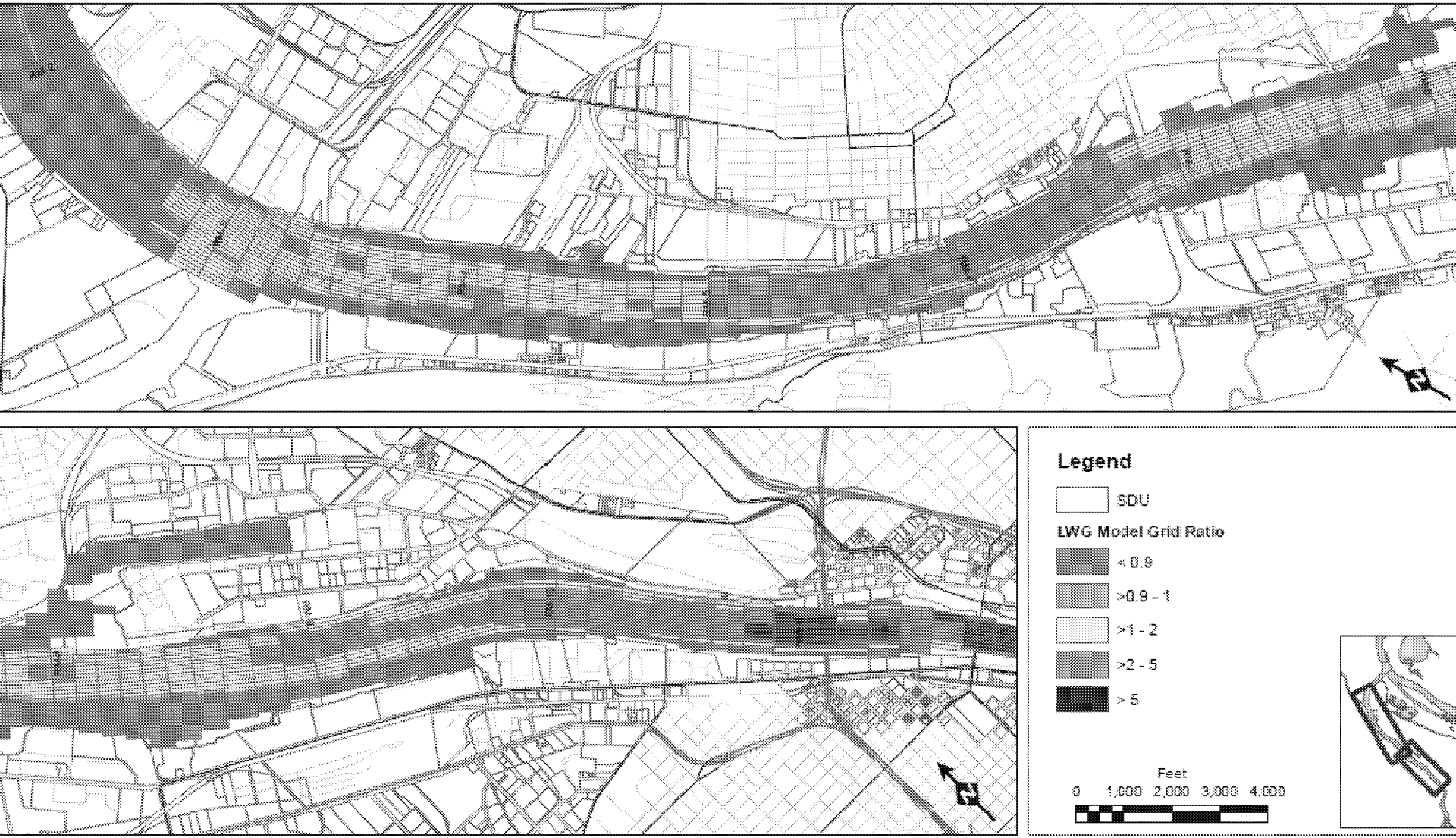


Figure 3.4-18c. Ratio of Bed Shear Stress (Pa) to Critical Bed Stress for Erosion (Pa) at Peak of Two-year Flood

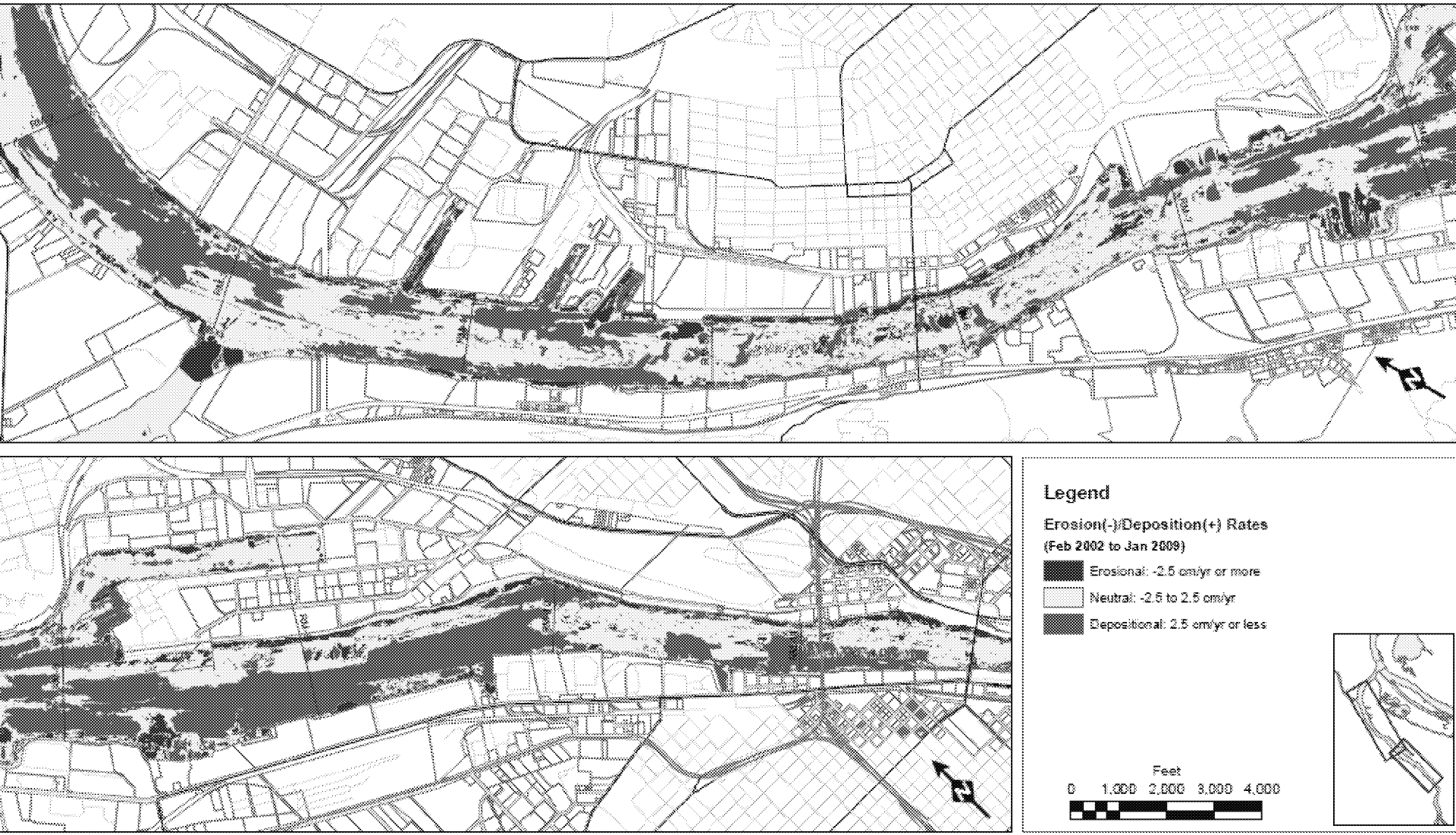
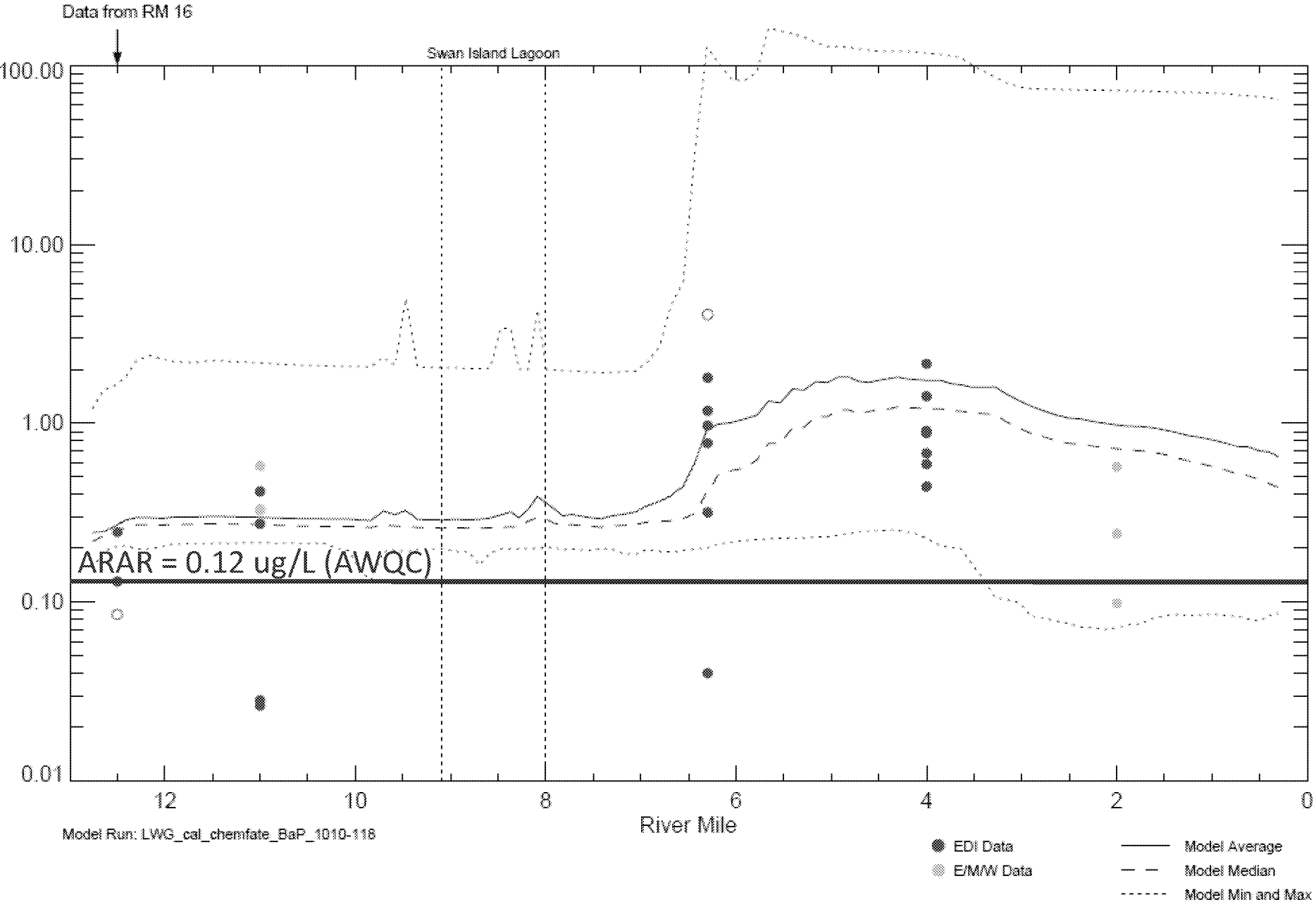
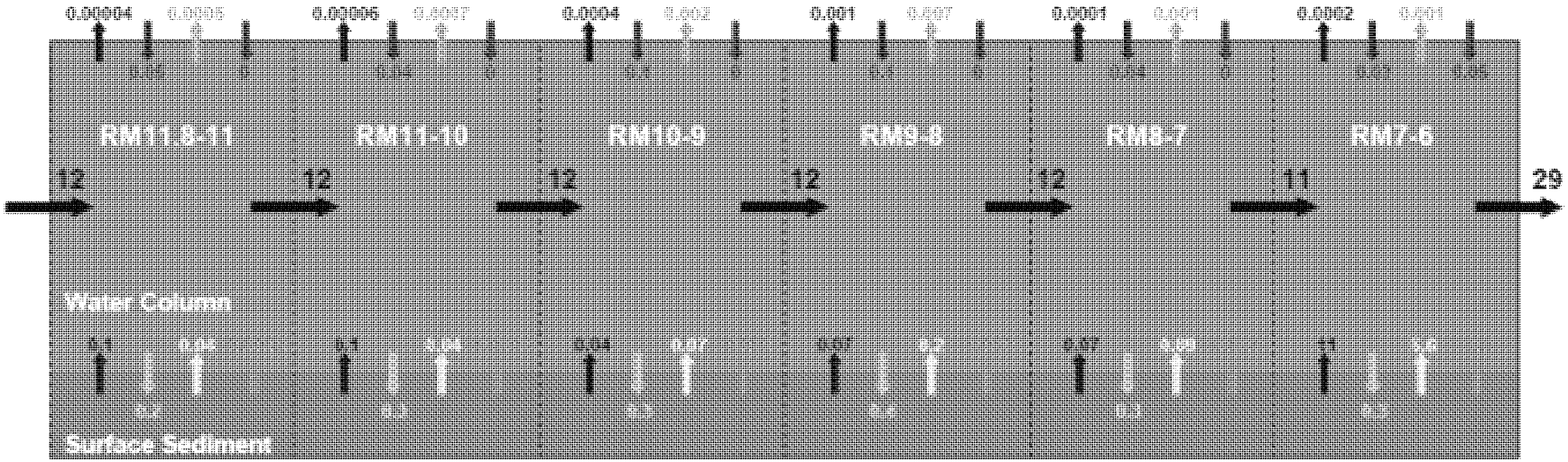
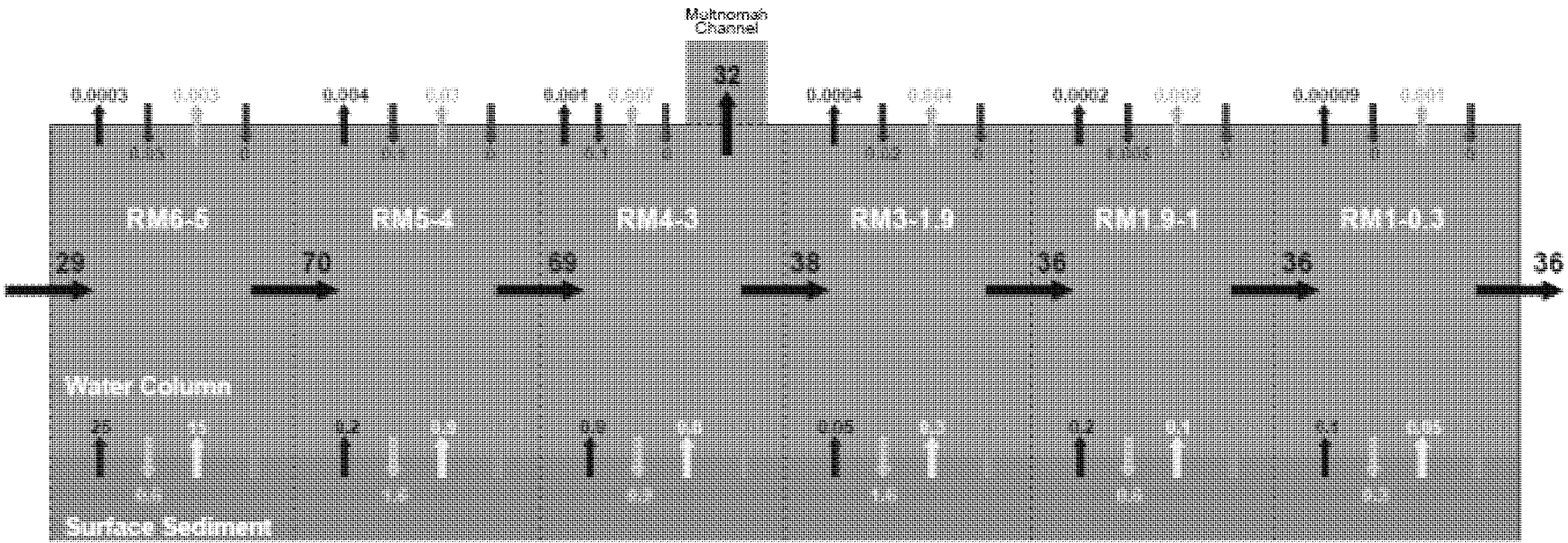


Figure 3.4-20. Sediment Deposition Rates


Data from RM 16
Swan Island Lagoon
100.00
10.00
1.00
0.10
0.01
ARAR = 0.12 ug/L (AWQC)
12
10
8
6
4
2
0
River Mile
Model Run: LWG_cal_chemfate_BaP_1010-118
EDI Data
E/M/W Data
Model Average
Model Median
Model Min and Max

Units are kilograms/year





Advection + Dispersion
Erosion
Deposition
PW Exchange
Groundwater
Decay
Volatilization
Stormwater Discharges
NPDES Discharges

ANCHOR QEA

DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part

Figure 3.3-44

Portland Harbor RI/F

Draft Feasibility Stu

Appendix A8

Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017

DRAFT

IEc

MEMORANDUM | September 26, 2017

TO Sean Sheldrake, United States Environmental Protection Agency (EPA)

FROM Gail Fricano, Rachel DelVecchio, and Dr. Rita Cabral (Industrial Economics, Inc.)

SUBJECT Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor

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PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" (from Amy Nelson and Taku Fuji, Anchor QEA, to Bob Wyatt, NW Natural).

OVERARCHING CONCERNS

1. The NW Natural memorandum advocates for increasing cleanup levels and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) at the Portland Harbor Superfund Site (PHSS) based on EPA's January 19, 2017, updates to the benzo(a)pyrene cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS). Modifying the cleanup levels and RALs would constitute a major change to the Record of Decision (ROD). In particular, a change to the RALs would warrant a ROD amendment. Issuing a ROD amendment is a very lengthy process that would significantly delay the cleanup schedule, likely by several years. As iterated in past comments to EPA, the Five Tribes urge EPA to achieve a timely and thorough cleanup of the PHSS in order to restore its myriad uses to the public and achieve a healthy ecosystem as quickly as possible. The community has waited long enough for a cleanup plan. We urge EPA to keep on schedule and begin in-water cleanup as soon as possible. We are deeply concerned about the effects of considering changes to the RALs on the project schedule.
2. EPA's cleanup plan was developed with meaningful input from the Five Tribes and other tribal, state, and federal partners, as well as the community and other interested parties. The Five Tribes have frequently provided input on numerous technical issues over many years. In developing the ROD, EPA weighed feedback provided at government-to-government consultations with the Five

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Tribes, as well as our written comments on the Proposed Plan provided during the public comment period. If EPA is considering changing the PAH RALs, a change that would likely require a ROD amendment, the Five Tribes assert our right to request government-to-government consultations with EPA so that our input on such an important potential change may be fully considered.

TECHNICAL COMMENTS

3. NW Natural's proposed change to the navigation channel cleanup level and RAL is based on the ROD remedial action objective (RAO) 2 (clam consumption by humans) cleanup level of 3,950 ug/kg carcinogenic PAH (cPAH). The ROD RAO 5 (benthic risk) cleanup level of 23,000 ug/kg total PAH (TPAH) that is also applicable to the navigation channel is not affected by the CSF update because the CSF is relevant to human health risk and not ecological risk. It appears that converting 23,000 ug/kg TPAH to cPAH using EPA's regression would yield a cPAH concentration of approximately 2,700 ug/kg. This value is substantially lower than NW Natural's proposed cPAH cleanup level of 108,000 ug/kg based on the ROD's RAO 2 cleanup level and the updated CSF. We are uncertain whether we are correctly applying the relevant risk-based concepts in this case, but the cleanup level should always default to the lowest value across RAOs; with the CSF update, the appropriate value for the navigation channel sediment cleanup level may now be based on RAO 5.

4. The ROD cPAH surface water cleanup level is based on the federal human health water quality criteria protective of fish consumption. NW Natural proposes changing the surface water cleanup level by applying the CSF update to the federal criteria. The federal criteria went through an extensive public review process and are published in the Federal Register (80 FR 36986). These criteria constitute applicable or relevant and appropriate requirements (ARARs) for the PHSS. Thus, the published values must be applied at the PHSS and cannot be changed without a rulemaking. Similarly, the Oregon water quality standards are promulgated standards that cannot be changed without a rulemaking.

5. The development of cPAH RALs for the nearshore area and navigation channel based on the updated CSF is not a straightforward exercise. NW Natural's two approaches to revising the RALs, "proportional adjustment approach" and "risk reduction approach," are inconsistent with the approach that EPA presented in the ROD, which instead considers surface-weighted average concentration (SWAC) reductions for a spectrum of RAL options. It may not be appropriate to adjust the RALs based on a direct relationship with cleanup levels. This inconsistency in methodology highlights the importance of careful consideration and discussion among EPA and their tribal, state, and federal partners of methods presented in the NW Natural memorandum, as well as alternative methods.

6. The CSF update to benzo(a)pyrene is only applicable to human health pathways and, as we assert above, is only relevant to sediment unless new federal and state water quality criteria are promulgated. EPA would need to evaluate whether NW Natural's proposed sediment RALs for the nearshore area and navigation channel are likely to achieve the surface water cleanup levels. In addition, as noted above, EPA must determine whether ecological pathways become driving factors of PAH cleanup (i.e., provide the basis for the PAH RAL) if the CSF update is applied to human health-based cleanup levels. Lastly, if PAH RALs were to be changed, EPA must determine the extent to which areas formerly considered PAH-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs) or non-aqueous phase liquid (NAPL)/not reliably contained (NRC) principal threat waste (PTW).

Appendix A9

Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017

DRAFT

IEc

MEMORANDUM | October 11, 2017

TO Michelle Pirzadeh, United States Environmental Protection Agency (EPA)

FROM Gail Fricano and Rachel DelVecchio (Industrial Economics, Inc.)

SUBJECT Terminal 4 Negotiations Regarding Human Health Risk and Remedial Action Levels (RALs)

PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on topics raised by the Port of Portland (Port) related to implementation of the Portland Harbor Superfund Site (Site) Record of Decision (ROD) at Terminal 4 (T4). Our comments focus on two issues raised in a series of briefing papers developed by the Port and shared with the United States Environmental Protection Agency (EPA) on August 16, 2017, titled "Terminal 4 Overview" (3 pp. plus figure) and "Human Health Direct Contact Risk at Terminal 4" (3 pp.). The issues are: (1) whether the human health direct contact pathway at T4 is complete, and if not, whether EPA's cleanup standards should be relaxed; and (2) whether navigation channel remedial action levels (RALs) should be applied at T4 rather than the Site-wide RALs. We have serious concerns about the Port's perceptions of and implied proposals regarding these issues, and we urge EPA to fully consider our comments below during upcoming discussions with the Port. In addition, we note that many of the comments we provided to EPA on October 9 related to Pre-RD Group negotiations also apply to discussions with T4, as described below.

HUMAN HEALTH DIRECT CONTACT RISK

The Port asserts that the human health risk exposure pathway may not be complete across the entirety of T4 due to site-specific characteristics including relatively deep (-30 to -40 feet Columbia River Datum) waters, the Baseline Human Health Risk Assessment's determination that beach use was not an applicable exposure scenario at T4, and the active, secure nature of the marine terminal facility that would limit human access to the area. The Port does not propose a specific resolution related to these assertions, but rather requests that EPA work with the Port to create a Remedial Design/Remedial Action process that accounts for these site-specific conditions at T4. The Port implies that cleanup levels should be relaxed because of the alleged lack of direct human contact at T4. The Five Tribes do not support relaxing cleanup levels at T4, and we urge EPA to consider the following points when discussing a path forward with the Port.

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

1. EPA must develop a remedy that is protective of Tribal treaty rights, which provide for Tribal fishing throughout the Site, including T4.
2. The Port asserts that it "operates an active, secure marine terminal facility," and "direct contact exposures are further limited by active marine terminal operations, including frequent vessel calls " (Human Health Direct Contact Risk at Terminal 4 briefing paper, p. 2). While we agree that these characteristics presently limit recreational access to the river, it is unknown whether this area will remain an active, secure facility in the future, for instance, in 100 years or more. The remedy must be protective in perpetuity, and current security measures at T4 do not provide sufficient assurance that recreational users will not access the area in the future. Further, it is uncertain whether these characteristics ensure a complete absence of recreational access, as institutional controls at Superfund sites are widely acknowledged to not be entirely effective. In addition, EPA must ensure that a remedy is protective of workers at T4, who also may be directly exposed to contamination, including contaminated sediments.
3. EPA must develop a remedy that is protective of ecological resources at T4. Regardless of human health direct contact within T4, fish, invertebrates, and other biota inhabit T4. Furthermore, fish that are exposed to contamination within T4 may move out of T4, thereby exposing fishers in other areas of the Site to T4 contamination.

APPLICATION OF RALS

The Port implies that, due to the prevailing navigational use and deep water at Slip 3 within T4, the navigation channel RALs are the appropriate RALs to apply at Slip 3, rather than the Site-wide RALs assigned to this area in the ROD.[2] The Five Tribes do not support the Port's argument. The ROD requires that Site-wide RALs be applied to future maintenance dredge (FMD) areas, such as Slip 3. FMD areas are typically nearshore areas with direct human contact. As noted in the Human Health Direct Contact Risk section above, direct human contact is a complete pathway at T4, including Slip 3. The navigation channel RALs are not protective of direct human contact and must not be applied at Slip 3.

ACHIEVING A TIMELY CLEANUP

We do not support a reexamination of Remedial Investigation/Feasibility Study (RI/FS) and ROD assumptions regarding exposure and their implications for cleanup levels and RALs, either for the Site collectively or for individual areas of the Site. Such an approach reopens analyses that were performed by EPA and potentially responsible parties (PRPs) with substantial input from EPA's Memorandum of Understanding (MOU) partners over a period of more than 10 years. The changes that the Port proposes may reopen the RI/FS

[2] The Port's briefing papers do not specifically assert that navigation channel RALs should be applied at Slip 3. However, they have made this assertion in discussions with EPA.

and at a minimum would reopen the ROD. A ROD amendment would likely be required to change the application of cleanup levels or RALs. Such a change would delay cleanup by at least several years. We strongly urge EPA to adhere to the ROD and achieve a timely cleanup.

REITERATION OF COMMENTS ON PRE-RD GROUP NEGOTIATIONS

The Five Tribes submitted comments to EPA on October 9 expressing significant concerns regarding the process and substance of EPA's negotiations with the Pre-RD Group. Although we have not seen a draft Administrative Order on Consent (AOC) or draft work plan for T4 negotiations, we stress that our comments on the Pre-RD Group negotiations also apply to any discussions or negotiations with T4. Key issues include:

1. EPA must provide the Five Tribes, as well as MOU partners more broadly, the opportunity for meaningful involvement in the cleanup process, consistent with past practices, the MOU signed by EPA and Technical Coordinating Team (TCT) members, and EPA's trust and consultation responsibilities to the Five Tribes. This includes providing MOU partners with sufficient time and opportunity to provide feedback on all drafts of documents and other correspondence related to cleanup and negotiations, including but not limited to position papers, AOCs, scopes of work, work plans, and assertions, positions, and other views or considerations expressed by EPA or the Port by email, verbally, at meetings, or otherwise. The Five Tribes cannot emphasize enough the importance of EPA transparency with the TCT. If EPA is not transparent with the TCT regarding T4 discussions and negotiations and does not provide for meaningful TCT involvement, the Five Tribes will be required to consider invoking dispute resolution provisions in the MOU.
2. Work plans must not be attached to AOCs, but rather developed with full TCT participation and finalized after AOCs are signed.
3. AOCs must require PRPs to fund Tribal Response Costs.
4. The scope of AOCs should encompass Remedial Design and should not be limited to one sampling event.
5. As discussed on the October 10 TCT call, the AOC must not provide PRPs the opportunity to appeal dispute resolutions issued by the Regional Administrator to the EPA Administrator.
6. Work plans must be based on statistically valid designs.
7. Work plan objectives and data uses must be consistent with the ROD.
8. EPA must not entertain PRP efforts designed to reopen the RI/FS, which was developed over more than ten years and represents a joint effort between EPA and the PRPs with significant input from governmental partners, including the

Five Tribes. Efforts to reopen the RI/FS are clearly stall tactics intended to postpone cleanup. EPA must move forward with the current RI/FS in order to achieve a timely cleanup.

Appendix A10

Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017

DRAFT

Administrator McCarthy signed EPA's Portland Harbor Record of Decision on January 3, 2017. On January 19, 2017, EPA announced the release of the *IRIS Toxicological Review of Benzo[a]pyrene (Final Report)* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136). The updated benzo[a]pyrene (BaP) toxicity values provided in the final IRIS report would significantly change the remediation goals established just two weeks earlier in the Portland Harbor ROD, eliminating more than $100 million of unnecessary cleanup.

EPA's ROD sets two (but applies three) sediment cleanup levels for carcinogenic polycyclic aromatic hydrocarbons (cPAHs), calculated as BaP equivalents (BaP eq):

(1) For nearshore areas of Portland Harbor, EPA's ROD identifies a cPAH (BaP eq) cleanup level of 12 µg/kg based upon human health direct contact with sediments. EPA's June 2016 Final Feasibility Study selected cPAH preliminary remediation goals of 12 µg/kg for direct contact with beach sediments and 106 µg/kg for sediments that are mostly or always under water. *See* FS Table 2.2-4. As part of the ROD, EPA provided an updated calculation of residual and post construction direct contact risk estimates that evaluates its selected remedy against the 106 µg/kg cPAH PRG for in-water sediments rather than the 12 µg/kg cPAH PRG for beach sediments. *See*, *Portland Harbor RI/FS Appendix J – Update, Calculation of Residual and Post Construction Risk Estimates*, Table J2.2-2c. This is consistent with EPA's baseline human health risk assessment (BHHRA) for in-water exposures, and so it appears that the 12 µg/kg cPAH cleanup level in ROD Table 17 is an error if applicable to in-water sediments (as opposed to beach sediments). (We note also that "highly toxic" principal threat waste concentrations are based on the 106 µg/kg in-water sediment direct contact PRG, rather than the beach PRG. *See* ROD, Table 6.) The appropriate cleanup level for human direct contact with nearshore sediment, based upon the assumptions and methods of the EPA BHHRA, should be 106 µg/kg.
(2) In deep water areas of the site, principally the navigation channel, EPA selected a cPAH cleanup level of 3950 µg/kg based on human consumption of clams.

See ROD, Table 17.

If the cPAH RGs were recalculated using the updated IRIS cancer slope factor and all of the same assumptions, exposure scenarios and methodologies employed in EPA's FS, the RGs would change significantly:

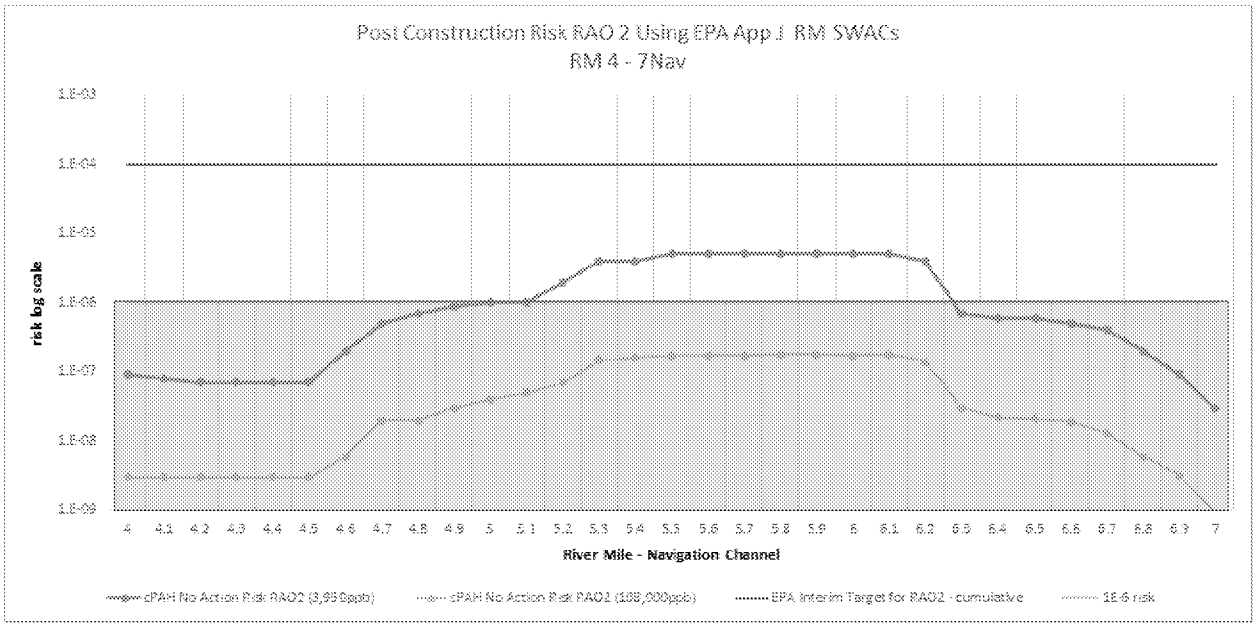
- The in-water sediment direct exposure cPAH RG would increase from 106 µg/kg to 773 µg/kg.
- The beach sediment direct exposure cPAH RG would increase from 12 µg/kg to 85 µg/kg.
- The clam consumption exposure cPAH RG would increase from 3,950 µg/kg to 108,000 µg/kg.

Further, the cPAH "highly toxic" principal threat waste threshold would increase from 106,000 µg/kg to 773,000 µg/kg.

The net result of these changes, based upon the methodologies in EPA's updated calculation of residual and post-construction risks, is that no areas of the site would exceed a 1×10^{-6} cPAH clam consumption risk, and all areas downstream of RM 6 (the approximate downstream edge of the Gasco site) would meet the 1×10^{-5} interim risk threshold for cPAH direct contact based on the no action alternative. In other words, based upon the existing data set, all areas of the site other than in the immediate vicinity

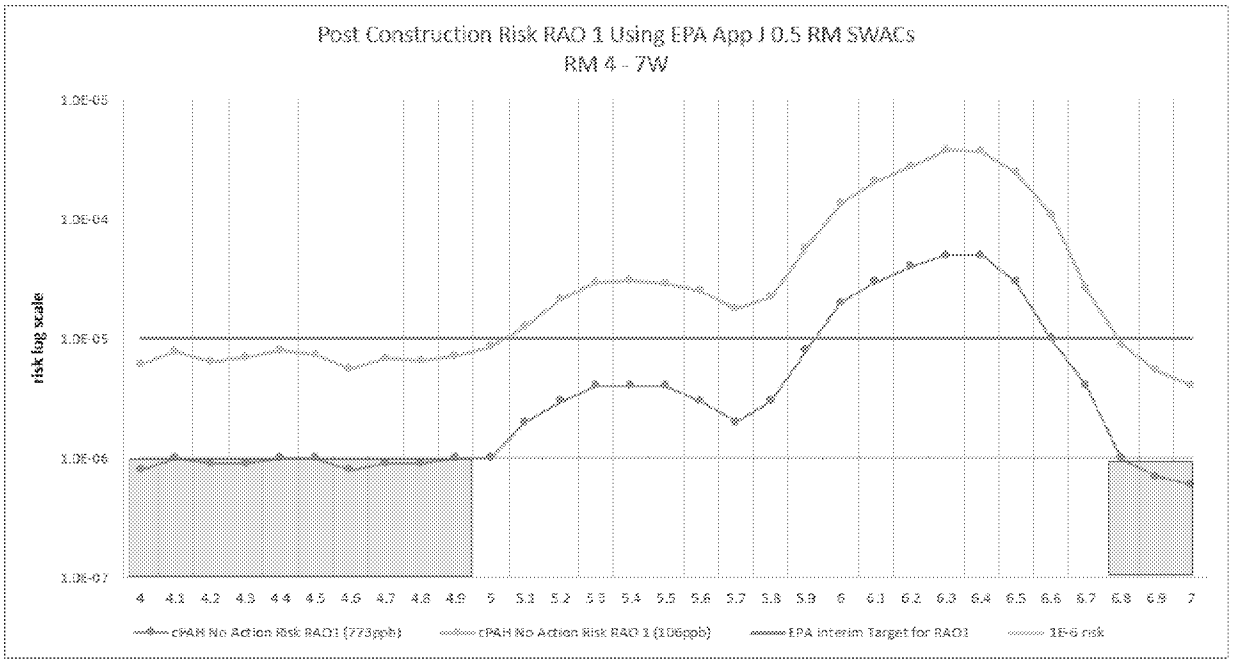
of Gasco do not present cPAH risks outside EPA's acceptable risk range based upon EPA's current BaP cancer slope factor.

Here is a simple graph showing "no action" cPAH clam consumption risks in the navigation channel using EPA's SWACs and methodologies:



The orange line depicts risks calculated by EPA relative to the RG set by EPA's January 6 ROD; the yellow line shows risk using updated RGs with the BaP cancer slope factor published on January 19. We have previously noted our concerns about application of a cleanup level based upon clam consumption in deep waters, including the fact that no such risk was identified in the BHHRA. Even if this were a valid risk scenario, however, no risk would exist based upon EPA's current toxicity values.

This graph shows similar risk comparisons for direct contact with in-water sediment:



Again, based upon the updated cancer slope factor, potential unacceptable risk for BaP in-water sediment direct contact downstream of the immediate vicinity of the Gasco is either below EPA's interim risk threshold or non-existent. No cleanup in these areas is necessary, based upon EPA's best and most current science.

The cPAH cleanup levels in the ROD should be updated now, before significant pre-design or design work begins. Updating the values requires only a straightforward mathematical calculation and does not involve review or revision of any of EPA's assumptions or methodologies in the BHHRA. An Explanation of Significant Difference that makes these corrections now could save millions of dollars of remedial design work and avoid tens, perhaps hundreds, of millions of dollars of unnecessary cleanup.

Appendix A11

Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017

DRAFT

MEMORANDUM

Yakama Nation Fisheries

Columbia River
Honor. Protect. Restore.

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October 12, 2017

To: Sean Sheldrake, United States Environmental Protection Agency (EPA)
From: Laura Shira, P.E., Environmental Engineer
Re: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site

This memo provides technical comments and concerns on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" from Anchor QEA and Pearl Legal Group, to NW Natural. NW Natural advocates for increasing cleanup levels (CULs) and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) within the Record of Decision (ROD) at the Portland Harbor Superfund Site (site) based on EPA's January 19, 2017 updates to the benzo(a)pyrene (BaP) cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS).

Although we acknowledge changes to IRIS as science-based, the Yakama Nation has significant concerns about the effects of the proposed changes on the project schedule and the protectiveness of the cleanup. With the limited information we have been presented it is impossible to evaluate the merits of the back-of-the envelope calculations provided by NW Natural. If EPA is considering making changes to the CULs and/or RALs, that process must include an analysis of the pros and cons of these changes with respect to overall project timeline, budgets, and protectiveness; and an in-depth evaluation of how any changes to the ROD resulting from these recommendations will address human and ecological risk at the Portland Site. Modifying the CULs and RALs as suggested would constitute a major change to the ROD. In fact, NW Natural's proposal suggests that modified RALs could potentially decrease the area actively cleaned up by greater than 10% (from 355 acres to as little as 304 acres). The Yakama Nation urges EPA to maintain RALs set in the ROD and keep on schedule for in-water cleanup. However, if EPA is considering changing the PAH RALs, or any changes that would require a change to the ROD including an Explanation of Significant Differences or amendment, the Yakama Nation requires meaningful engagement as prescribed in the 2001 Memorandum of Understanding (MOU) and EPA must offer government to government consultation on proposed changes before a decision is made.

At this point, without adequate information to review, we offer the following preliminary comments.

<u>Technical and Procedural Comments</u>:

The Yakama Nation supports the technical comments submitted on behalf of the Five Tribes by IEc on September 26, 2017. Below are our technical comments:

1. A change to the RALs or even CULs would warrant a change to the ROD which would significantly delay the cleanup schedule, likely by several years. The impacts of significant delays and their associated costs should be considered if this is the path EPA chooses to take.
    a. The water quality standards in the ROD are Federal and State standards that have been promulgated under the Clean Water Act. Until these standards are changed via a formal rule making process the water quality criteria used for CULs and RALs developed in the ROD are applicable or relevant and appropriate requirements and must stand as is.
    b. The update to the IRIS database may affect the water quality standards in future rule making processes but so will other factors that have yet to be determined.
2. In addition, the update to RALs or CULs is not as simple as plugging in a new cancer slope factor for BaP. All of the risks for all COCs associated with each area will need to be re-evaluated to ensure the remedy is protective of human health and the environment. For example:
    a. The revised IRIS data do not affect or consider ecological risk. Proposed changes to the navigation channel CUL and RAL must also consider ecological risk.
    b. NW Natural's proposed sediment CUL and RAL would need to be evaluated to determine whether they are likely to achieve surface water cleanup levels within porewater and the water column.
    c. NW Natural's two approaches to calculating the proposed CULs and RALs are not consistent with EPA's surface-weighted average concentration (SWAC) methodology presented in the ROD.
    d. If the proposed CUL and/or RAL changes are considered, sediment management areas (SMAs) would need to be re-evaluated to determine the extent to which areas formerly considered PAH risk-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs), non-aqueous phase liquid (NAPL), not reliably contained (NRC), and/or principal threat waste (PTW).

A change in the RAL or CUL would not be a quick process and would likely introduce much uncertainty to where the Portland Harbor remedy is headed. It is likely PRPs would want to delay any work until EPA made a final decision of RALs and CULs, if it chooses to revise either. We must reiterate any change the ROD will require meaningful involvement with the Yakama Nation and EPA must offer to consult on its proposal before it makes a final decision. Because of the gravity of this issue the proposal must be supported by in-depth scientifically sound evaluation that will explain if and how the change to the BaP cancer slope factor will truly justify a significant reduction in the active remediation at the facility or if other factors such as ecological risks and ARARs will negate any major reduction active remediation.

PH NW Natural Proposed CUL and RAL ROD changes (8/2/2017)

Comparison of Portland Harbor ROD vs. NW Natural Proposed Cleanup Levels and Remedial Action Levels.

media		RAO	ROD*	Proposed (NWNatl	Criteria	Chemical
Sediment/soil	riverbank	1 HH - direct contact	12 ug/kg	85 ug/kg	CUL	cPAHs (BaP equiv)
sediment	intermed (btwn be	1 HH - direct contact	***106 ug/kg	773 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nearshore	1 HH - tribal user - direct contact	106 ug/kg	773 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nav channel	2 HH - clam consumption	3,950 ug/kg	108,000 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nav channel	5 ECO - benthic	23,000 ug/kg		CUL	TPAH
sediment	beaches		12 ug/kg		BKGRD	cPAHs (BaP equiv)
sediment	all		106,000 ug/kg		PTW	cPAHs (BaP equiv)
sediment	all		870,000 ug/kg		PTW	TPAH
sediment	nearshore		1,500 ug/kg	10,800 ug/kg	RAL	cPAHs (BaP equiv)
sediment	nearshore (all?)		13,000 ug/kg	**92,000 ug/kg	RAL	TPAH
sediment	nav channel		20,000 ug/kg	540,000 ug/kg	RAL	cPAHs (BaP equiv)
sediment	nav channel		170,000 ug/kg	4,000,000 ug/kg	RAL	TPAH
surface water		3 HH- fish consumption	0.0001 ug/L	0.0009 ug/L	CUL	cPAHs (BaP equiv)
surface water		7 ECO -	0.014 ug/L		CUL	cPAHs (BaP equiv)

NW Natural's proposal, if accepted in full, would result in a decreased SMA area from 355 acreas (ROD) to 304 or 326 acres (proposed).
Table 17, ROD cleanup value
Table 6, ROD PTW value
Table 19, ROD RALs
* if the ROD values listed are not high-lighted, then NWNatural caluculated them or pulled them from elsewhere, including Non-ROD documents
** based on tribal use PRGs of 773 ug/kg
*** PRG used for many of the RAL calcs

Appendix A12

Memorandum from Portland Harbor ESD Team to EPA Region 10, Subject: Comments received verbally from TCT members during reading room reviews on March 21, April 4 and April 18, 2018, April 24, 2018

DRAFT

MEMORANDUM

To: EPA Region 10 Portland Harbor ESD File

From: Portland Harbor ESD Team

Date: April 24, 2018

Subject: Comments received verbally from TCT members during reading room reviews on March 21, April 4 and April 18, 2018

COMMENTS CAPTURED DURING ESD READING ROOM EVENTS

March 21 Comments

- Fix 2nd bullet on Summary of Significant Changes to clarify that the sediment CUL is based on the tribal fish direct contact exposure scenario and applicable to all nearshore sediments, except for recreational beach areas.
- Section 4.0 it is recommended to clarify the distinction between cPAH and Total PAH.
- Add text that documents additional data may revise RAO3 and RAO4 impacts as a result of this ESD.
- Footnote on decision summary table that Yakama Nation is currently evaluating
- Add note about rolling river miles for RAO 1 and 2 calculations to RAO Evaluation section (Page 27).

April 4 Comments

- Need to index key documents supporting Proposed ESD decisions in Appendix A
- Include TPAH conversion equation in the document
- Add a PAH figure showing relationship on this topic
- Change color of hatch area in the PAH areas in the Nav Channel
- Indicate what decision unit scale is used in the Figures and Tables
- Add ROD errata to Appendix B and refer to this errata in the text
- Compile additional key supporting documents used in the decision process for the Proposed ESD

April 18 Comments

- Add Fish/**Shellfish** tissue in updated Table 17 in Appendix A
- DEQ will be sending editorial comments in a separate markup of the Draft ESD

Appendix A13

April 19, 2018 e-mail from Sarah Greenfield (DEQ), Subject: DEQ Comments on ESD

DRAFT

19 APRIL 2018 E-MAIL FROM SARAH GREENFIELD (DEQ)

From: GREENFIELD Sarah <Sarah.GREENFIELD@state.or.us>
Sent: Thursday, April 19, 2018 3:40 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Coffey, Scott <CoffeySE@cdmsmith.com>
Cc: MCCLINCY Matt <Matt.MCCLINCY@state.or.us>; NOVAK Madi <Madi.NOVAK@state.or.us>
Subject: DEQ Comments on ESD

Sean and Scott-
Thank you both for a very productive meeting yesterday. We're looking forward to further discussions on in-water/source control overlays along the banks in our meeting next week. In the meantime, DEQ has compiled a number of mostly editorial comments on EPA's proposed ESD. We still have a couple folks who are planning to review, but I wanted to get you these initial thoughts sooner than later. We'll plan to get any remaining comments to you by end of next week. Please let me know if that works with your schedule.
As always, feel free to give me a call if you have questions.
Thanks!

Sarah Greenfield, PE
NW Region Cleanup Program
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600,
Portland, OR 97232
Office: (503) 229-5245
Fax: (503) 229-6945
Email: greenfield.sarah@deq.state.or.us

Appendix A14

April 27, 2018 e-mail from Sarah Greenfield (DEQ), Subject: DEQ Comments on ESD

DRAFT

27 APRIL 2018 E-MAIL FROM SARAH GREENFIELD (DEQ)

From: GREENFIELD Sarah <Sarah.GREENFIELD@state.or.us>
Sent: Friday, April 27, 2018 4:40 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Coffey, Scott <CoffeySE@cdmsmith.com>
Subject: RE: DEQ Comments on ESD

Sean and Scott-
DEQ folks had a couple additional minor comments on the ESD.

- Section 2.2, Nature and Extent of Contamination, page 12, paragraph 1. The ESD definition of the "shallow region" should be consistent with the definition provided in the ROD. This section of the ESD states "the shallow region, defined as shoreward of the riverbed elevation of 4 ft below mean low water…" while ROD Section 14.2.4 states "The shallow region is defined as shoreward of the riverbed elevation of approximately -2 ft CRD."
- Section 2.2, Nature and Extent of Contamination, page 13, paragraph 1. "Subsurface contamination was detected as deep as 34 ft." The text should clarify the relevant datum. DEQ assumes this is referring to 34 ft bml.

Thanks and I hope you have a great weekend!

Sarah Greenfield, ODEQ
700 NE Multnomah Street, Suite 600,
Portland, OR 97232
(503) 229-5245

From: GREENFIELD Sarah
Sent: Thursday, April 19, 2018 3:40 PM
To: 'Sheldrake, Sean' <sheldrake.sean@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>
Cc: MCCLINCY Matt <Matt.MCCLINCY@state.or.us>; NOVAK Madi <Madi.NOVAK@state.or.us>
Subject: DEQ Comments on ESD

Sean and Scott-
Thank you both for a very productive meeting yesterday. We're looking forward to further discussions on in-water/source control overlays along the banks in our meeting next week. In the meantime, DEQ has compiled a number of mostly editorial comments on EPA's proposed ESD. We still have a couple folks who are planning to review, but I wanted to get you these initial thoughts sooner than later. We'll plan to get any remaining comments to you by end of next week. Please let me know if that works with your schedule.
As always, feel free to give me a call if you have questions.
Thanks!

Sarah Greenfield, PE
NW Region Cleanup Program
Oregon Department of Environmental Quality
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Portland, OR 97232

Office: (503) 229-5245
Fax: (503) 229-6945
Email: greenfield.sarah@deq.state.or.us

Appendix A15

cPAH Sediment CUL Summary

DRAFT

cPAH Sediment CUL Summary

Overview

- The RAO 2 PRG for cPAHs was incorrectly presented in the Portland Harbor FS, Proposed Plan and Record of Decision
- The error resulted from inputting the acceptable tissue concentration into the log-log tissue/sediment regression equation in units of ug/kg rather than mg/kg
- No other chemicals are affected by this error
- Correcting the error results in a 100-fold decrease in the RAO 2 sediment CUL for cPAHs
- The error has a minimal effect on the protectiveness of the selected remedy
  - Increases the maximum post construction risk for the Selected Remedy from 3×10^{-8} to 3×10^{-6} within the Navigation Channel between RM 4.5 and RM 6

cPAH Target Tissue Levels

- Target Tissue Levels for cPAHs are based on the benzo(a)pyrene cancer slope factor (CSF)
- Target Tissue Levels are unaffected by error and calculated based on the following formula:

$$PRG_{tissue} = \frac{TR \times AT_c}{EF \times CR_{adj} \times CSF \times 0.001\, kg/g}$$

- Target Tissue Level Pre-BaP CSF Change: 7.1 µg/kg
- Target Tissue Level Post-BaP CSF Change: 51.6 µg/kg

cPAH Sediment Cleanup Levels

- Sediment Cleanup Levels for cPAH are based on the following equation describing the relationship between BaP in sediment and clam tissue:

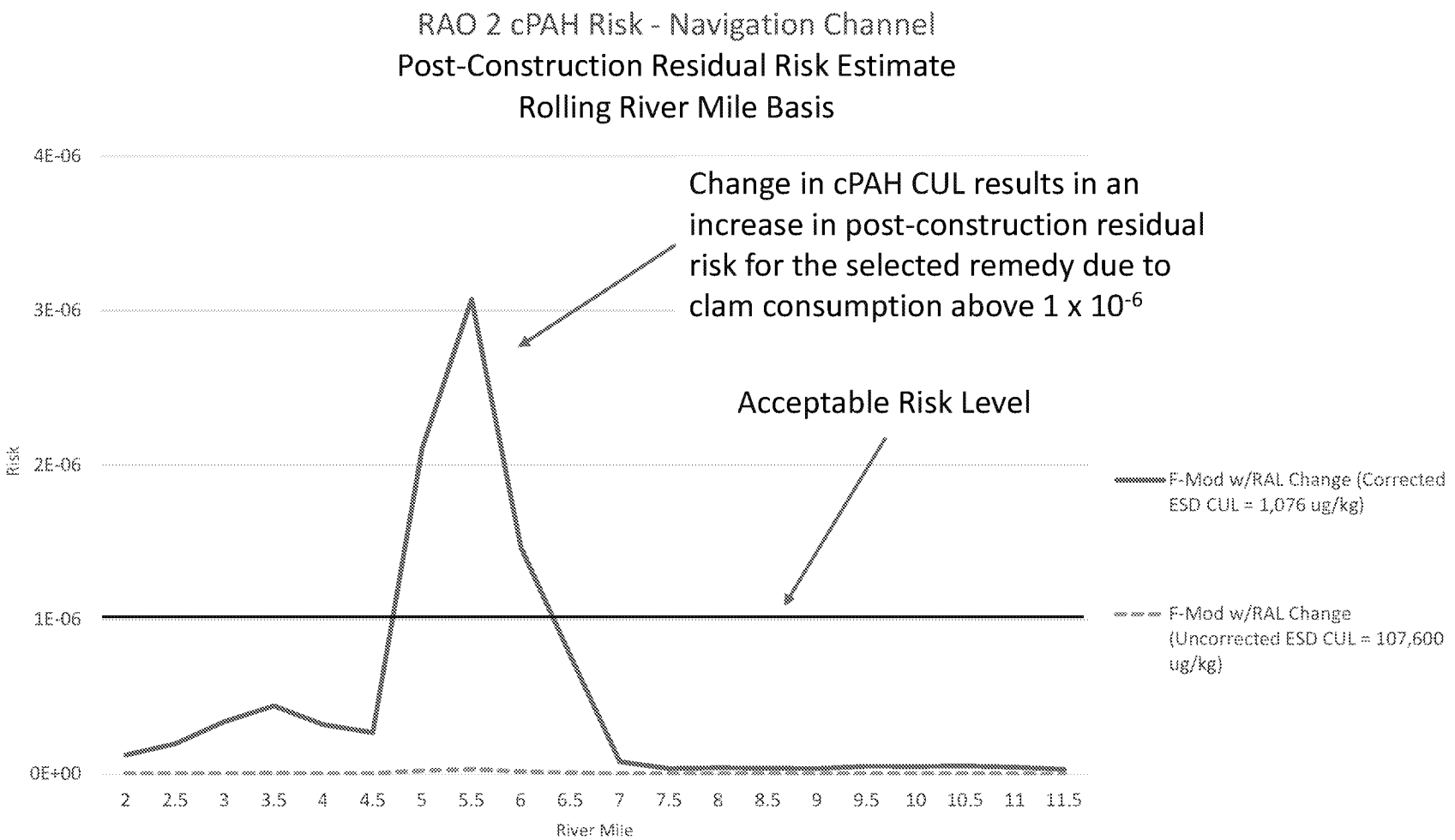
$$PRG_{\text{sed}} = e^{\left[\frac{\left(\ln\left(C_{\text{tissue}}\right)-\ln\left(f_{lipid}\right)\right)-\ln\left(CF\right)+2.47}{0.60}\right]+\ln\left(f_{oc}\right)}$$

- Error was based on use inputting acceptable tissue level into above equation in units of µg/kg rather than mg/kg
  - An acceptable tissue concentration of 7.1 µg/kg results in a sediment PRG of 3,950 µg/kg
  - An acceptable tissue concentration of 0.0071 mg/kg results in a sediment PRG of 0.0395 mg/kg (39.5 µg/kg) – a 100X reduction
  - The sediment cleanup levels following the BaP CSF change are similarly reduced 100X from 107,600 µg/kg to 1,076 µg/kg

Target Tissue Level and Sediment Cleanup Level Summary

Scenario	Target Tissue Level	Sediment Cleanup Level
ROD Value	7.1 µg/kg	3,950 µg/kg
Corrected ROD Value	0.0071 mg/kg	39.5 µg/kg
ESD Value	51.6 µg/kg	107,600 µg/kg
Corrected ESD Value	0.0516 mg/kg	1,076 µg/kg

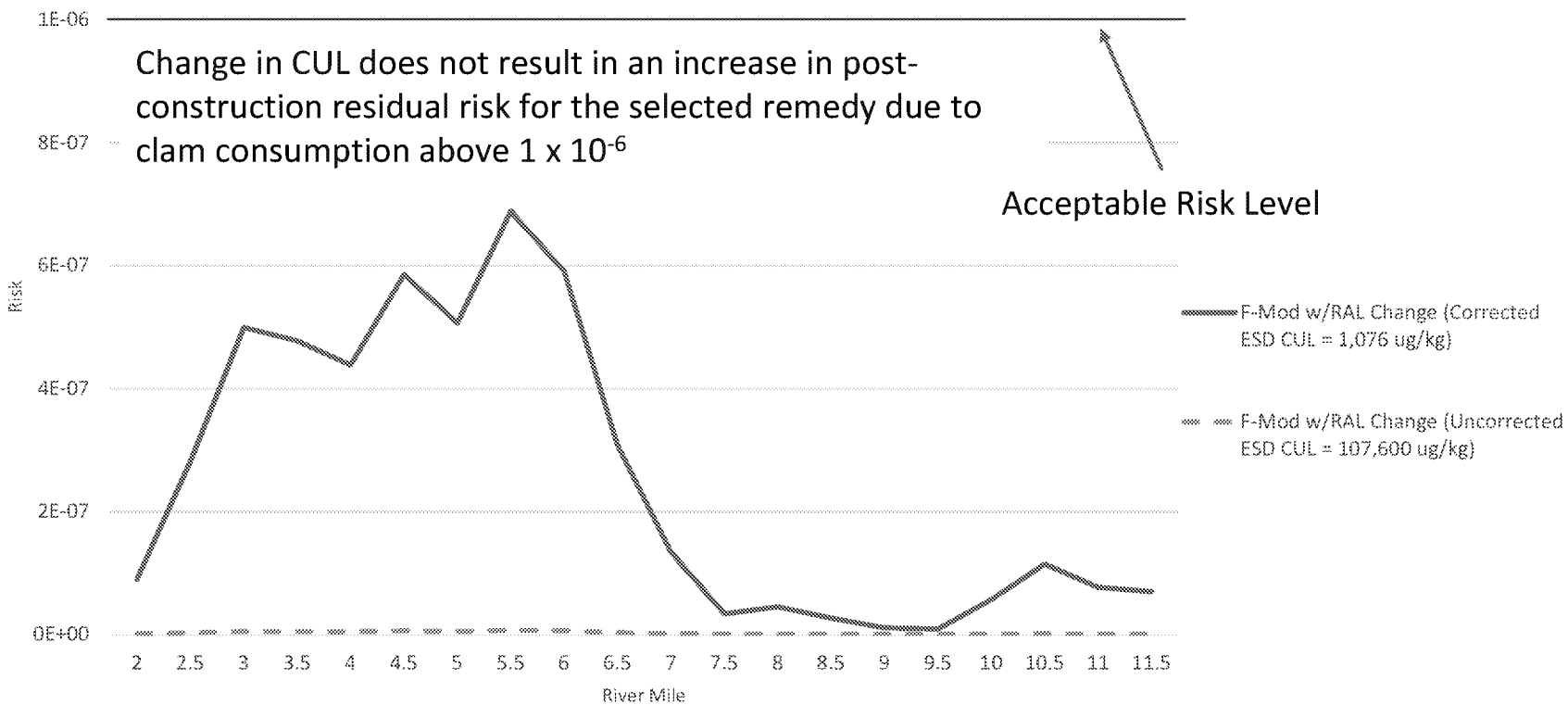
Note: Corrected target tissue levels represent a change in units from µg/kg to mg/kg only; the value is the same.


RAO 2 cPAH Risk - Navigation Channel
Post-Construction Residual Risk Estimate
Rolling River Mile Basis
Change in cPAH CUL results in an increase in post-construction residual risk for the selected remedy due to clam consumption above 1 x 10-6
Acceptable Risk Level
Risk
4E-06
3E-06
2E-06
1E-06
0E+00
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
River Mile
F-Mod w/RAL Change (Corrected ESD CUL = 1,076 ug/kg)
F-Mod w/RAL Change (Uncorrected ESD CUL = 107,600 ug/kg)

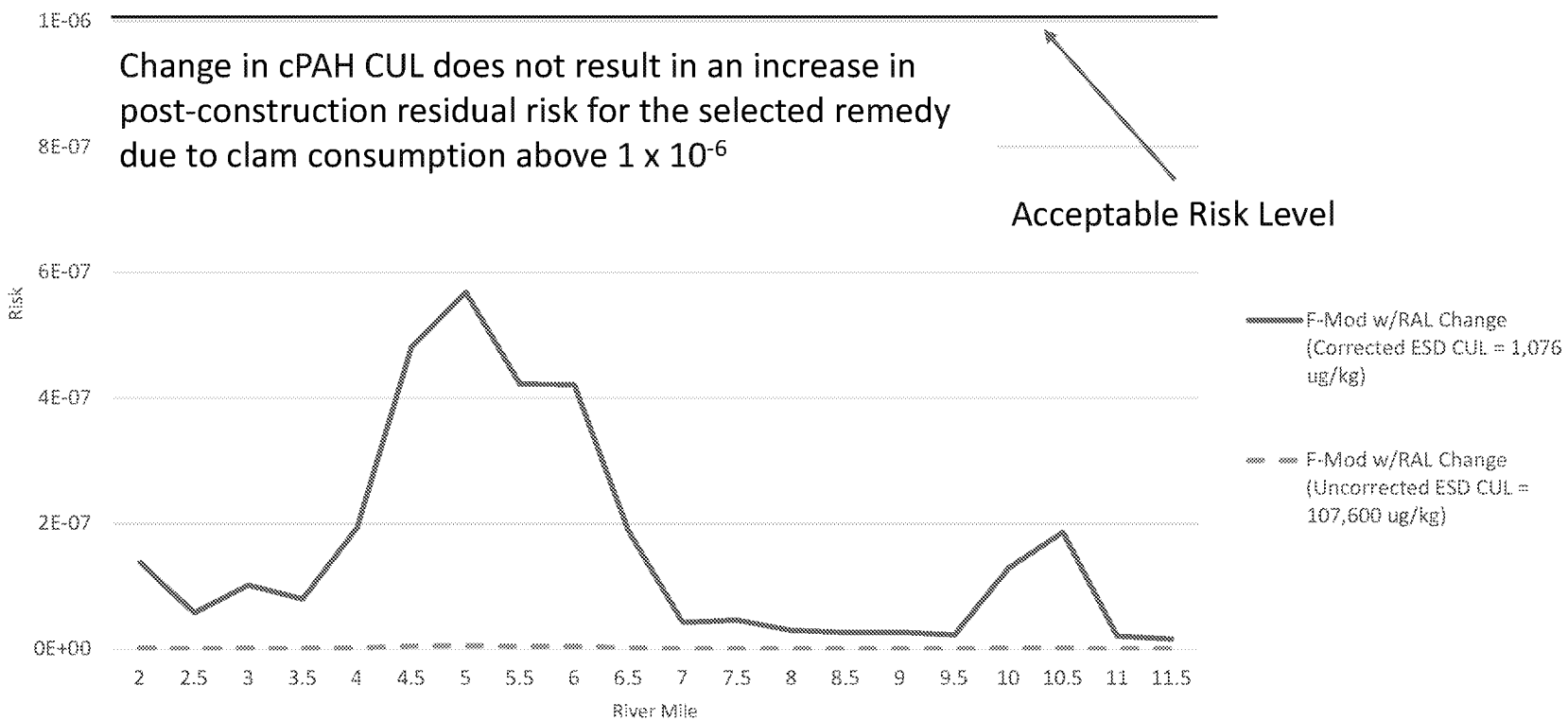
RAO 2 cPAH Risk – West

Post-Construction Residual Risk Estimate

Rolling River Mile Basis



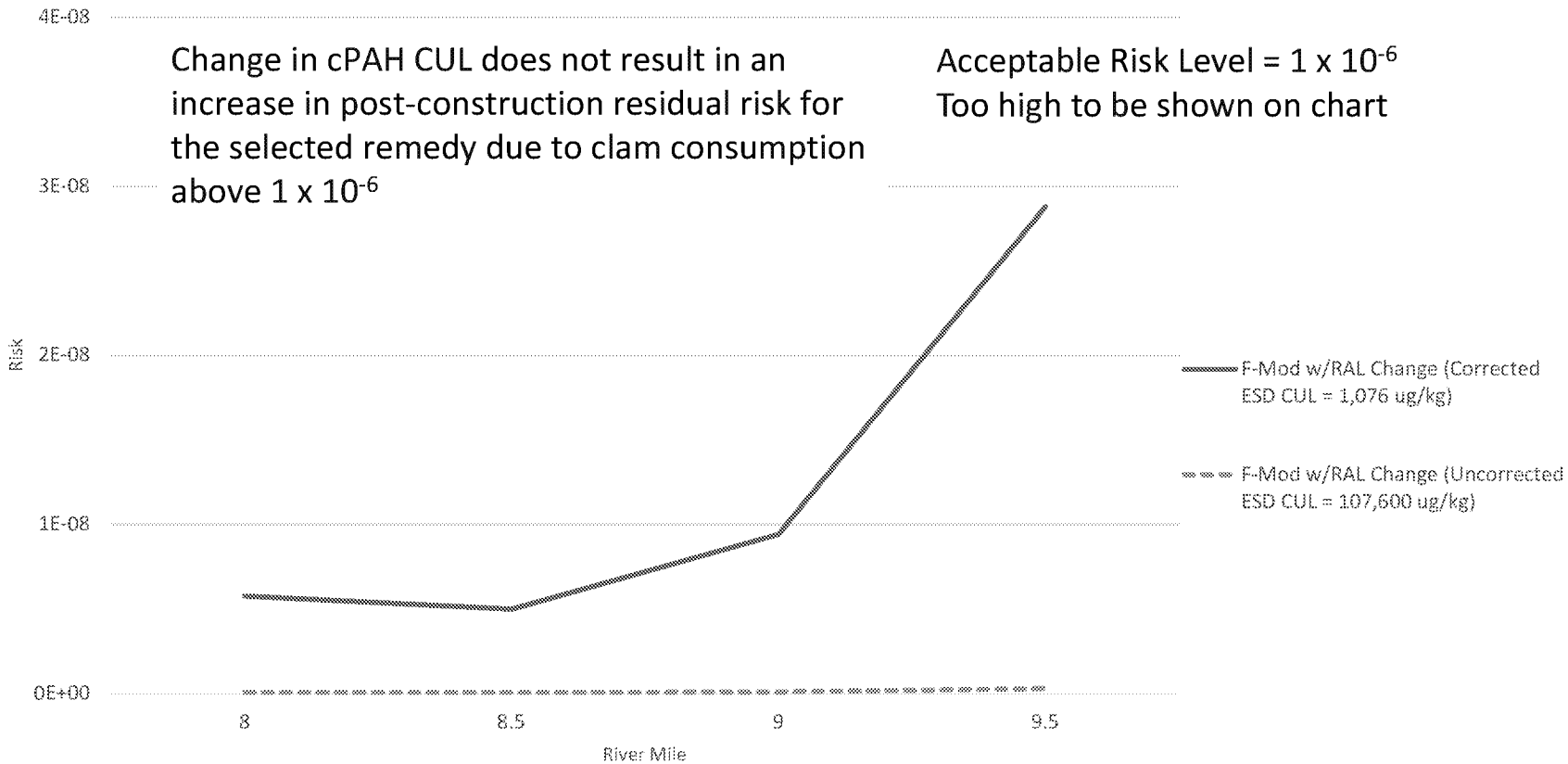
RAO 2 cPAH Risk – East
Post-Construction Residual Risk Estimate
Rolling River Mile Basis

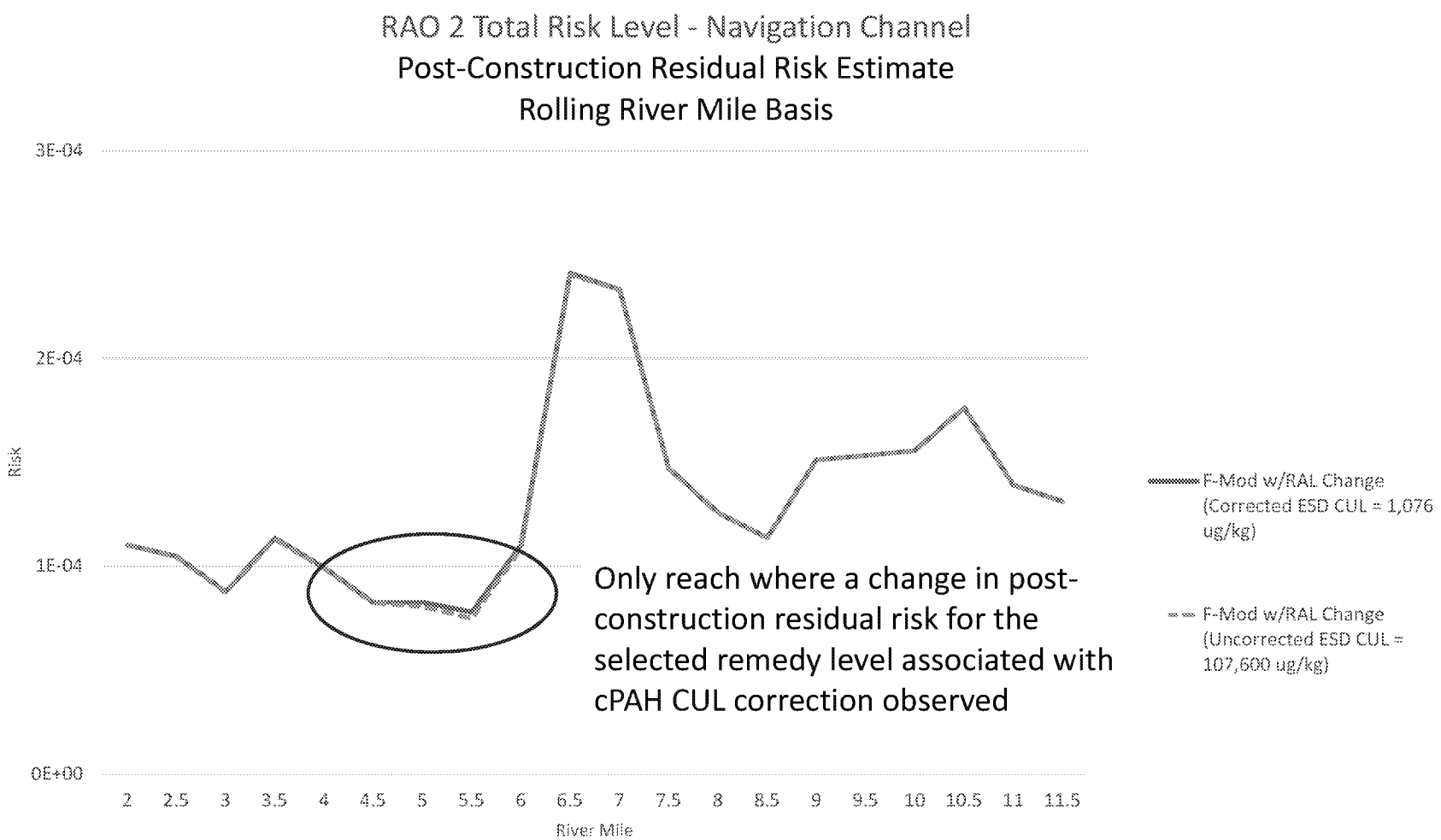


RAO 2 cPAH Risk - Swan Island Lagoon
Post-Construction Residual Risk Estimate
Rolling River Mile Basis

Change in cPAH CUL does not result in an increase in post-construction residual risk for the selected remedy due to clam consumption above 1×10^{-6}

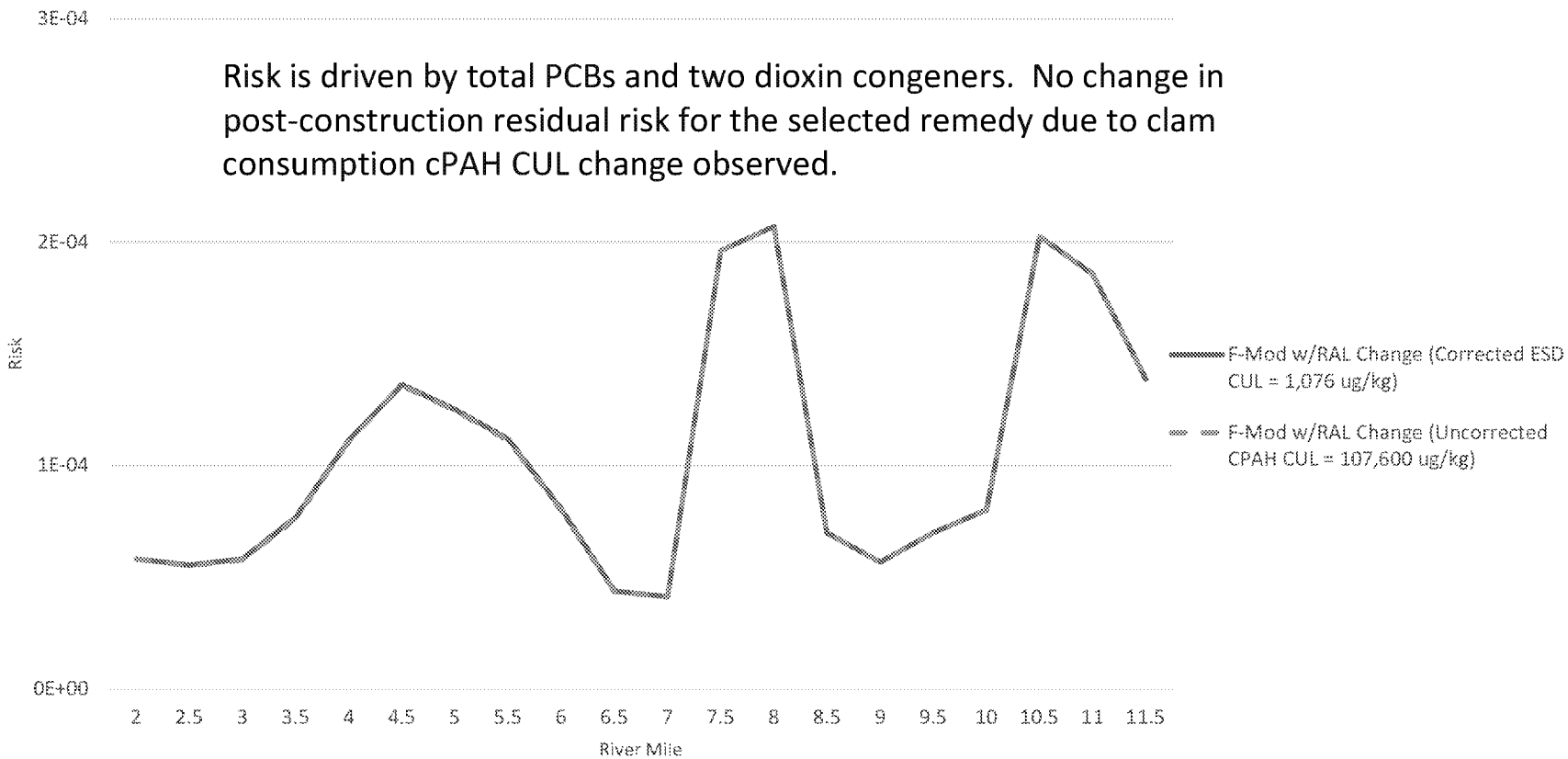
Acceptable Risk Level = 1×10^{-6}
Too high to be shown on chart




RAO 2 Total Risk Level - Navigation Channel
Post-Construction Residual Risk Estimate
Rolling River Mile Basis
3E-04
2E-04
1E-04
0E+00
Risk
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
River Mile
F-Mod w/RAL Change (Corrected ESD CUL = 1,076 ug/kg)
F-Mod w/RAL Change (Uncorrected ESD CUL = 107,600 ug/kg)
Only reach where a change in post-construction residual risk for the selected remedy level associated with cPAH CUL correction observed

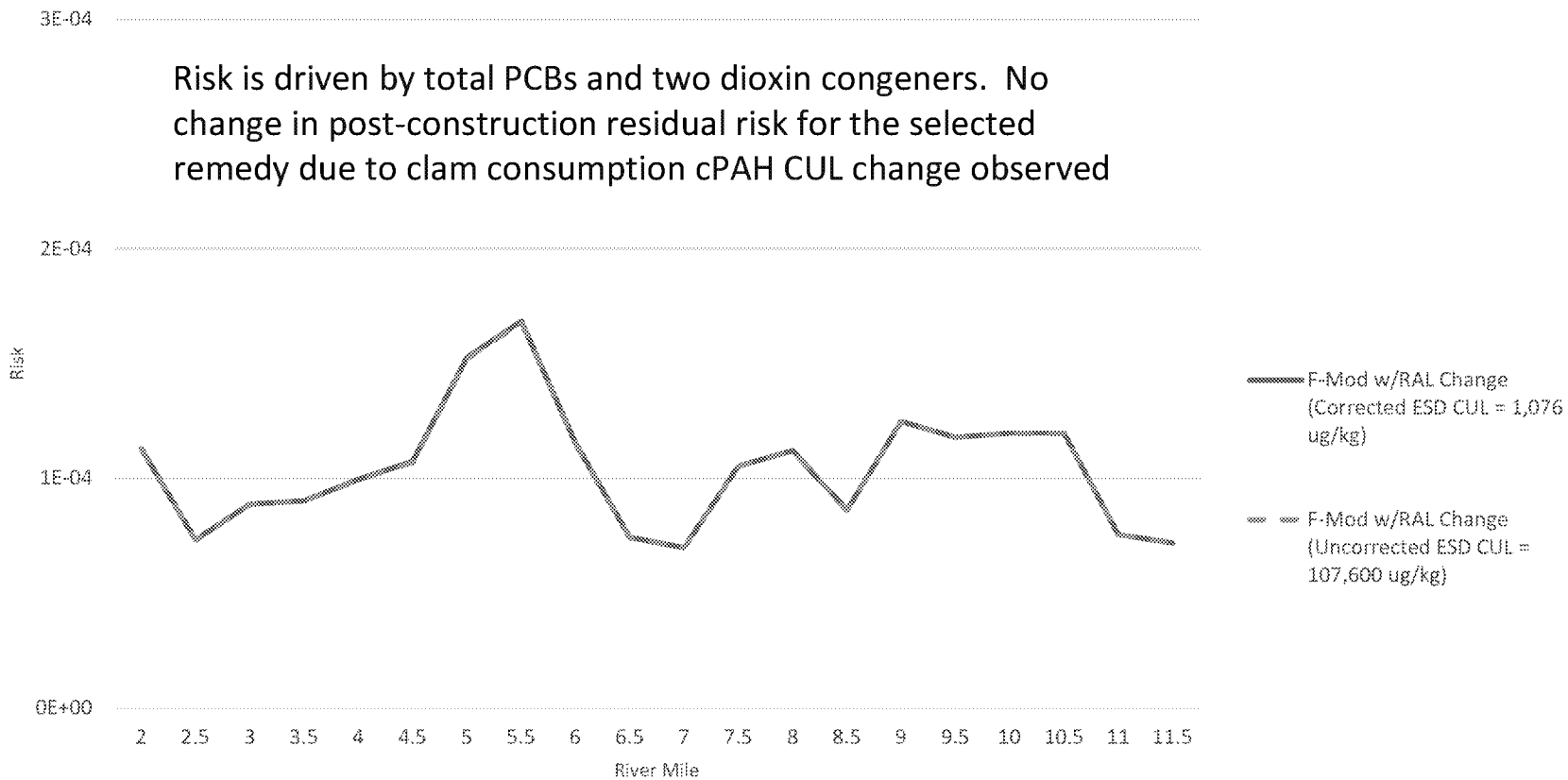
RAO 2 Total Risk Level – West
Post-Construction Residual Risk Estimate
Rolling River Mile Basis

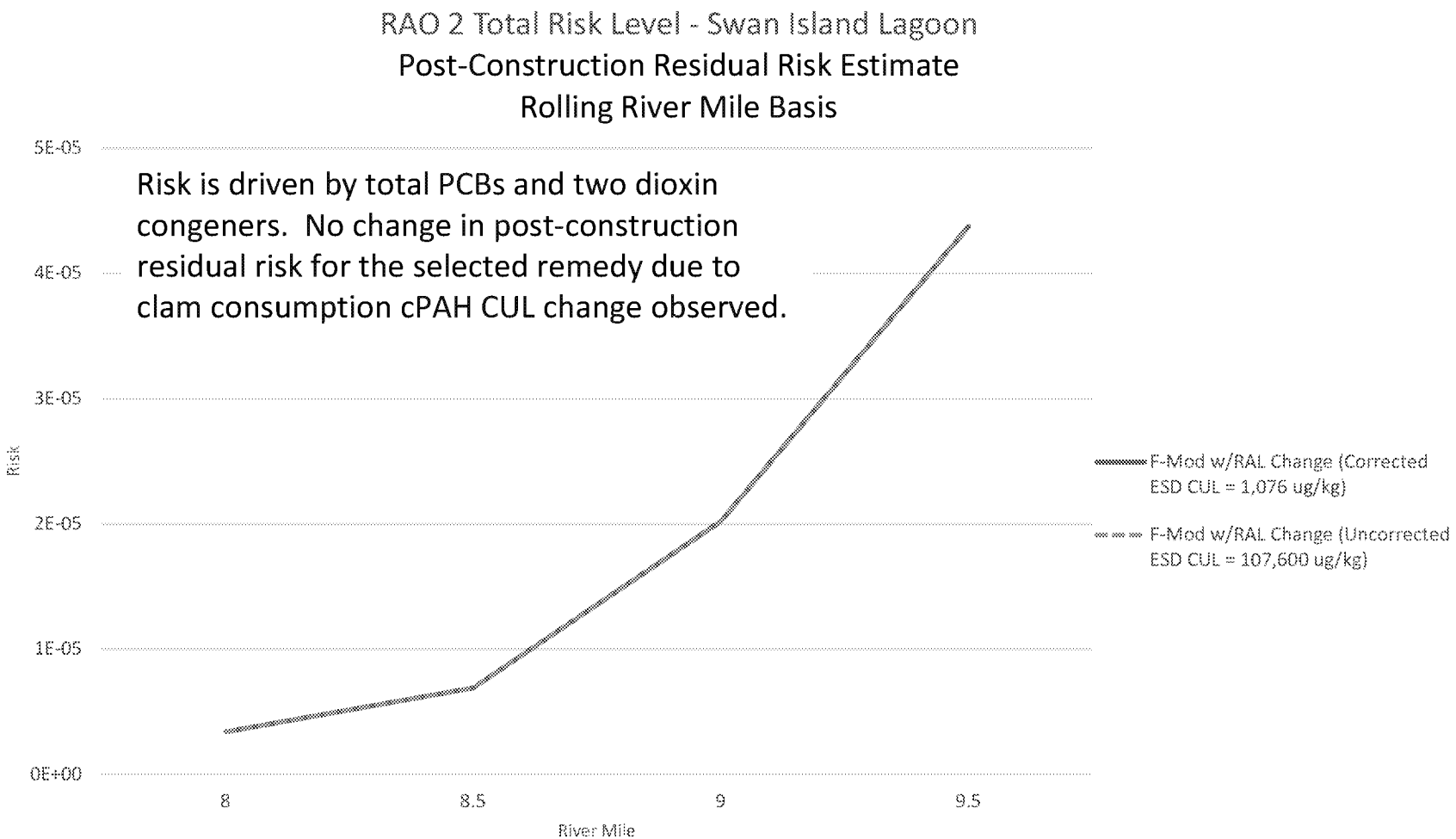
Risk is driven by total PCBs and two dioxin congeners. No change in post-construction residual risk for the selected remedy due to clam consumption cPAH CUL change observed.



RAO 2 Total Risk Level – East
Post-Construction Residual Risk Estimate
Rolling River Mile Basis

Risk is driven by total PCBs and two dioxin congeners. No change in post-construction residual risk for the selected remedy due to clam consumption cPAH CUL change observed




RAO 2 Total Risk Level - Swan Island Lagoon
Post-Construction Residual Risk Estimate
Rolling River Mile Basis
Risk is driven by total PCBs and two dioxin congeners. No change in post-construction residual risk for the selected remedy due to clam consumption cPAH CUL change observed.
5E-05
4E-05
3E-05
2E-05
1E-05
0E+00
Risk
8
8.5
9
9.5
River Mile
F-Mod w/RAL Change (Corrected ESD CUL = 1,076 ug/kg)
F-Mod w/RAL Change (Uncorrected ESD CUL = 107,600 ug/kg)

Appendix B

Errata Memorandum

DRAFT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL CLEANUP

April 3, 2018

MEMORANDUM

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

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

TO: Portland Harbor site file

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

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

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

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

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

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

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

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

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

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

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6. Appendix II, ROD Table 2 and Table 3. Two abbreviations in each table should be updated to include the correct congener for each abbreviation:

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

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

7. Appendix II, ROD Table 4. In the abbreviations list, the abbreviation for HxCDF should be 1,2,3,4,7,8-hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.

8. Appendix II, ROD Table 6. The contaminant listed as 1,2,3,4,6,7,8- HxCDF should be 1,2,3,4,7,8-HxCDF.

9. Appendix II, ROD Table 17. Revisions to this table include:

    a. The groundwater cleanup level of 9.9 µg/L listed for cis-1,2-Dichloroethene should be 70 µg/L.

    b. The fish tissue target concentration of 0.031 mg/kg listed for mercury should be 0.03 mg/kg.

    c. The river bank soil/sediment PAH cleanup level of 23000 µg/kg is a risk-based value so an "R" should be added to the basis column for this contaminant.

    d. The contaminant listed as TPH-Diesel (C10-C12 Aliphatic) should be Aliphatic Hydrocarbons C10-C12.

    e. The contaminant listed as 2,4,5-Trichlorophenol in the table should be 2,4,5-TP (Silvex). The full name for this contaminant, 2-(2,4,5-Trichlorophenoxy)propionic acid, should be added to the abbreviations.

    f. The abbreviation for HxCDF should be hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.

10. Appendix II, ROD Table 21. Revisions to this table include:

    a. This table does not have footnote 4 so the "(4)" in first column by Total PAHs should be deleted.

    b. The table should include µg/kg as the units for the values listed in this table.

    c. The additional contaminant listed as 1,2,3,4,6,7,8-HxCDF should be 1,2,3,4,7,8-HxCDF.

11. Appendix II, ROD Table 22. The reference to Oregon Health Authority (OHA) fish advisory regarding allowable fish meals under the no action Alternative A on pages

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

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

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

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

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

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

Attachment

ED_002671A_00012956-00329

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

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

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

Principal Threat Waste

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

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

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

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

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

6.6.6. River Banks

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

East Side of Willamette River

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

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

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

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

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

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RM 7: Willamette Cove (ECSI Site ID 20662363) – River bank contaminants are PCBs, dioxins/ furans, metals (lead, mercury, nickel, and copper), and PAHs.

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

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

West Side of Willamette River

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

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

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

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

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

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

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

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

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

6.6.7. RCRA Hazardous Waste in Media

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

6.7. Computer Models Used For Fate and Transport

6.7.1. Hydrodynamic and Sediment Transport Models

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

6.7.2. Mass Transfer Model

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

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

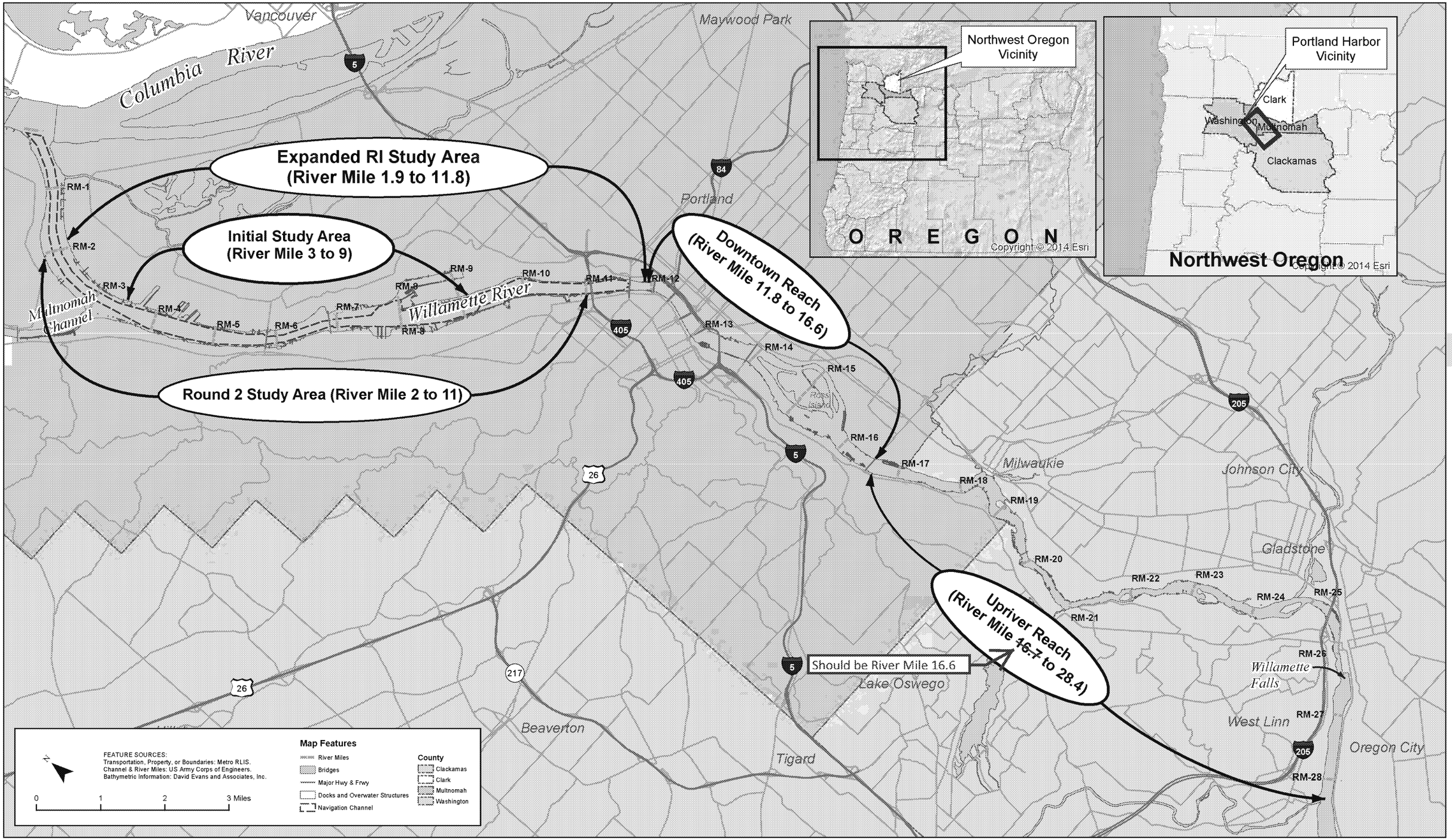

Figure 7. Portland Harbor Study Area and Vicinity

Portland Harbor Superfund Site

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Table 1. Summary of Contaminants of Concern in Sediment

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

Table 1. Summary of Contaminants of Concern in Sediment

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

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

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

Table 2. Summary of Contaminants of Concern in Surface Water

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

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

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

Table 2. Summary of Contaminants of Concern in Surface Water

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

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

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

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

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

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

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

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Table 4. Summary of Contaminants of Concern in Fish Tissue

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

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

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

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

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

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

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Table 17. Summary of Cleanup Levels or Targets by Media

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

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

Abbreviations:
2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex
ARAR - applicable or relevant and appropriate requirement
B - Background-based number
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
C - carbon

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations (continued):
Conc - concentration
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - ~~1,2,3,7,8,9~~ -hexachlorodibenzofuran
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbon
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
R - risk-based number
RAO - remedial action objective
TCDD - tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

Table 21. Sediment RALs and PTW Thresholds for Selected Remedy

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

Notes:
1 – Site wide includes all areas of the Site except the navigation channel. FMD areas are subject to these RALs.
2 – PTW thresholds are based on highly toxic PTW values (10^{-3} risk) except chlorobenzene and naphthalene, which are threshold values for not reliably contained PTW.

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

Table 22. Detailed Comparative Analysis of Remedial Alternatives

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

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
River Banks Addressed (%) (RAO 9)	0% - continued migration from river banks to sediment/ surface water.	32% of river banks addressed	46% of river banks addressed	61% river banks addressed	78% river banks addressed	78% river banks addressed	88% river banks addressed	65% river banks addressed
Benthic Areas Addressed (%) (RAO 5)[2] (IT: 50 % addressed)	0% - No reduction in benthic risk	48% of benthic areas addressed	64% of benthic areas addressed	73% of benthic areas addressed	72% of benthic areas addressed	87% of benthic areas addressed	93% of benthic areas addressed	64% of benthic areas addressed
Consumption of Prey (RAO 6) (IT: Eco HQ=10)	No reduction in HQ.	Does not achieve IT River mile (RM) scale: Maximum HQ = 19 (BEHP) Sediment decision unit (SDU) scale: Maximum HQ=7 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 17 (BEHP) SDU scale: Maximum HQ=5 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 15 (BEHP) SDU scale: Maximum HQ=4 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 3 (BEHP) SDU Scale: Maximum HQ = 1 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 19 (BEHP) SDU scale: Maximum HQ=3 (BEHP)
Direct Contact Surface Water (RAO 7)	Exceedances of surface water cleanup levels would continue.	Not quantifiable. Time to achieve cleanup levels through monitored natural recovery (MNR) uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)								
Chemical-specific ARARs	Would not meet water quality criteria (WQCs) and maximum contaminant levels (MCLs).	Would not be achieved	Complies	Complies	Complies	Complies	Complies	Complies
Location-specific ARARs	No location-specific ARARs	Complies. Addressed during design and implementation	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Action-specific ARARs	No action-specific ARARs	Complies. Addressed during design and implementation. 15 acres of mitigation	Same as Alternative B. 25 acres of mitigation	Same as Alternative B. 35 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 86 acres of mitigation	Same as Alternative B. 34 acres of mitigation
LONG-TERM EFFECTIVENESS AND PERMANENCE								

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Magnitude of Residual Risk (Post Construction [PC] Risk) **RAO 1**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Sediment: Post Construction risk: $4.8x10^{-5}$	Sediment: Post Construction risk: $2.2x10^{-5}$	Sediment: Post Construction risk: $1.5x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $7.2x10^{-6}$	Sediment: Post Construction risk: $1.8x10^{-5}$
RAO 2 (Allowable Fish Meals at Construction Completion)	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain. ~~OHA f~~Fish advisories would continue.	(see fish meal information under Overall Protectiveness)						
RAO 3 - Direct Contact Surface Water (Risk at Construction Completion vs. Risk at Cleanup Level for each Contaminant of Concern [COC])	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	PCBs – 16 times > cleanup levels TCDD TEQ – 13 times > cleanup level Carcinogenic polycyclic aromatic hydrocarbon (cPAH) – 2 times cleanup level	PCBs – 13 times > cleanup levels TCDD TEQ – 11 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 8 times > cleanup levels	PCBs – 10 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 8 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 6 times > cleanup levels TCDD TEQ – 5 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 9 times > cleanup level cPAH – 2 times cleanup level
RAO 4 **Migration Groundwater to Sediment/Surface Water** **(Contaminated Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed. The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed. Same as Alternative B	68% not addressed. Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed. Same as Alternative B	38% not addressed. Same as Alternative B	67% not addressed. Same as Alternative B
RAO 5[2] **Benthic Organisms** **(Benthic Areas not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	52% not addressed. Degree of recovery is uncertain because it is likely that an insufficient amount of the benthic risk areas will be addressed.	36% not addressed. Same as Alternative B	27% not addressed. Same as Alternative B	28 % not addressed Same as Alternative B	13% not addressed. Same as Alternative B	7% not addressed. Same as Alternative B	36% not addressed. Same as Alternative B

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
RAO 6 **Consumption of Prey**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 5 times TCDF – 6 times PeCDF – 4 times HxCDF – 3 times SDU scale: BEHP – 7 times PCBs – 4 times TCDF – 3 times PeCDF – 2 times HxCDF – 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 17 times PCBs – 3 times TCDF – 4 times PeCDF – 3 times HxCDF – 2 times SDU scale: BEHP – 5 times PCBs – 2 times TCDF – 3 times PeCDF– 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 15 times PCBs – 2 times TCDF – 1.4 times SDU scale: BEHP – 4 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 2 times SDU scale: BEHP – 4 times
RAO 7 **Direct Contact Surface Water**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Not quantifiable. Time to achieve protectiveness through MNR uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
RAO 8 **Migration Groundwater to Sediment/Surface Water** **(Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed Same as Alternative B	68% not addressed Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed Same as Alternative B	38% not addressed Same as Alternative B	67% not addressed Same as alternative B
RAO 9 **Migration River Banks** **(Contaminated River Banks not Addressed)**	Existing risk remains.	68% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated river banks will be addressed with this alternative.	54% not addressed Same as Alternative B	39% not addressed Same as Alternative B	22% not addressed Same as Alternative B	22% not addressed Same as Alternative B	12% not addressed Same as Alternative B	35% not addressed Same as Alternative B

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Adequacy and Reliability of Controls	No engineering controls ~~OHA ff~~Fish advisories may not prevent human exposure.	Technologies are proven and reliable Operation and maintenance (O&M) of caps Long-term monitoring Periodic inspections and sampling of media and fish Institutional Controls (ICs): - Fish advisories - Land-use restrictions - regulated navigation areas (RNAs) to protect caps RNA Areas Capped: 28.3 acres MNR Area: 1,966 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 55.8 acres MNR Area: 1,900 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,838 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,774 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,634 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 231.4 acres MNR Area: 1,391 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,876 acres
REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT								
Treatment Process Used	None	Activated carbon Organophilic clay Solidification/stabilization Thermal desorption	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Amount Destroyed or Treated *In-situ treatment includes areas within and outside of sediment management areas (SMAs).	None	In-situ treatment*: 70 acres Ex-situ treatment: 191,573 cubic yards (cy)	In-situ treatment*: 108 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 109 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 133 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 145 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 184 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 113 acres Ex-situ treatment: 191,573 cy
Reduction in Toxicity, Mobility, or Volume	None	• Broadcast activated carbon (AC): 6.7 acres • Reactive Caps: 23 acres • Reactive residual layer: 36 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 3.2 acres • Reactive Caps: 40 acres • Reactive residual layer: 61 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 60 acres • Reactive residual layer: 45 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 58 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive caps: 101 acres • Reactive residual layer: 80 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 64 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Irreversible Treatment	None	Permanent and Irreversible Treatment Activated carbon Low-temperature thermal desorption Solidification/stabilization forms stable solids that are non-hazardous or less-hazardous than the original materials	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B
Type and Quantity of Residuals Remaining after Treatment	Contaminated sediment and soil remains.	Principal threat waste (PTW) addressed: 37 % PTW remaining: 63%	PTW addressed: 57 % PTW remaining: 43 %	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%
SHORT-TERM EFFECTIVENESS								
Community Protection	Continued risks to community from no action. ~~OHA f~~Fish advisories would continue.	Community Impacts: 4 months per year for 4 years. • Temporary noise, light, odors, air quality impacts. • Disruptions to river use • potential for waterborne accidents during construction Addressed with health and safety (H&S) plans and use of best management practices (BMPs). Fish consumption advisories would continue until RAO achieved.	Community Impacts: 4 months per year for 6 years. Same as Alternative B	Community Impacts: 4 months per year for 7 years. Same as Alternative B	Community Impacts: 4 month per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 19 years. Same as Alternative B	Community Impacts for 4 months per year for 7 years. Same as Alternative E

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Worker Protection	No risk to workers	Risks to workers for 4-5 months per year for 4 years. • Physical hazards during construction. • Increased accident risks from heavy equipment, transport of materials, and increased vessel traffic. Addressed with H&S Plans and BMPs.	Risks to worker for 4-5 months per year for 6 years. Same as Alternative B	Risks to workers for 4-5 months per year for 7 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Environmental Impacts (Impacts of Construction Activities)	Continued impact from existing conditions.	Impact time frame: 4 months per year for 4 years. • Temporary loss of benthos and habitat, increased emissions from construction and transportation equipment. • Exposure to contamination greater than PRGs during MNR period Addressed with BMPs, engineering control measures, emissions control strategies.	Impact time frame: 4 months per year for 6 years. Same as Alternative B	Impact time frame: 4 months per year for 7 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Time Until Action is Complete	Not applicable.	Construction time: 4 years Estimated time to achieve RAOs is uncertain, but unlikely to occur in a reasonable timeframe.	Construction time: 6 years Same as Alternative B	Construction time: 7 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 19 years Same as Alternative B	Construction time: 7 years Same as Alternative B
IMPLEMENTABILITY								

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Ability to Construct and Operate	No construction or operation	Technologies successfully implemented at other Superfund sites. Material handling: 627,652 cy of sediment/soil 495,931 cy of fill	Same as Alternative B, except: Material handling: 1,181,238 cy of sediment/soil 727,154 cy of fill	Same as Alternative B, except: Material handling: 2,024,222 cy of sediment/soil 957,630 cy of fill	Same as Alternative B, except: Material handling: 3,017,189 cy of sediment/soil 1,339,587 cy of fill	Same as Alternative B, except: Material handling: 4,585,401 cy of sediment/soil 1,565,247 cy of fill	Same as Alternative B, except: Material handling: 7,396,598 cy of sediment/soil 2,257,357 cy of fill	Same as Alternative B, except: Material handling: 1,752,374 cy of sediment/soil 900,271 cy of fill,000 cy of fill
Ease of Doing More Action, if Needed	May require ROD amendment in the future.	Easy	Easy	Easy	Easy	Easy	Easy	Easy
Ability to Monitor Effectiveness	No monitoring required. Ongoing exposure and risks would continue	Monitoring of: RNAs: 28 acres of caps Capped areas (includes river banks): 39 acres MNR: 1,966 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 56 acres of caps Capped areas (includes river banks): 71 acres MNR: 1,900 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 101 acres MNR: 1,838 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,774 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,634 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 231 acres of caps Capped areas (includes river banks): 260 acres MNR: 1,391 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 102 acres MNR: 1,876 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals necessary.	Approvals and coordination with other agencies possible. Waste left in 2,088 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,032 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,964 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,920 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,780 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,596 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,000 acres of the Site.
COST								
Capital Cost	$0	$352,097,000	$556,004,000	$827,465,000	$1,184,607,000	$1,629,407,000	$2,500,545,000	$751,359,000
Periodic Cost	$0	$290,324,000	$397,028,000	$412,332,000	$524,028,000	$549,512,000	$708,114,000	$421,940,000
Present Value Cost	$0	$451,460,000	$653,700,000	$869,530,000	$1,054,200,000	$1,371,170,000	$1,777,320,000	$811,290,000

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Acronyms:

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

Notes:

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

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

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

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

J2.3 POST-CONSTRUCTION RISK ESTIMATES FOR RAO 2

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

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile ~~HQ~~~~Risk~~ Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile ~~HQ~~Risk Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

Appendix C

Oregon Department of Environmental Quality
Letter Supporting EPA's Explanation of Significant Differences

DRAFT

Pending ODEQ submittal after public review/comment period

Appendix D

Five Tribes
Letter Supporting EPA's Explanation of Significant Differences

DRAFT

IEc

MEMORANDUM | February 12, 2018

TO Sean Sheldrake, United States Environmental Protection Agency (EPA)

FROM Gail Fricano, Rachel DelVecchio, and Dr. Rita Cabral (Industrial Economics, Inc.)

SUBJECT Proposed Changes to Portland Harbor Superfund Site (PHSS) Remedy due to Updated Human Health Toxicity Values for Benzo(a)pyrene

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OVERVIEW

This memorandum provides technical comments on behalf of the Five Tribes[1] regarding EPA's proposed approach to modifying the PHSS remedy in order to address the Integrated Risk and Information System (IRIS) update to the cancer slope factor for benzo(a)pyrene. Our comments are specific to the approach described in materials provided by EPA (Attachment A) and discussed on a conference call with EPA and the PHSS Technical Coordinating Team (TCT) on January 11, 2018 (referred to as "EPA's proposed approach" in this memorandum).

The Five Tribes support EPA's proposed approach regarding updating cleanup levels and remedial action levels (RALs) in response to the IRIS benzo(a)pyrene revision. They also support EPA's use of an Explanation of Significant Differences (ESD), rather than a Record of Decision (ROD) amendment, to make these changes. EPA's approach and the rationale for the Five Tribes' support are outlined in the following sections. Note that if EPA modifies this approach in any way, the Five Tribes would need to evaluate the modified approach to determine whether they support it.

Notwithstanding their technical support for EPA's proposed approach for modifying the PHSS remedy to address the IRIS update, the Five Tribes are concerned about EPA's recent conduct relating to coordination and consultation with the Five Tribes in derogation of the EPA's trust duty to the Tribes. The Five Tribes hope that EPA will honor the spirit and letter of the Memorandum of Understanding for Portland Harbor Superfund Site and also coordinate and consult with the Five Tribes in a manner consistent with EPA's consultation obligations embodied in Executive Order 13175 and applicable statutes, such as CERCLA § 126(a). The Five Tribes expressly reserve their rights to address the foregoing concerns with EPA leadership.

SUPPORT FOR EPA'S PROPOSED APPROACH

EPA's IRIS posted an updated benzo(a)pyrene cancer slope factor on January 19, 2017. This update reflects the current scientific understanding that this contaminant is less

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

carcinogenic than previously known. Subsequently, EPA has contemplated the implications of this update on PHSS cleanup levels and RALs for polycyclic aromatic hydrocarbons (PAHs; carcinogenic PAH (cPAH) cleanup levels and total PAH RALs are based on benzo(a)pyrene). Conceptually, we support updates to the PHSS remedy that reflect best available science and believe that changes to the remedy are warranted in this case.

Below, we briefly describe EPA's proposed approach and our support for each element.

cPAH Cleanup Levels:

EPA proposes increasing the navigation channel cleanup level (based on clam consumption) from 3,950 µg/kg to 107,600 µg/kg.[2] EPA also proposes developing separate cleanup levels for beach and nearshore (i.e., in-water areas outside the navigation channel) sediments. The beach cleanup level (based on direct contact with beach sediments) would increase from 12 ug/kg to 85 ug/kg. The nearshore sediment cleanup level would increase from 106 µg/kg (the previous relevant preliminary remediation goal for direct contact with nearshore sediments outside beach areas) to 774 µg/kg.

We support these revised cleanup levels, which appropriately apply the updated benzo(a)pyrene cancer slope factor to the previous cleanup levels. We also agree that separate nearshore and beach cleanup levels more accurately reflect the Baseline Human Health Risk Assessment risk scenarios.

Principal Threat Waste (PTW):

EPA proposes increasing the highly toxic PTW threshold from 106,000 µg/kg to 774,000 µg/kg. We support this change, which appropriately applies the updated benzo(a)pyrene cancer slope factor to the previous highly toxic PTW threshold.

Total PAH RALs:

EPA proposes increasing the nearshore RAL from 13,000 µg/kg to 30,000 µg/kg and retaining the current navigation channel RAL of 170,000 µg/kg.

We support increasing the nearshore RAL to 30,000 µg/kg. This revised RAL is expected to achieve the revised cleanup levels.[3] At the same time, the revised RAL greatly minimizes remediation of areas that do not pose risk.[4]

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[2] The site-wide total PAH benthic risk cleanup level of 23,000 µg/kg is unaffected by the IRIS update.

[3] The revised RAL would result in achievement of the revised nearshore sediment cPAH cleanup level immediately following construction on a rolling river mile surface area weighted average concentration (SWAC) basis.

We support no change to the navigation channel RAL. Although remediation is no longer required to reduce the clam consumption risk, based on the updated sediment cPAH cleanup level for the navigation channel, it is required to achieve protection of benthic ecological receptors via the sediment pathway and human and ecological receptors via the surface water pathway. Thus, the navigation channel RAL should remain at 170,000 µg/kg.

In summary, EPA's proposed approach incorporates best available science while also remaining protective of human health and the environment and greatly minimizing cleanup of areas that do not pose risk.

MECHANISM FOR IMPLEMENTING CHANGES

The Five Tribes support the use of an ESD to implement the above changes, provided a public comment period is incorporated into the ESD process. We do not support the use of a ROD amendment. A ROD amendment is a lengthy process on the order of several years, while an ESD is a more streamlined process which would allow cleanup to proceed in a more expeditious manner. A ROD amendment may also provide an avenue for parties to challenge other elements of the ROD and advocate for additional changes beyond those related to the IRIS update. The ROD represents over a decade of collaborative decision making and consensus building with the TCT, the potentially responsible parties, and the public. Thus, changes to the ROD should be limited to addressing updates to best available science and other targeted instances.

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[4] The revised RAL would trigger cleanup in a total of 3 acres that already meet sediment cPAH cleanup levels on a rolling river mile SWAC basis.

ATTACHMENT A | MATERIALS PROVIDED BY EPA

Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136).

Human Health Risk:

Within the navigation channel, the current cleanup level is 3,950 ppb CPAHs and is based on the clam consumption exposure pathway. Direct contact with contaminated sediment is not considered a complete exposure pathway in the navigation channel. Surface water exposure pathways (ingestion, inhalation and dermal contact) are complete within the navigation channel. Although it is known that contaminated sediments contribute to surface water COCs, there is not a sediment cleanup levels associated with the protection of drinking water. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling ½ river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

PAH contaminated sediments within the Navigation Channel also pose risks to ecological receptors. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg, a value which is already 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." The areas that exceed the Navigation Channel RAL within the for PAHs are isolated to areas between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may further limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. Sediments within the navigation channel are significantly elevated in cPAH concentration and are likely contribute to cPAH exceedances of the human health and ecological AWQCs. As shown in Figures 3 and 4, taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that the high levels of PAH contamination within the Navigation Channel between RM 5 and 6.6are contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, RAOs 3, 5, and 7 are not affected by the IRIS change. Due to the exceedances of the benthic cleanup levels in the navigation channel between RM 5 and 7, the limited effectiveness of MNR in that area, and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor is not warranted in the navigation channel area.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

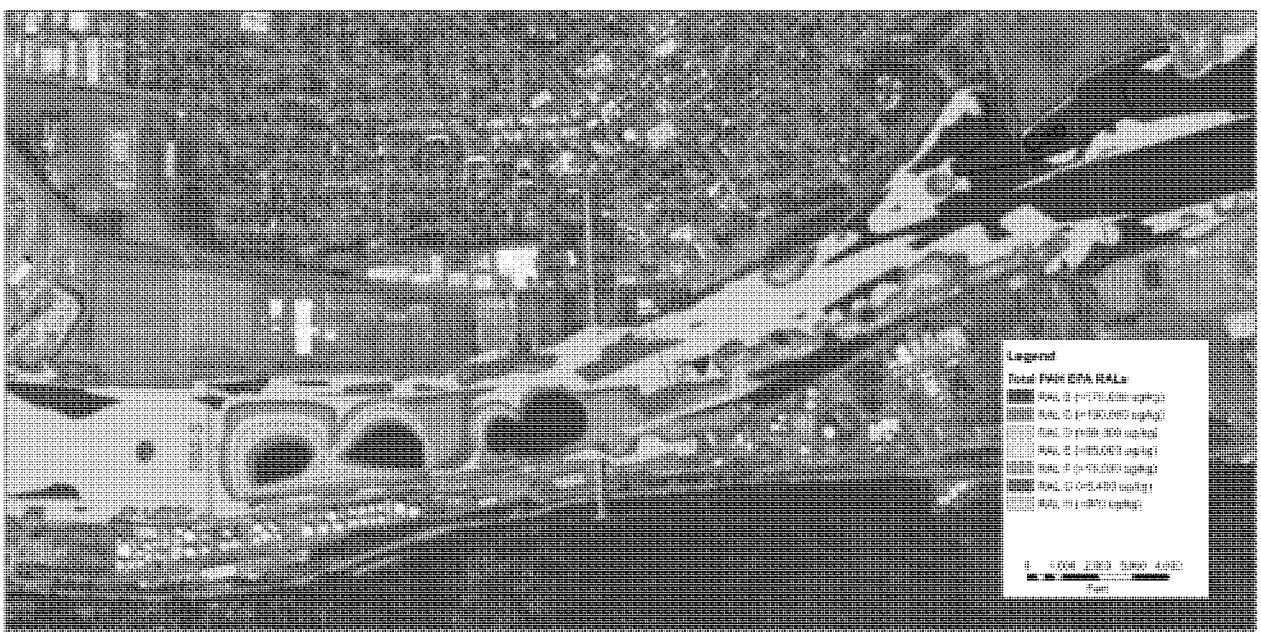


Figure 2 – MNR Average Score for Six Lines of Evidence

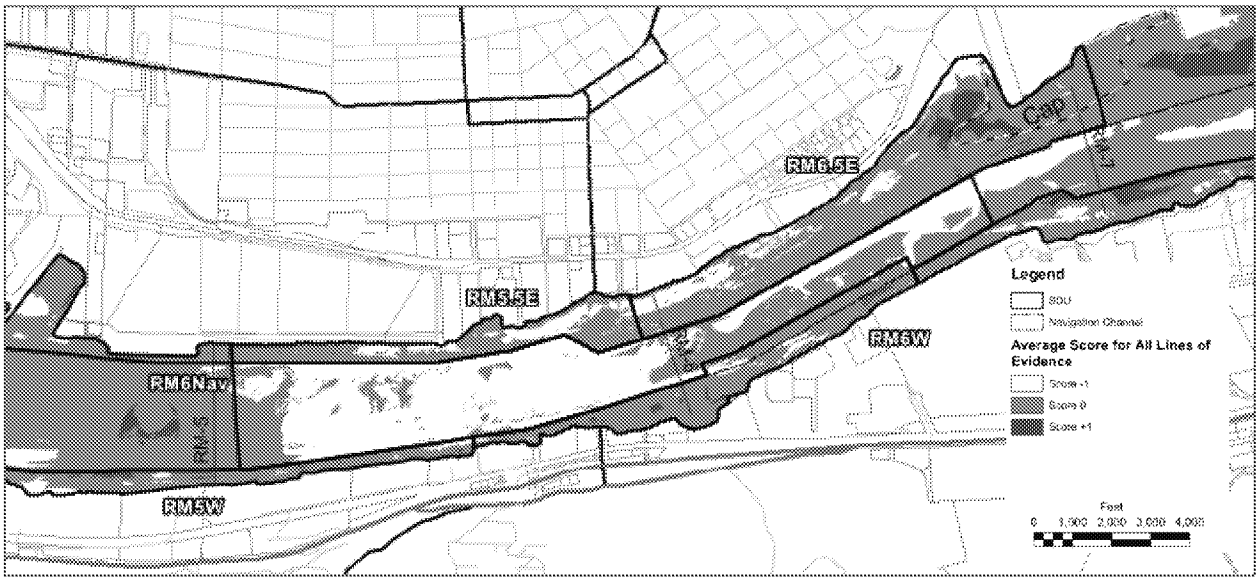


Figure 3 – PAH Loading under Low Flow Conditions

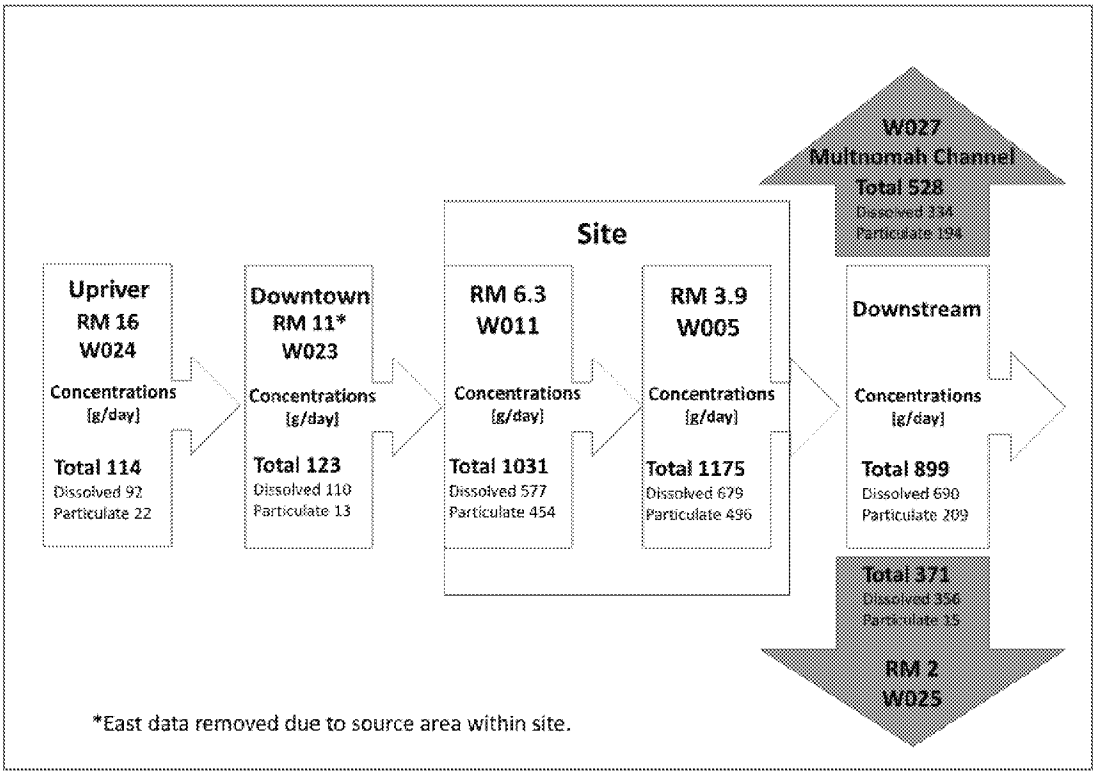
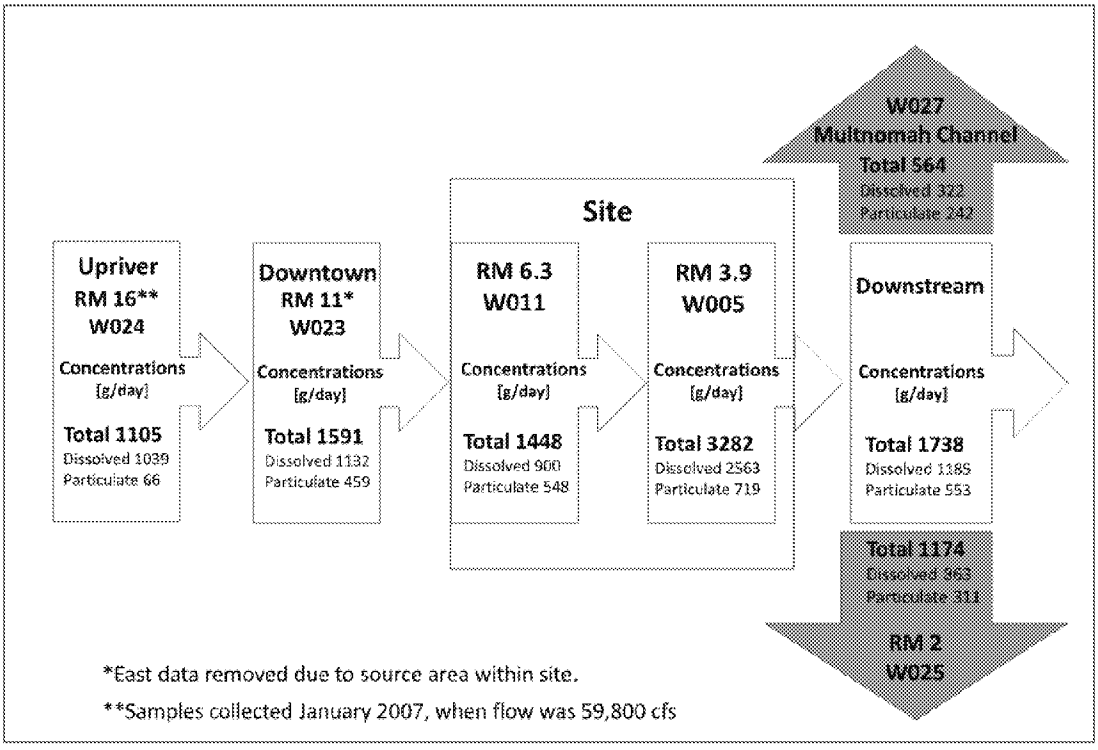


Figure 4 – PAH Loading under High Flow Conditions



Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 11, 2018

CONFIDENTIAL WORKING DRAFT –
FOR DELIBERATIVE PURPOSES

ED_002671A_00012956-00376

Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- Requires evaluation of potential RAL changes related to cPAH direct contact and clam consumption risk
  - Must also consider impact of potential RAL change on RAOs 3 and 5

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Proposed cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 12 µg/kg to 85 µg/kg
  - Updated in-water sediment CUL: 106 µg/kg to 774 µg/kg
  - Updated clam consumption CUL: 3950 µg/kg to 107,600 µg/kg
  - Updated highly toxic PTW threshold: 106,000 µg/kg to 774,000 µg/kg
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

Proposed Nearshore* Total PAH RAL Change

- EPA proposes that the current total PAH nearshore * RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - EPA conducted an analysis that showed that a total PAH RAL of 30,000 µg/kg addresses all areas with cPAH exceeding 774 µg/kg on a rolling river mile SWAC basis (½ mile increments)
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon)

*Outside the Navigation Channel

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Proposed Navigation Channel Total PAH RAL

- EPA proposes that the current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading to surface water has been observed downstream of RM 6.3
  - Increasing the total PAH RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data and may not achieve the ROD specified protectiveness standards for RAOs 3 and 5

CUL, PTW and RAL Change Summary

Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL (RAO 1)	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL (RAO 1)	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level (RAO 2)	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL (RAO 2)	Site-Wide	3,950 µg/kg	107,600 µg/kg
Benthic Risk total PAH Sediment CUL (RAO 5)	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

* No Change Proposed

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RAL Change Evaluation Summary

Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (230,000 µg/kg)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
State Acceptance	No	Yes	Yes	No

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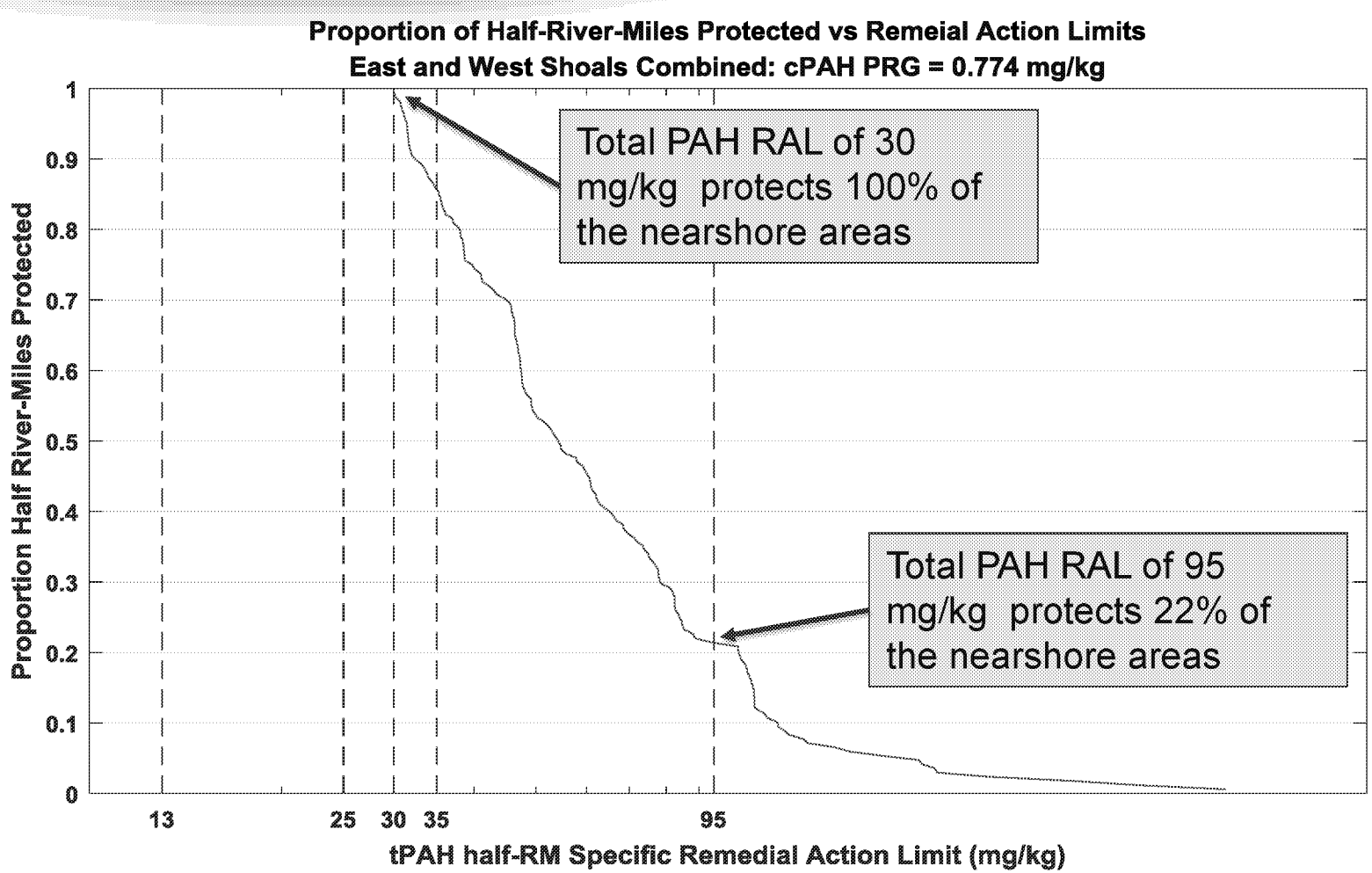
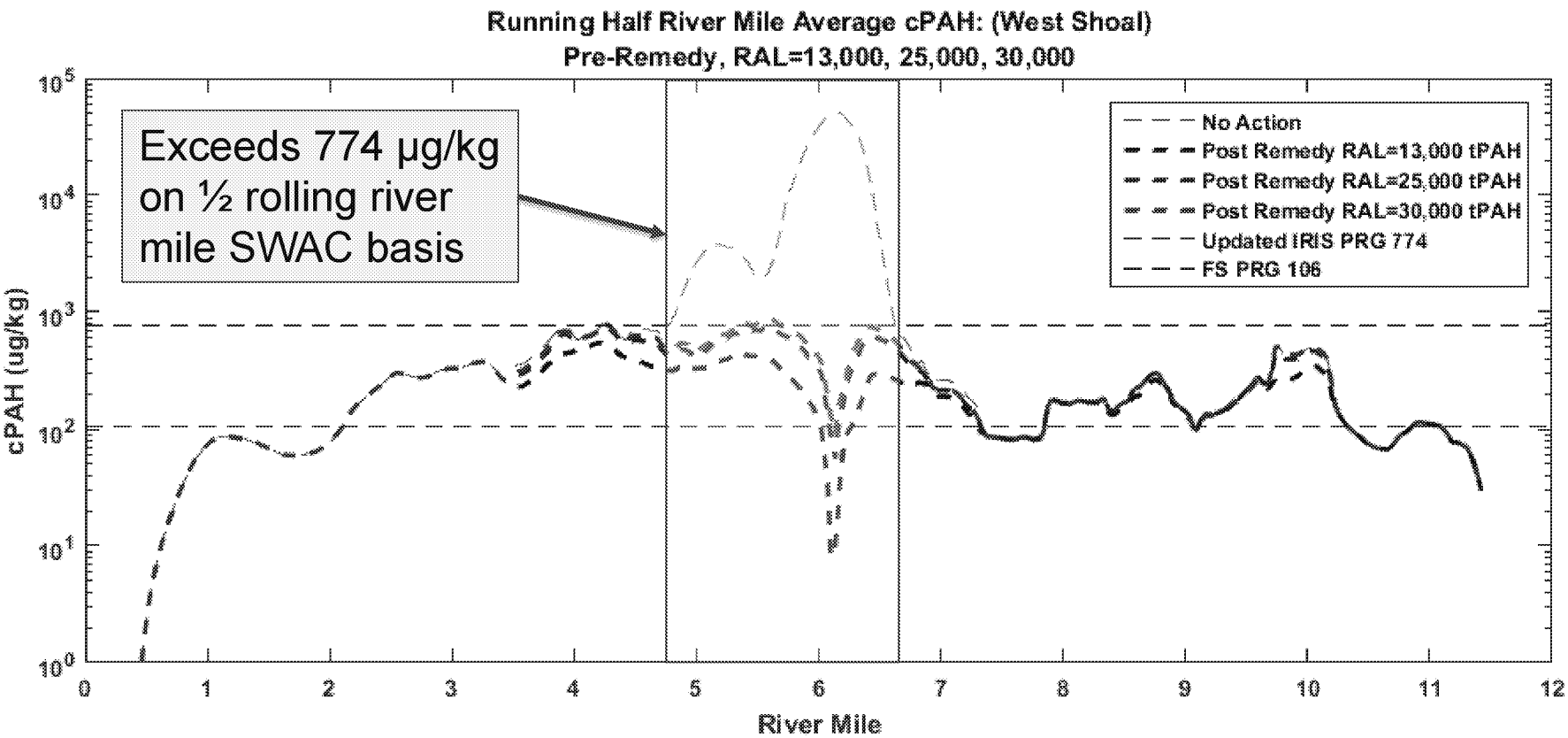
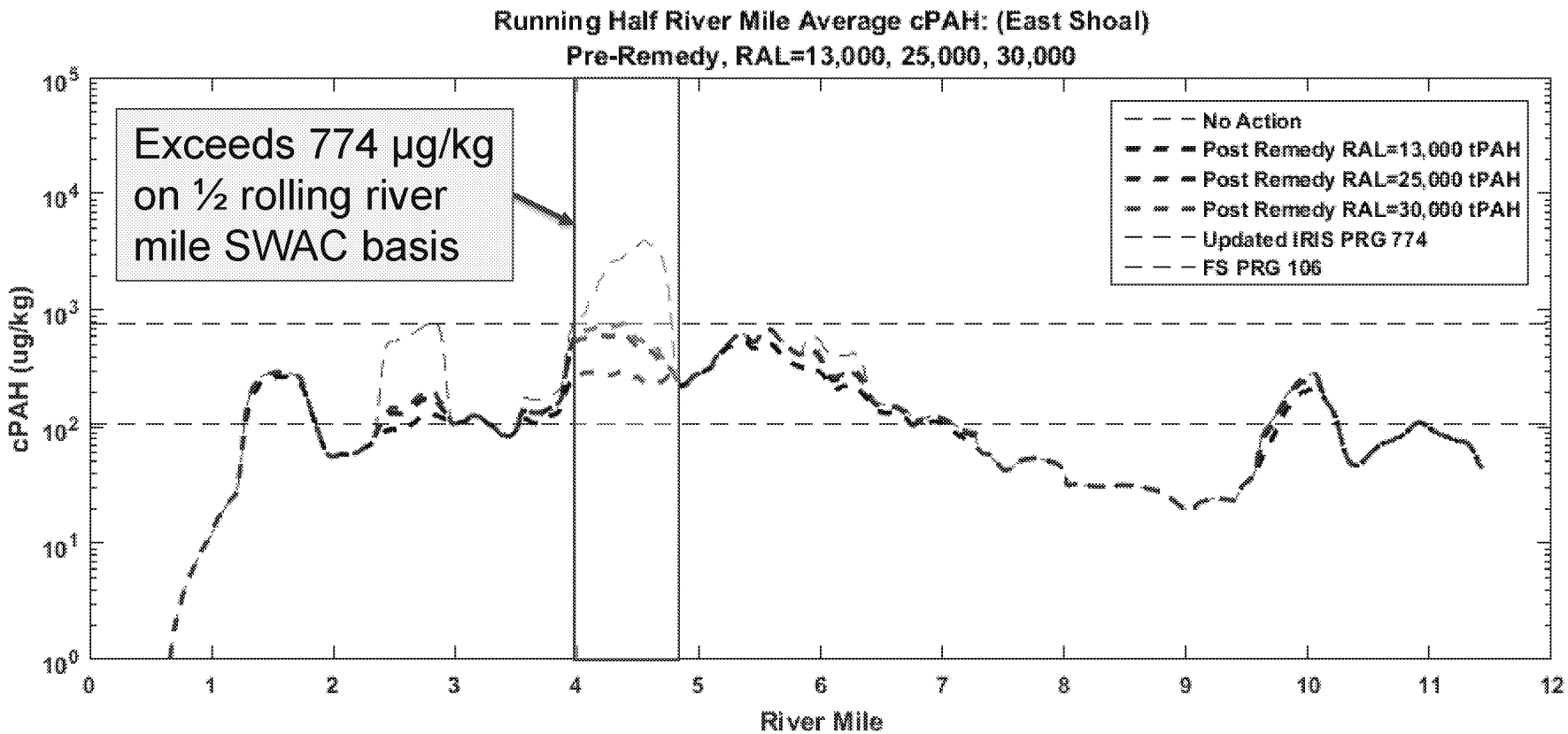
Backup Slides for Discussion

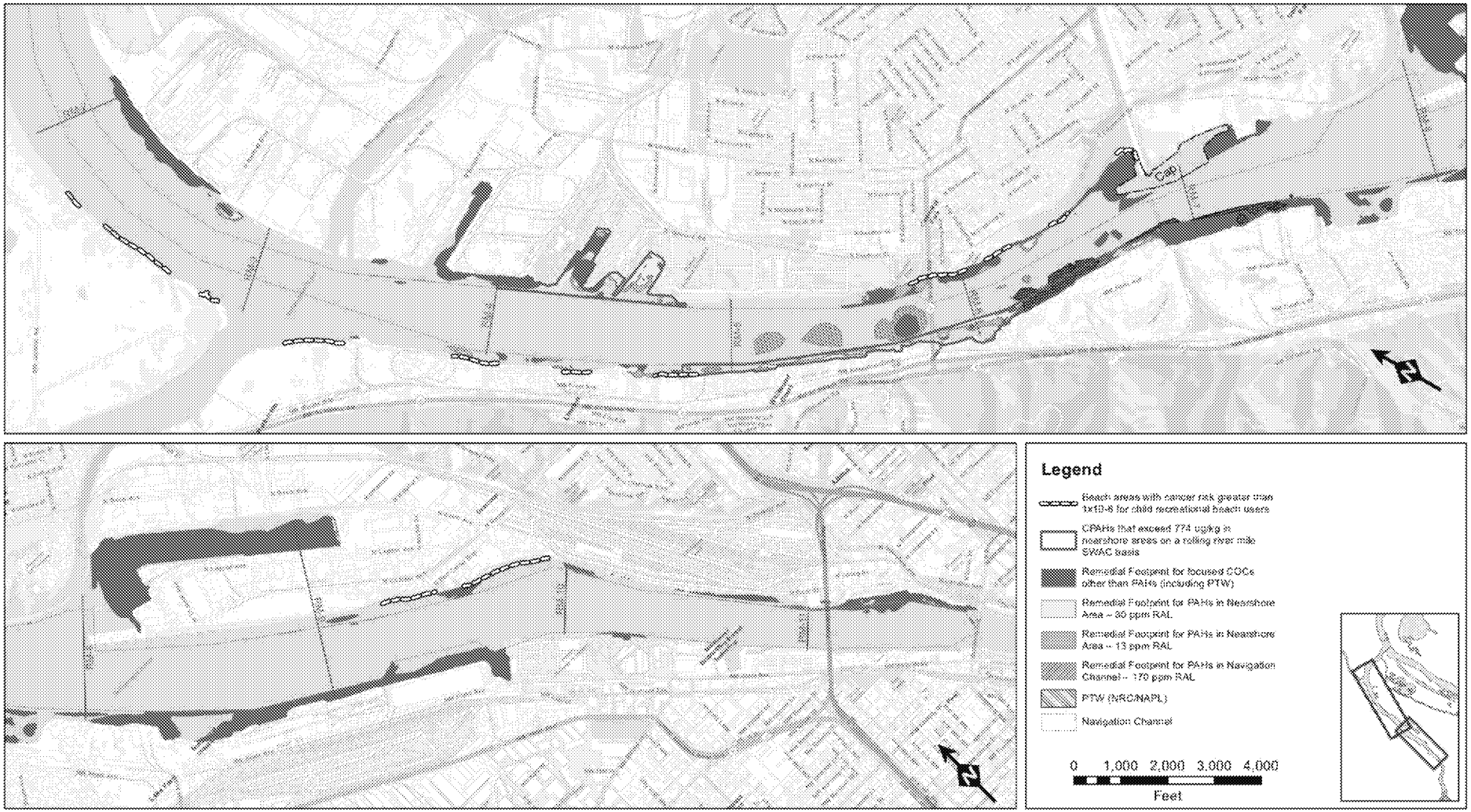

Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)
Total PAH RAL of 30 mg/kg protects 100% of the nearshore areas
Total PAH RAL of 95 mg/kg protects 22% of the nearshore areas



Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario



Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario



Source Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User

Figure X-X. Selected Remedy Footprint comparison

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\PAH analysis\FigX-X_SMAs-based-on-PAHs-30ppm.mxd

Date: 1/2/2018

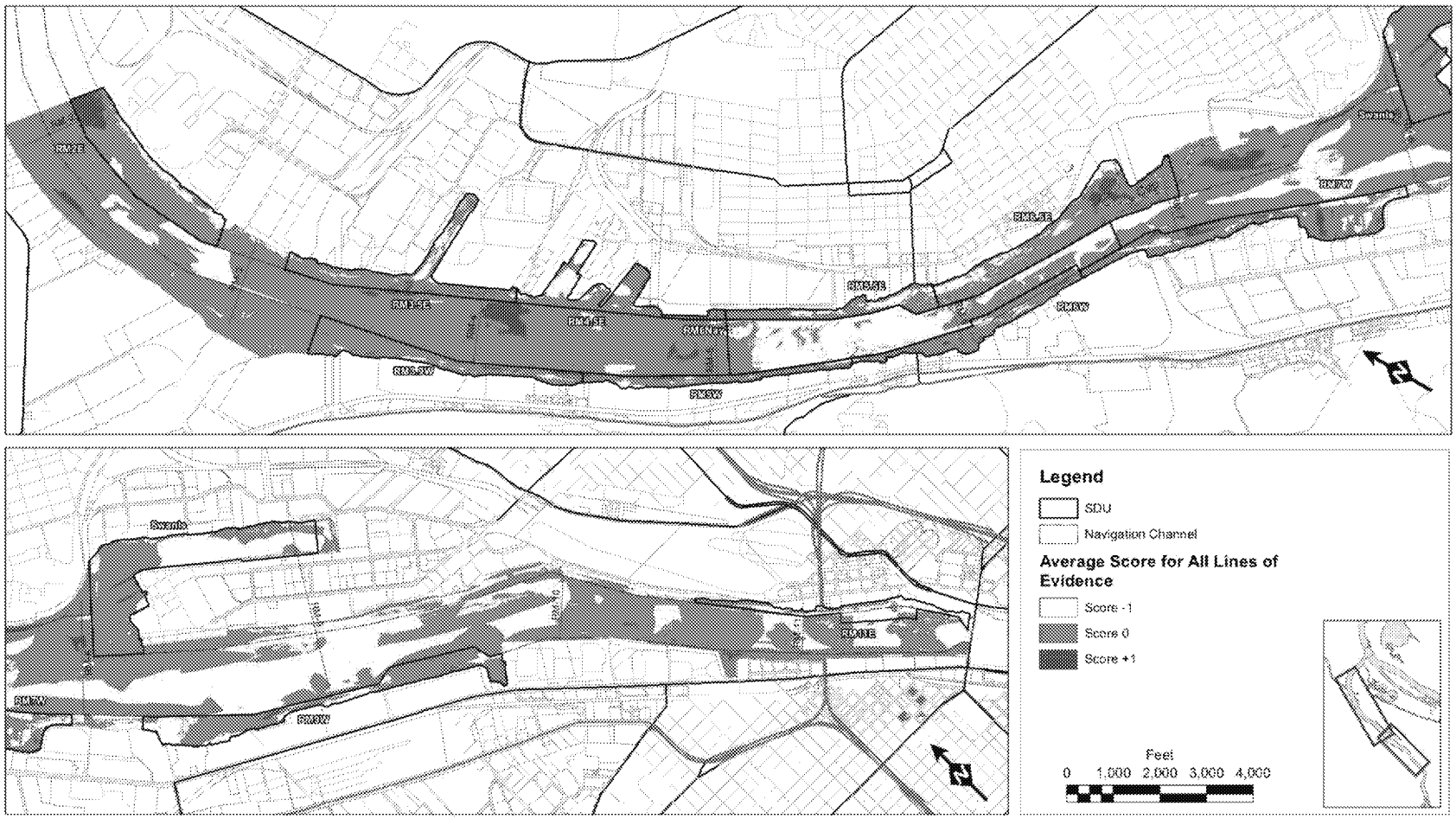
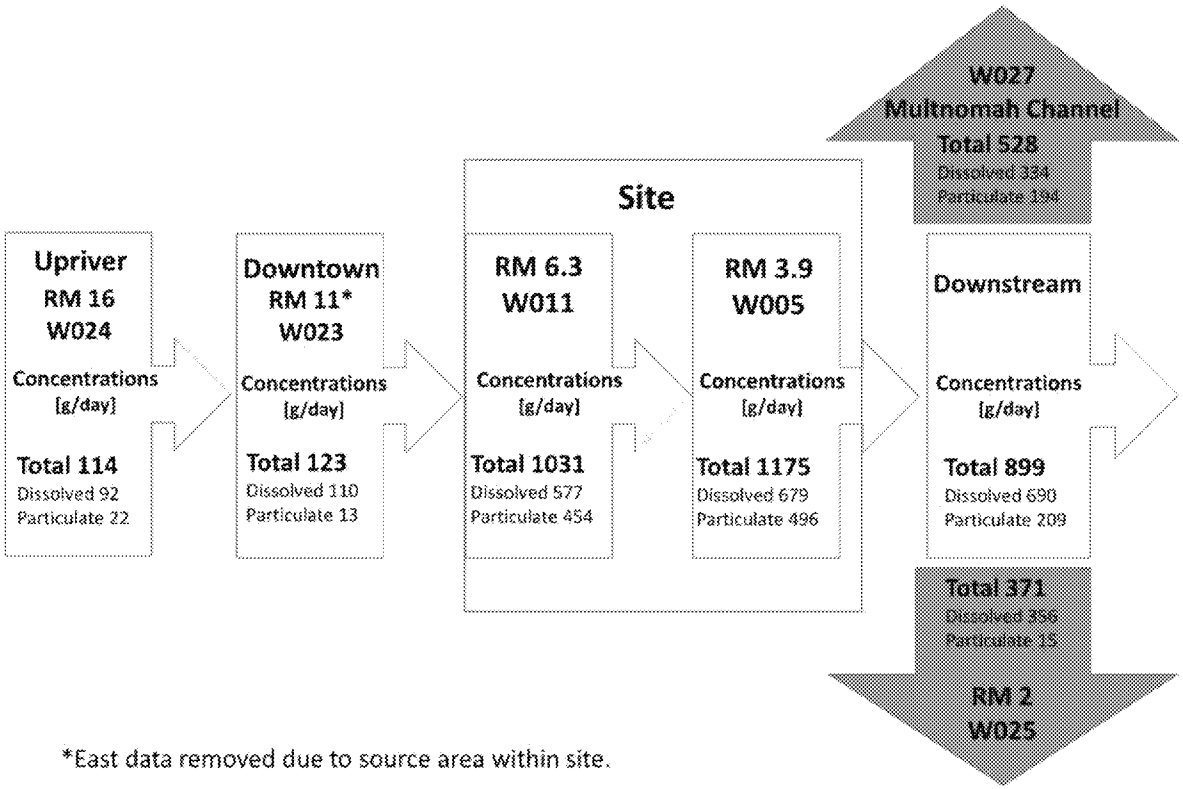


Figure D8-7. Average Score for Six Lines of Evidence

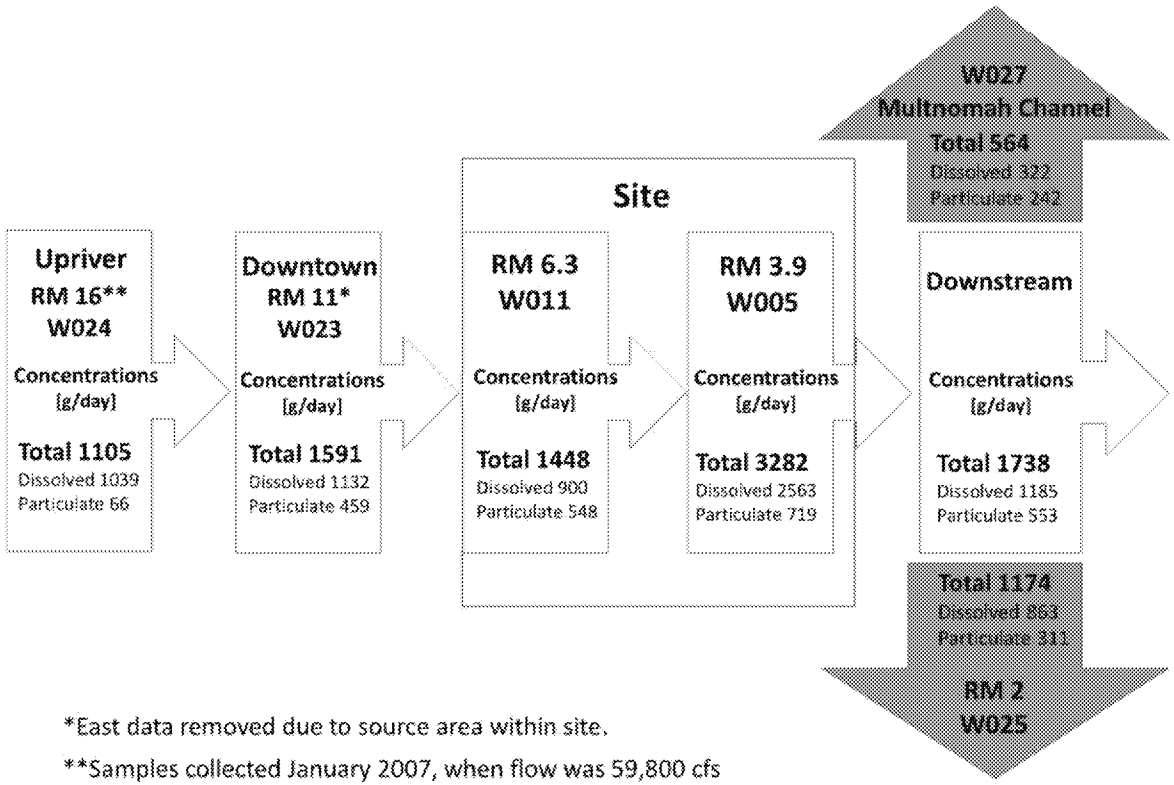
Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS_Figures\Appendix D\FigureD8-x_MNR-Scoring.mxd, Created by: MLF

Date: 5/23/2016



*East data removed due to source area within site.

Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs

Remedial Footprint Area Summary

Scenario	Remedial Footprint (Acres)			Notes
	Current Remedy	Nearshore Total PAH RAL Change from 13 to 30 ppm	Remedial Footprint Change	
Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint

ED_002671A_00012956-00391

Message

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 1/11/2018 7:02:21 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Blischke, Eric [blischkee@cdmsmith.com]

CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]
Subject: RE: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_update_1-11-18.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx; Five Tribes comments on T4 issues 11Oct17.pdf

Importance: High

TCT Members.

Attached is an updated presentation on the CPAH Slope Factor Change considerations. The narrative (attached Word File) that explains why EPA is not considering any changes to the Nav. Channel **has not been updated**, but is re-attached for completeness. Please use these documents for our discussion this afternoon.

Finally, we've attached a comment memo provided by the Five Tribes in October that everyone has seen previously. While this comment memo has a focus on the Port's T4 issues, it also provides comment on site wide RAL adjustments that EPA has considered during its evaluation process for the CPAH slope factor change considerations.

Looking forward to a great discussion this afternoon!

-----Original Appointment-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Wednesday, January 03, 2018 4:18 PM
To: Sheldrake, Sean; Alex Liverman (liverman.alex@deq.state.or.us); bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca; Coffey, Scott; Cora, Lori; Courtney Johnson (courtney@crag.org); Dan Hafley (HAFLEY.Dan@deq.state.or.us); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; Holly Partridge (Holly.Partridge@grandronde.org); Jen Graham; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Josh Newton (jn@karnopp.com); jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; Kristin Callahan; Peterson, Lance; Laura Klasner Shira; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com); Rita Cabral (rcabral@indecon.com); Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us); Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us
Cc: PARRETT Kevin; NOVAK Madi
Subject: TCT -ad hoc- IRIS update background discussion Personal Privacy / Ex. 6
When: Thursday, January 11, 2018 2:00 PM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018

2pm to 4pm Pacific Time

Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation Personal Privacy / Ex. 6

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
  - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 11, 2018

CONFIDENTIAL WORKING DRAFT --
FOR DELIBERATIVE PURPOSES

Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- Requires evaluation of potential RAL changes related to cPAH direct contact and clam consumption risk
  - Must also consider impact of potential RAL change on RAOs 3 and 5

Proposed cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 12 µg/kg to 85 µg/kg
  - Updated in-water sediment CUL: 106 µg/kg to 774 µg/kg
  - Updated clam consumption CUL: 3950 µg/kg to 107,600 µg/kg
  - Updated highly toxic PTW threshold: 106,000 µg/kg to 774,000 µg/kg
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

Proposed Nearshore* Total PAH RAL Change

- EPA proposes that the current total PAH nearshore * RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - EPA conducted an analysis that showed that a total PAH RAL of 30,000 µg/kg addresses all areas with cPAH exceeding 774 µg/kg on a rolling river mile SWAC basis (½ mile increments)
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon)

*Outside the Navigation Channel

Proposed Navigation Channel Total PAH RAL

- EPA proposes that the current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading to surface water has been observed downstream of RM 6.3
  - Increasing the total PAH RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data and may not achieve the ROD specified protectiveness standards for RAOs 3 and 5

CUL, PTW and RAL Change Summary

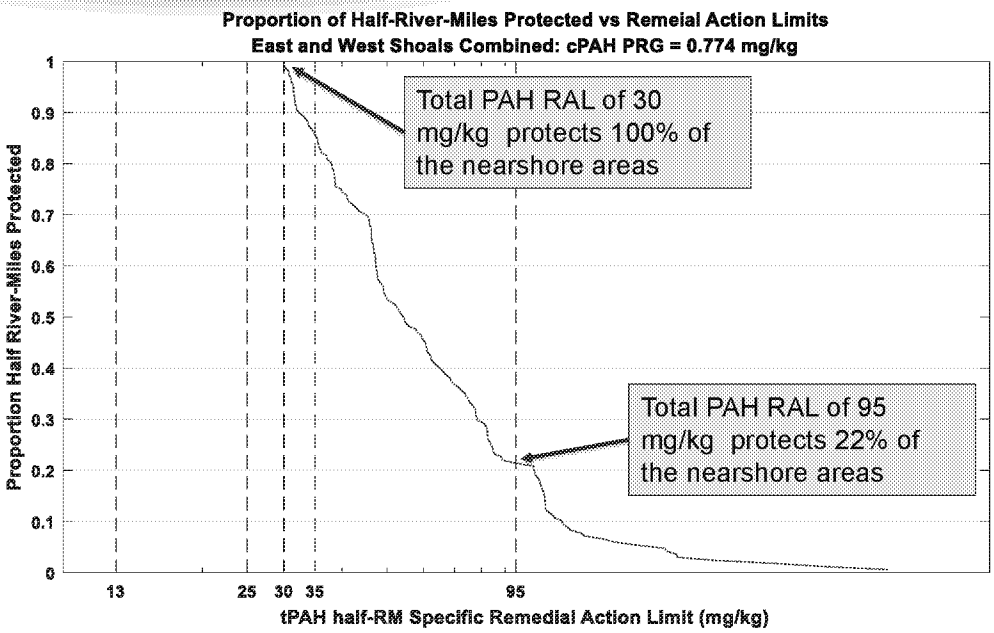
Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL (RAO 1)	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL (RAO 1)	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level (RAO 2)	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL (RAO 2)	Site-Wide	3,950 µg/kg	107,600 µg/kg
Benthic Risk total PAH Sediment CUL (RAO 5)	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

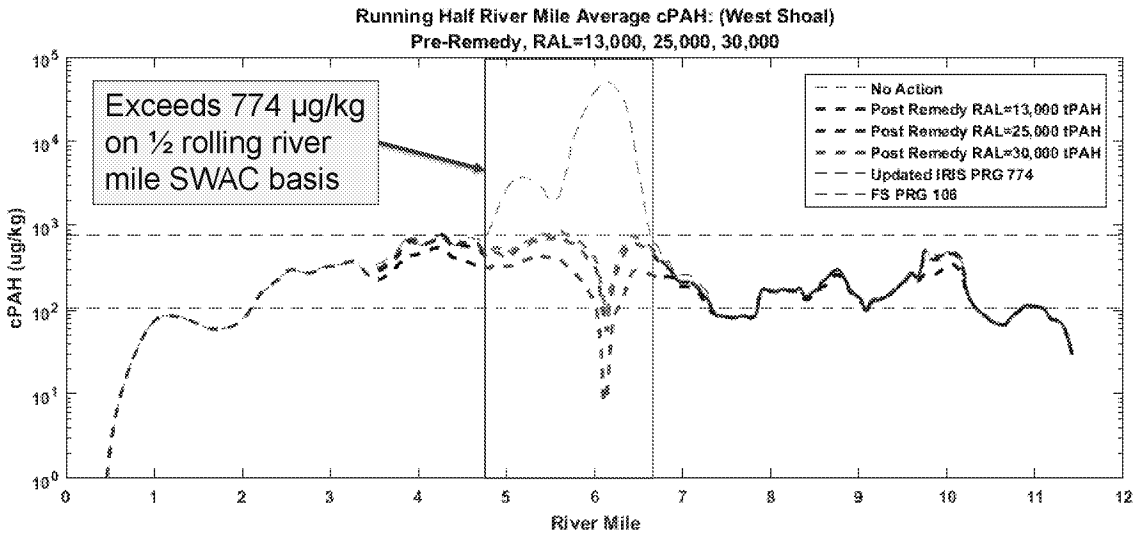
* No Change Proposed

RAL Change Evaluation Summary

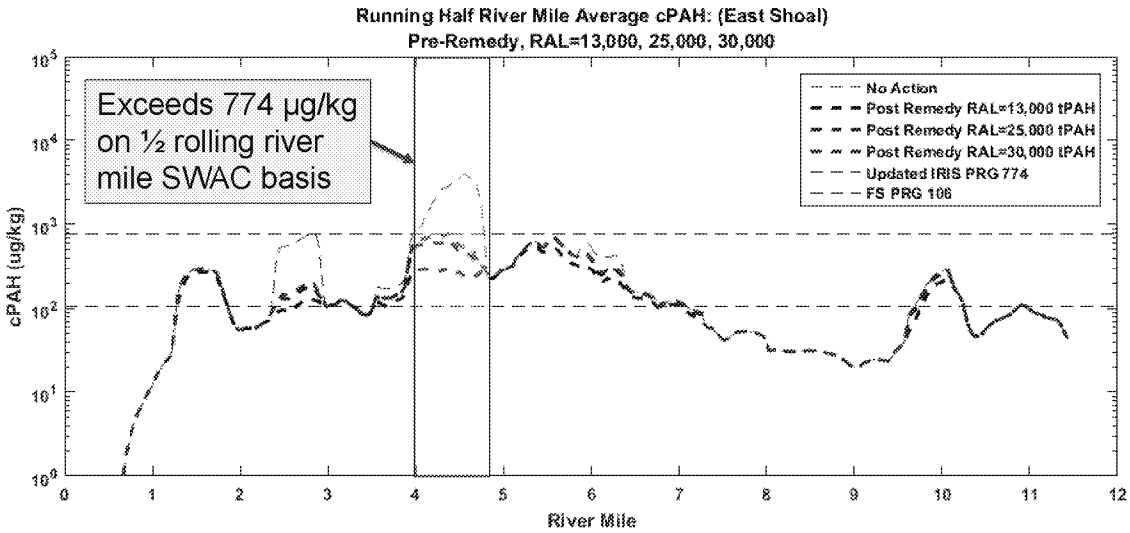
Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (230,000 µg/kg)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
State Acceptance	No	Yes	Yes	No

Backup Slides for Discussion


Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)
Total PAH RAL of 30 mg/kg protects 100% of the nearshore areas
Total PAH RAL of 95 mg/kg protects 22% of the nearshore areas



Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario



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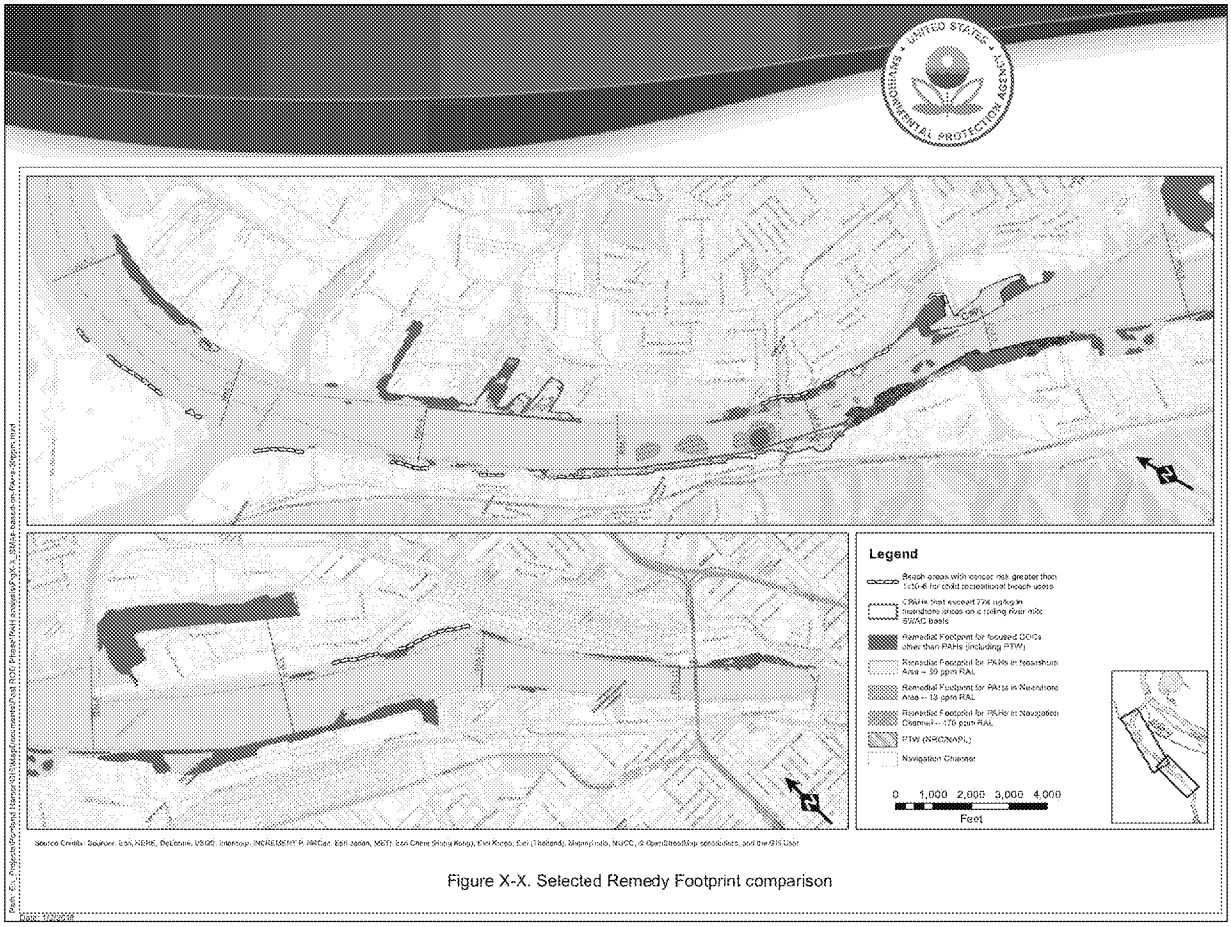


Figure X-X. Selected Remedy Footprint comparison

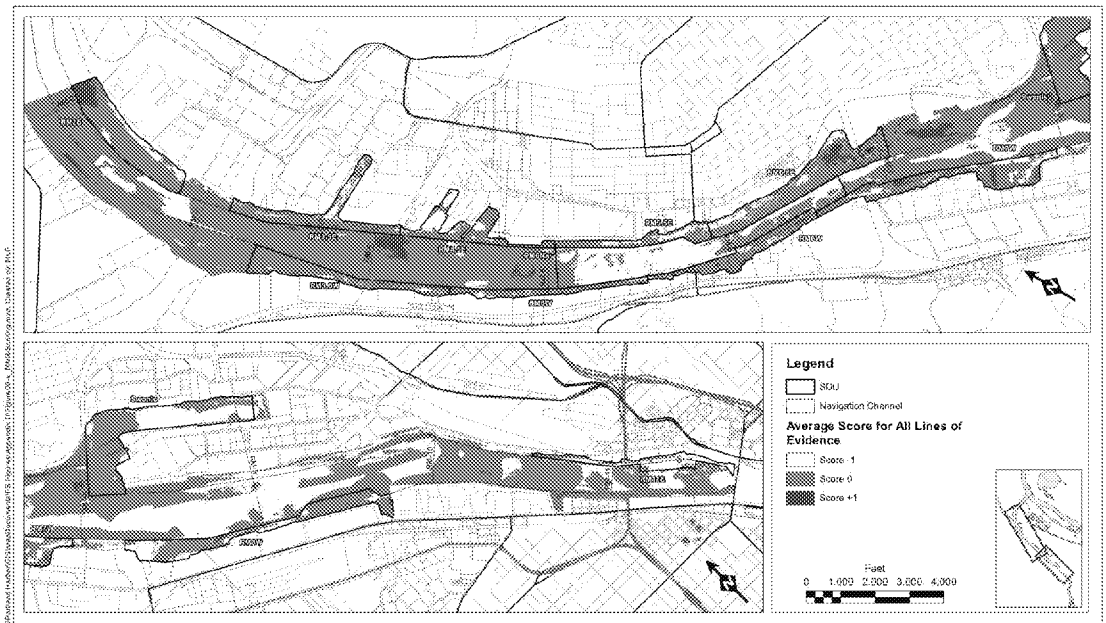


Figure D8-7. Average Score for Six Lines of Evidence

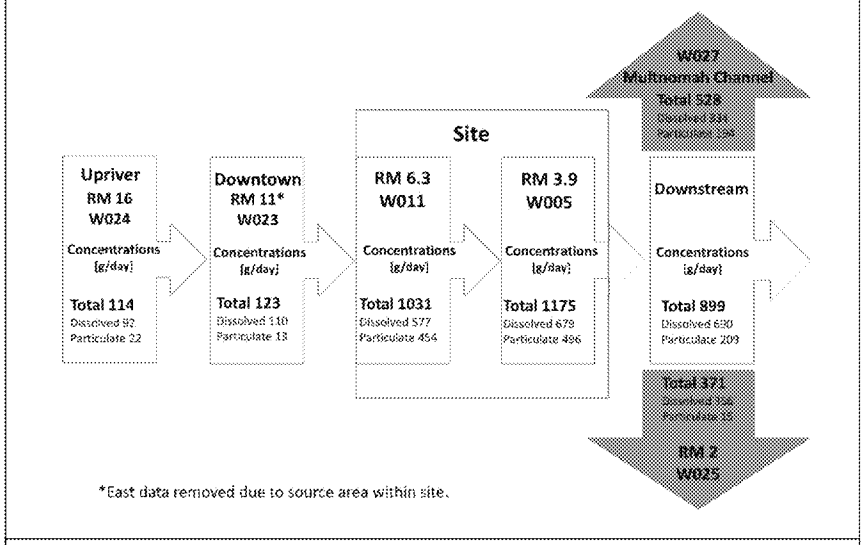
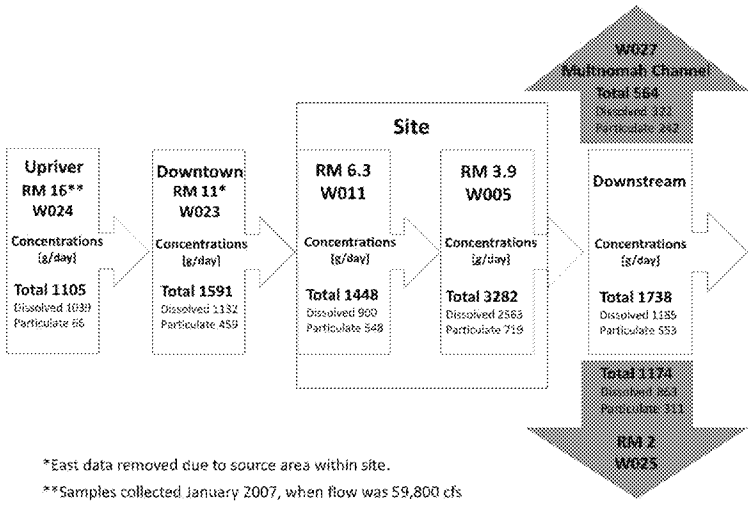


Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs

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Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint

IEc

MEMORANDUM | October 11, 2017

TO Michelle Pirzadeh, United States Environmental Protection Agency (EPA)

FROM Gail Fricano and Rachel DelVecchio (Industrial Economics, Inc.)

SUBJECT Terminal 4 Negotiations Regarding Human Health Risk and Remedial Action Levels (RALs)

PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on topics raised by the Port of Portland (Port) related to implementation of the Portland Harbor Superfund Site (Site) Record of Decision (ROD) at Terminal 4 (T4). Our comments focus on two issues raised in a series of briefing papers developed by the Port and shared with the United States Environmental Protection Agency (EPA) on August 16, 2017, titled "Terminal 4 Overview" (3 pp. plus figure) and "Human Health Direct Contact Risk at Terminal 4" (3 pp.). The issues are: (1) whether the human health direct contact pathway at T4 is complete, and if not, whether EPA's cleanup standards should be relaxed; and (2) whether navigation channel remedial action levels (RALs) should be applied at T4 rather than the Site-wide RALs. We have serious concerns about the Port's perceptions of and implied proposals regarding these issues, and we urge EPA to fully consider our comments below during upcoming discussions with the Port. In addition, we note that many of the comments we provided to EPA on October 9 related to Pre-RD Group negotiations also apply to discussions with T4, as described below.

HUMAN HEALTH DIRECT CONTACT RISK

The Port asserts that the human health risk exposure pathway may not be complete across the entirety of T4 due to site-specific characteristics including relatively deep (-30 to -40 feet Columbia River Datum) waters, the Baseline Human Health Risk Assessment's determination that beach use was not an applicable exposure scenario at T4, and the active, secure nature of the marine terminal facility that would limit human access to the area. The Port does not propose a specific resolution related to these assertions, but rather requests that EPA work with the Port to create a Remedial Design/Remedial Action process that accounts for these site-specific conditions at T4. The Port implies that cleanup levels should be relaxed because of the alleged lack of direct human contact at T4. The Five Tribes do not support relaxing cleanup levels at T4, and we urge EPA to consider the following points when discussing a path forward with the Port.

---

[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

1. EPA must develop a remedy that is protective of Tribal treaty rights, which provide for Tribal fishing throughout the Site, including T4.
2. The Port asserts that it "operates an active, secure marine terminal facility," and "direct contact exposures are further limited by active marine terminal operations, including frequent vessel calls " (Human Health Direct Contact Risk at Terminal 4 briefing paper, p. 2). While we agree that these characteristics presently limit recreational access to the river, it is unknown whether this area will remain an active, secure facility in the future, for instance, in 100 years or more. The remedy must be protective in perpetuity, and current security measures at T4 do not provide sufficient assurance that recreational users will not access the area in the future. Further, it is uncertain whether these characteristics ensure a complete absence of recreational access, as institutional controls at Superfund sites are widely acknowledged to not be entirely effective. In addition, EPA must ensure that a remedy is protective of workers at T4, who also may be directly exposed to contamination, including contaminated sediments.
3. EPA must develop a remedy that is protective of ecological resources at T4. Regardless of human health direct contact within T4, fish, invertebrates, and other biota inhabit T4. Furthermore, fish that are exposed to contamination within T4 may move out of T4, thereby exposing fishers in other areas of the Site to T4 contamination.

APPLICATION OF RALS

The Port implies that, due to the prevailing navigational use and deep water at Slip 3 within T4, the navigation channel RALs are the appropriate RALs to apply at Slip 3, rather than the Site-wide RALs assigned to this area in the ROD.[2] The Five Tribes do not support the Port's argument. The ROD requires that Site-wide RALs be applied to future maintenance dredge (FMD) areas, such as Slip 3. FMD areas are typically nearshore areas with direct human contact. As noted in the Human Health Direct Contact Risk section above, direct human contact is a complete pathway at T4, including Slip 3. The navigation channel RALs are not protective of direct human contact and must not be applied at Slip 3.

ACHIEVING A TIMELY CLEANUP

We do not support a reexamination of Remedial Investigation/Feasibility Study (RI/FS) and ROD assumptions regarding exposure and their implications for cleanup levels and RALs, either for the Site collectively or for individual areas of the Site. Such an approach reopens analyses that were performed by EPA and potentially responsible parties (PRPs) with substantial input from EPA's Memorandum of Understanding (MOU) partners over a period of more than 10 years. The changes that the Port proposes may reopen the RI/FS

[2] The Port's briefing papers do not specifically assert that navigation channel RALs should be applied at Slip 3. However, they have made this assertion in discussions with EPA.

and at a minimum would reopen the ROD. A ROD amendment would likely be required to change the application of cleanup levels or RALs. Such a change would delay cleanup by at least several years. We strongly urge EPA to adhere to the ROD and achieve a timely cleanup.

REITERATION OF COMMENTS ON PRE-RD GROUP NEGOTIATIONS

The Five Tribes submitted comments to EPA on October 9 expressing significant concerns regarding the process and substance of EPA's negotiations with the Pre-RD Group. Although we have not seen a draft Administrative Order on Consent (AOC) or draft work plan for T4 negotiations, we stress that our comments on the Pre-RD Group negotiations also apply to any discussions or negotiations with T4. Key issues include:

1. EPA must provide the Five Tribes, as well as MOU partners more broadly, the opportunity for meaningful involvement in the cleanup process, consistent with past practices, the MOU signed by EPA and Technical Coordinating Team (TCT) members, and EPA's trust and consultation responsibilities to the Five Tribes. This includes providing MOU partners with sufficient time and opportunity to provide feedback on all drafts of documents and other correspondence related to cleanup and negotiations, including but not limited to position papers, AOCs, scopes of work, work plans, and assertions, positions, and other views or considerations expressed by EPA or the Port by email, verbally, at meetings, or otherwise. The Five Tribes cannot emphasize enough the importance of EPA transparency with the TCT. If EPA is not transparent with the TCT regarding T4 discussions and negotiations and does not provide for meaningful TCT involvement, the Five Tribes will be required to consider invoking dispute resolution provisions in the MOU.
2. Work plans must not be attached to AOCs, but rather developed with full TCT participation and finalized after AOCs are signed.
3. AOCs must require PRPs to fund Tribal Response Costs.
4. The scope of AOCs should encompass Remedial Design and should not be limited to one sampling event.
5. As discussed on the October 10 TCT call, the AOC must not provide PRPs the opportunity to appeal dispute resolutions issued by the Regional Administrator to the EPA Administrator.
6. Work plans must be based on statistically valid designs.
7. Work plan objectives and data uses must be consistent with the ROD.
8. EPA must not entertain PRP efforts designed to reopen the RI/FS, which was developed over more than ten years and represents a joint effort between EPA and the PRPs with significant input from governmental partners, including the

Five Tribes. Efforts to reopen the RI/FS are clearly stall tactics intended to postpone cleanup. EPA must move forward with the current RI/FS in order to achieve a timely cleanup.

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 8/25/2017 11:03:54 PM
To: Ryan Barth [rbarth@anchorqea.com]
CC: Stuesse, Gregory L. [stuessegl@cdmsmith.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Foster, Malena L. (fosterml@cdmsmith.com) [fosterml@cdmsmith.com]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Bob Wyatt [rjw@nwnatural.com]; Jen Mott [jmott@anchorqea.com]
Subject: RE: Portland Harbor GIS Layers - Application of Revised cPAH IRIS Values

Thank you Ryan. S

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From: Ryan Barth [mailto:rbarth@anchorqea.com]
Sent: Wednesday, August 23, 2017 5:25 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Peterson, Lance <PetersonLE@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Foster, Malena L. (fosterml@cdmsmith.com) <fosterml@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Bob Wyatt <rjw@nwnatural.com>; Jen Mott <jmott@anchorqea.com>
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720 Olive Way, Suite 1900
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Direct: 206.903.3334
Cell: 206.719.3605

From: Ryan Barth
Sent: Thursday, August 10, 2017 9:47 PM
To: Sean Sheldrake <sheldrake.sean@epa.gov>

Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Peterson, Lance <PetersonLE@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Foster, Malena L. (fosterml@cdmsmith.com) <fosterml@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Bob Wyatt <rjw@nwnatural.com>; Jen Mott <jmott@anchorqea.com>
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From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Friday, August 04, 2017 4:24 PM
To: Bob Wyatt <rjw@nwnatural.com>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Ryan Barth <rbarth@anchorqea.com>; Foster, Malena L. (fosterml@cdmsmith.com) <fosterml@cdmsmith.com>
Subject: RE: [External]GIS layers

Bob, Will do—thanks for clarifying so quickly as we're working hard to look at this asap.

Scott/Greg/Malena/Eric, can you verify the layers we'll need to work on the R-code run with Arthur?

Thanks everyone.

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Sent: Friday, August 04, 2017 4:14 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Stuesse, Gregory L. <stuessegl@cdmsmith.com>; Scott Coffey <coffeyse@cdmsmith.com>; Gustavson, Karl <Gustavson.Karl@epa.gov>; rbarth@anchorenv.com
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Sean, we are working to compile the GIS layer files and want to make sure the list below is correct. Can you verify these are the GIS layers your team is looking for, and let me know if there are any others you'd like us to send?

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Thank you,

Bob

From: Sheldrake, Sean [sheldrake.sean@epa.gov]
Sent: Friday, August 04, 2017 8:50 AM
To: Wyatt, Robert
Cc: Stuesse, Gregory L.; Scott Coffey; Gustavson, Karl; rbarth@anchorenv.com
Subject: RE: [External]GIS layers

Much appreciated Bob. S

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Message

From: Ryan Barth [rbarth@anchorqea.com]
Sent: 8/24/2017 12:25:28 AM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
CC: Stuesse, Gregory L. [stuessegl@cdmsmith.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Foster, Malena L. (fosterml@cdmsmith.com) [fosterml@cdmsmith.com]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Bob Wyatt [rjw@nwnatural.com]; Jen Mott [jmott@anchorqea.com]
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Attachments: BaPIrisUpdate_Fig5_CombinedFootprint.pdf

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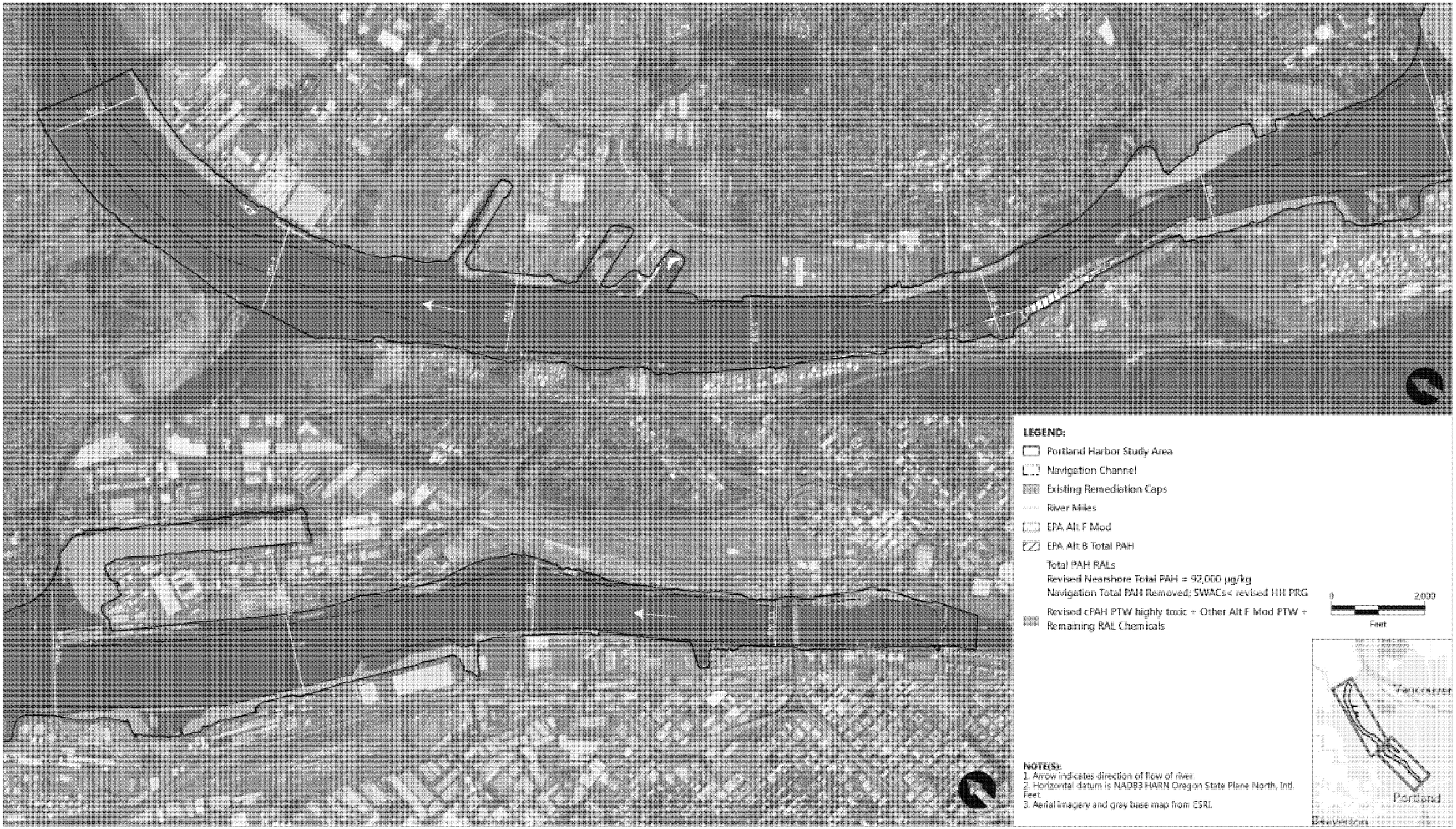

Publish Date: 2017/08/03, 1:56 PM | User: eiverson
Filepath: \\orrac\GIS\Jobs\NW_Natural_Gas_0029\Gasco_Sediments\Maps\requests\AQ_TPAHcomparison.mxd

ANCHOR QEA

Figure 5
Sediment Management Areas (SMAs) Using Revised TPAH RALs and Revised cPAH PTW-Highly Toxic
Portland Harbor Record of Decision Review
Gasco Sediments Cleanup Action

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 8/23/2017 6:51:18 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jen Kassakian (jkassakian@indecon.com) [jkassakian@indecon.com]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; ted_buerger@fws.gov; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]
Subject: Exxon and BP letters (sf)
Attachments: 08.14.17 Letter to R. Whitman.pdf; Submission of Haley & Aldrich's Pyrogenic PAH Source Evaluation; 2017-07-21 Edwards letter to Whitman follow up re meeting request.pdf - ....pdf; Letter to Ms. Cora and Mr. Sheldrake dated July 21, 2017

Hello everyone, Here are the letters sent by Exxon and BP requested by McClure Tosch/YN on the TCT this morning.

Thank you.

S

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206.553.1220 desk
206.225.6528 cell
http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

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Message

From: Knudsen, Laura [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=EE4D40361DC54627953429D619F5C808-KNUDSEN, LAURA]
Sent: 12/12/2018 5:34:48 PM
To: Young, Hunter [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a3a74b6a034a4542abf33d93e285834e-Young, Hunt]; bob@ridolfi.com; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dana Bayuk (dana.bayuk@state.or.us) [dana.bayuk@state.or.us]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; holly.partridge@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a95333ea0d224764ab954fb2bf3a1bdf-holly.partr]; Jeff Schatz (Jeff.SCHATZ@state.or.us) [Jeff.SCHATZ@state.or.us]; jennifer.graham@ctwsbnr.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=77c45a2245254d8a85cd133ca275f43c-jennifer.gr]; Jennifer Hart [jhart@indecon.com]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; jweis@hk-law.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=07c4bc35a18a4d8a9ab1dd71c3b26ad2-jweis@hk-la]; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; kristin@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=38574deacb8341a89be3e43734dfee5e-kristin@rid]; Peterson, Lance [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user1c445729]; shil@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1c7df2d27980455baba704947050b08d-shil@yakama]; liverman.alex@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9563df3063644ec2bd4c9482f682076e-liverman.al]; madi.novak@state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d8aada1636074687bf907f947fd60738-madi.novak@]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=184c8dadeefb45e090f39c74474eb02f-mcclincy.ma]; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Paul Seidel [paul.seidel@state.or.us]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; rcabral@indecon.com [/o=ExchangeLabs/ou=Exchange Administrative Group

(FYDIBOHF23SPDLT)/cn=Recipients/cn=c64ca848f03e492bbb42ca0a591482c2-rcabral@ind]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; dexb@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=981e32a8e45a4a52a0e47ba80fd84a26-dexb@yakama]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; greenfield.sarah@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4de9c0ea08f3412594cfbcdb6123d167-greenfield.]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]

Subject: Proposed ESD 'Top 10' Questions || Thank You!

Hello TCT Members! I look forward to our call today. I realized that I had not yet followed up with all of you on the "Top 10 Questions" that we are planning to address at the December 12th public forum this evening. Please find them below!

Proposed ESD 'Top 10' (and a Bonus) Questions

1. **What is the difference between an Explanation of Significant Differences (ESD) and a Record of Decision (ROD) amendment?**

2. **How common is it to issue an Explanation of Significant Differences (ESD) during the Superfund process?**

3. **Who issued this change, what was the methodology, and who funded it?**

4. **This national change upgrades Benzo[a]pyrene's status from 'probable human carcinogen' to 'human carcinogen.' Why then is EPA saying that BaP is about 7 times less toxic to human health than previously thought?**

5. **For the Benzo[a]pyrene change, what does 7 times less potent mean? 7 times less than what?**

6. **Did the national EPA Benzo[a]pyrene update consider children and infants who are more vulnerable (for both cancer and non-cancer effects)?**

7. **Did the Portland Harbor Superfund Site take site-specific cancer & non-cancer BaP human health risk into account with this toxicity change? Were children and infants considered?**

8. **How was wildlife or ecological health considered with this proposed ESD (both with the national BaP change and the Portland Harbor specific change)?**

9. **Does this proposed ESD take into account mixtures of PAHs? I have heard that mixtures of PAHs may be more toxic than individual chemicals.**

10. **Has there been a site-specific analysis in the area of Gasco and Terminal 4 with the combination of BaP and the other chemicals at the Site based on new data and how the combination of those chemicals can affect people?**

11. **(BONUS QUESTION) When we submit comment, what is EPA's responsibility to respond to the comments? What could cause EPA to reconsider this change?**

Thank you all very much and talk to you soon,

Laura Knudsen
U.S. Environmental Protection Agency | Region 10
206-553-1838 | knudsen.laura@epa.gov

"Be kind whenever possible. It is always possible."
~Dalai Lama

Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 4/12/2018 1:23:36 AM
To: Bill Ross [bross@rossstrategic.com]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'Richard Whitman' [richard.whitman@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'SEIDEL Paul' [paul.seidel@state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]

Subject: Portland Harbor Sr Leadership
Location: Call-in number Personal Privacy / Ex. 6

Start: 4/13/2018 10:30:00 PM
End: 4/13/2018 11:30:00 PM
Show Time As: Busy

Recurrence: (none)

Here is the agenda for Friday?s senior leaders call on the Portland Harbor Cleanup. The agenda has been organized to focus time on the issues needing the most discussion and interaction. Thanks, Bill

Agenda:

- Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation. Discuss potential SMAs/AOCs that ODEQ might provide lead technical oversight and how and when to consult with TCT/tribes on the purpose of the protocol.
- Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
- 4 (Port project) - Port is revising their original proposal for T4 and is now not requesting a potential ROD amendment. They are proposing a standard application of the RALs as per the ROD. Senior Port leadership meeting with EPA on April 17 to discuss.
- Willamette Cove - results of US Department of Justice meeting on March 20 to discuss federal participation. 60 day notice letter recently sent out. Will state and federal participation be sufficient to begin RD?

- ESD for PAHs - EPA is preparing an ESD in response to NW Natural's request that the RALs for PAHs be reconsidered in light of the updated cancer potency for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation (and can/should consultation occur prior to seeking public comment?). As this commences, how and when should DEQ indicate its concurrence?
- Nature of the response to the PCI letter to all PRP's and implications for EPA's stated desire that allocation be completed by 2020.
- Gasco - ExxonMobil has communicated with both EPA and DEQ that it believes the Gasco AOC needs to be substantially expanded to include downriver PAH contamination. DEQ has sent a response letter to EM focusing on EM's assertion of inadequate source control. EM also requested an opportunity to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. How should EPA and DEQ respond to EM's requests for agency interaction/decisions?
- OHA Fish Advisory. The Oregon Health Authority issued this week an updated fish consumption advisory for the Lower Willamette River based on information provided in EPA's 2017 ROD. The updated advisory follows OHA's consultation with Oregon Tribes and EPA's engagement with the Yakama Nation.
- Timing of next meeting and determination of the value and frequency of these more focused strategic discussions.

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 10/3/2018 7:11:01 PM
To: Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Stern, Allyn [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2e2d6f5df08d4e9abbff2c0880407775-Stern, Allyn]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]
CC: Personal Privacy / Ex. 6 Lowery, Brigid [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da8c8861510148a6bdcd084192758505-Lowery, Brigid]; Fitz-James, Schatzi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=91ad13b033f14eda8364bded00eafa8c-Fitz-James, Schatzi]; Libelo, Laurence [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da33642e6438407daf4c35afe870046b-Libelo, Laurence]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Wallace-Wilson, Barbara [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=bf8f9f01251e4741bac1aed6e69ac072-Wallace-Wilson, Barbara]
Subject: RE: IRIS - Portland Harbor (sf)
Attachments: FW: IRIS - Portland Harbor

Thank you Jim; I will have that included in our admin record.

Sorry to do this, but per input from counsel could you provide me with any **notes taken** (if any) at the meeting to complete our file and for me to verify due consideration of any issues raised before the Administrator brief tomorrow/ESD signing (hopefully)?

Thank you.

S

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https://www.epa.gov/superfund/portland-harbor

-----Original Message-----
From: Woolford, James
Sent: Wednesday, October 3, 2018 11:14 AM
To: Bilbrey, Sheryl <Bilbrey.Sheryl@epa.gov>; Fleming, Sheila <fleming.sheila@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>; Sheldrake, Sean <sheldrake.sean@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>; Ingemansen, Dean <Ingemansen.Dean@epa.gov>

Cc: Personal Privacy / Ex. 6 Lowery, Brigid <Lowery.Brigid@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>; Libelo, Laurence <Libelo.Laurence@epa.gov>; Mackey, Cyndy <Mackey.Cyndy@epa.gov>
Subject: FW: IRIS - Portland Harbor

Just in

Jim Woolford, Director
Office of Superfund Remediation and Technology Innovation Office of Land and Emergency Management US Environmental Protection Agency
1200 Penn. Ave., NW
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(Mail Code 5201-P)
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Phone: (703) 603 8960– Main Office Line

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-----Original Message-----
From: Laws, Elliott [mailto:ELaws@crowell.com]
Sent: Wednesday, October 03, 2018 2:09 PM
To: Woolford, James <Woolford.James@epa.gov>
Cc: rjw@nwnatural.com
Subject: IRIS - Portland Harbor

Jim please see the attached memo to you from Bob Wyatt.

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 10/3/2018 6:14:17 PM
To: Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; Fleming, Sheila [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5d3e29dad0ec4cd98d87e1a142435c57-Fleming, Sheila]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Stern, Allyn [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2e2d6f5df08d4e9abbff2c0880407775-Stern, Allyn]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]
CC: Dana Stalcup [Personal Privacy / Ex. 6] Lowery, Brigid [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da8c8861510148a6bdcd084192758505-Lowery, Brigid]; Fitz-James, Schatzi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=91ad13b033f14eda8364bded00eafa8c-Fitz-James, Schatzi]; Libelo, Laurence [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da33642e6438407daf4c35afe870046b-Libelo, Laurence]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]
Subject: FW: IRIS - Portland Harbor
Attachments: 2018-10-02 NW Natural ESD White Paper.pdf; ATT00001.htm

Just in

Jim Woolford, Director
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(Mail Code 5201-P)
Our mission is to return the most contaminated areas of the country to communities for safe reuse in a healthy environment.
Phone: (703) 603 8960– Main Office Line

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2777 S. Crystal Dr.
Arlington, VA 22202

-----Original Message-----
From: Laws, Elliott [mailto:ELaws@crowell.com]
Sent: Wednesday, October 03, 2018 2:09 PM
To: Woolford, James <Woolford.James@epa.gov>
Cc: rjw@nwnatural.com
Subject: IRIS - Portland Harbor

Jim please see the attached memo to you from Bob Wyatt.

NW Natural
220 NW 2ND AVENUE
PORTLAND, OR 97209
TEL 503.226.4211
www.nwnatural.com

To: Jim Woolford
From: Bob Wyatt
Date: October 2, 2018
Regarding: Portland Harbor cPAH Cleanup Level Update

Jim,

NW Natural very much appreciates the opportunity to provide you with more detail on our additional analysis of how the PAH cleanup criteria for Portland Harbor should be revised to reflect the updated IRIS cancer slope factor for benzo(a)pyrene (BaP). During our September 11 meeting, we provided an overview of our evaluation of three of the key factors EPA is considering at Portland Harbor. We also discussed the fact that EPA has determined that the direct contact risk associated with BaP is now approximately seven times less than was previously thought, and the risk of consuming shellfish in contact with sediments is approximately 27 times less than previously calculated. As we mentioned during the meeting, we believe EPA's revised cleanup requirements at Portland Harbor for cPAH and TPAH should reflect the magnitude of these changes. The three factors and our summary positions were:

1. *Human consumption of clams harvested from the navigation channel*. The Baseline Human Health Risk Assessment concluded that there is no human health risk from clam consumption in the navigation channel. That means that there should be no remedy required for that pathway. Even if clam consumption *had* been identified as a pathway for the navigation channel, no active remediation would be required. Cleanup in nearshore areas would reduce potential risks from clam consumption to well within EPA's acceptable risk range for the site. In fact, according to EPA's ROD residual risk evaluation, current clam consumption risks in navigation channel sediments are already within EPA's acceptable risk range.

2. *Protection of Surface Water.* The ambient water quality cleanup level for BaP based on the revised IRIS cancer slope factor should be 0.0009 µg/l. It is reasonable for EPA to apply a revised water quality criteria at Portland Harbor. Further, as ROD Appendix IV, Figure 4.2-8b shows, predicted surface water cPAH concentrations associated with the site for the "no action" alternative are already below the updated cleanup level and well below the most stringent Oregon water quality standard. Therefore, no cPAH cleanup of sediments is necessary to protect surface water quality for PAHs.

3. *Benthic Risk.* The revised cancer slope factor for BaP does not affect the calculation of benthic risk. EPA's ROD allows for delineation of benthic risk areas for active cleanup using the multiple lines of evidence approach used in the BERA. The ROD responsiveness summary clarifies that additional lines of evidence (e.g. toxicity testing) may be used to "refine delineation of benthic risk areas in areas that are not driven by risk via another RAO." Because PAH cleanup in the

navigation channel is not driven by risks to human health or protection of surface water, the application of TPAH RALs in the navigation channel is not necessary to protect the benthic community.

Our detailed supporting analysis is provided below.

Reconciliation of Updated B(a)P Toxicity Information and Portland Harbor Remedial Action Objectives Key Technical Issues

On January 19, 2017, EPA updated its Integrated Risk Information System (IRIS) by decreasing the oral cancer slope factor for benzo(a)pyrene (BaP) from 7.3 per mg/kg-day to 1 per mg/kg-day. This update reflects an approximate seven-fold decrease in calculated post-construction cancer risk from direct contact with BaP and, due to the log-log biota sediment accumulation regression equation used at Portland Harbor, an approximate 27-fold decrease in calculated post-construction cancer risk from shellfish consumption. Carcinogenic PAH cleanup levels for Portland Harbor, which are expressed as BaP equivalent values, should be updated as follows:

		ROD cleanup level	Updated cleanup level
In-water direct contact sediment	RAO 1	106 µg/kg[1]	774 µg/kg
Shellfish consumption sediment	RAO 2	39.5[2] µg/kg	1,080[3] µg/kg
Surface water	RAO 3	0.00012 µg/l	0.0009 µg/l[4]

[1] EPA's Baseline Human Health Risk Assessment identified potential risk from direct contact with cPAHs in nearshore in-water sediment to in-water workers, fishers, and divers. Based upon the BHHRA, EPA developed a direct contact PRG of 106 µg/kg for in-water sediment to be protective of tribal fishers. In the ROD, however, EPA selected a cPAH direct contact sediment cleanup level of 12 µg/kg, based upon background concentrations (which are equivalent to the PRG for the child recreational beach exposure scenario). Although EPA's cPAH in-water sediment cleanup level is based upon a child recreational beach exposure assumption, virtually all of EPA's evaluations supporting its remedy selection for nearshore sediments are based upon the 106 µg/kg PRG for tribal fishers. For example, the Remedial Action Levels for Total PAHs developed in the Feasibility Study and used to define action areas in the ROD were based on the 106 µg/kg cPAH PRG for in-water sediment exposure. The "highly toxic" principal threat waste concentration in the Feasibility Study and ROD is also based on the 106 µg/kg cPAH PRG. Most importantly, the Feasibility Study evaluated the performance of all alternatives (including the selected alternative) for EPA's Remedial Action Objective 1 (reduce risks to people from direct contact with chemicals in sediment and beaches) against the 106 µg/kg tribal fisher PRG. EPA's residual risk evaluations led it to conclude that its selected remedy would be protective of direct contact with sediments "immediately after construction." However, even a cursory review of EPA's residual risk tables in the final Feasibility Study reveals that the 12 µg/kg cPAH sediment cleanup level would not be met in almost every segment of the river at the rolling half-mile scale evaluated for RAO 1 immediately following construction.

[2] Portland Harbor ROD Table 17 sets the shellfish consumption sediment cleanup level at 3,950 µg/kg applicable to navigation channel sediments. We understand that EPA has identified an apparent unit error in the calculation of the preliminary remediation goal for shellfish consumption and believes the PRG should have been set at 39.5 µg/kg based on the former cancer slope factor. We have used the more conservative value in this table.

[3] Updated following equation presented in Appendix B of EPA's Feasibility Study.

[4] EPA's surface water cleanup level for Portland Harbor is based on the federal ambient water quality criteria rather than the risk assessment. In 2015, EPA stated that it "anticipates updating the AWQC for benzo(a)pyrene following finalization of EPA's IRIS toxicological assessment." *Update of Human Health Ambient Water Quality*

As we have previously presented to EPA,[5] adjusted nearshore RALs corresponding to the updated in-water direct contact sediment cleanup level could range from approximately 92,000 to 170,000 µg/kg.[6] The highly toxic principal threat waste (PTW) threshold would increase to 774,000 µg/kg.

We understand that EPA is concerned about redefining areas of active remedy to correspond to the updated IRIS assessment on three grounds: risk associated with human consumption of clams harvested from the navigation channel, protection of surface water, and benthic risk.

1. *Human consumption of clams harvested from the navigation channel*

The clam consumption cleanup level is the only human health-related cPAH or PAH cleanup level in the ROD applicable to the navigation channel. EPA's Baseline Human Health Risk Assessment (BHRRA) did not identify human consumption of clams harvested from the navigation channel as a complete exposure pathway and therefore did not assess potential risks associated with such consumption. In directing the exposure pathways to be evaluated in the BHRRA, EPA stated,

> It is unclear whether the maximum consumption rate for shellfish assumed in the risk assessment (18 g/day which is a little more than 1 pound per month (one pound in 3.6 weeks)) is sustainable at some or all of the areas where bivalves were collected, now or in the future. EPA believes that sufficient information exists to support the clam consumption scenario. However, EPA acknowledges that an appropriate exposure area should be determined in consideration of water depth (i.e. nearshore areas) and the area over which a sustainable shellfish harvest consistent with the clam consumption is possible.[7]

Accordingly, the final BHHRA identified <u>no human health risk</u> from clams harvested in the navigation channel.[8] EPA never deviated from this risk finding prior to the ROD, when it acknowledged that it could not technically support a cPAH sediment cleanup level based on fish consumption and substituted the clam consumption scenario[9] as a justification for petroleum cleanup in the navigation channel.[10]

Even if this risk pathway were supported by EPA's risk assessment, extensive remediation in the navigation channel is not necessary to address it. As shown in the figure below, cleanup in nearshore areas to even the least conservative adjusted TPAH RAL would reduce potential risks from clam

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Criteria: Benzo(a)pyrene 50-32-8, EPA 820-R-15-012 (June 2015). As a point of comparison, Oregon's water quality criteria for BaP (water + organism) is 0.0013 µg/l. OAR 340-041-8033, Table 40.

[5] *See,* Memorandum, *USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor* (Anchor QEA, August 2, 2017).

[6] Upper bound of TPAH RAL of 170,000 µg/kg equivalent to Alternative B in the FS.

[7] EPA Comments on Comprehensive Round 2 Site Summary and Data Gaps Analysis Report (January 15, 2008), page 26.

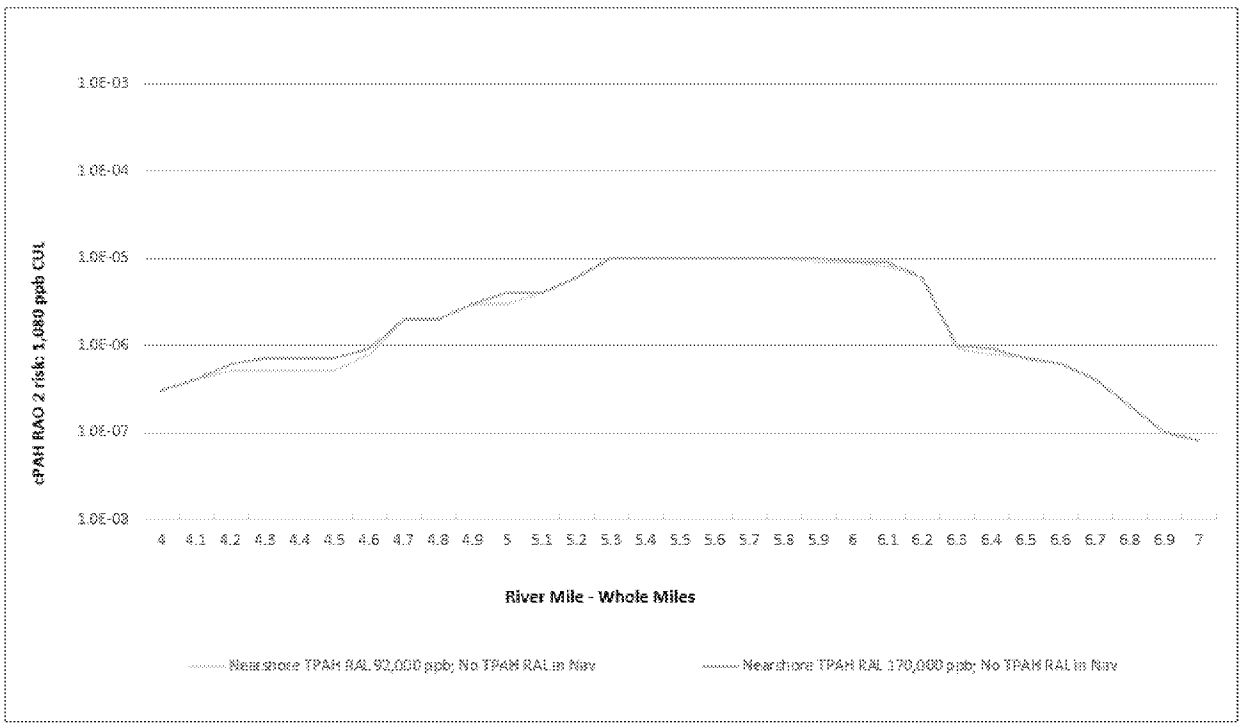
[8] See Map 5-4.1 (Portland Harbor RI/FS Appendix F, March 28, 2013 – Risks from Clam Consumption, RME).

[9] *See Portland Harbor RI/FS, Revised Draft Bioaccumulation Modeling Report* (June 19, 2015), Table 4-1.

[10] See also EPA's April 21, 2010 letter providing direction on PRGs for use in the Feasibility Study and attached Table 1 ("B(a)P HH Clam Consumption. EPA considered making alternative water depth or consumption exposure assumptions but prefers using assumptions consistent with the risk assessment.")

consumption to well within EPA's acceptable risk range[11] at the completion of construction without any active TPAH cleanup in the navigation channel.[12] In fact, according to EPA's ROD residual risk evaluation, current clam consumption risks in navigation channel sediments are within EPA's acceptable risk range at the updated cleanup level.

Post Construction Clam Consumption Risk
RM 4-7 Whole River Miles
Log Scale



2. *Protection of Surface Water*

As noted above, EPA anticipates updating the BaP ambient water quality criteria consistent with the 2017 toxicological assessment. The updated cleanup level for protection of surface water should be 0.0009 µg/l. Because remedy implementation is still a number of years in the future, the new water quality criteria will almost certainly be in effect at the time cleanup commences. The most stringent Oregon water quality standard (0.0013 µg/l) is less stringent than the EPA AWQC.

EPA's FS estimated surface water concentrations following implementation of the various remedial alternatives. As ROD Appendix IV, Figure 4.2-8b (below) shows, predicted surface water cPAH concentrations associated with the site for the "no action" alternative are already below the updated cleanup level and well below the most stringent Oregon water quality standard.[13] Therefore, no

[11] Carcinogenic risk between 10-6 and 10-4 per National Contingency Plan (NCP), 40 CFR 300.430(e)

[12] Figure shows residual risk calculated on a whole river mile basis, the smallest scale evaluated in the BHRRA for consumption scenarios not limited by water depth. See BHHRA §3.4.5.

[13] Note that EPA's selected alternative, F Mod, would not itself attain protection of the current cPAH cleanup level immediately following construction of remedial actions.

petroleum cleanup of sediments is necessary to protect surface water quality for PAHs, but application of adjusted TPAH RALs in the nearshore and remediation of areas of PTW-NAPL will reduce cPAH water concentrations below current levels.

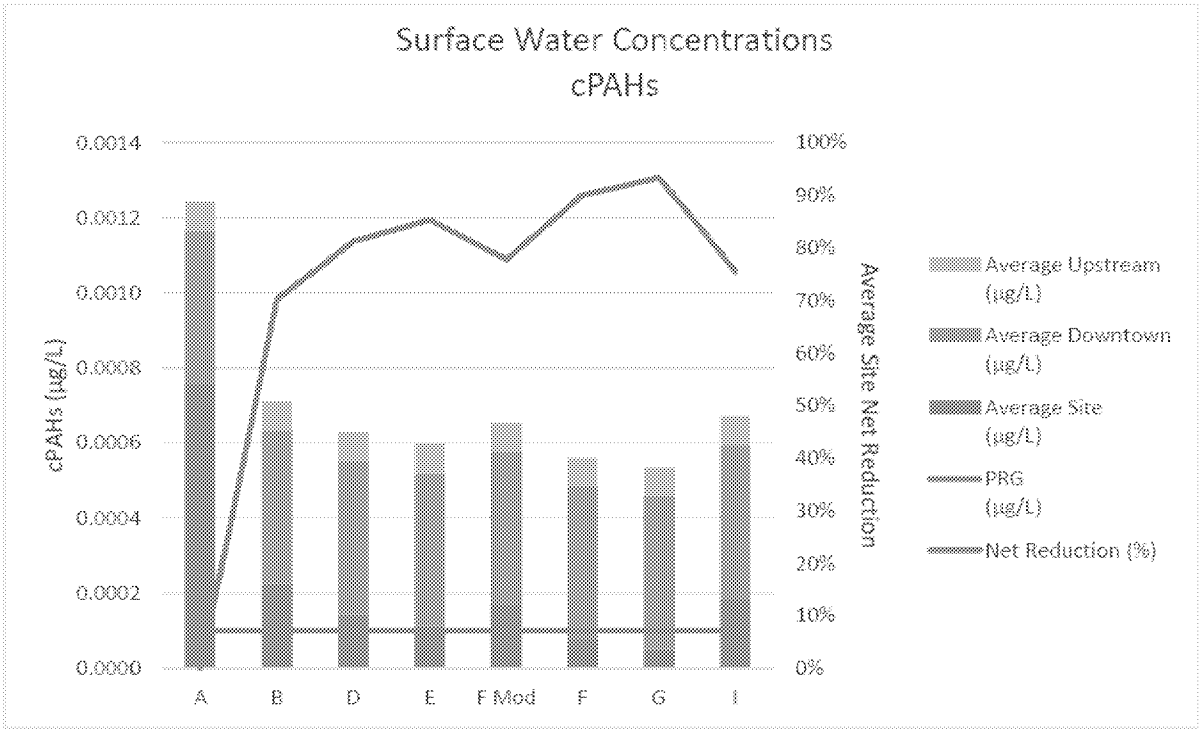


Figure 4.2-8b. Predicted surface water cPAH concentration reductions.

3. *Benthic Risk*

The assessment of potential ecological risk (RAO 5) would, of course, not be affected by the change in the human health cancer slope factor. Table 17 of the ROD does not identify the basis for the PAH PRG of 23,000 ppb, but we understand it to be for protection of benthic organisms.

EPA's Baseline Ecological Risk Assessment (BERA) used a multiple lines of evidence approach to evaluate benthic risk. Although EPA adopted a different approach for estimating benthic risk in the ROD,[14] the ROD responsiveness summary clarifies that additional lines of evidence (e.g., toxicity testing) may be used to "refine delineation of benthic risk areas in areas that are not driven by risk via another RAO." Because, as discussed above, petroleum cleanup in the navigation channel is not driven by risks to human health or protection of surface water, EPA's ROD allows for delineation of benthic risk areas for active cleanup using the multiple lines of evidence approach used in the BERA. Therefore, application of TPAH RALs in the navigation channel is not necessary to protect the benthic community.

[14] *See, e.g.,* Portland Harbor RI Appendix G, p. 774 ("[u]nacceptable risks to benthic invertebrates are located in approximately 4-8 percent of the Site,"); *cf.* ROD, Appendix IV, Table 4.2-7 (1,289 acres of benthic risk within the 2,190 acre Portland Harbor Site, or approximately 59% of the Site).

Conclusion

EPA's risk assessment did not identify human consumption of clams from the navigation channel as a risk. Even if it had, cleanup of petroleum in the nearshore areas to even the least conservative adjusted TPAH RAL would reduce potential risks from clam consumption to well within EPA's NCP acceptable risk range at the completion of construction without any active TPAH cleanup in the navigation channel. Site contributions to cPAH surface water concentrations are already below the updated cleanup level at the no action alternatives, and those concentrations will be further reduced through active remediation of areas defined by nearshore TPAH RALs and PTW-NAPL. Benthic risk can be delineated and addressed consistent with the ROD through the multiple lines of evidence approach used in the BERA.

Appointment

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Sent: 3/20/2018 10:58:13 PM
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Subject: FW: Portland Harbor ROD ESD
Location: Personal Privacy / Ex. 6

Start: 3/21/2018 10:00:00 PM
End: 3/21/2018 11:00:00 PM
Show Time As: Tentative

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Subject: Portland Harbor TCT Meeting for 11/28/2018 is CALL-IN only.
Location: EPA's Oregon Operations Office; call-in Personal Privacy / Ex. 6

Start: 11/28/2018 6:00:00 PM
End: 11/28/2018 8:30:00 PM
Show Time As: Busy

Recurrence: (none)

Hi all- Just a reminder that our next TCT meeting is tomorrow. It is call-in only! I've attached the agenda below. Let me know if you have questions. Thanks.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, November 28, 2018

Call-In only Personal Privacy / Ex. 6

10am to Noon Pacific Time

Our agenda:

- Dec. 3rd week of exciting events
- ESD update
- ASAOC/SOW updates (11E, NWN/Siltronic, RM7W, T4, ICIAP/DMP, Cove)
- River Bank Guidance – deadline for comments extended to 12/20 per Trustee request, ad hoc?
- DEQ Upland Source Control
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
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P: 206-553-1970 | demaria.eva@epa.gov

Appointment

To: DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; bob@ridolfi.com; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; callie@ridolfi.com; Scott Coffey [coffeyse@cdmsmith.com]; Cora, Lori [cora.lori@epa.gov]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dana Bayuk (dana.bayuk@state.or.us) [dana.bayuk@state.or.us]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [Gustavson.Karl@epa.gov]; holly.partridge@grandronde.org [Holly.Partridge@grandronde.org]; Jeff Schatz (Jeff.SCHATZ@state.or.us) [Jeff.SCHATZ@state.or.us]; jennifer.graham@ctwsbnr.org [Jennifer.graham@ctwsbnr.org]; Jennifer Hart [jhart@indecon.com]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Clark, Josie [clark.josie@epa.gov]; jweis@hk-law.com; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [Knudsen.Laura@epa.gov]; kristin@ridolfi.com; Peterson, Lance [PetersonLE@cdmsmith.com]; shil@yakamafish-nsn.gov; liverman.alex@deq.state.or.us; madi.novak@state.or.us; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org; Paul Seidel [paul.seidel@state.or.us]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; rcabral@indecon.com; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; dexb@yakamafish-nsn.gov; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; greenfield.sarah@deq.state.or.us [Greenfield.Sarah@deq.state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; Buerger, Ted [ted_buerger@fws.gov]; tomd@ctsi.nsn.us; Zhen, Davis [Zhen.Davis@epa.gov]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]

CC: GREENFIELD Sarah [Sarah.GREENFIELD@state.or.us]

Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 10/10/2018 5:00:00 PM
End: 10/10/2018 7:00:00 PM

Recurrence: (none)

Hi all - We'll have lots of updates for next week's TCT meeting even though Sean won't be able to attend. See below for latest agenda. If you have anything else you want to discuss, please forward to me. Thank you!

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, October 10, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New stuff:

- 10/4 Acting Administrator Wheeler briefing update (ESD, baseline sampling/data usage)
- 10/18 PCI meeting (small group/private?) - FAQ followup
- 12/5 PRP meeting

Our regular agenda:

- DEQ Upland Source Control
- AOC updates (baseline sampling, 11E, NWN/Gasco, RM7W, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update

- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
Office of Environmental Cleanup | Superfund Site Cleanup Unit #2
U.S. EPA Region 10 | 1200 Sixth Avenue, Ste. 900, ECL-122 | Seattle, WA 98101
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To: Zhen, Davis [Zhen.Davis@epa.gov]; tomd@ctsi.nsn.us; Buerger, Ted [ted_buerger@fws.gov]; Skadowski, Suzanne [Skadowski.Suzanne@epa.gov]; greenfield.sarah@deq.state.or.us [Greenfield.Sarah@deq.state.or.us]; rose@yakamafish-nsn.gov; Robert.Neely@noaa.gov; dexb@yakamafish-nsn.gov; rcabral@indecon.com; NaomiStacy@ctuir.org; Michael.karnosh@grandronde.org [Michael.Karnosh@grandronde.org]; tosm@yakamafish-nsn.gov; mcclincy.matt@deq.state.or.us; Mairs, Stephanie [Mairs.Stephanie@epa.gov]; madi.novak@state.or.us; liverman.alex@deq.state.or.us; shil@yakamafish-nsn.gov; Peterson, Lance [PetersonLE@cdmsmith.com]; kristin@ridolfi.com; Knudsen, Laura [Knudsen.Laura@epa.gov]; Kevin Parrett [Parrett.Kevin@deq.state.or.us]; jweis@hk-law.com; Clark, Josie [clark.josie@epa.gov]; Jeremy_Buck@fws.gov [jeremy_buck@fws.gov]; jennifer.graham@ctwsbnr.org [Jennifer.graham@ctwsbnr.org]; holly.partridge@grandronde.org [Holly.Partridge@grandronde.org]; Gustavson, Karl [Gustavson.Karl@epa.gov]; Ebright, Stephanie [EBRIGHT.STEPHANIE@EPA.GOV]; Cora, Lori [cora.lori@epa.gov]; Scott Coffey [coffeyse@cdmsmith.com]; callie@ridolfi.com; brandy.humphreys@grandronde.org [Brandy.Humphreys@grandronde.org]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; bob@ridolfi.com; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dana Bayuk (dana.bayuk@state.or.us) [dana.bayuk@state.or.us]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; holly.partridge@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a95333ea0d224764ab954fb2bf3a1bdf-holly.partr]; Jeff Schatz (Jeff.SCHATZ@state.or.us) [Jeff.SCHATZ@state.or.us]; jennifer.graham@ctwsbnr.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=77c45a2245254d8a85cd133ca275f43c-jennifer.gr]; Jennifer Hart [jhart@indecon.com]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; jweis@hk-law.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=07c4bc35a18a4d8a9ab1dd71c3b26ad2-jweis@hk-la]; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; kristin@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=38574deacb8341a89be3e43734dfee5e-kristin@rid]; Peterson, Lance [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user1c445729]; shil@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1c7df2d27980455baba704947050b08d-shil@yakama]; liverman.alex@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9563df3063644ec2bd4c9482f682076e-liverman.al]; madi.novak@state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d8aada1636074687bf907f947fd60738-madi.novak@]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=184c8dadeefb45e090f39c74474eb02f-mcclincy.ma]; tosm@yakamafish-

nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Paul Seidel [paul.seidel@state.or.us]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; rcabral@indecon.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c64ca848f03e492bbb42ca0a591482c2-rcabral@ind]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; dexb@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=981e32a8e45a4a52a0e47ba80fd84a26-dexb@yakama]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; greenfield.sarah@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4de9c0ea08f3412594cfbcdb6123d167-greenfield.]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]

CC: GREENFIELD Sarah [Sarah.GREENFIELD@state.or.us]; lonr@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c2400bf6fdb84e1fa8003e57f7ba217d-lonr@yakama]; Young, Hunter [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a3a74b6a034a4542abf33d93e285834e-Young, Hunt]

Location: Teleconference only; call-in Personal Privacy / Ex. 6

Start: 11/14/2018 6:00:00 PM
End: 11/14/2018 8:00:00 PM

Recurrence: (none)

Hi all – Just a reminder that our next TCT meeting is Wednesday, November 14 via teleconference only! Let me know if you have additional agenda items. Thank you.

Portland Harbor TCT Project Update Meeting Agenda

Wednesday, November 14, 2018

Teleconference only

Call-In Personal Privacy / Ex. 6

10am to Noon Pacific Time

New agenda items:

- ESD update
- Dec. 3rd week of activities/meetings

Our regular agenda:

- DEQ Upland Source Control
- AOC updates (Baseline sampling, 11E, NWN/Gasco, RM7W, T4, ICIAP/DMP, Willamette Cove)
- Community Involvement Update
- CERCLA Coordination Permitting
- Other/Next TCT Meeting on Project Updates

Feel free to call me if you have questions. Thanks.

Eva

Eva DeMaria
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Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 3/21/2018 7:16:12 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; sheldrake.sean@epa.gov; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]

Subject: PH ESD - use this call in (not YN line)
Attachments: Information for the IRIS overview - confidential
Location: Personal Privacy / Ex. 6

Start: 3/21/2018 10:00:00 PM
End: 3/21/2018 11:00:00 PM
Show Time As: Busy

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 3/21/2018 5:56:11 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; sheldrake.sean@epa.gov; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]
Subject: Information for the IRIS overview - confidential

Hello everyone,

Please see the attached supporting information for our call today at 3.

Thank you.

S

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https://www.epa.gov/superfund/portland-harbor

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 3/21/2018 7:16:12 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; sheldrake.sean@epa.gov; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]

Subject: PH ESD - use this call in (not YN line)
Attachments: Information for the IRIS overview - confidential
Location: Personal Privacy / Ex. 6

Start: 3/21/2018 10:00:00 PM
End: 3/21/2018 11:00:00 PM
Show Time As: Busy

Apologies everyone—Laura and McClure noted that their line probably can't hold all the participants—so we had to provide a new line.

Hello everyone,

This call is to go over for the TCT the upcoming proposed ESD, to follow up on our January meeting. Please login to the attached meeting room to go over materials. My hope is that this will give everyone a good idea of what EPA is looking to propose to the public soon, following (requested) tribal consultation.

Personal Privacy / Ex. 6

Thank you.

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Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
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Subject: Information for the IRIS overview - confidential
Attachments: CPAH_Slope_Factor_Change_2-27-18_Revised.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx; CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx; USEPA_BaPToxUpdate_2017-08-02 (002).pdf; Tabs 1-6 - 2017-11-27 cPAH Memo.pdf; Tabs 7-10 - 2017-11-27 cPAH Memo.pdf

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Appointment

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CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; BAYUK Dana [Dana.BAYUK@state.or.us]; Blischke, Eric [blischkee@cdmsmith.com]

BCC: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=usere7e308b1]

Subject: TCT ad-hoc Gasco dredging pre-meeting Personal Privacy / Ex. 6

Attachments: Map_5-1-1_App F_Final BHHRA_Complete Report.pdf; CPAH_Recreational_Beach_Risk_Estimates.xlsx

Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/23/2018 5:30:00 PM

End: 1/23/2018 7:00:00 PM

Show Time As: Busy

(Scott, let me know if this isn't a good line to use).

All, I want to go over some preliminary Gasco dredge design thoughts, and a likely presentation to the TCT by NWN tentatively planned for February 27 in seattle and via web conference. We can address other questions as time allows.

~~As requested, this is another availability session for EPA to go over what the cancer slope factor change may or may not mean, and answer any questions. The goal is to inform the TCT and get input that we can include in internal briefings such that we may come to an informed decision including partner input. Again, no decisions have been made by EPA as of yet.~~

-

~~As it gets closer, I'll include background materials along with a web meeting link in case it's needed.~~

Thank you.

S

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/4/2018 12:18:01 AM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]; Blischke, Eric [blischkee@cdmsmith.com]
BCC: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=usere7e308b1]

Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx; RE: TCT -ad hoc- IRIS update background discussion; 1-844-566-5330,87887381#; RE: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/11/2018 10:00:00 PM
End: 1/12/2018
Show Time As: Busy

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018

2pm to 4pm Pacific Time

Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: http://epawebconferencing.acms.com/divingsafety/

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
  - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Message

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 1/11/2018 7:02:21 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Blischke, Eric [blischkee@cdmsmith.com]

CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]
Subject: RE: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_update_1-11-18.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx; Five Tribes comments on T4 issues 11Oct17.pdf

Importance: High

TCT Members.

Attached is an updated presentation on the CPAH Slope Factor Change considerations. The narrative (attached Word File) that explains why EPA is not considering any changes to the Nav. Channel **has not been updated**, but is re-attached for completeness. Please use these documents for our discussion this afternoon.

Finally, we've attached a comment memo provided by the Five Tribes in October that everyone has seen previously. While this comment memo has a focus on the Port's T4 issues, it also provides comment on site wide RAL adjustments that EPA has considered during its evaluation process for the CPAH slope factor change considerations.

Looking forward to a great discussion this afternoon!

-----Original Appointment-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Wednesday, January 03, 2018 4:18 PM
To: Sheldrake, Sean; Alex Liverman (liverman.alex@deq.state.or.us); bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca; Coffey, Scott; Cora, Lori; Courtney Johnson (courtney@crag.org); Dan Hafley (HAFLEY.Dan@deq.state.or.us); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; Holly Partridge (Holly.Partridge@grandronde.org); Jen Graham; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Josh Newton (jn@karnopp.com); jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; Kristin Callahan; Peterson, Lance; Laura Klasner Shira; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com); Rita Cabral (rcabral@indecon.com); Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us); Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us
Cc: PARRETT Kevin; NOVAK Madi
Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
When: Thursday, January 11, 2018 2:00 PM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

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Meeting Agenda
IRIS update background discussion

January 11, 2018

2pm to 4pm Pacific Time

Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: Personal Privacy / Ex. 6

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
    - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Message

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 1/11/2018 11:41:17 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; callie@ridolfi.com [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=26fd618bc50645a58e292f2536779db6-callie@ridolfi.com]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; Jeremy_Buck@fws.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=181f930130c24d72b4d92719891126ff-Jeremy_Buck@fws.gov]; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Peterson, Lance [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Michael.karnosh@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6cdc8fcc0ca249f78393546ee03b1151-Michael.karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=79e46f864d914ddab31a75af6114a898-Robert.Neely@noaa.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Buerger, Ted [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userea8fe60d]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Blischke, Eric [blischkee@cdmsmith.com]

CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]
Subject: RE: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: Section 7 from rod_guidance.pdf

Importance: High

As a follow-up to Gail's request:

Attached is pertinent information on what Post ROD changes constitute ESD vs ROD Amendment.

See highlighted portion on page 7-2.

From: Coffey, Scott
Sent: Thursday, January 11, 2018 11:02 AM
To: 'Sheldrake, Sean' <sheldrake.sean@epa.gov>; Alex Liverman (liverman.alex@deq.state.or.us) <liverman.alex@deq.state.or.us>; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca <Chu.Rebecca@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>; Courtney Johnson (courtney@crag.org) <courtney@crag.org>; Dan Hafley (HAFLEY.Dan@deq.state.or.us) <HAFLEY.Dan@deq.state.or.us>; Zhen, Davis <Zhen.Davis@epa.gov>; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) <deirdre.donahue@sol.doi.gov>; dexb@yakamafish-nsn.gov; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Gail Fricano (gfricano@indecon.com) <gfricano@indecon.com>; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) <Genevieve.Angle@noaa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Holly Partridge (Holly.Partridge@grandronde.org) <Holly.Partridge@grandronde.org>; Jen Graham <jennifer.graham@ctwsbnr.org>; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org) <joepitt@ctuir.org>; Josh Newton (jn@karnopp.com) <jn@karnopp.com>; jweis@hk-law.com; Kevin Parrett <Parrett.Kevin@deq.state.or.us>; Knudsen, Laura <Knudsen.Laura@epa.gov>; Kristin Callahan <kristin@ridolfi.com>; Peterson, Lance <PetersonLE@cdmsmith.com>; Laura Klasner Shira <shil@yakamafish-nsn.gov>; Madi Novak (novak.madi@deq.state.or.us) <novak.madi@deq.state.or.us>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) <MatthewJohnson@ctuir.org>; mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com) <MLW@karnopp.com>; NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com) <rdelvecchio@indecon.com>; Rita Cabral (rcabral@indecon.com) <rcabral@indecon.com>; Robert Brunoe (robert.brunoe@ctwsbnr.org) <robert.brunoe@ctwsbnr.org>; Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) <Greenfield.Sarah@deq.state.or.us>; Skadowski, Suzanne <Skadowski.Suzanne@epa.gov>; Buerger, Ted <ted_buerger@fws.gov>; tomd@ctsi.nsn.us; Blischke, Eric <blischkee@cdmsmith.com>
Cc: PARRETT Kevin <Kevin.Parrett@state.or.us>; NOVAK Madi <Madi.NOVAK@state.or.us>
Subject: RE: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Importance: High

TCT Members.

Attached is an updated presentation on the CPAH Slope Factor Change considerations. The narrative (attached Word File) that explains why EPA is not considering any changes to the Nav. Channel **has not been updated**, but is re-attached for completeness. Please use these documents for our discussion this afternoon.

Finally, we've attached a comment memo provided by the Five Tribes in October that everyone has seen previously. While this comment memo has a focus on the Port's T4 issues, it also provides comment on site wide RAL adjustments that EPA has considered during its evaluation process for the CPAH slope factor change considerations.

Looking forward to a great discussion this afternoon!

-----Original Appointment-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Wednesday, January 03, 2018 4:18 PM
To: Sheldrake, Sean; Alex Liverman (liverman.alex@deq.state.or.us); bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Chu, Rebecca; Coffey, Scott; Cora, Lori; Courtney Johnson (courtney@crag.org); Dan Hafley (HAFLEY.Dan@deq.state.or.us); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; Holly Partridge (Holly.Partridge@grandronde.org); Jen Graham; Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Josh Newton (jn@karnopp.com); jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; Kristin Callahan; Peterson, Lance; Laura Klasner Shira; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; Rachel DelVecchio (rdelvecchio@indecon.com); Rita Cabral (rcabral@indecon.com); Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us); Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us
Cc: PARRETT Kevin; NOVAK Madi
Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
When: Thursday, January 11, 2018 2:00 PM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018
2pm to 4pm Pacific Time
Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: **Personal Privacy / Ex. 6**

- **Roll Call**

- **Meeting Objectives**

- **Presentation**
    - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

7.0 DOCUMENTING POST-ROD CHANGES: MINOR CHANGES, EXPLANATIONS OF SIGNIFICANT DIFFERENCES, AND ROD AMENDMENTS[1]

7.1 EVALUATING POST-RECORD OF DECISION INFORMATION

After a ROD is signed, new information may be received or generated that could affect the implementation of the remedy selected in the ROD, or could prompt the reassessment of that remedy.[1] The information could be identified at any time during, immediately prior to, or after the implementation of the remedy. Where information is submitted by a PRP, the public, or the support agency after a ROD is signed, the lead agency must consider and respond to this information and place such comments and responses in the Administrative Record file when *all* of the following criteria are met (per NCP §300.825(c)):

- Comments contain significant information;
- The new information is not contained elsewhere in the Administrative Record file;
- The new information could not have been submitted during the public comment period; and
- The new information substantially supports the need to significantly alter the response action.

The lead agency also may evaluate whether a remedy change is warranted on its own merits, even where the requirements of NCP §300.825(c) are not triggered.[2]

[1] It is EPA's policy to encourage appropriate remedy changes in response to advances in remediation science and technology (*Superfund Reforms: Updating Remedy Decisions,* (EPA 540-F-96-026, September 1996).

[2] Responding to post-ROD comments submitted by PRPs, the public, or the support agency may only require a general overview of the comments and a simple EPA response if no change to the remedy is involved or the change is minor (see *Answers to Comments Submitted After the Superfund ROD Is Signed,* EPA memorandum, October 11, 1995, http://es.epa.gov/oeca/osre/951011. html). However, a formal public comment period may be conducted depending upon whether the change is significant or fundamental (for definitions of these types of changes see Section 7.2).

7.2 TYPES OF POST-RECORD OF DECISION CHANGES

The lead agency's categorization of a post-ROD change to the Selected Remedy is a site-specific determination and must consider the following as set out in NCP §300.435(c)(2).

- *Scope.* Does the change alter the scope of the remedy (*e.g.*, type of treatment or containment technology, the physical area of the response, remediation goals to be achieved, type and volume of wastes to be addressed)?
- *Performance.* Would the change alter the performance (*e.g.*, treatment levels to be attained, long-term reliability of the remedy)?
- *Cost.* Are there significant changes in costs from estimates in the ROD, taking into account the recognized uncertainties associated with the hazardous waste engineering process selected? (Feasibility Study cost estimates are expected to provide an accuracy of +50 percent to -30 percent.)

Based on this evaluation, and depending on the extent or scope of modification being considered, the lead agency must make a determination as to the type of change involved (*i.e.*, nonsignificant or minor, significant, or fundamental change). Remedy changes should fall along a continuum from minor to fundamental. Similarly, an aggregate of nonsignificant or significant changes could result in a fundamental change.

Post-ROD changes fit into one of the three following categories:

- *Nonsignificant or Minor Changes* usually arise during design and construction, when modifications are made to the functional specifications of the remedy to address issues such as performance optimization, new technical informa-

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tion, support agency/community concerns and/or cost minimization (*e.g.*, value engineering process). Such changes may affect things such as the type or cost of materials, equipment, facilities, services, and supplies used to implement the remedy. The change will not have a significant impact on the scope, performance or cost of the remedy.

- *Significant Changes* generally involve a change to a component of a remedy that does not fundamentally alter the overall cleanup approach.
- *Fundamental Changes* involve an appreciable change or changes in the scope, performance, and/or cost or may be a number of significant changes that together have the effect of a fundamentalchange. An example of a fundamental change is one that results in a reconsideration of the overall waste management approach selected in the original ROD.

Highlight 7-1 provides examples of post-ROD changes. (See also NCP preamble, 55 *FR* 8772 for more information.) Please note that the examples presented in Highlight 7-1 are not meant to present strict thresholds for changes in cost, volume, or time.

7.3 DOCUMENTING POST-RECORD OF DECISION CHANGES

The type of documentation required for a post-ROD change depends on the nature of the change. Changes that significantly or fundamentally affect the remedy selected in the ROD will require more explanation and/or opportunity for public comment than those that do not. Each type of post-ROD change is associated with one of three documentation procedures: (1) a memo or note to the post-ROD file for an insignificant or minor change; (2) an explanation of significant differences (ESD) for a significant change, and (3) a ROD amendment for a fundamental change. Sample outlines for ESDs and ROD Amendments are provided in Highlight 7-2.

7.3.1 Documenting Non-Significant (or Minor) Post-ROD Changes: Memo to the Site File

Any non-significant or minor changes should be recorded in the post-ROD site file (*e.g.*, the RD/RA case file). If the lead agency chooses, non-significant changes can also be documented for the public in a Remedial Design Fact Sheet. Although not legally required, a written statement describing the change is generally recommended (See "*Answers to Comments Submitted After the Superfund ROD is Signed*," EPA memorandum, October 11, 1995, http://es.epa.gov/oeca/osre/951011. html).

7.3.2 Documenting Significant Post-ROD Changes: Explanation of Significant Differences

When documenting significant changes made to a remedy, the lead agency must comply with CERCLA §117(c) and NCP §§300.435(c)(2)(i) and 300.825(a)(2). An ESD must describe to the public the nature of the significant changes, summarize the information that led to making the changes, and affirm that the revised remedy complies with the NCP and the statutory requirements of CERCLA.

To describe the nature of the significant changes, it is suggested that a side-by-side comparison of the original and proposed remedy components be used to clearly display the significant differences.

The ESD should provide additional information on changes that have resulted in the remedy as a result of the change (*e.g.*, changes in the cleanup cost estimate or remediation time frame). Generally, a new nine-criteria analysis is not required; however, the ESD should include a statement that the ROD remains protective and continues to meet ARARs (NCP §§300.430(f)(1)(ii)(B)(1) and (2)).[3] It is also generally appropriate to prepare an ESD document when the lead agency decides to exercise a contingency remedy that was previously described in the ROD (see Section 8.3).

While the ESD is being prepared and made available to the public, the lead agency may proceed with the pre-design, design, construction, or operation activities associated with the remedy. The lead agency

[3] An ESD does not generally reopen consideration of ARARs for the remedy since an ESD does not fundamentally change the remedy. However, if an ESD results in the addition of any new components to the remedy, any ARARs that apply to the change that the ESD describes must be discussed and met or waived. For example, if any ARARs apply to an ESD change which adds stabilization of residuals to a thermal treatment remedy, they must be discussed in the ESD and met or waived.

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Highlight 7-1: Examples of Post-Record of Decision Changes

(NOTE: Examples are not meant to present strict thresholds for changes in cost, volume, or time.)

Minor Changes

- **Small Increase in Volume:** Remedial design testing shows that the volume of soil requiring treatment is 75,000 cubic yards rather than the 60,000 estimated in the ROD, but the estimated cost of the overall remedy will only increase by a small percentage.

- **Disposal Location:** During remedial design, it is discovered that it is not feasible to construct the on-site landfill (which is part of the Selected Remedy) in the location specified in the ROD. However, another similar location at the site is suitable for a landfill, and this location is chosen.

- **Ground-Water Monitoring:** The Selected Remedy calls for long-term pump and treat of contaminated ground water with monitoring on a quarterly basis. After a period of time, a determination is made that no significant change in data quality or monitoring effectiveness will occur if monitoring contaminant levels in the ground water is less frequent. Ground-water monitoring is changed to semi-annual sampling.

Significant Changes

- **Large Increase in Volume/ Cost Increase:** Sampling during the remedial design phase indicates the need to significantly increase the volume of contaminated waste material to be incinerated in order to meet selected cleanup levels, thereby substantially increasing the estimated cost of the remedy.

- **Disposal Location:** The lead agency determines that it is not feasible to construct an on-site landfill for treated waste in accordance with the remedy selected in the ROD. The treated wastes must be sent to an off-site landfill. Although the overall management approach for the treated waste (landfill disposal) will remain the same, the costs and implementation time will increase significantly.

- **Contingency Remedy:** As part of an active ground-water pump and treat system, contaminant concentrations decrease to an asymptotic level which is close to attainment of the cleanup level. Investigation shows that adding additional wells to pump and treat ground water will not improve the performance of the remedy in attaining the cleanup level. The ROD included contingency language that the pump and treat remedy would continue operating until contaminant levels were reduced by at least 90%. At such time, monitored natural attenuation would be relied upon to attain the cleanup levels specified in the ROD (if performance monitoring data indicated that this would be an effective method of achieving the final cleanup levels). A decision is made to implement the contingency, thus changing the remedy from pump and treat to monitored natural attenuation. This represents a significant change in achieving the cleanup levels at the site.

- **New ARAR Promulgated (Impacts on Cleanup Levels and Other Parameters):** The lead agency determines that the attainment of a newly promulgated requirement is necessary, based on new scientific evidence, because the existing ARAR is no longer protective. Although this new requirement will significantly change the remedy (*i.e.*, cleanup level, timing, volume, or cost), it will not fundamentally alter the remedy specified in the ROD (*i.e.*, the selected technology will not change) and it will not impact the level of protection (*i.e.*, risk reduction) that the remedy will provide.

- **Land Use:** During remedial design, the local zoning board decides to change the current land use from residential to commercial. Although this new requirement will significantly change features of the remedy (*i.e.*, determination of principal or low level threats, reasonable risk scenarios, appropriate cleanup levels), it will not fundamentally alter the remedy specified in the ROD (*e.g.*, the selected technology will not change).

- **Secondary Technology:** The lead agency decides to use a biological treatment method instead of air stripping (which was specified in the ROD) for ex-situ treatment of extracted ground water. The basic pump and treat approach remains unaltered and the cleanup level specified in the ROD will be met by the alternate technology; the change is significant, but not fundamental. [See *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (EPA 540-R-96-023, October 1996).]

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Highlight 7-1: Examples of Post-Record of Decision Changes (continued)

- **Institutional Controls:** During a five-year review, the lead agency reviews institutional control measures implemented at the site and determines that additional measures, that differ significantly from what was described in the ROD, are necessary to be protective (*e.g.*, need for an easement to replace a deed notice).

- **Change in ARARs:** At a five-year review, it is determined that a cleanup level is not consistent with an updated State cleanup standard, and thus is not protective and needs to be modified. This change will not cause a fundamental change in the volume of waste to be remediated.

Fundamental Changes

- **Change Primary Treatment Method:** The in-situ soil washing remedy selected in the ROD proves to be infeasible to implement after testing during remedial design. A decision is made to fundamentally change the remedy to excavate and thermally treat the waste.

- **Change Primary Treatment Method with Cost Increase:** Additional information obtained during remedial design testing demonstrates that the Selected Remedy for ground water, monitored natural attenuation, will not meet cleanup levels, as had been originally predicted in the RI/FS. The lead agency decides to fundamentally change the remedy from monitored natural attenuation to pump and treat. The estimated cost of the cleanup increases significantly.

- **Change Primary Treatment Method with Cost Decrease:** Pump and treat is the Selected Remedy for ground water. Prior to construction of a pump and treat system, interested parties collect and present ground-water information to the lead agency showing that contaminant concentrations are decreasing due to natural processes (*e.g.*, biodegradation, dilution, adsorption, dispersion). Modeling indicates that monitored natural attenuation will achieve cleanup levels in a time frame comparable to pump and treat at substantially less cost.

- **Change from Containment to Treatment with Cost Increase:** At a five-year review for a small industrial site, tests indicate that the containment remedy will not be protective and now a more active response approach (*e.g.*, treatment) is necessary. A new remedy must be selected that will meet protectiveness requirements, resulting in unanticipated costs for the site.

- **Technical Impracticability Waiver:** While implementing an active pump and treat remedy, the presence of DNAPL is discovered. A determination is made to invoke a Technical Impracticability Waiver of the ARAR because treatment of the DNAPL zone is impracticable from an engineering perspective. Rather than treat the source material (DNAPL) a decision is made to implement a containment approach (*e.g.*, slurry wall) for the DNAPL zone. Pump and treat will continue outside the containment zone. As a result, the scope, performance, and cost of the original remedy is fundamentally changed.

- **Community Preference:** The original remedy selected in the ROD was on-site incineration of contaminated soils with estimated costs of $50 million. The community opposes the building of an incinerator and requests that an alternate remedy be selected. New information received after the ROD was signed demonstrates that thermal desorption can meet the cleanup goals in a reasonable time frame for less cost with no loss in protection. This change is based on the community's preference for an alternative to the original Selected Remedy.

- **Volume Decrease Changes Primary Treatment Method:** The Selected Remedy called for treatment by lead recovery and recycling of lead contaminated materials. Additional investigation in design showed the volume of waste to be smaller than originally presumed. The decrease in volume made recycling uneconomical. The amended remedy calls for treatment and containment such that waste is stabilized and consolidated in a lined and capped on-site containment facility. The scope of the new remedy is more efficient, is cost-effective, and is supported by the State and the community.

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should consult with the support agency, as appropriate, before issuing an ESD (NCP §300.435(c)(2)). Although not specifically required by CERCLA §121(f) and NCP §300.435(c)(2)(i), it is also recommended that the lead agency provide the support agency the opportunity to comment, and summarize the support agency's comments in the ESD. The lead agency also must publish a notice of availability and a brief description of the ESD in a major local newspaper of general circulation (as required by NCP §300.435(c)(2)(i)(B)). The ESD must be made available to the public by placing it in the Administrative Record file and information repository (NCP §§300.435(c)(2)(i)(A) and 300.825(a)(2)). A formal public comment periodis *not* required when issuing an ESD.

In some cases, an additional public comment period or public meeting may be held voluntarily on a planned ESD (NCP §300.825(b)). This may be useful where there is considerable public or PRP interest in the matter. The Office of Emergency and Remedial Response (OERR) recommends issuing the ESD in a fact sheet format as outlined in Highlight 7-2. The Regional Administrator (or their designee) must sign an ESD. In such cases it may be appropriate to delay implementation of the remedy relating to the ESD to allow a consideration of possible concerns.

7.3.3 Documenting Fundamental Post-ROD Changes: ROD Amendment

When a fundamental change is made to the basic features of the remedy selected in a ROD with respect to scope, performance, or cost, the lead agency is required to develop and document the change consistent with the ROD process (NCP §§300.435(c)(2)(ii)(A) through (H)). This entails the issuance of a revised Proposed Plan that highlights the proposed changes. An amended ROD that documents the change follows the Proposed Plan. The portion of the ROD being amended is evaluated using the nine criteria, focusing on those central to the rationale for the Selected Remedy.

In general, the introductory sections of the ROD do not need to be readdressed in the ROD Amendment but may be referenced from the previous ROD. The focus of the amendment should be to document the rationale for the amendment and provide assurances that the proposed remedy satisfies the statutory requirements. This is accomplished through an evaluation, utilizing the nine criteria, of the portion of the remedy being changed.

To describe the nature of the changes, it is suggested that a side-by-side comparison of the original and proposed remedy components be used to clearly display the differences.

The information included in a ROD Amendment is a function of the type of change made and the rationale for that change. If the amended ROD addresses the entire response action for the site or a series of operable units (*e.g.*, soil, surface water, ground water), only the portion of the remedy that is being changed (*e.g.*,ground water) requires an amendment. For the portion of the ROD being amended, a new nine-criteria analysis, including a new ARARs analysis, will be necessary (see NCP §300.430(f)(1)(ii)(B)(2)). Portions of the analysis in the original ROD can be cross-referenced, where appropriate. RD/RA activities being conducted on other portions of the site or at operable units not proposed for changes may continue during the amendment process.

When fundamental changes are proposed to the ROD, the lead agency must conduct the public participation and documentation procedures specified in NCP §§300.435(c)(2)(ii) and 300.825(a)(2). This would include issuing a revised Proposed Plan that highlights the proposed changes. The format should follow that of the Proposed Plan described in Chapter 3. The final decision to amend is not made until after consideration of public comment (NCP §300.435(c)(2)(ii)).

If a fundamental change is made after a consent decree has been entered at an enforcement-lead site, the decree may need to be modified to conform to the amended ROD, and perhaps involve the Department of Justice or the Court. RPMs should check with their Regional Counsel on how this may be accomplished.

ROD Amendments, like RODs, must be signed by the Regional Administrator (or their designee). A recommended outline and checklist can be found in Highlight 7-2.

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7.4 HEADQUARTERS REVIEW AND FILING OF DECISION CHANGES

Draft ESDs and ROD Amendments (including revised Proposed Plans) should be submitted to EPA Headquarters for review and comment pursuant to *Focus Areas for Headquarters OERR Support for Regional Decision Making* (OSWER 9200.1-17, May 22, 1996). In the event that the remedy change meets the criteria for review by the National Remedy Review Board, the appropriate consultation procedures should be followed. For more information on the National Remedy Review Board, see http://www.epa. gov/superfund/programs/nrrb/index.htm. See also Appendix C, *Consolidated Guide to ConsultationProcedures for Superfund Response Decisions* (EPA 540-F-97-009, May 1997).

A copy of a signed final ESD or ROD Amendment should be submitted within 30 days of signature to the following Headquarters office:

ROD Clearinghouse
Superfund Document Center
U.S. EPA Mail Code 5202G
401 M Street, SW
Washington, DC 20460

Please refer to Appendix D for guidance on submitting decision documents to EPA Headquarters.

ED_002671A_00022887-00006

Appointment

From: Bill Ross [bross@rossstrategic.com]
Sent: 8/29/2017 8:22:31 PM
To: Bill Ross [bross@rossstrategic.com]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Woolford, James [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9a70358e7660435cbe6afa87b7b9b71b-Woolford, James]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]; 'Richard Whitman' [richard.whitman@state.or.us]; Bilbrey, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=45612dba9a7f4a718d12e27feec7590f-Bilbrey, Sh]; 'Katie Ogrodnik' [ogrodnik.katie@deq.state.or.us]; Opalski, Dan [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b5ed6410d934bf699a008a252791a55-Opalski, Dan]; Barber, Anthony [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5e1b829ad1824045b9b91334160bd8b3-Barber, Anthony]; 'Bruce Gilles' [bruce.a.gilles@state.or.us]; 'Tyson.Linda@epa.gov'; Patterson, Kenneth [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8124081dc0f5490d983dbd6764b0a3f1-KPATTERS]; Nearhood, Jennifer [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=20b4526e6bad4a3fa51ed3c14ca51a04-Nearhood, J]; 'PARRETT Kevin' [kevin.parrett@state.or.us]; 'JOHNSON Keith' [keith.johnson@state.or.us]; 'DECONCINI Nina' [nina.deconcini@state.or.us]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; 'GREENFIELD Sarah' [sarah.greenfield@state.or.us]; Stern, Allyn [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2e2d6f5df08d4e9abbff2c0880407775-Stern, Allyn]; 'OGRODNIK Katie' [katie.ogrodnik@state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Soscia, Marylou [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0849f6bc30264a53b883725e58333224-Soscia, Mary L.]; seidel.paul@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7425335f49334052b6ec6c5ba02f2ee7-seidel.paul@deq.state.or.us]; SEIDEL Paul [paul.seidel@state.or.us]

Subject: Portland Harbor Sr Leadership call
Location: Call-in number Personal Privacy / Ex. 6

Start: 9/7/2017 7:00:00 PM
End: 9/7/2017 8:00:00 PM
Show Time As: Busy

Recurrence: (none)

The next meeting/call of the Portland harbor cleanup senior leaders will be on September 7 at noon PDT/3:00 EDT. An agenda will follow closer to the date.
Thanks, Bill.

1. Status of the negotiations with the private PRPs and next steps to get additional data sampling

2. Status of getting RD/RA action efforts going in 2017
3. Analysis of the implications for the new risk number for PAH
4. Review of the Port's request for slip T4
5. Status of DEQ's identification of potential 'reuse' sites
6. Updating communication and consultation protocols for DEQ and the TCT
7. Connecting with Jim and Cyndy when they are in Seattle on September 18?
8. Other items as requested

Appointment

From: Knudsen, Laura [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=EE4D40361DC54627953429D619F5C808-KNUDSEN, LAURA]
Sent: 8/8/2018 8:14:34 PM
To: Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kizz Prusia [kprusia@triangleassociates.com]; Annie Kilburg [akilburg@triangleassociates.com]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; GREENFIELD Sarah [Sarah.GREENFIELD@state.or.us]; mcclincy.matt@deq.state.or.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=184c8dadeefb45e090f39c74474eb02f-mcclincy.ma]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Mbabaliye, Theogene [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2f4e21654dc14262a6a2592614fa1405-Mbabaliye, Theogene]; Congdon, Julie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3d74a01220c747c19b2a1d7f3e111f02-Congdon, Julie]; Stohs, Sheryl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=fe0a4aefb24248a7b88131efb4fc6f10-Stohs, Sheryl M.]; Young, Hunter [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a3a74b6a034a4542abf33d93e285834e-Young, Hunt]; Alex Liverman [alex.liverman@state.or.us]
CC: Barber, Anthony [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5e1b829ad1824045b9b91334160bd8b3-Barber, Anthony]

Subject: (CONFIRMED) Portland Harbor: 3rd EPA PUBLIC FORUM (with ODEQ Support)
Attachments: Final Logistics E-mail for 12/12 Portland Harbor Meetings || Thank You All!; Draft Final PPT + Talking Points for Proposed ESD 12/12 Presentation | | Thoughts/Comments by Today | | Deliberative
Location: Revolution Hall || 1300 SE Stark St., Portland OR 97214

Start: 12/12/2018 10:00:00 PM
End: 12/13/2018 5:00:00 AM
Show Time As: Busy

Hello EPA + ODEQ + Triangle folks!

Just putting a placeholder here for the 3rd public forum in everyone's calendars for now. It looks like Josie Clark may be out and others may have plans, so please let me know if this doesn't work for you and we can rethink/discuss/problem solve.

Current schedule (also tentative…may change after feedback from the 2nd meeting):

- **3pm – 5pm: Community leader and EPA/ODEQ ONLY meeting (please arrive at 2:30pm)**
- **6pm – 8:30pm: General Public Forum (open to all)**

Thank you!!

Laura Knudsen
U.S. Environmental Protection Agency | Region 10
206-553-1838 | knudsen.laura@epa.gov

"Be kind whenever possible. It is always possible."
~Dalai Lama

Message

From: Knudsen, Laura [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=EE4D40361DC54627953429D619F5C808-KNUDSEN, LAURA]
Sent: 12/11/2018 1:46:11 PM
To: Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Blischke, Eric [blischkee@cdmsmith.com]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
Subject: Draft Final PPT + Talking Points for Proposed ESD 12/12 Presentation | | Thoughts/Comments by Today | | Deliberative
Attachments: Pages from 2013_03_28_Final_BHHRA_text.pdf; Proposed ESD Top 10 Questions DELIBERATIVE (12.12.2018).docx; FINAL PH Prop ESD Public Forum Deck (12.12.2018).pptx

Importance: High

Hello Suzanne, Sean, Lori & Davis!

Attached is the updated PowerPoint for tomorrow & the accompanying word document with talking points (**we will not be handing out the word document – this is for reference only**) for the 'Top 10 Proposed ESD Questions' section of the PowerPoint.

Suzanne: Could you please take a gander at this today and provide me with any edits? I'll finalize and print for Sean and myself for tomorrow.

Sean: Please feel free to start reviewing this material again today and if you have any edits to the PowerPoint, please feel free to make those changes today and I will incorporate! Also, for Question 6 "Did the national EPA Benzo[a]pyrene update consider children and infants who are more vulnerable (for both cancer and non-cancer effects)?" – while children were considered, it is true that this is really an exposure-specific question that is dealt with at the case study level. So, for Portland Harbor, this was addressed in the risk assessment through Age Dependent Factors (text excerpt provided – this helps answer this question).

Eric: Could you please take a quick look at the answers to Questions 6 & 7 in the word document after you look at the attached PDF regarding child/infant exposure again? I just want to make sure those answers are solid and we can give a cogent answer as to what was evaluated in the HHRA. Perhaps Cassandra could weigh in too (Scott?)? Also, there is additional information about this point in Section 3 of Appendix B in the feasibility study, which presents the calculation of the PRGs (I haven't looked at that just yet but will review). Please feel free to give me a call this afternoon if you have time to discuss, or I may call you too!

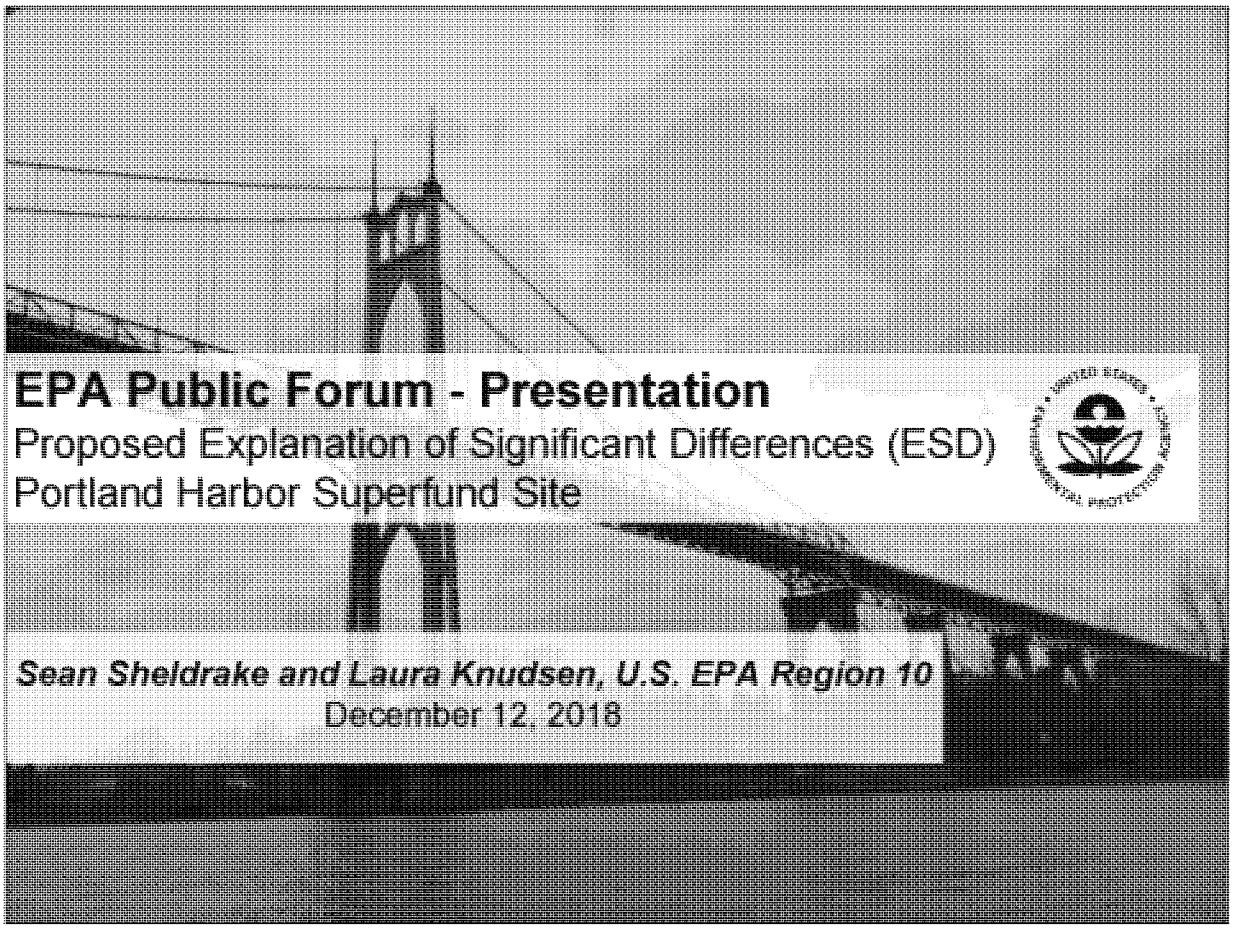
Lori/Davis: If you have any thoughts on the PowerPoint or the talking points, please feel free to provide them to me today and I will incorporate them.

Thank you all!

Laura Knudsen

U.S. Environmental Protection Agency | Region 10
206-553-1838 | knudsen.laura@epa.gov

"Be kind whenever possible. It is always possible."
~Dalai Lama



EPA Public Forum - Presentation

Proposed Explanation of Significant Differences (ESD)
Portland Harbor Superfund Site

Sean Sheldrake and Laura Knudsen, U.S. EPA Region 10

December 12, 2018

Agenda

EPA

- Site background
- Why is there a proposed ESD (Explanation of Significant Differences)? What is a proposed ESD?
- What does this change mean for the Portland Harbor Superfund Site?
- Top 10 Proposed ESD Questions

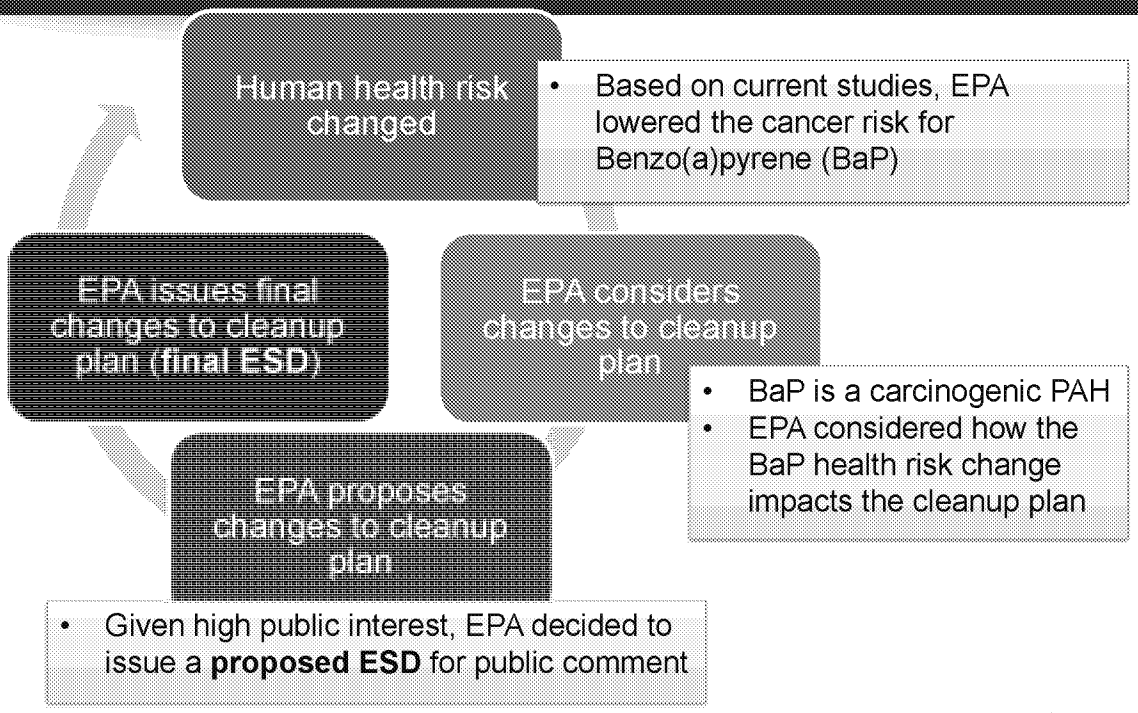
Site Background

These Focused COCs are:

- ❑ The most widespread
- ❑ Have the most associated risk
- ❑ Address other COCs

- **Focused Contaminants of Concern**
  - **Polychlorinated Biphenyl (PCBs)**
    - ☆**Where Do They Come From?** Used in electrical equipment, oil, plastics
  - **Polycyclic Aromatic Hydrocarbons (PAHs)**
    - ☆**Where Do They Come From?** Produced when coal, oil, and gas are burned, spilled, etc.…
    - ☆**Benzo(a)pyrene (BaP) is a PAH.** BaP cancer risk is used to assess cancer risk for other carcinogenic PAHs
  - **DDx (DDT, DDE, DDD)**
    - ☆**Where Do They Come From?** Commonly used in pesticides
  - **Dioxins/Furans**
    - ☆**Where Do They Come From?** Created when certain products are made, like herbicides, pulp/paper, or when products are burned.

Proposed ESD (Explanation of Significant Differences?): What is it and why?



What does this mean for the Portland Harbor Superfund Site?

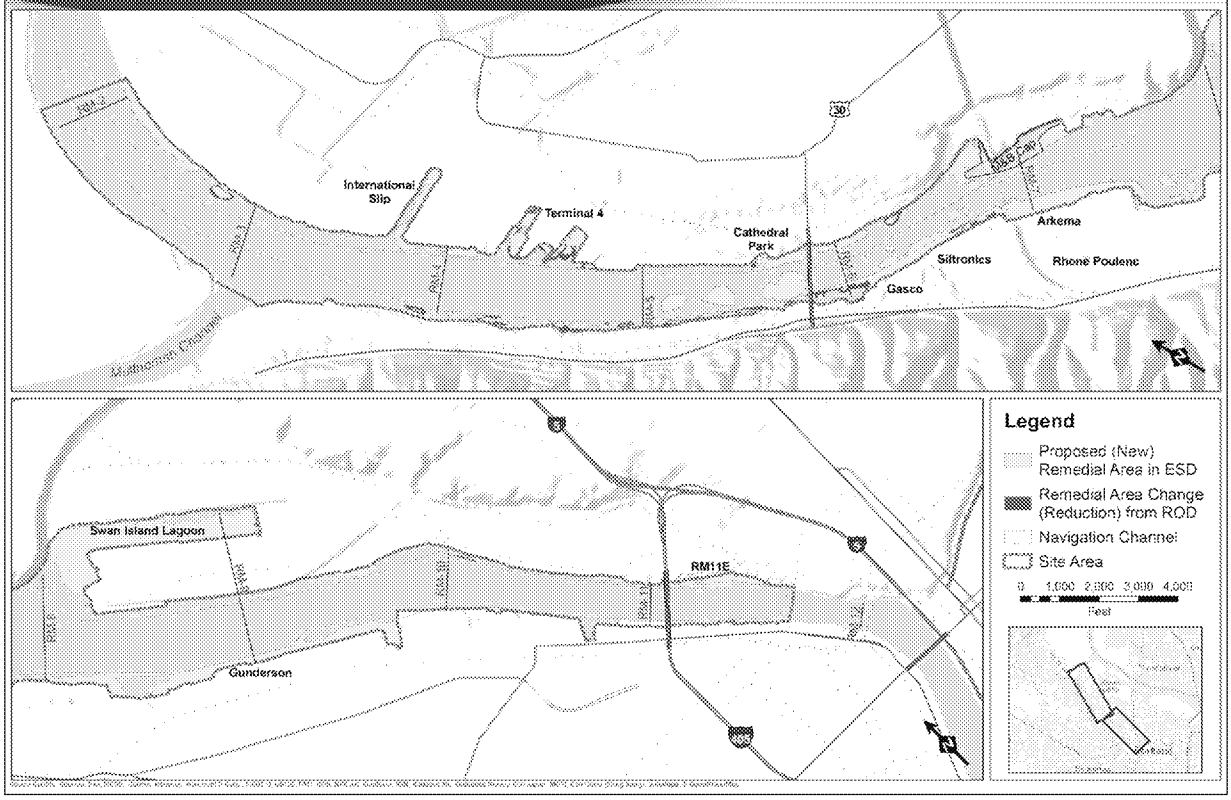
EPA

"BIG PICTURE"

	Total Remedial Area (Acres)	Cubic Yards (CY) Dredging & Riverbank Excavation	Cost
ROD	~364	~3.02 million	~$1.05 billion
Proposed ESD	~347	~2.94 million	~$1.015 billion
Change *From ROD to Proposed ESD*	~17 *4.67% decrease*	~80 thousand *2.66% decrease*	~$35 million *3.33% decrease*

What does this mean for the Portland Harbor Superfund Site?

EPA



How can I be involved?

EPA

- **Provide written comments to EPA on the proposed ESD until Friday, December 21:**
  - Send comments via **e-mail** to HarborComments@epa.gov
  - **Mail** Comments: Attn: Portland Harbor Superfund Comments, U.S. Environmental Protection Agency, 805 SW Broadway, Suite 500, Portland OR 97205
- **Review EPA's November 1st webinar recording of the proposed ESD presentation:** https://bit.ly/2zqWelL
- **Review the full slide deck from EPA's November 20th in-person proposed ESD session:** https://semspub.epa.gov/src/document/10/100122434.pdf
- **Visit EPA's Portland Harbor website for the most up-to-date information:** www.epa.gov/superfund/portland-harbor

Top 10 Questions

EPA

#1: What is the difference between an Explanation of Significant Differences (ESD) and a Record of Decision (ROD) amendment?

Talking Points:
*We are not changing the foundation or the technology of the final clean-up plan with this ESD.

*An ESD is considered a significant difference to the final clean-up plan. It is a non-fundamental change to the Record of Decision or final clean-up plan. Making a change that is significant but we are following all of the previous processes that were applied before for the final cleanup plan. Looking at the same risk assessment process.
----With this ESD, we are not changing the amount of risk that people are exposed to.
*A ROD amendment is considered a fundamental change to the Record of Decision (such as a change in a clean-up technology for the final clean-up plan). A ROD amendment must have a public comment period.
*Timeframe: Normally an ESD doesn't take less time compared to a ROD amendment.

Top 10 Questions

EPA

#2: How common is it to issue an Explanation of Significant Differences (ESD) during the Superfund process?

Talking Points:
*Taking new information into account is part of the Superfund process, so ESDs are not uncommon.
*Other Superfund sites may take this BaP update into account (Wycoff, Duwamish)
*EPA cannot predict what other toxicity value changes will occur, but other toxicity value changes are possible.

Top 10 Questions

EPA

#3: Who issued this change, what was the methodology, and who funded it?

Talking Points:
*Who issued this change:
---EPA's Integrated Risk Information System (IRIS). The last time that BaP was updated was in 1984. The latest update was January 2017.
*Methodology of this change:
---IRIS had enough chemical-specific information on BaP to reassess the chemical.
---IRIS looks at a broad suite of studies for whatever chemical is being assessed to determine toxicity updates. Specifically, a search is conducted in the comprehensive per-reviewed database HERO (Health and Environmental Research Online – https://hero.epa.gov/hero/). You can look at the 'Literature Search. Weight of evidence – good term.
---For BaP about 700 references were cited in the draft toxicological review covering non-cancer and cancer effects.
*Who funded the change:
*EPA was in charge of making this change and led this BaP chemical assessment.
*Some studies that were used in updating this change were not conducted or funded by EPA. EPA pulled it all together and ran the peer review.

Top 10 Questions

EPA

#4: This national change upgrades Benzo[a]pyrene's status from 'probable human carcinogen' to 'human carcinogen.' Why then is EPA saying that BaP is about 7 times less toxic to human health than previously thought?

Talking Points:
*There are 2 parts to EPA's BaP IRIS assessment (1) Considering whether BaP causes cancer and (2) Considering how toxic BaP is to human health or how likely it is to cause cancer
---(1) It is true that in 1984, EPA considered BaP a 'probable human carcinogen' and with the 2017 update, EPA now considers it a 'human carcinogen'. This means that EPA's position is that BaP does cause cancer in humans.
---(2) However, labeling BaP as definitively causing cancer in humans does not reflect how the powerful or potent of a cancer-causing chemical BaP is. That is why EPA has a cancer slope factor (or oral slope factor) for BaP because this estimates how likely BaP is to cause cancer in humans. And EPA has determined from current studies that it is less likely to cause cancer (or a less potent carcinogen) than was previously estimated.
The environmental media that people are exposed to, that relationship is better understood so for a given concentration, we understand a lot better now how likely people are to get cancer (from 1984).
-Could we provide an everyday example? Pumping gas at the gas pump – what is the cancer risk? One in ten million is not very good odds.
-The toxicity is where we are finding more understanding. We are more sure that it is causal but at a higher dose than we realized...

Top 10 Questions

EPA

#5: For the Benzo[a]pyrene change, what does 7 times less potent mean? 7 times less than what?

Talking Points:
*Great question – to help illustrate, let's imagine that we are on an island and there are a million people.
*Initially, we saw that 7 in those million people were getting cancer and now (after reviewing hundred of studies), EPA thinks that it is more like 1 person in a million that will be getting cancer if the concentration of BaP in the beach did not change.

Top 10 Questions

EPA

#6: Did the national EPA Benzo[a]pyrene update consider children and infants who are more vulnerable (for both cancer and non-cancer effects)?

Talking Points:
*EPA's national IRIS update for BaP did consider children's susceptibility in the development of cancer and non-cancer values.
Confirm Infants with Kathleen, what age of children/weight?
*However, EPA's national IRIS update states that age-specific susceptibility should be taken into account when applying this BaP toxicity value (the next question covers this piece).

Top 10 Questions

EPA

#7: Did the Portland Harbor Superfund Site take site-specific cancer & non-cancer BaP human health risk into account with this toxicity change? Were children and infants considered?

Talking Points:
*Yes – the Portland Harbor Superfund Site did take cancer & non-cancer BaP human health risk into account for skin-contact & ingestion exposure scenarios.
*Cancer: The original Portland Harbor Human Health Risk Assessment evaluated combined child/adult exposure cancer-risk scenarios for polycyclic aromatic hydrocarbons (PAHs), so children were considered for the recreational scenario and this was re-done with the revised BaP toxicity value. For dockworker scenario – no kids, for tribal fisher – no kids. Cancer risks are also low – tribal fishing is what the risk (then recreational), then the non-cancer risk, is designed around because recreational risk was not that elevated. There are 1 or 2 beaches where we need to make sure that is the case once we do the sampling.
*****The non-cancer risks will also be addressed with the cleanup levels that are being driven by cancer risk.
Why is it that tribal fisherman present the most risk for BaP/cancer: The amount of exposure you can get from sediment is higher...a line fisherman doesn't get as much exposure. But because tribal fishers pick up nets with sediment, that puts them at much greater risk than your typical line fisherman. Net fishing....

*Non-Cancer: Non-cancer risks are very low. The original Portland Harbor Human Health Risk Assessment also evaluated non-cancer risks for children, but cancer was still found to be the driver. cancer-risk scenarios for polycyclic aromatic hydrocarbons (PAHs), so children were considered and this was re-done with the revised BaP toxicity value.
*Note about cleanup levels & cancer risk versus non-cancer risk: EPA set cleanup levels based on cancer risk because we found those were more stringent than setting cleanup levels on non-cancer risk.

*Infants: Breastmilk is different....

Top 10 Questions

EPA

#8: How was wildlife or ecological health considered with this proposed ESD (both with the national BaP change and the Portland Harbor specific change)?

Talking Points:
*No, the national EPA IRIS update only concerned human health risk, not ecological or wildlife risk.
*However, we did look at how different cleanup level changes based on the BaP change might also have an effect on ecological health (for example, the navigation channel).
**In looking at what kind of change would be appropriate, we had to look at all of the objectives from the ROD, some of them were ecological…didn't want to have any ripple effects.

Top 10 Questions

EPA

#9: Does this proposed ESD take into account mixtures of PAHs? I have heard that mixtures of PAHs may be more toxic than individual chemicals.

Talking Points:
*This change does apply to all 7 carcinogenic (or cancer causing) PAHs as a mixture because the carcinogenicity of other PAHs is assessed relative to BaP through the application of a toxicity equivalency factor (TEF).
*PAHs are one of those groups of chemicals that are assessed in groups, rather than individually.

*For example: For 1 beach, EPA takes the risk of all 7 carcinogenic PAHs into account for a total risk.

Top 10 Questions

EPA

#10: Has there been a site-specific analysis in the area of Gasco and Terminal 4 with the combination of BaP and the other chemicals at the Site based on the new data and how the combination of those chemicals can affect people?

Talking Points:
*No – standard risk assessment practice across the board is to look at each contaminant and evaluates risk for each contaminant, and then add those individual risks for each contaminant (additive risk). This is what EPA did in our risk assessment for Portland Harbor.
*The science is not there yet to assess "synergistic risk" or how different combinations of different chemicals are having an effect on human health.

BONUS QUESTION!

EPA

BONUS: When we submit comments, what is EPA's responsibility to respond to the comments? What could cause EPA to reconsider this change?

Talking Points:
Laura: EPA is recording every comment we receive and will prepare a responsiveness summary showing how we responded to the comments. We will also explain any changes that we made to the proposed ESD based on comments we received.
*Sean: It is not a vote but if there is a flaw in the logic this is our opportunity to fix it. If we receive comments that cause us to think about something we didn't consider before, that could cause us to make a change. During the development of the ROD this occurred with public comments we received.

More Questions?

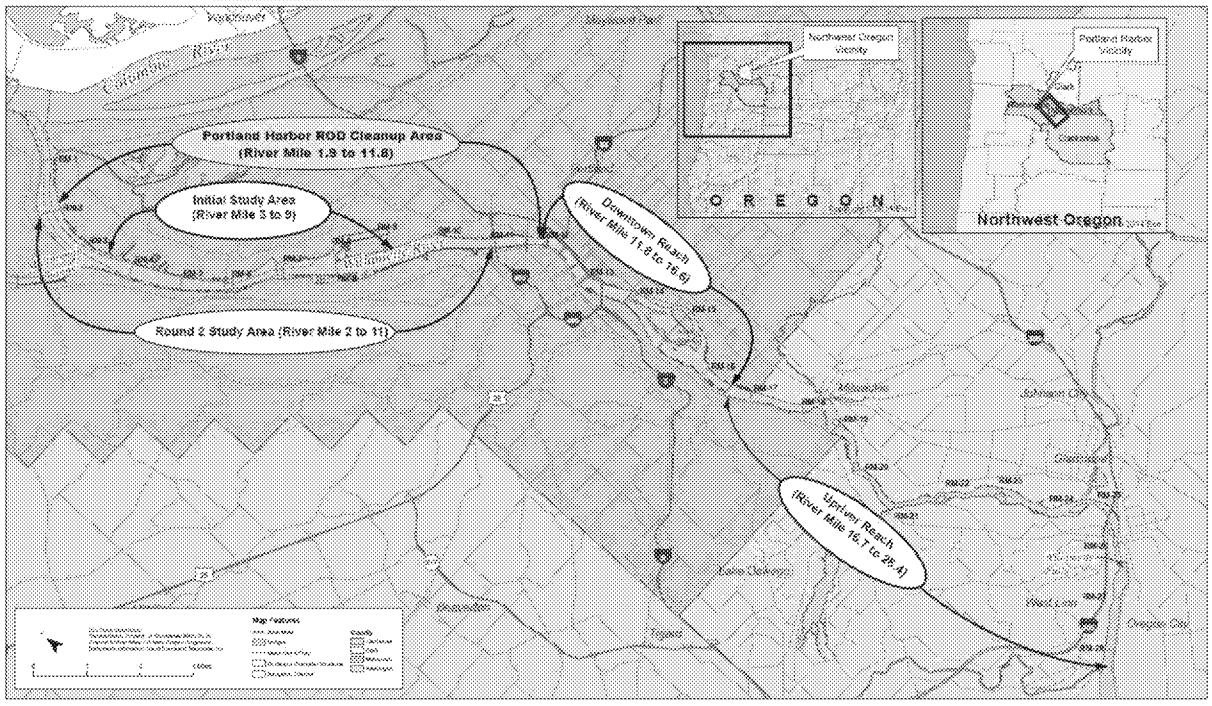
EPA

- **Sean Sheldrake,** EPA Remedial Project Manager
  - **E-mail:** sheldrake.sean@epa.gov
  - **Phone:** 206-553-1220
- **Laura Knudsen,** EPA Community Involvement Coordinator
  - **Email:** knudsen.laura@epa.gov
  - **Phone: 206-553-1838**

Extra Slides

Site Background

EPA



Why did the Benzo(a)pyrene health risk change?

EPA

- EPA's Integrated Risk Information System (IRIS) updated their BaP assessment in 2017
- EPA's IRIS program has worked for over 10 years on this assessment
- The BaP IRIS assessment was extensively reviewed with many agencies and scientists (next slide)
- Current studies show that cancer risk for BaP is about seven times less toxic for people who contact or ingest the chemical

What is the EPA IRIS Program?

- **Created in 1985** to provide a database of human health assessments for chemicals
- **Goal:** Foster consistency in the evaluation of chemical toxicity across EPA

Who reviewed this BaP cancer health risk change?

EPA

- **Some of the other Agencies who reviewed:**
  - Agency for Toxic Substances and Disease Registry
  - Department of Defense
  - National Aeronautics and Space Administration (NASA)
  - National Institute for Occupational Safety and Health
- **Public comments:** Assessment released for public comment in 2013
- **Peer review by 27 independent, expert scientists including:**
  - University of Washington, Seattle WA
  - University of California, Irvine CA
  - University of New Mexico, Albuquerque NM
  - Harvard School of Public Health, Boston MA
  - The University of Texas at Austin, Austin TX
  - University of Illinois, Chicago IL
  - National Institute of Health, Bethesda MD
  - Department of Statistics and Evaluation, American Cancer Society, Atlanta GA

What are PRGs, PTW and RALs?

EPA

- **Cleanup Levels:** Long-term contaminant concentrations that the cleanup must achieve to meet the Remedial Action Objectives. These also may be referred to as Preliminary Remediation Goals (PRGs).
  - Developed for all contaminants of concern on a media-specific (sediment, water, clam tissue, etc…) basis
- **Highly Toxic Principal Threat Waste (PTW):** Contaminant source material that requires special management due to high toxicity
- **Remedial Action Levels (RALs):** Define areas where capping and/or dredging must be conducted to facilitate natural recovery throughout the site
  - Separate RALs established in Portland Harbor for Navigation Channel and nearshore sediments

What does this mean for the Portland Harbor Superfund Site?

EPA

★ = Affected by change

	RAO	Media
Human	RAO 1	Sediment ★
	RAO 2	Biota ★
	RAO 3	Surface Water
	RAO 4	Groundwater
Eco	RAO 5	Sediment
	RAO 6	Biota
	RAO 7	Surface Water
	RAO 8	Groundwater
H&E	RAO 9	Riverbanks

Remedial Action Objectives (RAOs)

- **RAOs:** Media specific goals for protecting human health and the environment
- Cleanup plan established RAOs and cleanup levels for sediment, groundwater, surface water, and river bank soils
- Any change in remedial action levels must consider impact on all RAOs

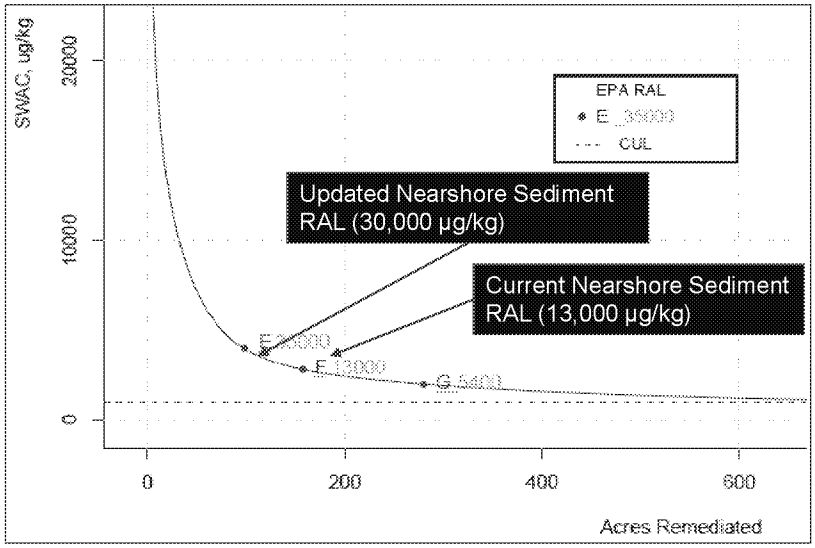
What does this mean for the Portland Harbor Superfund Site?

EPA

Scenario	Impacted Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment cleanup level	Beach Areas	12 µg/kg (parts per billion)	85 µg/kg
Direct Contact cPAH In-Water Sediment cleanup level	Nearshore sediment (excluding beach areas)	Not Included (106 µg/kg)	774 µg/kg
Clam Tissue Consumption cPAH Target Level	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment cleanup level	Site-Wide	**3,950 µg/kg** *(This should have been 39.5 µg/kg)*	1,076 µg/kg
Benthic Risk total PAH Sediment cleanup level	Site-Wide	23,000 µg/kg	23,000 µg/kg *No Change Proposed*
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *No Change Proposed*

Proposed Nearshore Total PAH RAL Change

- **EPA proposes revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg:**



Why did the proposed navigation channel total PAH RAL not change?

EPA

- **The total PAH navigation channel RAL of 170,000 µg/kg <u>will not change</u> because of human health and benthic (critters that fish eat) risk that is present**

- **Other Issues:**
  - The navigation channel has benthic community habitat
  - The total PAH cleanup level of 23,000 µg/kg is exceeded in the navigation channel between RM 5 – 7 with unacceptable risk to the benthic community
  - Natural recovery processes such as sediment deposition within the navigation channel are not happening for contaminated areas between RM 5 – 7
  - An increase in PAH loading to surface water is happening downstream of RM 6.3

Development of Human Health Clam Consumption Clean-up Levels

EPA

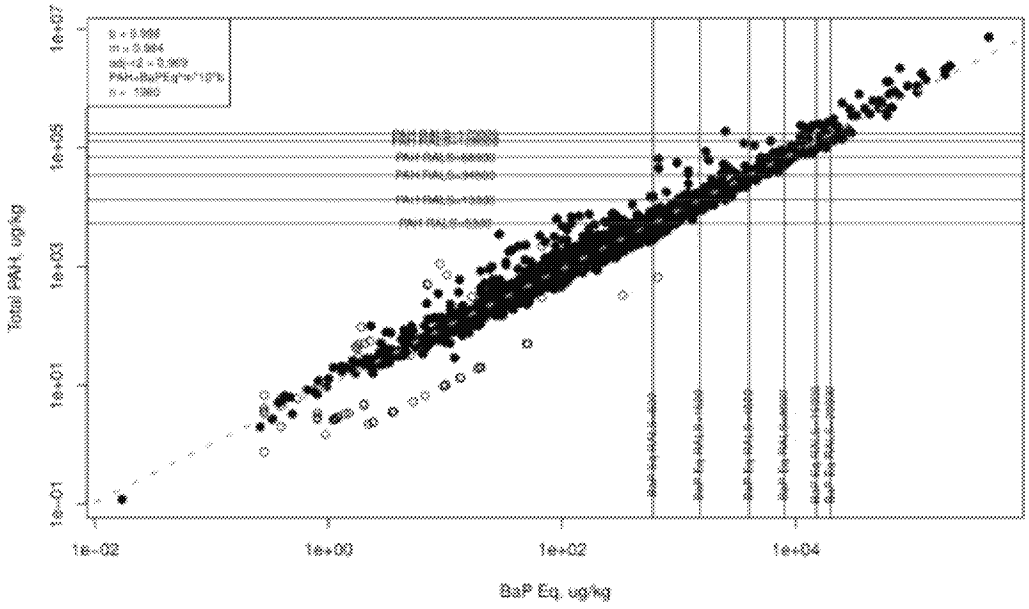
- The human health clam consumption target tissue level increases by a factor of 7.3 from 7.1 µg/kg to 51.6 µg/kg due to the BaP health risk change

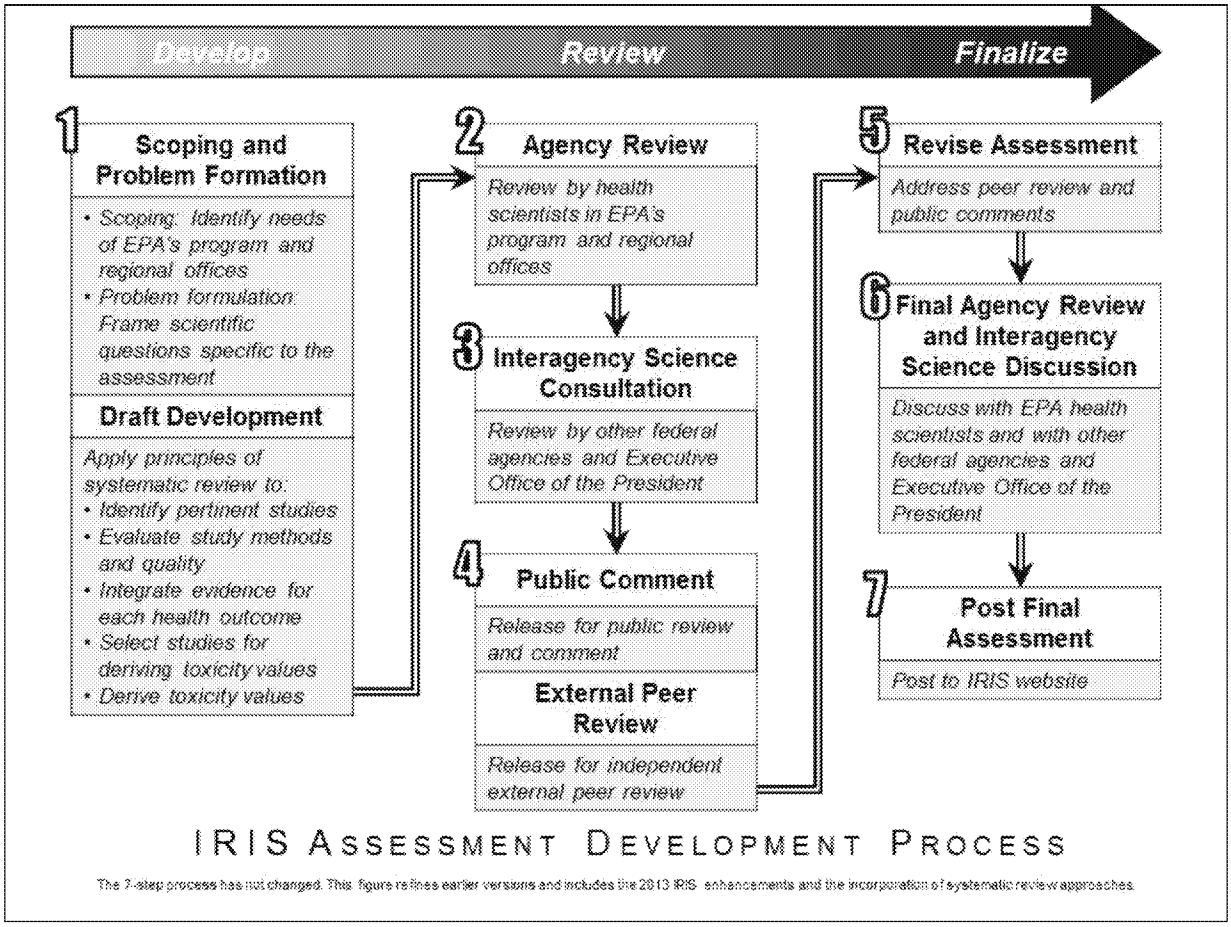
- The relationship between cPAH (BaP Eq) clam tissue levels is a **non-linear** log-log relationship represented by the following equation:

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue}) - (\ln(f_{lipid}) - \ln(CF) + 2.47)}{0.6} + ln(f_{oc})$$

- Based on the non-linear relationship, the cPAH human health clam consumption CUL increases from 39.5 to 1,076 µg/kg due to the BaP health risk change

Total PAH - cPAH Relationship




Develop
Review
Finalize
1 Scoping and Problem Formation
• Scoping: Identify needs of EPA's program and regional offices
• Problem formulation: Frame scientific questions specific to the assessment
Draft Development
Apply principles of systematic review to:
• Identify pertinent studies
• Evaluate study methods and quality
• Integrate evidence for each health outcome
• Select studies for deriving toxicity values
• Derive toxicity values
2 Agency Review
Review by health scientists in EPA's program and regional offices
3 Interagency Science Consultation
Review by other federal agencies and Executive Office of the President
4 Public Comment
Release for public review and comment
External Peer Review
Release for independent external peer review
5 Revise Assessment
Address peer review and public comments
6 Final Agency Review and Interagency Science Discussion
Discuss with EPA health scientists and with other federal agencies and Executive Office of the President
7 Post Final Assessment
Post to IRIS website
IRIS ASSESSMENT DEVELOPMENT PROCESS
The 7-step process has not changed. This figure refines earlier versions and includes the 2013 IRIS enhancements and the incorporation of systematic review approaches.

IRIS References for BaP Review

EPA

Approximately **700 references** cited in the Draft Toxicological Review

- Developmental toxicity: **37 references**
- Reproductive toxicity: **70 references**
- Immunotoxicity: **58 references**
- Other Toxicological Effects: **27 references**
  - Forestomach toxicity: **5 references**
  - Hematological toxicity: **3 references**
  - Liver toxicity: **3 references**
  - Kidney toxicity: **3 references**
  - Cardiovascular toxicity: **11 references**
  - Neurological toxicity: **12 references**
- Carcinogenicity: **171 references**
- Toxicokinetic: **115 references**
- Genotoxicity: **196 references**

Doesn't a decrease to 1 per mg/kg-day from 7.3 per mg/kg-day mean BaP is more carcinogenic?

EPA

- **Short Answer**: No
- **This decrease means that someone has less risk of developing cancer if they are exposed to BaP**

Cancer Risk = Lifetime Average Daily Intake x Cancer Slope Factor (CSF)

If **CSF** goes down, **Risk** goes down

- **However, the cleanup level may* increase (less restrictive) because one divides by the cancer slope factor (CSF):**

$$CUL_{sediment} = \frac{Target\ Excess\ Cancer\ Risk\ \text{x}\ Averging\ Time}{CSF\ x\ Exposure\ x\ Age\ Adjusted\ Dermal\ Contact\ x\ 10{-}6\ kg/mg}$$

- **Remedial Action Levels (RALs) may* also increase to prevent cleaning up sediments that do not pose unacceptable risk**

**Depends on the area within the Site*

Has EPA updated health risk values to be less toxic for other chemicals?

- IRIS does not keep track of this type of information.
- IRIS evaluates the available data with current methodologies to interpret the currently available science as best we can.
- This evaluation can lead to characterizations of toxicity that may be relatively more or less toxic than previous characterizations.

Did EPA consider the non-cancer reference dose (RfD) change?

EPA

- **Short answer:** Yes, EPA previously considered the RfD change.
- **Long answer:**
  - The Toxicological Review of Benzo(a)pyrene (USEPA, 2017) also included a non-cancer oral reference dose of 0.0003 (mg/kg-day).
  - This value was utilized in the development of Preliminary Remediation Goals (PRGs) for the Portland Harbor Site (See Table B3-2 of the Portland Harbor Feasibility Study).
  - PRGs for non-cancer risk presented in Appendix B of the Portland Harbor Feasibility Study, are significantly higher than cancer risk and thus are not a factor for developing PAH Cleanup Levels at the Portland Harbor Site.

What was the exact cancer slope factor change for BaP?

EPA

PREVIOUS CSF	REVISED CSF* **Revised January 19, 2017*
7.3 per mg/kg-day	1 per mg/kg-day

Application of Benzo(a)pyrene Potency Equivalence Factor

EPA

- The carcinogenicity of PAHs is assessed relative to benzo(a)pyrene using a potency equivalence factor (PEF)
  - PEFs range between 1 and 0.001 for individual carcinogenic PAHs
  - Allows estimation of total carcinogenic PAH risk measured as benzo(a)pyrene equivalents (BaPEq)
  - The BaP slope factor change affects all carcinogenic PAHs

Location	Chemical	EPC (ug/kg)	B(a)P CSF (mg/kg-day)$^{-1}$	Potency Equivalent Factor	Adjusted CSF (mg/kg-day)$^{-1}$	Daily Dose (mg/kg-day)	Cancer Risk
RM 7 West	Benzo(a)anthracene	2.2E+03	1	0.1	0.1	7.20E-07	7.E-08
RM 7 West	Benzo(a)pyrene	1.7E+03	1	1	1	5.50E-07	6.E-07
RM 7 West	Benzo(b)fluoranthene	4.5E+03	1	0.1	0.1	1.45E-06	1.E-07
RM 7 West	Benzo(k)fluoranthene	1.4E+03	1	0.01	0.01	4.60E-07	5.E-09
RM 7 West	Chrysene	-	1	0.001	0.001	-	-
RM 7 West	Dibenzo(a,h)anthracene	7.1E+02	1	1	1	2.30E-07	2.E-07
RM 7 West	Indeno(1,2,3-cd)pyrene	1.4E+03	1	0.1	0.1	4.50E-07	5.E-08
RM 7 West	Total cPAHs as B(a)P Equivalents						**1.E-06**

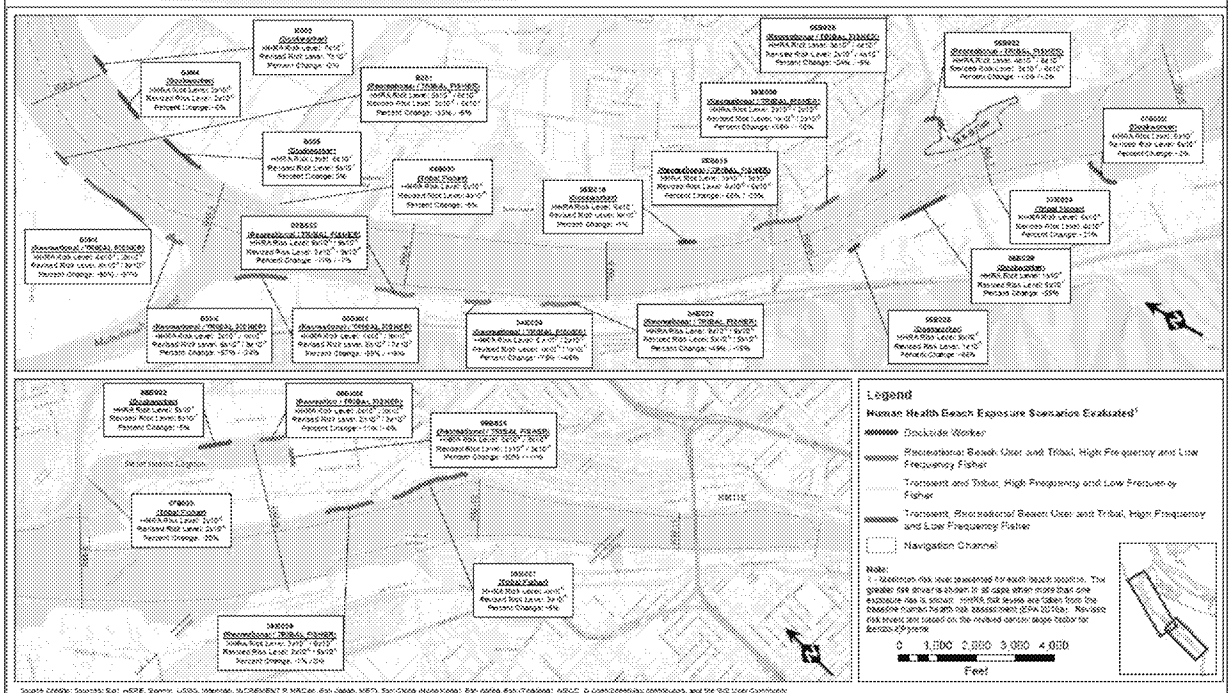
Evaluation of Children and Infants in the Portland Harbor HHRA

EPA

- **Carcinogens**
  - The **Human Health Risk Assessment (HHRA)** evaluated a combined adult/child exposure scenario for recreational beach users and all fish consumption exposure scenarios
  - The HHRA did not consider children in the clam and crayfish consumption exposure scenario
- **Non-carcinogens**
  - The HHRA evaluated a child recreational beach user and all fish consumption exposure scenarios
  - The HHRA evaluated breastfeeding Infants for all adult exposure scenarios for select bioaccumulative chemicals (PCBs, DDx, PBDEs, and dioxin and furans)
  - The HHRA did not consider children in the clam and crayfish consumption exposure scenario

Human Health Beach Exposure

EPA



Legend

Human Health Beach Exposure Scenarios Evaluated[1]

- Dockside Worker
- Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Transient and Tribal, High Frequency and Low Frequency Fisher
- Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Navigation Channel

Note:

1 - Maximum risk level selected for each beach location. The greater risk driver is shown in all cases when more than one exposure risk is shown. HHRA risk levels are taken from the baseline human health risk assessment (EPA 2010a). Revised risk levels are based on the revised cancer slope factor for benzo-a-pyrene.

0 1,500 2,000 3,000 4,000

Feet

Source Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

f_{mbm}	=	fraction of fat in breast milk
CR_{milk}	=	consumption rate of breast milk (kg/day)
ED_{inf}	=	exposure duration of breastfeeding infant (days)
BW_{inf}	=	average infant body weight (kg)
AT	=	averaging time (days)

Additional information regarding the evaluation of persistent, bioaccumulative COPCs is presented in Section 5.1.3.

3.5.7 Calculation of Intake for Mutagenic COPCs

Early-in-life susceptibility to carcinogens has long been recognized by the scientific community as a public health concern. In its revised Cancer Assessment Guidelines, EPA concluded that existing risk assessment approaches did not adequately address the possibility that exposures to a chemical in early life may can result in higher lifetime cancer risks than a comparable duration adult exposure (EPA 2005b). In order to address this increased risk, the agency recommends use of a potency adjustment to account for early-in-life exposures. When no chemical-specific data are available to assess directly cancer susceptibility from early-life exposure, the following default Age Dependent Adjustment Factors (ADAFs) are recommended to be used when evaluating a carcinogen known to cause cancer through a mutagenic mode of action:

- 10-fold adjustment for exposures during the first 2 years of life;
- 3-fold adjustment for exposures from ages 2 to <16 years of age; and
- No adjustment for exposures after turning 16 years of age.

Of the COPCs evaluated in this HHRA, EPA considers that there is sufficient weight-of-evidence to conclude the carcinogenic PAHs cause cancer through a mutagenic mode of action.

The equations used to calculate intake for mutagenic COPCs are presented in the following sections. The exposure parameters are presented in Tables 3-21 to 3-25.

3.5.7.1 Incidental Ingestion of Sediment

The following equation was used to calculate the intake in mg/kg-day for mutagenic COPCs associated with incidental ingestion of soil or sediment:

$$CDI / LADI = \frac{C_s \times \left(\frac{(ED_{0\text{-}2} \times IRS_c) \times 10}{BW_c} + \frac{(ED_{2\text{-}6} \times IRS_c) \times 3}{BW_c} + \frac{(ED_{6\text{-}16} \times IRS_a) \times 3}{BW_a} + \frac{(ED_{16\text{-}30} \times IRS_a) \times 1}{BW_a} \right) \times EF}{AT}$$

DELIBERATIVE – CONFIDENTIAL

Portland Harbor Proposed ESD || Top 10 Questions + Bonus Question

December 12th, 2018 EPA Portland Harbor Public Forum || Revolution Hall in SE Portland

1. **What is the difference between an Explanation of Significant Differences (ESD) and a Record of Decision (ROD) amendment?**
   - We are not changing the foundation or the technology of the final clean-up plan for the Portland Harbor Superfund Site with this ESD.
   - **An ESD** is considered a significant difference to the final clean-up plan; it is not a fundamental change to the final clean-up plan (also called Record of Decision or ROD). We are making a change that is significant, but EPA is still following all the previous processes that were applied before for the final cleanup plan (the same risk assessment process). An ESD does not require a public comment period.
   - **A ROD Amendment** is considered a fundamental change to the final cleanup plan, such as a change in clean-up technology. A ROD must have a public comment period and typically takes more time than an ESD.

2. **How common is it to issue an Explanation of Significant Differences (ESD) during the Superfund process?**
   - It is **not uncommon** to issue an ESD during the Superfund process because taking new information into account is part of the Superfund process.
   - Other Superfund Sites may take this BaP update into account (Wycoff, Duwamish)
   - EPA cannot predict what other toxicity value changes will occur down the line, but other chemical toxicity value changes are possible.

3. **Who issued this change, what was the methodology, and who funded it?**
   - **Who Issued this Change:** EPA's Integrated Risk Information System (IRIS). The last time BaP was updated was in 1984. The latest update was January 19, 2017.
   - **Methodology of this Change:** IRIS had enough chemical-specific information on BaP to reassess the chemical. IRIS looked at a hundreds of peer-reviewed studies for BaP to determine the toxicity update. About 700 references covering non-cancer and cancer effects for BaP were cited in the IRIS report for BaP.
   - **Who Funded this Change:** EPA oversaw making this change and led this BaP chemical assessment. Some studies that were used in updating this change were not conducted or funded by EPA.

4. **This national change upgrades Benzo[a]pyrene's status from 'probable human carcinogen' to 'human carcinogen.' Why then is EPA saying that BaP is about 7 times less toxic to human health than previously thought?**
   - **There are 2 parts to the BaP IRIS assessment (and all assessments):**
     - **(1) Considering whether BaP causes cancer:** With the January 2017 update, EPA's position is that BaP causes cancer in humans. However, this does not reflect how powerful or potent of a cancer-causing chemical BaP is.
     - **(2) Considering how likely BaP is to cause cancer:** With the January 2017 update, EPA has determined from current research that BaP is less likely to cause cancer than was previously thought. The relationship is better understood between how people are exposed to BaP in the environment at a given BaP concentration and the corresponding human health risk, so

ED_002671A_00023075-00001

we understand a lot better now how likely people are to get cancer from BaP than we did in 1984.

5. **For the Benzo[a]pyrene change, what does 7 times less potent mean? 7 times less than what?**
   - To help illustrate what this means, let's imagine that we are on an island and there are a million people. Initially, EPA saw that 7 in those million people were getting cancer.
   - Now (after reviewing hundreds of studies), EPA thinks that it is more likely that 1 person in a million will develop cancer if the concentration of BaP in the beach did not change.

6. **Did the national EPA Benzo[a]pyrene update consider children and infants who are more vulnerable (for both cancer and non-cancer effects)?**
   - EPA's national IRIS update for BaP did consider children's susceptibility in the development of cancer and non-cancer values.
   - However, EPA's national IRIS update states that age-specific susceptibility should be considered when using the BaP toxicity value.
   - The Portland Harbor Superfund Site applied age dependent adjustment factors (ADAFs) for exposure to infants and children.

Commented [KL1]: This is per the excerpt from the HHRA. I do want to run this by Eric if possible, however, since he thought we had no taken infants into account at all with the BaP change.

7. **Did the Portland Harbor Superfund Site take site-specific cancer & non-cancer BaP human health risk into account with this toxicity change? Were children and infants considered?**
   - Yes, the Portland Harbor Superfund Site did take cancer & non-cancer BaP human health risk into account for skin contact (dermal exposure) and ingestion of BaP. After evaluating all relevant exposure routes and populations, EPA found that tribal fishers presented the most human health risk from exposure to BaP because the amount of exposure to sediment is higher as a tribal fisher.
   - Children were considered for cancer health risks. For cancer, the Portland Harbor Human Health Risk assessment evaluated the combined child/adult exposure cancer-risk scenarios for polycyclic aromatic hydrocarbons (PAHs), so children were considered for the recreational scenario and this was re-done with the revised BaP value.
   - Children were considered for non-cancer health risks. The non-cancer risks at the site are very low & were also evaluated for children. However, cancer-risk was found to be the main cause of human health concern, and if cancer health risk was addressed; non-cancer risks would also be addressed.
   - Infants --- still working on this response.....

Commented [KL2]: Per my comment above, it seems like infants were assessed to some degree because of the ADAFs for cancer (per the HHRA excerpt)? Eric, could you please weigh in? Thank you!

8. **How was wildlife or ecological health considered with this proposed ESD (both with the national BaP change and the Portland Harbor specific change)?**
   - No, the national EPA IRIS update only concerned human health risk not ecological or wildlife risk.
   - However, for the Portland Harbor Superfund Site we did look at how different cleanup level changes based on the BaP update might have an effect on ecological health (for example, in the navigation channel).
   - In looking at what kind of change would be appropriate at the Portland Harbor Superfund Site, we had to look at all of the objectives from the final cleanup plan and some of those were ecological.

We did not want any change we made to polycyclic aromatic hydrocarbons (PAHs) to human health objectives to have any ripple effects to the ecological objectives.

9. **Does this proposed ESD take into account mixtures of PAHs? I have heard that mixtures of PAHs may be more toxic than individual chemicals.**
   - Yes. This change does apply to all 7 cancer causing PAHs as a mixture.
   - The carcinogenicity of other PAHs is assessed relative to BaP through the application of a factor that measures how toxic the other PAHs are in relation to BaP.
   - PAHs are one of those groups of chemicals that are assessed in groups, rather than individually.

10. **Has there been a site-specific analysis in the area of Gasco and Terminal 4 with the combination of BaP and the other chemicals at the Site based on new data and how the combination of those chemicals can affect people?**
    - No. Standard risk assessment practice is to look at each contaminant individually and evaluate the risk for that contaminant on human health. Then those individual risks for each contaminant are added to form a total risk value (additive risk).
    - Synergistic effects of one chemical interacting with other chemicals is not taken into account in standard risk assessment practice and as a result, was not evaluated at Portland Harbor.

11. **(BONUS QUESTION) When we submit comment, what is EPA's responsibility to respond to the comments? What could cause EPA to reconsider this change?**
    - EPA is recording every comment that we receive and will prepare a responsiveness summary showing how we responded to the comments.
    - We will also explain any changes that were made to the proposed ESD base on the comments we received.
    - If we receive comments that cause us to think about something we did not consider before, that could cause us to make a change. During the development of the final cleanup plan, this occurred with public comments we received.

Message

From: Knudsen, Laura [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=EE4D40361DC54627953429D619F5C808-KNUDSEN, LAURA]
Sent: 12/10/2018 10:42:48 PM
To: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Young, Hunter [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a3a74b6a034a4542abf33d93e285834e-Young, Hunt]; Congdon, Julie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3d74a01220c747c19b2a1d7f3e111f02-Congdon, Julie]; Mbabaliye, Theogene [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2f4e21654dc14262a6a2592614fa1405-Mbabaliye, Theogene]
CC: Kizz Prusia [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=userf5c493f6]; Annie Kilburg [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user3511c0d0]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]
Subject: Final Logistics E-mail for 12/12 Portland Harbor Meetings || Thank You All!
Attachments: 12-12-18 FINAL Comm Leader EPA DEQ Ant Agenda v.12-10-18.docx; 12-12 FINAL Public Forum Evening Ant Agenda (v. 12.10.18).docx

Importance: High

Hello team! The time has come for another set of Portland Harbor quarterly forum meetings – yay! Thank you all so much for your time, energy, and awesomeness!

Arrival Time & Place: Unless your name is Annie or Kizz, please plan to arrive at **Revolution Hall** at 2:30pm (**1300 SE Stark Street, Portland OR 97214**) this coming Wednesday (12/12).

Proposed Car and/or Public Transportation Options for EPA team to Revolution Hall in SE Portland:
Note: Laura, Annie & Kizz will be arriving at Revolution Hall pretty early & will get to the venue on their own.

- **Julie's Car (**Leaving no later than 2:15pm from the Oregon Operations Office): Eva, Josie, Theo
- **OOO Durango** (Laura has reserved in Hunter's name for whomever needs it just in case): Hunter (*if you decide to take this car, could you please take the lead in driving?*), Sean (*if he is not biking*), Davis
- **Public Transportation Options (if you don't want to or can't go in a car):** Revolution Hall is on the East Side of Portland and is located within one block of TriMet bus lines 70 and 15, and five blocks from lines 12, 29, and 20.

Parking Options:

- **Free Street Parking:** Free, non-metered street parking is available starting at **SE 16th and Stark**, two blocks to the West side of the building.
- **Parking Lots:** The Revolution Hall parking lots are only available to the general public after **6:00 p.m.** If you arrive after this time, there is a parking lot South of the building.

Food: I am compelled to remind you that while the Pre-Remedial Design Group is providing food for the evening public forum, technically EPA employees are not supposed to eat this food. That being said, no signs

will be posted by the Pre-Remedial Design group this time around indicating food fees in order for EPA or federal staff to pay for food on their own, because no one did this for the September public forum.

Media Policy: Quick recap is that our media policy is to steer people to Sean & Davis (as our spokespeople) but to encourage people to go through all the booths & listen to the proposed ESD presentation first before conducting interviews. For any videotaping requests, please send people to Laura. *Please do try and take some pictures at the event (no kids though) for Suzanne to utilize for social media* ☺

Final Annotated Agendas: Attached are the community leaders annotated agenda & the evening open house/public forum agenda. Please note the following:

- The community leader agenda has changed slightly so we will begin with the community leader presentation & group discussion of the subgroup recommendation. Then we will continue into site-wide updates with the remaining time.
- Currently, I have marked down Julie & Theo to leave the community leaders meeting a little bit early if possible (slightly before 5pm) to help direct booth folks coming in (everything should be set-up booth-wise, we just need some folks to help direct people to their booths). Kizz is the executive booth director and will join you as soon as possible.

Thank you all and please let me know if you have any questions and please feel free to call or text me at any time!

Laura Knudsen
U.S. Environmental Protection Agency | Region 10
206-553-1838 | knudsen.laura@epa.gov

"Be kind whenever possible. It is always possible."
~Dalai Lama

FINAL ANNOTATED PROPOSED AGENDA

Portland Harbor Superfund Site EPA Open House & Public Forum

Date/Time/Location: Wednesday, December 12th, 2018
5:30 p.m. - 8:30 p.m.
Revolution Hall • 1300 SE Stark Street, Portland, OR 97214

We invite and encourage you to attend the December 12th Open House and Public Forum from 5:30 p.m. – 8:30 p.m. Based on feedback, the December 12th meeting will be broken into two sections as follows.

1. **Open House/Tabling/Booths: 5:30 p.m. – 7:00 p.m.** ***(Location: 2nd Floor Hallway)***
2. **Public Forum: 7:00 – 8:30 p.m.** ***(Location: Room 101 on ground floor)***

Note for Attendees: EPA is organizing this meeting, with support from the Oregon Department of Environmental Quality (DEQ) and the Portland Harbor Community Advisory Group (CAG), to provide open house tabling/booths and a public forum for members of the public to get updates on the Portland Harbor Superfund Site, and to have the opportunity to ask questions of the Potentially Responsible Parties (PRPs).

Food will be provided by the Pre-Remedial Design Group and River Mile 11 East Group and will include gluten-free, vegan, and vegetarian options from Miss'ipi Chef, a minority- and women-owned business.* ***The food will be served on a first-come first-served basis.*

Time	Agenda Topic	Annotated Notes Will be removed before final version of agenda.
Up until 5:30 p.m.	***Greet Meeting Attendees***	• **5pm: Julie & Theo** help direct booth participants to their areas and answer questions. Kizz will join as soon as possible • Greet meeting attendees and guide them to open house booths/tabling. Let them know that the plenary portion of the meeting begins at 7:00 p.m. in the 101 Room. • Confirm that public forum sign is outside the venue.
5:30 p.m. – 7:00 p.m.	**Open House** ***(Location: 2nd Floor Hallway)*** • Overview of the Open House format, including descriptions of the booths offered, and the accompanying materials. • Booths will be set-up focusing on the following topics: ○ **Booth #1**: State of Oregon ○ **Booth #2**: Willamette Cove ○ **Booth #3**: Superfund 101 & Proposed Explanation of Significant Differences (ESD) ○ **Booth #4**: Community Advisory Group (CAG) ○ **Booth #5**: Portland Harbor Community Coalition ○ **Booth #6**: Terminal 4 ○ **Booth #7**: Source Control (DEQ) ○ **Booth #8**: Fish Consumption (Multnomah County) ○ **Booth #9**: City of Portland	• Ask booth people to provide a 10 minutes warning and if they still have questions to write them down on cards at the booth and give them to the main person at the booth. Then the booth person will keep it and address it during the panel. • Ensure booth people know where to go at 7:00 for report-out (main microphone stand). • At 6:50 p.m. start sending people back to the conference room. • **Proposed EPA Staff Assignments:** ---Sign-in Table: Julie & Theo ---Floater: Annie (help Kizz) ---Willamette Cove: Eva ---Superfund 101 & Proposed ESD: Laura ---Terminal 4: Josie ---Pre-RD: Davis ---Gasco: Sean ---River Mile 11 East: Hunter

Time	Agenda Topic	Annotated Notes Will be removed before final version of agenda.
	○ **Booth #10**: Pre-Remedial Design & Baseline Sampling ○ **Booth #11**: Gasco (NW Natural) ○ **Booth #12**: River Mile 11 East	
Prior to 7:00 p.m.	***Portland Harbor Slide Show***	Set up Laura's computer with: **(1)** the slide show and **(2)** the Proposed ESD PowerPoint
7:00 - 7:20 p.m.	**Welcome and Overview *(Location: Room 101 on ground floor)*** • **Annie Kilburg**, Facilitator (Triangle Associates) • **Laura Knudsen**, EPA Region 10 Community Involvement Coordinator (CIC) • **Jackie Calder**, Community Advisory Group (CAG)	**Welcome and Overview** • Annie welcomes and introduces Sheryl • EPA staff will provide a short welcome and introduction. • Annie will provide overview of Triangle's role and ask for EPA and DEQ introductions (name and title) • Annie shares that there is **food in the back** *courtesy of the Pre-Remedial Design Group and River Mile 11 East from Miss'ipi Chef, a minority- and women-owned business* and restrooms out the doors. • Annie introduces Laura • Laura acknowledges any congressional representatives, tribal elders, members, or representatives in the audience. • Laura gives September 12th feedback and Technical Assistance Grant (TAG) announcement with Theo (5 mins). • Jackie provides brief CAG update. • Annie will go over ground rules. • Annie will note that a summary of today's public forum will be provided afterwards via EPA's Portland Harbor listserv. • Annie will provide an overview of the agenda, open house format, and topic
7:20 – 7:40 p.m.	**Report-Outs from Open House Tables/Booths**	• Annie will introduce report-outs, go in order of booths. • Report-outs from open house booths • Two minutes per booth; Kizz use time cards if needed. • Ask EPA if they have anything to add to the PRPs report-outs • Kizz coordinates report-out order at the microphone
7:40– 8:25 p.m.	**Proposed Explanation of Significant Difference (ESD) Brief Overview with Question & Answer Opportunity** • Facilitator will introduce topic • Presentation by EPA of proposed ESD	• Q&A etiquette: ○ State your name, affiliation, and who your question is for. ○ Stay on topic to the site and the specific action areas. ○ This time is for questions only, please remain brief.

Time	Agenda Topic	Annotated Notes Will be removed before final version of agenda.
	• Question and answer session (no formal public comments)	○ Go up to the standing microphone and begin to form a line. ○ If you are unable to go up to the microphone, please raise your hand and Kizz will come to you with a microphone. ○ If you would like to write your question down and have me read it, please do so and raise your hand for Kizz to pick it up. Remember to put your name, affiliation, and who your question is for on the card. • The cards can also be used to suggest future meeting topics or provide feedback to EPA on this meeting. These cards can be turned in at any time to Kizz. If you cannot find Kizz, please give them to me. • Annie watch for Davis' tent card going up and Laura's pen going "no".
8:25 – 8:30 p.m.	**Wrapping Up and Next Steps** **Annie Kilburg**, Facilitator (Triangle Associates) • Next meeting is tentatively scheduled for Wednesday, March 13th.	• We will provide all of the cards to EPA with suggestions on future topics and feedback on public forum.
8:30 p.m.	**Adjourn Meeting**	

Portland Harbor EPA and DEQ Contact Information

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Additional Booth Participant Contact Information

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Terminal 4
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Gasco (NW Natural)
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Pre-Remedial Design Group
Please contact Laura Knudsen due to the short duration of this project ([HYPERLINK "mailto:knudsen.laura@epa.gov"], 206-553-1838)

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FINAL ANNOTATED AGENDA
Portland Harbor Superfund Site
Community Leader Briefing and Discussion with EPA & DEQ

**Please do not share this agenda as this is an invite-only meeting for community leaders and space is limited*

Wednesday, December 12th, 2018
Time: 3:00 p.m. - 5:00 p.m.
Room: Sunset Room (2nd Floor)
Revolution Hall • 1300 SE Stark Street, Portland, OR 97214

Agenda Topics:

- At this meeting, you will hear about the follow-up from the September meeting visioning exercise, including subgroup in-between meeting work and proposed recommended next steps to discuss potential community involvement approaches going forward.
- EPA and DEQ will listen to community leaders about their vision for the future of this group.
- Updates regarding the Community Involvement Plan (CIP), proposed Explanation of Significant Differences (ESD), Technical Assistance Grant (TAG), and site-wide and specific areas at the Portland Harbor Superfund Site.

Notes for Attendees:

- EPA and DEQ are providing you with information so that you can communicate it with members of your community.
- Please ask questions to get the information and context that you need to communicate with your constituents or community members.

Time	Agenda Topic	Annotated Notes - Will be removed before final version.
Up to 3:00 p.m.	**Portland Harbor Slide Show**	• Put slideshow up on projector. • Post ground rules on flip chart, map, EJ posters, and story map (including dots)
3:00-3:15 p.m.	**Introductions, Agenda and Meeting Protocols** **Annie Kilburg**, Facilitator (Triangle Associates) **Laura Knudsen**, EPA Region 10 Community Involvement Coordinator	**Introductions** • Total time for topic: 15 mins • Annie will go over the following: o HOLD: For EPA staff that can provide a welcome (Sheryl). o Third party neutral facilitator will highlight experience with other environmental policy projects for those that have not met me. o Lead a round of introductions for community leaders at the table and audience members. o Pass around the sign-in sheet. o Reminder regarding tent card protocol. o Acknowledge everyone's time. o Acknowledge any tribal representatives, staff or members in the audience. Thank them for their time and for traveling to the meeting. o Provide community leaders and audience policy. The intent of these meetings is to provide a briefing space to help the community build capacity to engage in the ongoing cleanup directly with EPA and DEQ, which is referenced in the Community Involvement Plan. Those sitting at the table represent their communities and are speaking on behalf of them. All other attendees are welcome to sit in listening mode in the audience and to participate in the visioning exercise. o Give overview of 9/12 meeting notes and visioning exercise.

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Time	Agenda Topic	Annotated Notes - Will be removed before final version.
		Agenda and Meeting Protocols • A meeting summary will be written for those who are unable to attend. • Large notecards will be provided to everyone for feedback about the meeting or to write down questions that were not answered during the meeting and follow-up would be appreciated. Please put your name, affiliation, and who your question is for on the card. • Go over ground rules and tent card protocol. • Go over agenda and materials.

3:15 – 4:10 p.m.	**Community Leaders Visioning Subgroup Updates and Discussion**
	
	Annie Kilburg, Facilitator (Triangle Associates)
	
	Jackie Calder, Portland Harbor Community Advisory Group
	
	Cassie Cohen, Portland Harbor Community Coalition
	
	• Subgroup presents overview of visioning exercise process and steps taken since September meeting to get to recommendations
	• Questions/Answers/Group Discussion
	• Summarize the recommended steps and issues shared by community leaders (if time allows)
	• Confirm approach between now and March meeting
		• Total time for topic: 55 mins
		• Kizz: Put documents up on the screen; hand slide changer to Jackie or Donovan
		• Flow of presentation is as follows:
		  ○ Annie introduces the presentation and provides overview
		  ○ Jackie presents the Community Leader Subgroup themes
		  ○ Cassie presents the final recommendation and graphic slide
		• At 4:00 - strive to summarize where we landed and next steps on this exercise

4:10 – 4:20	***Break***	
4:20 – 4:40 p.m.	**Overview of Site-Wide and Specific Area Updates at the Portland Harbor Superfund Site** **Sean Sheldrake**, EPA Region 10 Remedial Project Manager **Opportunity for Clarifying Questions Regarding Source Control** **Matt McClincy**, Oregon Department of Environmental Quality (DEQ) Portland Harbor Source Control Coordinator	• Total time for topic: 20 mins • Kizz: Put map up on projector. • Explain to community leaders that more information will be provided at the booths during the public forum. • Once Davis has completed the overview, Annie will introduce the opportunity for questions regarding source control. Any questions asked will be directed to Sarah. • **Question for attendees:** Do these updates give you the information you need to answer questions for your communities?
4:40-4:55 p.m.	**Community Involvement Plan (CIP), Proposed Explanation of Significant Differences (ESD), and Technical Assistance Grant (TAG), and Other Updates** **Laura Knudsen**, EPA Region 10 Community Involvement Coordinator	• Total time for topic: 15 mins • Provide update regarding CIP timeline • Provide update following 11/1 webinar and 11/20 community information session on proposed ESD • Status of the Public Comment Period for Benzo(a)pyrene Integrated Risk Information System (IRIS) Value Change • Technical Assistance Grant (TAG) – with **Theo (EPA)** • Status of Technical Assistance Support for PCB concerns at Portland Harbor • Leave time for questions and answers • Interim Data Portal

Time	Agenda Topic	Annotated Notes - Will be removed before final version.
4:55-5:00 p.m.	**Wrap Up and Reminder of Public Forum with Potentially Responsible Parties (PRPs)** • Next meeting is tentatively scheduled for Wednesday, March 13th.	• EPA will continue talking to community leaders, if desired, in the room • **Theo & Julie leave at 5** to direct booth participants to their areas. Kizz will join as soon as possible as lead booth director.

Potential topics for future meetings:

- For potential topics, please use the comment cards or speak to Laura Knudsen.

Portland Harbor EPA and DEQ Contact Information

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EPA Community Involvement Coordinator:
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Sarah Greenfield, Portland Harbor In-Water Coordinator
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Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 3/20/2018 10:58:13 PM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; sheldrake.sean@epa.gov; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]

Subject: FW: Portland Harbor ROD ESD
Location: Personal Privacy / Ex. 6

Start: 3/21/2018 10:00:00 PM
End: 3/21/2018 11:00:00 PM
Show Time As: Tentative

Hello everyone,

This call is to go over for the TCT the upcoming proposed ESD, to follow up on our January meeting. Please login to the attached meeting room to go over materials. My hope is that this will give everyone a good idea of what EPA is looking to propose to the public soon, following (requested) tribal consultation.

http://epawebconferencing.acms.com/divingsafety/

Thank you.

S

-----Original Appointment-----
From: shil@yakamafish-nsn.gov [mailto:shil@yakamafish-nsn.gov]
Sent: Monday, March 19, 2018 12:00 PM
To: shil@yakamafish-nsn.gov; tosm@yakamafish-nsn.gov; Robert Dexter; Sheldrake, Sean
Subject: Portland Harbor ROD ESD
When: Wednesday, March 21, 2018 3:00 PM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Personal Privacy / Ex. 6

Hey Sean, We adjusted calendars and this Wed could work for us too. We are fine with this discussion being open to other TCT members. Thanks again for agreeing to talk with us. -Laura

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/9/2018 1:03:34 AM
To: Alex Liverman (liverman.alex@deq.state.or.us) [liverman.alex@deq.state.or.us]; bayuk.dana@deq.state.or.us; Brandy Humphreys (Brandy.Humphreys@grandronde.org) [Brandy.Humphreys@grandronde.org]; Callie Ridolfi (callie@ridolfi.com) [callie@ridolfi.com]; Chu Rebecca (Chu.Rebecca@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; coffeyse@cdmsmith.com; cora.lori@epa.gov; Courtney Johnson (courtney@crag.org) [courtney@crag.org]; Dan Hafley (HAFLEY.Dan@deq.state.or.us) [HAFLEY.Dan@deq.state.or.us]; Davis Zhen (Zhen.Davis@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov) [deirdre.donahue@sol.doi.gov]; dexb@yakamafish-nsn.gov; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gail Fricano (gfricano@indecon.com) [gfricano@indecon.com]; Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov) [Genevieve.Angle@noaa.gov]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Holly Partridge (Holly.Partridge@grandronde.org) [Holly.Partridge@grandronde.org]; Jen Graham [jennifer.graham@ctwsbnr.org]; jeremy_buck@fws.gov; Joe Pitt (joepitt@ctuir.org) [joepitt@ctuir.org]; Josh Newton (jn@karnopp.com) [jn@karnopp.com]; jweis@hk-law.com; Kevin Parrett - ODEQ (Parrett.Kevin@deq.state.or.us) [Parrett.Kevin@deq.state.or.us]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Kristin Callahan [kristin@ridolfi.com]; Lance Peterson (PetersonLE@cdmsmith.com) [PetersonLE@cdmsmith.com]; Laura Klasner Shira [shil@yakamafish-nsn.gov]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; mcclincy.matt@deq.state.or.us; Mcclure Tosch (tosm@yakamafish-nsn.gov) [tosm@yakamafish-nsn.gov]; Michael Karnosh (Michael.Karnosh@grandronde.org) [Michael.Karnosh@grandronde.org]; Michel L. Wigney (MLW@karnopp.com) [MLW@karnopp.com]; Naomi Stacy (NaomiStacy@ctuir.org) [NaomiStacy@ctuir.org]; Rachel DelVecchio (rdelvecchio@indecon.com) [rdelvecchio@indecon.com]; Rita Cabral (rcabral@indecon.com) [rcabral@indecon.com]; Robert Brunoe (robert.brunoe@ctwsbnr.org) [robert.brunoe@ctwsbnr.org]; Robert.Neely@noaa.gov; Rose Longoria (rose@yakamafish-nsn.gov) [rose@yakamafish-nsn.gov]; Sarah Greenfield (Greenfield.Sarah@deq.state.or.us) [Greenfield.Sarah@deq.state.or.us]; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; ted_buerger@fws.gov; Tom Downey (tomd@ctsi.nsn.us) [tomd@ctsi.nsn.us]
CC: PARRETT Kevin [Kevin.Parrett@state.or.us]; NOVAK Madi [Madi.NOVAK@state.or.us]
BCC: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=usere7e308b1]

Subject: TCT -ad hoc- IRIS update background discussion; Personal Privacy / Ex. 6
Attachments: CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx; Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx
Location: R10Sea-Room-12Hemlock/R10-Rooms-Service-Center

Start: 1/11/2018 10:00:00 PM
End: 1/12/2018
Show Time As: Tentative

Hello everyone, please see the attached agenda and draft powerpoint and navigation channel rationale regarding the IRIS update considerations for our meeting next week. The draft agenda is below.

Thank you.

S

VI. CONFIDENTIALITY
The Parties recognize that to effectively and efficiently exercise their authorities concerning the Site, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product, and other forms of privilege. The Parties intend to keep certain information shared under this MOU confidential. To avoid interference with a potential enforcement proceeding in which the parties have a common interest, the parties will protect from disclosure any law enforcement records exchanged in anticipation of litigation. The Parties agree to protect these privileges, to the full extent permissible under applicable law. The Parties will make every effort in accordance with law to maintain the confidentiality of cultural resource information that a signatory Tribe identifies as sensitive. A Party who cannot protect the confidentiality of a document will decline and/or return the document to the originator. This provision shall remain in effect after this MOU terminates.

Whenever sharing information deemed confidential, the Party shall clearly mark any information to which it asserts a privilege as "Privileged and Confidential Information Do Not Release Without Authorization." The Party receiving information so marked agrees not to release, or allow to be released, such information to a non-party, to the extent permitted by law. The Parties agree that failure to so mark information developed or shared under this Agreement does not preclude the parties from asserting the protections under the Freedom of Information Act or Oregon law, or from asserting privileges and exceptions in seeking to protect the information from discovery.

Meeting Agenda
IRIS update background discussion

January 11, 2018

2pm to 4pm Pacific Time

Call-in Number: Personal Privacy / Ex. 6

adobe connect link for presentation: **Personal Privacy / Ex. 6**

- **Roll Call**
- **Meeting Objectives**
- **Presentation**
    - **Background, Summary of Draft Decisions, Technical Evaluation Performed by EPA to Support Draft Decisions**
- **Comments/Questions**
- **Action Items**

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 12/15/2017 6:18:52 PM
To: Kevin Parrett [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0ab0cbee]; Madi Novak (novak.madi@deq.state.or.us) [novak.madi@deq.state.or.us]

Subject: FW: Parallel meeting invite to provide materials for PAH discussion on January 4th
Attachments: 12-7-17_Portland Harbor cPAH Cleanup Levels Memo.docx; PAH_RAL_CUL_Evaluation.pdf; PAH_RAL_CUL_Evaluation.docx; Beach_Sediment_Risk_Summary.pdf; Attachment_1_CPAH_RRM_greater CUL.XLSX; Figure_2_cPAH_RRM_774 CUL_Comp.pdf; Figure_1_SMA-Selected-Remedy-minus-PAHs.pdf; RollingRiverMileStratifiedNaturalNeighborGrid (RAL 13000 25000 30000) Revised 2017_12_12.pptx
Location: Personal Privacy / Ex. 6

Start: 1/4/2018 5:30:00 PM
End: 1/4/2018 7:30:00 PM
Show Time As: Tentative

Kevin, Madi, As we discussed this morning I've asked Karl for a memo on what path forward he can support—I think we're getting closer. Here are some supporting pieces that we've had Eric and Kern working on that I think will help to look at beforehand.

Thank you.

(MOU confidentiality provisions apply to this transmittal)

-----Original Appointment-----
From: Coffey, Scott [mailto:CoffeySE@cdmsmith.com]
Sent: Friday, December 15, 2017 9:54 AM
To: Coffey, Scott; Sheldrake, Sean; Gustavson, Karl; Blischke, Eric; John Kern; Chu, Rebecca; Grandinetti, Cami; Zhen, Davis
Subject: Parallel meeting invite to provide materials for PAH discussion on January 4th
When: Thursday, January 04, 2018 9:30 AM-11:30 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Personal Privacy / Ex. 6

Technical materials for our PAH discussion/decision making meeting.
Sean: I've kept this invite currently for EPA team only since several of the documents are working draft, or pending completion, but feel free to forward on to DEQ if you want them to also have this information.
Eric's review summary and response on the three main points presented in the 11/28/2017 memo from Patty Dost to Elliott Laws (**MS Word file titled – 12-7-17_Portland Harbor cPAH Cleanup Levels Memo**)
Eric's rolling river mile evaluation which looks at where active remediation is designated (footprint) against the cPAH cleanup levels, including IRIS adjusted values. Eric presents a summary of the cPAH questions that have been raised during relevant CUL and RAL adjustment discussions and provides answers gleaned from this analysis (**6 files immediately below**)
John Kern's analysis per Karl's direction to develop a statistically based Adjusted RAL for the nearshore (**Powerpoint slide titled: RollingRiverMileStratifiedNaturalNeighborGrid……)**
Updated GIS PAH coverage map showing footprint of SMA related to Total PAHs, the differences if nearshore TPAH RAL is revised to E-RAL and Stat based RAL of 30ppm
Pending Completion (should be added later today, or tomorrow morning) – Technical Lead: Malena Foster

3 slide summary of PAH decisions – those agreed upon, ongoing considerations/factors, Options with ranking summary table

Pending Completion next week; Technical Lead: Eric Blischke

Rationale Summary for retaining B-RAL in Nav Channel

Pending Completion next week; Technical Lead: Eric Blischke

River Mile
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Notes:
Green Cells indicate that direct contact CUL of 774 ug/kg is exceeded under no action alternative.
Gold Cells indicate that Alternative has reduced Rolling River mile SWAC concentration below CUL

	Alternative							
Segment	A	B	D	E	F Mod	F	G	I
East	285.27	285.27	285.22	283.78	282.50	282.50	281.82	283.78
East	186.86	183.32	182.29	179.84	176.96	176.96	175.82	179.84
East	109.20	96.92	94.10	91.09	87.40	87.40	85.85	91.09
East	70.52	53.34	48.21	43.79	39.56	39.56	37.86	43.79
East	68.53	46.11	40.46	35.65	30.23	30.23	27.86	35.65
East	68.30	47.58	42.36	38.13	31.09	31.09	28.41	38.13
East	72.13	53.50	48.88	45.39	37.72	37.72	34.39	45.39
East	100.32	90.32	83.48	69.85	51.04	51.04	39.92	69.85
East	260.05	230.35	127.55	89.82	58.76	58.76	42.40	89.82
East	291.09	265.35	155.32	106.32	67.62	67.62	49.07	118.83
East	330.61	302.02	178.48	123.59	83.63	83.63	63.97	137.65
East	366.76	335.38	199.80	139.56	98.14	98.14	77.89	154.99
East	378.99	342.93	193.30	140.72	111.59	111.59	100.92	158.45
East	147.28	147.28	144.53	129.07	117.79	117.79	114.39	147.28
East	123.17	123.17	122.85	122.85	122.69	122.69	122.47	122.85
East	136.32	136.32	133.30	133.30	132.93	132.93	128.12	133.30
East	127.61	127.61	124.55	124.55	124.09	124.09	118.04	124.55
East	103.45	103.45	100.97	100.52	91.46	91.46	80.28	100.52
East	172.84	97.27	84.23	78.46	61.95	61.95	50.44	78.46
East	179.17	100.32	86.96	79.70	61.10	61.10	45.42	79.70
East	178.68	93.22	80.33	70.51	47.73	47.73	31.63	70.51
East	195.24	106.54	91.25	69.90	40.86	40.86	19.42	69.90
East	248.27	129.99	109.63	81.01	46.48	46.48	19.35	81.01
East	728.16	726.84	721.31	477.94	159.25	159.25	56.39	477.94
East	1246.57	1245.78	1198.34	929.37	181.08	181.08	43.96	929.37
East	1782.86	1773.03	1345.04	975.23	235.15	235.15	60.41	975.23
East	3074.92	2823.89	1741.18	1095.22	257.00	257.00	65.42	1095.22
East	3710.28	3478.82	1862.81	1093.30	281.79	281.79	61.57	1093.30
East	4185.69	3902.69	1927.87	1114.36	293.82	293.82	61.92	1114.36
East	4957.91	4571.35	1919.87	905.11	337.01	337.01	91.48	905.11
East	4953.33	4494.46	1855.23	841.19	324.02	324.02	100.17	841.19
East	3027.23	3027.23	1047.80	489.04	353.49	353.49	151.99	489.04
East	327.32	327.32	327.32	327.32	326.85	326.85	258.05	327.32
East	396.32	396.32	396.32	396.32	396.32	396.32	261.20	396.32
East	472.15	472.15	472.15	472.15	472.15	472.15	253.14	472.15
East	487.34	487.34	487.34	487.34	470.21	470.21	257.25	470.21
East	648.39	648.39	648.39	648.39	473.76	473.76	201.41	473.76
East	791.48	791.48	791.48	705.73	425.67	425.67	146.70	425.67
East	756.13	754.13	754.13	662.10	327.38	327.38	96.74	327.38
East	753.01	751.51	751.51	682.34	400.16	400.16	101.62	400.16
East	783.51	782.16	782.16	719.82	444.98	444.98	122.94	475.43
East	708.01	706.78	706.78	646.17	462.45	462.45	210.21	511.54
East	619.79	618.74	618.64	607.09	486.73	486.73	267.41	542.06
East	767.76	767.76	716.22	622.10	489.94	489.94	294.15	744.48

East	746.34	746.34	685.98	575.15	425.84	425.84	315.52	742.84
East	622.76	622.76	565.35	461.89	343.59	343.59	285.64	619.62
East	514.43	513.47	457.38	362.84	266.85	266.85	215.13	512.61
East	411.54	401.88	341.10	255.14	177.55	177.55	134.57	400.61
East	175.43	159.12	140.00	130.70	105.92	105.92	78.44	157.40
East	85.51	70.14	56.22	55.99	53.65	53.65	45.73	68.53
East	63.97	49.64	37.28	37.07	34.93	34.93	30.21	48.14
East	58.10	44.76	34.06	33.86	31.91	31.91	28.18	44.38
East	63.19	44.64	35.46	35.27	33.73	33.73	31.64	56.05
East	83.64	60.65	42.47	42.46	41.88	41.88	40.58	83.25
East	95.25	72.49	50.52	50.52	47.62	47.62	45.94	93.68
East	97.98	74.98	52.76	52.76	49.83	49.83	48.32	96.40
East	98.34	73.13	48.63	48.63	45.35	45.35	44.13	96.57
East	88.78	74.07	50.80	50.80	46.58	46.58	44.95	86.51
East	60.06	58.83	50.07	50.07	45.79	45.79	42.16	57.54
East	47.33	47.33	47.33	47.33	47.29	47.29	42.92	47.33
East	53.59	51.37	51.37	50.95	50.59	50.59	32.93	50.95
East	60.86	41.71	41.71	41.29	40.91	40.91	22.79	41.29
East	64.55	32.80	32.80	32.44	31.19	31.19	15.85	32.44
East	61.58	30.57	30.57	30.22	29.04	29.04	17.10	30.22
East	58.26	27.88	27.88	27.54	26.38	26.38	15.42	27.54
East	50.11	13.97	13.97	13.97	12.84	12.84	12.45	13.97
East	45.83	24.04	24.04	24.04	22.74	22.74	22.30	24.04
East	34.24	34.24	34.24	34.24	34.24	34.24	34.20	34.24
East	36.89	36.89	36.89	36.89	36.79	36.79	36.69	36.89
East	38.29	38.29	38.29	38.29	38.00	38.00	37.70	38.29
East	38.44	38.44	38.44	38.44	37.77	37.77	33.74	38.44
East	36.13	36.13	36.13	36.13	33.72	33.72	26.51	36.13
East	34.04	34.04	34.04	34.04	31.13	31.13	22.15	34.04
East	28.84	28.84	28.84	28.84	26.01	26.01	17.38	28.84
East	23.29	23.29	23.29	23.29	20.75	20.75	12.61	23.29
East	22.38	22.38	22.38	22.38	19.02	19.02	13.09	22.38
East	25.39	25.39	25.39	25.39	17.81	17.81	12.92	25.39
East	24.85	24.85	24.85	24.85	17.40	17.40	11.87	24.85
East	27.04	27.04	27.04	27.04	19.92	19.92	14.41	27.04
East	33.15	33.15	33.15	33.15	26.13	26.13	20.71	33.15
East	50.35	50.25	50.16	48.52	39.91	39.91	28.13	48.52
East	157.81	157.70	157.60	149.77	67.36	67.36	38.05	154.95
East	218.90	218.78	218.67	210.07	118.10	118.10	78.51	215.75
East	303.54	303.39	303.26	292.62	178.88	178.88	121.87	299.65
East	378.63	378.44	378.28	364.85	221.32	221.32	148.55	373.72
East	435.76	435.76	435.76	422.58	247.08	247.08	171.42	433.75
East	216.49	216.49	216.49	216.49	206.99	206.99	167.83	216.49
East	127.54	127.54	127.54	125.13	113.66	113.66	92.83	125.13
East	58.37	58.37	58.37	49.33	35.81	35.81	29.97	49.33
East	55.75	55.75	55.75	46.54	27.37	27.37	17.73	46.54
East	66.50	66.50	66.50	57.49	29.84	29.84	13.99	57.49

East	71.11	70.31	69.04	58.82	34.29	34.29	15.51	58.82
East	74.55	71.13	65.00	54.79	33.29	33.29	12.65	54.79
East	86.31	71.05	60.46	52.10	31.40	31.40	10.07	52.10
East	88.58	59.17	46.90	37.41	22.56	22.56	7.26	37.41
East	72.01	42.92	30.43	20.47	13.20	13.20	5.28	20.47
East	63.35	34.72	23.18	13.76	7.00	7.00	1.38	13.76
East	59.21	29.21	20.91	12.40	6.58	6.58	1.78	12.40
East	47.93	23.63	18.33	12.13	6.79	6.79	1.90	12.13
East	26.65	23.05	20.74	16.24	10.33	10.33	2.89	16.24
West	62.11	62.11	62.11	62.11	62.11	62.11	62.11	62.11
West	62.46	62.46	62.46	62.46	62.46	62.46	62.46	62.46
West	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
West	86.86	86.86	86.86	86.86	86.86	86.86	86.86	86.86
West	109.69	109.69	109.69	109.69	109.69	109.69	109.69	109.69
West	160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70
West	216.19	216.19	216.19	216.19	216.19	216.19	215.28	216.19
West	256.95	256.95	256.95	256.95	256.95	256.95	246.87	256.95
West	320.09	320.09	320.09	320.09	320.09	320.09	285.84	320.09
West	427.95	427.95	427.95	427.95	427.95	427.95	321.95	427.95
West	513.27	513.27	513.27	513.27	513.27	513.27	352.94	513.27
West	526.51	526.51	526.51	526.51	526.51	526.51	371.27	526.51
West	586.96	586.96	586.96	586.96	586.96	586.96	394.01	586.96
West	647.53	647.53	647.53	647.53	647.53	647.53	407.71	647.53
West	617.29	617.29	617.29	617.29	617.29	617.29	404.33	617.29
West	546.32	546.32	546.32	546.32	545.47	545.47	365.34	546.32
West	516.01	516.01	516.01	516.01	515.01	515.01	319.22	516.01
West	431.10	431.10	431.10	431.10	429.87	429.87	282.44	431.10
West	320.54	320.54	320.54	320.54	318.90	318.90	251.50	320.54
West	373.99	373.99	373.99	352.46	258.36	258.36	194.92	352.46
West	426.48	426.48	426.48	400.88	287.29	287.29	192.64	400.88
West	503.13	503.13	503.13	472.48	330.22	330.22	212.62	472.48
West	644.46	644.46	644.46	605.28	390.05	390.05	176.66	605.28
West	821.69	821.69	821.69	782.88	489.17	489.17	144.37	782.88
West	682.16	682.16	682.16	677.65	533.94	533.94	145.20	677.65
West	732.10	732.10	732.10	727.05	571.97	571.97	135.33	727.05
West	840.73	840.73	840.73	835.63	557.96	557.96	94.96	835.63
West	772.50	772.50	772.50	772.50	499.14	499.14	119.79	772.50
West	593.79	593.79	593.79	592.04	376.81	376.81	136.58	592.04
West	718.99	718.99	711.00	652.47	325.64	325.64	160.79	652.47
West	696.78	696.78	688.77	630.08	296.69	296.69	182.46	630.08
West	756.67	756.67	706.02	604.99	298.34	298.34	201.23	604.99
West	904.84	904.84	845.85	597.11	283.58	283.58	187.08	597.11
West	1352.60	1352.60	980.81	638.54	300.18	300.18	167.35	638.54
West	2277.41	1934.17	906.25	545.19	286.52	286.52	127.53	545.19
West	3143.22	2757.01	1149.48	648.54	279.96	279.96	65.85	648.54
West	3233.89	2819.33	1154.25	673.79	396.69	396.69	59.08	673.79
West	3059.56	2650.05	1008.27	707.00	475.85	475.85	75.97	707.00

West	2640.67	2264.25	1070.46	836.59	518.55	518.55	127.89	859.25
West	1869.14	1836.29	1266.85	917.04	504.08	504.08	171.97	1158.39
West	2391.43	1841.79	1354.01	1098.30	510.74	510.74	165.33	1354.01
West	6066.89	2386.42	1320.10	1019.74	404.12	404.12	140.70	1320.10
West	14260.55	2215.14	1193.81	906.11	328.49	328.49	116.58	1193.81
West	21991.86	2044.06	1034.16	760.87	249.80	249.80	81.87	1034.16
West	29236.75	1824.08	779.40	627.65	183.65	183.65	41.57	779.40
West	40104.32	1213.09	285.27	177.98	22.86	22.86	0.00	285.27
West	38796.86	294.52	214.70	165.60	46.48	46.48	10.64	47.78
West	25684.49	586.63	504.02	402.75	89.43	89.43	13.56	90.77
West	11444.97	950.62	843.35	662.72	130.46	130.46	15.80	131.76
West	2747.09	819.26	678.48	511.10	100.81	100.81	12.81	101.80
West	955.57	730.89	601.93	447.69	88.31	88.31	11.43	88.31
West	573.49	476.19	403.08	296.09	51.95	51.95	4.36	51.95
West	431.07	288.39	222.10	150.91	26.41	26.41	2.66	26.41
West	388.34	93.24	39.15	7.75	1.09	1.09	1.19	1.09
West	337.05	32.98	18.15	6.13	1.25	1.25	0.00	1.25
West	301.70	27.00	18.52	12.86	8.11	8.11	4.10	8.11
West	242.36	38.97	36.32	33.02	28.44	28.44	18.99	28.44
West	174.70	51.50	49.49	45.92	36.50	36.50	22.23	36.50
West	72.27	65.47	64.07	61.45	49.58	49.58	27.75	49.58
West	67.72	65.88	64.55	62.32	51.23	51.23	28.44	51.23
West	65.82	65.80	65.73	64.95	53.14	53.14	28.90	54.27
West	69.93	69.92	69.83	66.98	47.04	47.04	21.18	55.04
West	81.38	81.38	81.38	71.75	44.11	44.11	18.32	64.36
West	154.22	154.22	152.78	127.27	13.66	13.66	2.77	126.62
West	182.11	182.11	180.96	158.76	37.60	37.60	8.66	158.76
West	166.50	165.99	165.12	142.72	43.08	43.08	20.70	142.72
West	164.84	163.87	163.05	131.35	39.75	39.75	19.52	131.35
West	157.94	156.98	156.07	122.94	38.06	38.06	19.12	122.94
West	127.83	119.42	110.27	78.72	40.20	40.20	20.23	78.72
West	126.22	90.14	77.50	40.06	21.28	21.28	17.73	40.06
West	157.77	85.13	59.05	15.14	2.29	2.29	0.58	15.14
West	199.49	73.54	34.76	5.52	0.00	0.00	0.00	5.52
West	244.30	88.99	22.98	3.73	0.00	0.00	0.00	3.73
West	177.20	61.01	24.76	13.06	4.58	4.58	2.95	13.06
West	117.12	60.71	33.93	24.75	10.68	10.68	6.83	24.75
West	88.48	58.85	42.66	34.62	11.69	11.69	7.59	34.62
West	102.36	77.62	61.19	36.99	12.35	12.35	8.13	36.99
West	148.22	125.81	81.07	34.07	10.73	10.73	7.05	34.07
West	173.60	145.67	90.06	34.97	10.55	10.55	7.00	34.97
West	212.97	176.37	103.49	31.20	7.10	7.10	5.20	31.20
West	277.97	226.84	125.00	23.84	8.75	8.75	7.45	23.84
West	300.06	277.99	132.37	28.88	19.25	19.25	12.56	28.88
West	122.87	122.87	121.18	110.42	90.67	90.67	38.14	112.11
West	156.51	156.51	155.27	144.59	87.73	87.73	31.04	145.83
West	282.49	282.49	281.38	272.30	222.85	222.85	121.80	273.41

West	354.58	354.58	353.49	344.85	297.10	297.10	199.55	345.93
West	352.57	352.57	351.48	342.73	295.04	295.04	208.29	343.81
West	186.72	186.72	186.72	185.45	167.31	167.31	106.71	185.45
West	146.85	146.85	146.85	146.85	146.85	146.85	100.48	146.85
West	92.15	92.15	92.15	92.15	92.15	92.15	70.90	92.15
West	70.85	70.85	70.85	70.85	70.85	70.85	52.63	70.85
West	66.88	66.88	66.88	66.88	66.88	66.88	50.18	66.88
West	65.35	65.35	65.35	65.35	65.35	65.35	65.33	65.35
West	77.48	77.48	77.48	77.48	77.48	77.48	77.48	77.48
West	91.43	91.43	91.43	91.43	91.43	91.43	90.27	91.43
West	89.88	89.88	89.88	89.88	89.88	89.88	88.54	89.88
West	79.16	79.16	79.16	79.16	79.16	79.16	77.95	79.16
West	84.56	84.56	84.56	84.56	84.56	84.56	83.18	84.56
West	77.70	77.70	77.70	77.70	77.70	77.70	75.99	77.70
West	49.64	49.64	49.64	49.64	49.64	49.64	49.64	49.64
Swan Isl	274.24	34.87	34.82	3.82	1.90	1.90	0.28	3.82
Swan Isl	180.11	14.06	13.93	7.22	1.90	1.90	0.72	7.22
Swan Isl	230.60	19.33	18.31	9.87	4.01	4.01	0.98	9.87
Swan Isl	270.08	21.30	19.69	11.76	5.88	5.88	1.26	11.76
Swan Isl	306.92	20.23	18.69	11.55	6.23	6.23	2.12	11.55
Swan Isl	324.18	18.63	17.03	11.80	6.47	6.47	2.34	11.80
Swan Isl	385.51	21.35	19.09	13.03	8.70	8.70	3.54	13.03
Swan Isl	388.14	18.20	15.29	11.45	9.16	9.16	5.45	11.45
Swan Isl	359.27	21.05	10.30	7.14	6.12	6.12	5.51	7.14
Swan Isl	288.09	25.06	8.82	5.66	4.49	4.49	3.91	5.66
Swan Isl	258.99	26.91	8.34	5.28	3.96	3.96	3.54	5.28
Swan Isl	309.88	108.46	63.12	40.65	6.27	6.27	4.28	87.76
Swan Isl	339.31	131.60	76.02	49.89	7.15	7.15	4.69	109.02
Swan Isl	325.88	167.56	104.18	68.44	8.88	8.88	5.55	151.36
Swan Isl	379.46	258.88	169.67	111.36	13.46	13.46	8.08	249.40
Swan Isl	431.88	369.29	248.47	162.50	19.22	19.22	11.44	366.47
Swan Isl	63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59

River Mile	Segment	A
1.8	East	170.23
1.9	East	172.41
2	East	169.06
2.1	East	158.63
2.2	East	110.79
2.3	East	101.63
2.4	East	172.25
2.5	East	178.14
2.6	East	188.39
2.7	East	203.00
2.8	East	215.89
2.9	East	219.75
3	East	238.23
3.1	East	259.12
3.2	East	271.66
3.3	East	220.33
3.4	East	151.80
3.5	East	158.87
3.6	East	162.77
3.7	East	169.27
3.8	East	180.16
3.9	East	494.16
4	East	694.35
4.1	East	1217.16
4.2	East	2184.60
4.3	East	2816.17
4.4	East	2970.07
4.5	East	3036.49
4.6	East	3036.03
4.7	East	3065.94
4.8	East	3124.12
4.9	East	3307.20
5	East	3509.67
5.1	East	2795.42
5.2	East	628.53
5.3	East	611.50
5.4	East	614.06
5.5	East	668.16
5.6	East	686.31
5.7	East	680.47
5.8	East	670.21
5.9	East	770.25
6	East	721.24
6.1	East	639.58
6.2	East	548.26

6.3	East	459.68
6.4	East	377.23
6.5	East	306.61
6.6	East	253.96
6.7	East	212.55
6.8	East	194.66
6.9	East	99.41
7	East	84.51
7.1	East	78.81
7.2	East	75.96
7.3	East	73.49
7.4	East	79.50
7.5	East	84.90
7.6	East	87.87
7.7	East	89.18
7.8	East	61.90
7.9	East	54.84
8	East	50.08
8.1	East	53.57
8.2	East	53.31
8.3	East	51.97
8.4	East	50.70
8.5	East	47.99
8.6	East	41.93
8.7	East	38.36
8.8	East	33.70
8.9	East	31.88
9	East	30.22
9.1	East	31.09
9.2	East	29.93
9.3	East	28.24
9.4	East	28.13
9.5	East	28.91
9.6	East	62.38
9.7	East	104.83
9.8	East	130.98
9.9	East	148.72
10	East	162.94
10.1	East	170.90
10.2	East	182.19
10.3	East	200.22
10.4	East	221.95
10.5	East	246.52
10.6	East	196.02
10.7	East	116.09
10.8	East	78.41
10.9	East	75.56

11	East	71.48
11.1	East	68.99
11.2	East	65.87
11.3	East	67.99
11.4	East	70.13
11.5	East	65.73
11.6	East	61.04
11.7	East	60.14
1.8	Nav Channel	94.48
1.9	Nav Channel	112.50
2	Nav Channel	131.41
2.1	Nav Channel	145.46
2.2	Nav Channel	156.94
2.3	Nav Channel	173.97
2.4	Nav Channel	192.46
2.5	Nav Channel	210.15
2.6	Nav Channel	231.11
2.7	Nav Channel	258.78
2.8	Nav Channel	290.00
2.9	Nav Channel	322.06
3	Nav Channel	364.72
3.1	Nav Channel	417.32
3.2	Nav Channel	472.55
3.3	Nav Channel	486.41
3.4	Nav Channel	489.12
3.5	Nav Channel	474.63
3.6	Nav Channel	463.41
3.7	Nav Channel	434.03
3.8	Nav Channel	391.64
3.9	Nav Channel	358.24
4	Nav Channel	342.93
4.1	Nav Channel	333.09
4.2	Nav Channel	289.35
4.3	Nav Channel	271.09
4.4	Nav Channel	282.20
4.5	Nav Channel	287.39
4.6	Nav Channel	682.48
4.7	Nav Channel	1997.84
4.8	Nav Channel	2572.56
4.9	Nav Channel	3654.45
5	Nav Channel	4652.32
5.1	Nav Channel	4998.01
5.2	Nav Channel	8019.66
5.3	Nav Channel	16026.23
5.4	Nav Channel	17092.79
5.5	Nav Channel	18145.66
5.6	Nav Channel	18886.15

5.7	Nav Channel	18510.04
5.8	Nav Channel	19403.38
5.9	Nav Channel	18902.95
6	Nav Channel	18526.53
6.1	Nav Channel	19050.57
6.2	Nav Channel	15202.90
6.3	Nav Channel	2712.53
6.4	Nav Channel	2391.94
6.5	Nav Channel	2236.51
6.6	Nav Channel	2029.97
6.7	Nav Channel	1450.71
6.8	Nav Channel	684.69
6.9	Nav Channel	345.53
7	Nav Channel	99.43
7.1	Nav Channel	58.82
7.2	Nav Channel	42.34
7.3	Nav Channel	36.63
7.4	Nav Channel	35.16
7.5	Nav Channel	36.70
7.6	Nav Channel	37.30
7.7	Nav Channel	35.66
7.8	Nav Channel	36.28
7.9	Nav Channel	42.34
8	Nav Channel	42.40
8.1	Nav Channel	41.36
8.2	Nav Channel	40.36
8.3	Nav Channel	40.44
8.4	Nav Channel	40.50
8.5	Nav Channel	39.26
8.6	Nav Channel	38.04
8.7	Nav Channel	40.45
8.8	Nav Channel	42.72
8.9	Nav Channel	38.10
9	Nav Channel	37.08
9.1	Nav Channel	37.92
9.2	Nav Channel	39.92
9.3	Nav Channel	42.69
9.4	Nav Channel	46.49
9.5	Nav Channel	53.32
9.6	Nav Channel	54.88
9.7	Nav Channel	53.05
9.8	Nav Channel	49.60
9.9	Nav Channel	47.97
10	Nav Channel	51.73
10.1	Nav Channel	53.10
10.2	Nav Channel	62.51
10.3	Nav Channel	62.70

10.4	Nav Channel	60.82
10.5	Nav Channel	54.87
10.6	Nav Channel	54.75
10.7	Nav Channel	55.12
10.8	Nav Channel	52.74
10.9	Nav Channel	51.32
11	Nav Channel	47.75
11.1	Nav Channel	47.09
11.2	Nav Channel	35.67
11.3	Nav Channel	34.38
11.4	Nav Channel	33.75
11.5	Nav Channel	33.20
11.6	Nav Channel	33.47
11.7	Nav Channel	35.66
1.8	West	84.35
1.9	West	88.66
2	West	97.01
2.1	West	121.43
2.2	West	142.65
2.3	West	167.05
2.4	West	218.75
2.5	West	303.33
2.6	West	369.79
2.7	West	419.68
2.8	West	488.64
2.9	West	531.15
3	West	538.15
3.1	West	525.22
3.2	West	522.51
3.3	West	538.98
3.4	West	543.79
3.5	West	525.92
3.6	West	511.00
3.7	West	503.13
3.8	West	481.36
3.9	West	483.38
4	West	516.74
4.1	West	586.41
4.2	West	694.55
4.3	West	706.23
4.4	West	702.30
4.5	West	712.03
4.6	West	726.69
4.7	West	833.47
4.8	West	839.14
4.9	West	1112.13
5	West	1582.87

5.1	West	1766.71
5.2	West	1795.88
5.3	West	1925.91
5.4	West	2050.80
5.5	West	2278.56
5.6	West	3487.52
5.7	West	8409.98
5.8	West	13479.96
5.9	West	17086.82
6	West	18580.34
6.1	West	18714.22
6.2	West	18527.99
6.3	West	18272.10
6.4	West	17468.68
6.5	West	17750.77
6.6	West	16532.02
6.7	West	11153.42
6.8	West	6241.05
6.9	West	2577.95
7	West	936.36
7.1	West	454.78
7.2	West	335.21
7.3	West	234.87
7.4	West	164.68
7.5	West	153.69
7.6	West	152.87
7.7	West	147.05
7.8	West	102.37
7.9	West	110.08
8	West	108.74
8.1	West	116.86
8.2	West	122.14
8.3	West	132.01
8.4	West	146.55
8.5	West	155.92
8.6	West	172.41
8.7	West	180.09
8.8	West	173.97
8.9	West	123.61
9	West	122.12
9.1	West	117.19
9.2	West	161.20
9.3	West	177.63
9.4	West	167.70
9.5	West	163.19
9.6	West	149.80
9.7	West	146.52

9.8	West	155.61
9.9	West	195.02
10	West	259.23
10.1	West	333.66
10.2	West	248.95
10.3	West	158.57
10.4	West	142.60
10.5	West	138.48
10.6	West	132.47
10.7	West	123.04
10.8	West	114.53
10.9	West	104.91
11	West	82.45
11.1	West	74.06
11.2	West	72.24
11.3	West	75.88
11.4	West	78.07
11.5	West	75.05
11.6	West	74.42
11.7	West	80.62
7.6	Swan Isl	178.81
7.7	Swan Isl	209.75
7.8	Swan Isl	248.67
7.9	Swan Isl	284.82
8	Swan Isl	321.18
8.1	Swan Isl	318.91
8.2	Swan Isl	300.52
8.3	Swan Isl	302.60
8.4	Swan Isl	304.56
8.5	Swan Isl	297.70
8.6	Swan Isl	321.10
8.7	Swan Isl	361.34
8.8	Swan Isl	359.68
8.9	Swan Isl	336.06
9	Swan Isl	292.09
9.1	Swan Isl	293.54
9.2	Swan Isl	328.60
9.3	Swan Isl	330.90
9.4	Swan Isl	334.75
9.5	Swan Isl	423.17
9.6	Swan Isl	500.60

Notes:
Clam Consumption CUL of 107,600 ug/kg is not exceeded in the Navigation Channel

Alternative						
B	D	E	F Mod	F	G	I
161.66	159.14	157.04	154.92	154.92	154.06	157.04
162.32	159.52	156.67	154.00	154.00	152.97	156.67
157.71	154.83	151.85	148.38	148.38	146.82	151.85
147.24	144.35	141.36	136.36	136.36	134.43	141.36
99.65	96.82	93.89	88.43	88.43	85.27	93.89
90.05	78.99	67.53	54.30	54.30	47.11	67.53
148.66	93.87	67.78	46.47	46.47	36.39	73.69
154.01	97.97	71.91	50.59	50.59	40.53	77.95
163.65	105.97	79.45	57.81	57.81	47.63	85.69
180.79	119.08	91.02	68.61	68.61	57.87	97.75
197.37	133.32	103.92	80.39	80.39	69.07	111.15
202.63	137.36	108.16	84.72	84.72	73.27	115.56
221.87	150.07	118.66	94.32	94.32	82.67	126.70
241.63	164.86	131.29	107.50	107.50	93.56	139.89
252.84	170.22	134.09	109.36	109.36	95.82	143.34
191.47	128.73	106.58	88.19	88.19	78.44	114.22
106.96	99.22	95.79	85.64	85.64	77.82	95.79
110.93	102.67	97.89	85.61	85.61	75.40	97.89
112.06	102.49	95.08	80.37	80.37	67.33	95.08
117.17	106.87	94.00	73.96	73.96	56.67	94.00
126.87	116.33	103.17	79.16	79.16	55.25	103.17
446.02	417.16	298.48	104.80	104.80	49.36	298.48
649.29	623.26	487.80	135.70	135.70	47.34	487.80
1159.29	794.93	559.68	150.12	150.12	43.89	559.68
2012.37	1089.33	640.50	165.79	165.79	42.24	640.50
2609.88	1415.93	840.02	231.40	231.40	54.83	840.02
2787.37	1513.33	898.06	250.11	250.11	63.32	898.06
2850.03	1549.21	922.27	262.39	262.39	70.63	922.27
2850.47	1554.22	931.61	275.67	275.67	81.65	931.61
2878.32	1568.22	944.39	286.61	286.61	94.74	944.39
2932.80	1596.87	960.74	293.84	293.84	101.97	960.74
3078.17	1506.89	900.53	352.36	352.36	125.39	900.53
3239.03	1382.43	710.43	373.97	373.97	154.20	708.98
2525.53	1180.10	655.21	396.93	396.93	168.76	619.99
628.53	607.69	582.07	426.14	426.14	194.63	438.86
610.59	610.59	552.79	357.73	357.73	177.51	357.73
613.01	613.01	564.96	388.69	388.69	157.66	388.69
667.24	667.24	624.85	441.83	441.83	161.14	451.90
685.47	685.47	644.41	462.45	462.45	189.79	487.65
679.72	679.72	642.60	462.21	462.21	213.14	501.74
669.53	667.07	633.34	463.45	463.45	233.60	507.83
769.62	733.57	635.88	425.40	425.40	229.32	620.80
720.66	685.73	595.40	401.61	401.61	226.69	583.92
639.04	606.12	522.90	361.03	361.03	214.22	529.65
546.25	514.40	446.76	334.68	334.68	205.75	490.12

451.93	418.35	371.10	291.61	291.61	179.70	433.48
367.77	335.97	293.19	226.96	226.96	155.95	358.08
297.54	267.13	226.22	173.97	173.97	138.89	295.31
245.39	216.66	179.13	136.54	136.54	113.48	244.39
203.31	175.72	140.53	107.91	107.91	88.05	203.66
174.52	140.78	107.01	78.50	78.50	62.46	186.12
79.66	60.42	60.31	57.72	57.72	51.81	90.35
65.63	47.96	47.86	45.29	45.29	41.71	75.85
60.03	42.87	42.76	40.24	40.24	37.63	70.27
57.05	39.95	39.84	37.19	37.19	35.06	68.28
57.41	43.02	42.95	40.80	40.80	38.87	70.24
63.55	48.16	48.16	46.12	46.12	43.74	78.39
68.00	51.68	51.68	49.52	49.52	46.08	83.74
66.76	49.44	49.33	46.95	46.95	41.42	83.35
62.96	44.70	44.58	41.95	41.95	35.84	79.51
48.97	43.01	42.87	39.53	39.53	32.61	47.96
40.62	40.44	40.28	39.47	39.47	32.09	40.46
32.80	32.80	32.60	31.92	31.92	23.50	32.60
33.50	33.50	33.27	32.48	32.48	22.71	33.27
33.49	33.49	33.26	32.48	32.48	22.83	33.26
33.36	33.36	33.15	32.44	32.44	24.32	33.15
32.73	32.73	32.52	31.75	31.75	25.23	32.52
29.24	29.24	29.03	28.14	28.14	22.34	29.03
27.63	27.63	27.63	26.21	26.21	23.25	27.63
32.72	32.72	32.72	30.67	30.67	26.09	32.72
33.70	33.70	33.70	32.22	32.22	27.79	33.70
31.88	31.88	31.88	30.46	30.46	26.20	31.88
30.22	30.22	30.22	28.83	28.83	24.50	30.22
31.09	31.09	31.09	27.24	27.24	21.59	31.09
29.93	29.93	29.93	24.58	24.58	17.77	29.93
28.24	28.24	28.24	22.98	22.98	15.88	28.24
28.13	28.13	28.13	23.14	23.14	16.28	28.13
28.91	28.91	28.91	24.04	24.04	18.27	28.91
62.32	62.27	60.96	35.43	35.43	22.18	60.96
104.77	104.72	100.74	54.27	54.27	33.81	103.37
130.92	130.87	126.66	77.67	77.67	52.03	129.44
148.66	148.60	144.02	90.73	90.73	62.83	147.05
162.87	162.80	157.83	99.75	99.75	68.95	161.12
170.83	170.76	165.46	105.93	105.93	74.40	168.96
182.11	182.04	176.27	112.82	112.82	80.14	180.03
200.13	200.05	191.66	120.46	120.46	85.04	195.79
221.85	221.76	210.89	129.81	129.81	89.26	215.53
246.42	246.32	234.27	139.03	139.03	90.78	239.41
196.02	195.66	184.86	126.79	126.79	89.95	190.31
114.32	112.30	105.90	89.24	89.24	68.38	105.90
75.20	70.68	62.57	44.70	44.70	30.05	62.57
60.91	54.44	45.32	28.15	28.15	14.55	45.32

54.92	47.98	38.41	21.95	21.95	10.08	38.41
52.36	45.23	35.43	19.74	19.74	8.51	35.43
49.86	42.99	33.34	19.57	19.57	7.44	33.34
50.03	42.33	34.04	20.36	20.36	6.95	34.04
49.88	41.19	33.64	19.76	19.76	5.67	33.64
43.54	34.02	25.75	17.18	17.18	5.83	25.75
35.61	25.17	16.78	9.92	9.92	3.55	16.78
33.05	23.36	14.96	8.64	8.64	1.70	14.96
94.48	94.48	94.48	94.48	94.48	92.12	94.48
112.50	112.50	112.50	112.50	112.50	103.72	112.50
131.41	131.41	131.41	131.41	131.41	121.23	131.41
145.46	145.46	145.46	145.46	145.46	135.41	145.46
156.94	156.94	156.94	156.94	156.94	147.02	156.94
173.97	173.97	173.97	173.97	173.97	164.00	173.97
192.46	192.46	192.46	192.46	192.46	182.45	192.46
210.15	210.15	210.15	210.15	210.15	200.04	210.15
231.11	231.11	231.11	231.11	231.11	220.92	231.11
258.78	258.78	258.78	258.78	258.78	248.60	258.78
290.00	290.00	290.00	290.00	290.00	281.65	290.00
322.06	322.06	322.06	322.06	321.87	309.26	322.06
364.72	364.72	364.72	364.72	356.78	312.24	364.72
417.32	417.32	417.13	417.13	398.68	300.28	417.13
472.55	472.55	472.36	472.36	450.06	285.53	472.36
486.41	486.41	486.23	486.23	464.12	293.92	486.23
489.12	489.12	488.95	488.95	468.31	309.22	488.95
474.63	474.63	474.47	474.47	455.05	303.44	474.47
463.41	463.41	463.26	463.26	444.97	295.83	463.26
434.03	434.03	433.89	433.89	416.73	276.66	433.89
391.64	391.64	391.50	391.50	375.34	243.65	391.50
358.24	358.24	358.11	358.11	342.89	224.05	358.11
342.93	342.93	342.81	342.81	330.75	222.84	342.81
333.09	333.09	333.08	333.08	325.58	234.08	333.08
289.35	289.35	289.35	289.35	284.77	236.81	289.35
271.09	271.09	271.09	271.09	267.24	229.26	271.09
282.20	282.20	282.20	282.20	278.33	235.60	282.20
287.39	287.39	287.39	287.39	283.49	241.83	287.39
658.06	397.84	314.19	658.06	272.63	226.36	658.06
1130.63	493.08	336.21	1130.63	265.31	210.03	1130.63
1612.45	647.39	386.05	1612.45	271.63	206.75	1612.45
1958.26	716.35	403.80	1958.26	263.92	195.20	1958.26
2270.01	823.76	451.79	2270.01	242.25	175.64	2270.01
2480.52	926.65	519.04	2480.52	231.84	153.23	2480.52
2685.73	982.16	538.37	2685.73	231.51	145.21	2685.73
2796.09	1008.55	543.11	2796.09	216.91	126.40	2796.09
3074.01	1162.89	655.31	3074.01	181.52	82.36	3074.01
3305.32	1279.19	705.89	3305.32	182.77	54.60	3305.32
3052.44	1274.50	716.85	3052.44	185.61	51.74	3052.44

2776.98	1290.94	749.09	2776.98	195.76	56.04	2674.45
2306.39	1169.30	738.02	2306.39	200.11	59.76	2176.00
1947.23	1145.53	754.37	1947.23	219.48	71.23	1806.82
1576.87	997.51	666.64	1576.87	215.58	75.02	1429.20
1384.77	849.05	528.61	1383.14	168.89	72.24	1228.75
1251.99	839.51	531.60	1247.35	158.18	62.09	1085.37
1244.25	852.89	541.16	1239.41	162.00	59.65	1070.19
972.88	611.93	319.87	967.93	144.71	54.77	794.97
827.81	474.15	240.16	822.90	99.70	46.16	651.21
655.04	306.83	174.90	650.20	76.54	39.05	481.17
289.98	171.23	118.38	285.22	62.18	38.12	253.30
151.77	114.89	86.39	147.10	53.14	34.10	141.76
99.11	80.83	64.72	94.54	41.29	25.47	93.96
88.94	74.91	60.24	84.53	38.07	23.42	84.55
58.64	57.44	52.03	55.98	36.51	23.30	56.00
42.18	42.18	42.12	42.10	35.81	24.17	42.11
36.49	36.49	36.43	36.42	33.01	24.98	36.43
35.07	35.07	35.02	35.00	32.37	26.23	35.01
36.62	36.62	36.58	36.56	34.26	28.90	36.57
37.24	37.24	37.21	37.19	35.05	29.41	37.19
35.60	35.60	35.57	35.56	33.51	28.21	35.56
36.24	36.24	36.22	36.21	34.24	30.06	36.21
42.31	42.31	42.30	42.30	40.61	37.57	42.30
42.40	42.40	42.40	42.40	41.21	38.83	42.40
41.36	41.36	41.35	41.36	40.96	39.18	41.36
40.36	40.36	40.34	40.36	40.27	39.47	40.36
40.43	40.43	40.41	40.43	40.40	39.67	40.43
40.47	40.47	40.45	40.47	40.01	38.99	40.47
39.20	39.20	39.18	39.20	37.33	35.98	39.20
37.99	37.98	37.95	37.98	34.75	33.89	37.98
40.40	40.39	40.28	40.31	34.27	33.03	40.31
42.67	42.65	42.53	42.57	32.68	30.12	42.57
38.04	38.02	37.91	37.94	27.28	23.44	37.94
37.02	37.00	36.89	36.92	25.94	21.87	36.92
37.86	37.84	37.73	37.75	26.38	22.03	37.75
39.86	39.83	39.73	39.75	27.64	22.95	39.75
42.63	42.61	42.51	42.53	29.85	25.14	42.53
46.47	46.45	46.34	46.36	33.91	28.18	46.36
53.32	53.30	53.19	53.21	38.34	30.43	53.21
54.88	54.86	54.76	54.77	41.59	33.33	54.77
53.05	53.04	53.04	53.04	43.08	34.74	53.04
49.60	49.60	49.60	49.60	42.58	33.88	49.60
47.97	47.97	47.97	47.97	38.72	30.14	47.97
51.73	51.73	51.73	51.73	42.06	32.82	51.73
53.10	53.10	53.10	53.10	43.30	34.08	53.10
62.51	62.51	62.51	62.51	52.82	42.60	62.51
62.70	62.70	62.70	62.70	52.86	42.27	62.70

60.82	60.82	60.82	60.82	50.47	39.35	60.82
54.87	54.87	54.87	54.87	48.25	38.34	54.87
54.75	54.75	54.75	54.75	47.71	37.71	54.75
55.07	55.03	55.00	55.00	47.76	38.00	55.00
52.52	52.46	52.41	52.41	46.91	39.40	52.41
50.89	50.57	50.13	50.13	47.80	41.26	50.13
47.32	46.99	46.56	46.56	44.70	38.64	46.56
46.66	46.33	45.88	45.88	44.11	38.08	45.88
35.20	34.84	34.37	34.37	32.69	27.64	34.37
33.86	33.46	32.93	32.93	31.33	26.00	32.93
33.16	32.71	32.11	32.11	30.75	27.20	32.11
32.53	32.01	31.33	31.33	30.63	28.57	31.33
32.68	32.08	31.27	31.27	30.46	28.24	31.27
34.82	34.17	33.24	33.24	32.26	29.63	33.24
84.35	84.35	84.35	84.35	84.35	84.35	84.35
88.66	88.66	88.66	88.66	88.66	88.66	88.66
97.01	97.01	97.01	97.01	97.01	97.01	97.01
121.43	121.43	121.43	121.43	121.43	121.43	121.43
142.65	142.65	142.65	142.65	142.65	140.28	142.65
167.05	167.05	167.05	167.05	167.05	159.40	167.05
218.75	218.75	218.75	218.75	218.75	189.19	218.75
303.33	303.33	303.33	303.33	303.33	234.03	303.33
369.79	369.79	369.79	369.79	369.79	280.01	369.79
419.68	419.68	419.68	419.68	419.68	323.31	419.68
488.64	488.64	488.64	488.64	488.64	341.37	488.64
531.15	531.15	531.15	531.15	531.15	364.85	531.15
538.15	538.15	538.15	537.71	537.71	367.29	538.15
525.22	525.22	525.22	524.77	524.77	351.88	525.22
522.51	522.51	522.51	522.05	522.05	347.86	522.51
538.98	538.98	538.98	538.49	538.49	356.51	538.98
543.79	543.79	543.15	532.48	532.48	352.85	543.15
525.92	525.92	519.45	490.43	490.43	330.77	519.45
511.00	511.00	503.57	468.39	468.39	308.70	503.57
503.13	503.13	494.16	447.33	447.33	265.76	494.16
481.36	481.36	469.37	386.93	386.93	242.66	469.37
483.38	483.38	469.56	363.81	363.81	196.15	469.56
516.74	516.74	500.86	380.59	380.59	170.96	500.86
586.41	586.41	568.01	422.00	422.00	167.40	568.01
694.55	694.55	674.89	440.27	440.27	155.45	674.89
706.23	706.23	686.10	439.66	439.66	144.32	686.10
702.30	702.30	677.29	438.19	438.19	148.28	677.29
712.03	708.26	678.08	441.91	441.91	154.41	678.08
726.69	722.77	691.37	445.62	445.62	158.44	691.37
833.47	808.05	724.84	423.50	423.50	146.96	724.84
839.14	773.19	643.78	371.84	371.84	151.61	643.78
1066.07	772.93	611.02	327.32	327.32	148.44	611.02
1436.42	835.86	615.65	293.96	293.96	138.48	615.65

1602.05	912.32	664.41	308.37	308.37	132.96	664.41
1620.32	884.88	620.50	353.17	353.17	143.60	620.50
1739.46	958.40	677.65	389.89	389.89	143.55	677.65
1872.79	1116.44	781.43	403.26	403.26	140.48	858.02
2104.70	1196.09	842.08	416.88	416.88	143.52	999.54
2341.84	1341.62	965.70	409.96	409.96	117.58	1166.77
2441.84	1199.76	876.49	391.59	391.59	108.98	1077.71
2245.89	1084.94	813.57	356.82	356.82	100.56	1007.20
1968.50	1010.51	762.87	324.49	324.49	95.35	951.73
1663.38	931.32	723.73	306.53	306.53	94.76	912.81
1572.02	884.14	685.43	276.85	276.85	92.25	848.53
1605.75	919.27	715.74	262.58	262.58	83.79	825.50
1648.95	974.94	750.59	222.09	222.09	68.82	766.93
1498.82	826.02	627.47	173.03	173.03	45.49	562.05
1105.63	606.87	464.71	102.49	102.49	14.36	324.71
684.54	347.68	255.50	51.67	51.67	7.41	57.11
394.57	321.92	239.40	48.13	48.13	6.76	48.60
386.20	315.25	234.82	47.76	47.76	6.99	48.21
388.41	317.18	236.12	48.39	48.39	7.35	48.85
382.17	312.07	232.24	47.31	47.31	7.32	47.76
282.72	240.09	180.29	44.41	44.41	10.58	44.41
190.91	159.59	113.52	28.70	28.70	12.74	28.70
114.52	87.42	60.71	33.65	33.65	14.36	33.65
59.06	50.59	42.03	33.28	33.28	18.62	33.28
53.02	48.82	44.74	35.55	35.55	19.42	35.80
52.07	50.25	48.03	37.46	37.46	19.97	39.68
59.20	57.96	53.13	38.95	38.95	20.41	44.60
69.28	68.09	61.38	39.35	39.35	20.47	52.82
107.81	106.48	96.78	42.73	42.73	19.13	89.24
108.50	107.46	98.16	48.20	48.20	24.18	91.49
116.36	115.91	100.62	45.92	45.92	22.79	94.59
121.60	121.10	101.08	42.19	42.19	19.46	97.19
130.59	127.05	99.22	36.02	36.02	18.07	98.99
132.70	126.30	96.58	29.42	29.42	13.32	96.38
134.86	126.82	96.57	28.68	28.68	13.43	96.57
137.26	125.65	94.53	27.95	27.95	13.61	94.53
137.58	122.65	93.42	28.30	28.30	14.16	93.42
131.93	113.87	84.53	27.98	27.98	14.20	84.53
80.18	62.11	36.80	22.55	22.55	15.90	36.80
76.03	56.85	30.79	11.49	11.49	7.97	30.79
65.87	44.78	24.63	7.32	7.32	4.85	24.63
97.83	66.72	24.84	7.72	7.72	5.09	24.84
112.34	62.59	25.53	7.97	7.97	5.26	25.53
115.23	66.09	27.04	8.43	8.43	5.56	27.04
118.38	69.48	28.95	9.65	9.65	6.67	28.95
122.07	74.99	32.50	11.95	11.95	8.74	32.50
126.26	81.32	37.34	15.63	15.63	9.25	37.34

133.41	89.08	43.75	17.93	17.93	9.80	43.90
168.02	114.11	59.24	29.60	29.60	13.53	59.41
224.97	156.55	86.90	61.11	61.11	39.51	87.12
291.73	199.52	113.75	91.70	91.70	63.43	114.05
244.94	161.96	153.66	131.87	131.87	87.68	154.07
158.57	158.20	154.95	138.08	138.08	84.80	155.32
142.60	142.29	139.56	125.46	125.46	80.91	139.87
138.48	138.21	135.78	123.25	123.25	83.71	136.05
132.47	132.22	130.00	118.59	118.59	82.67	130.25
123.04	122.80	120.69	110.38	110.38	81.65	120.93
114.53	114.53	114.53	111.94	111.94	85.72	114.53
104.91	104.91	104.91	104.91	104.91	88.10	104.91
82.45	82.45	82.45	82.45	82.45	70.01	82.45
74.06	74.06	74.06	74.06	74.06	62.17	74.06
72.24	72.24	72.24	72.24	72.24	63.98	72.24
75.88	75.88	75.88	75.88	75.88	75.28	75.88
78.07	78.07	78.07	78.07	78.07	77.39	78.07
75.05	75.05	75.05	75.05	75.05	74.22	75.05
74.42	74.42	74.42	74.42	74.42	73.39	74.42
80.62	80.62	80.62	80.62	80.62	79.37	80.62
19.25	19.16	8.29	1.31	1.31	0.50	8.29
15.78	15.53	8.60	2.73	2.73	0.89	8.60
21.05	19.43	11.23	5.28	5.28	1.02	11.23
20.78	19.17	11.65	6.09	6.09	1.77	11.65
19.62	18.12	11.32	6.20	6.20	2.22	11.32
19.10	17.58	11.06	6.15	6.15	2.27	11.06
18.27	16.88	10.84	6.29	6.29	2.78	10.84
19.99	16.46	10.19	5.97	5.97	2.78	10.19
21.83	15.48	9.58	5.64	5.64	2.71	9.58
22.15	14.75	9.19	5.36	5.36	2.61	9.19
31.87	16.98	12.68	5.91	5.91	2.90	18.80
67.44	42.34	27.91	8.33	8.33	4.58	52.62
73.57	44.62	29.74	7.59	7.59	5.44	59.39
81.49	48.55	31.97	7.01	7.01	5.25	65.92
92.82	54.73	35.66	6.90	6.90	5.05	75.03
99.30	58.41	37.94	6.98	6.98	5.14	80.35
119.38	69.24	44.49	6.63	6.63	4.44	96.61
146.35	87.43	57.41	7.79	7.79	4.96	126.24
201.17	129.01	84.83	10.53	10.53	6.45	188.80
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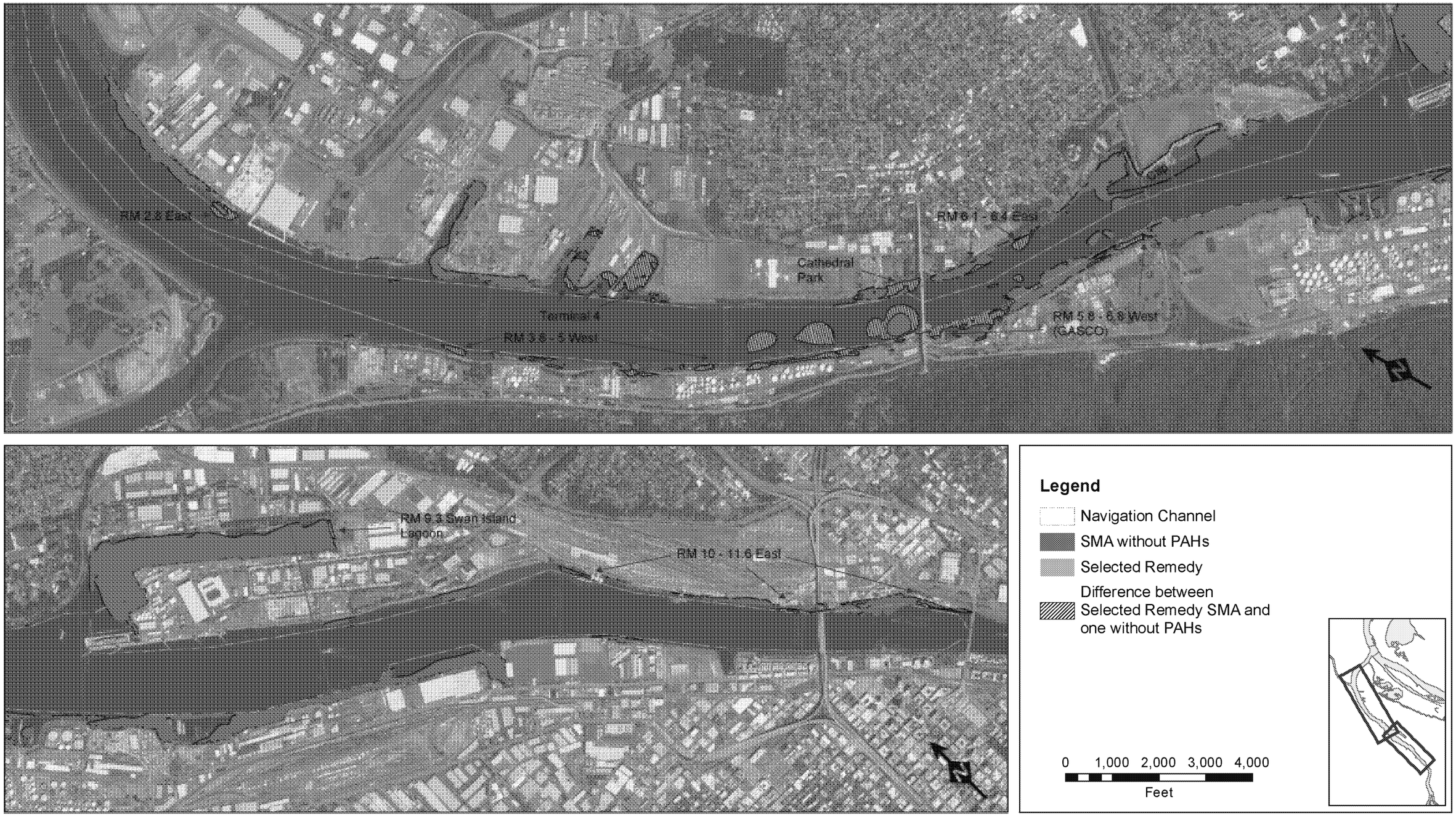


Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1 Selected Remedy Footprint comparison

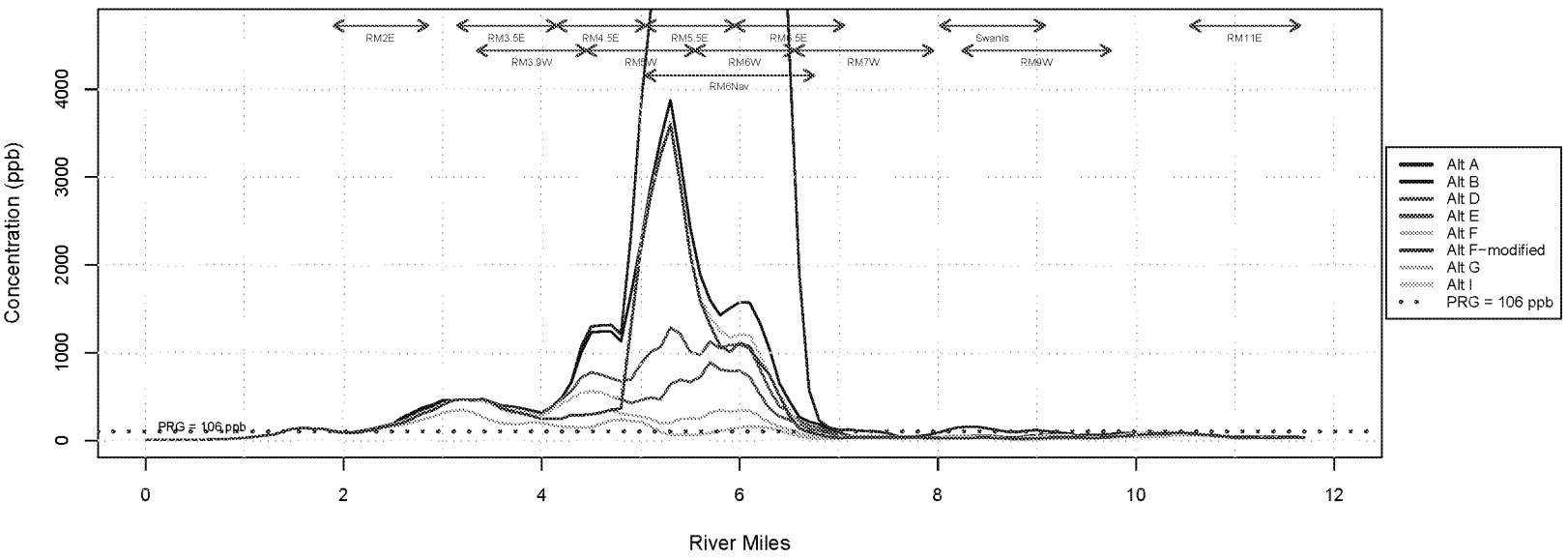
Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\PAH analysis\FigX-X_SMA-Selected-Remedy-minus-PAHs.mxd

Date: 12/2/2017

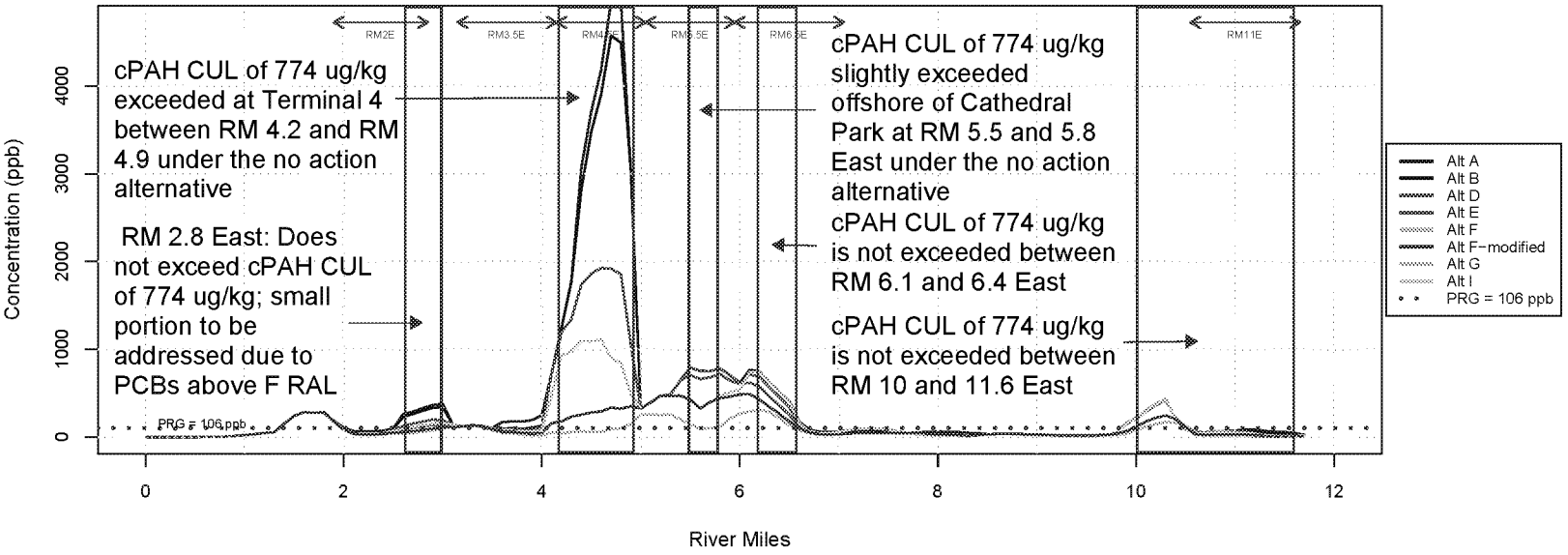
Figure 2

CPAH Rolling River Mile Plots

Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − Site − Rolling Avg 0.5 mile



Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − East − Rolling Avg 0.5 mile



Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − Nav Channel − Rolling Avg 0.5 mile

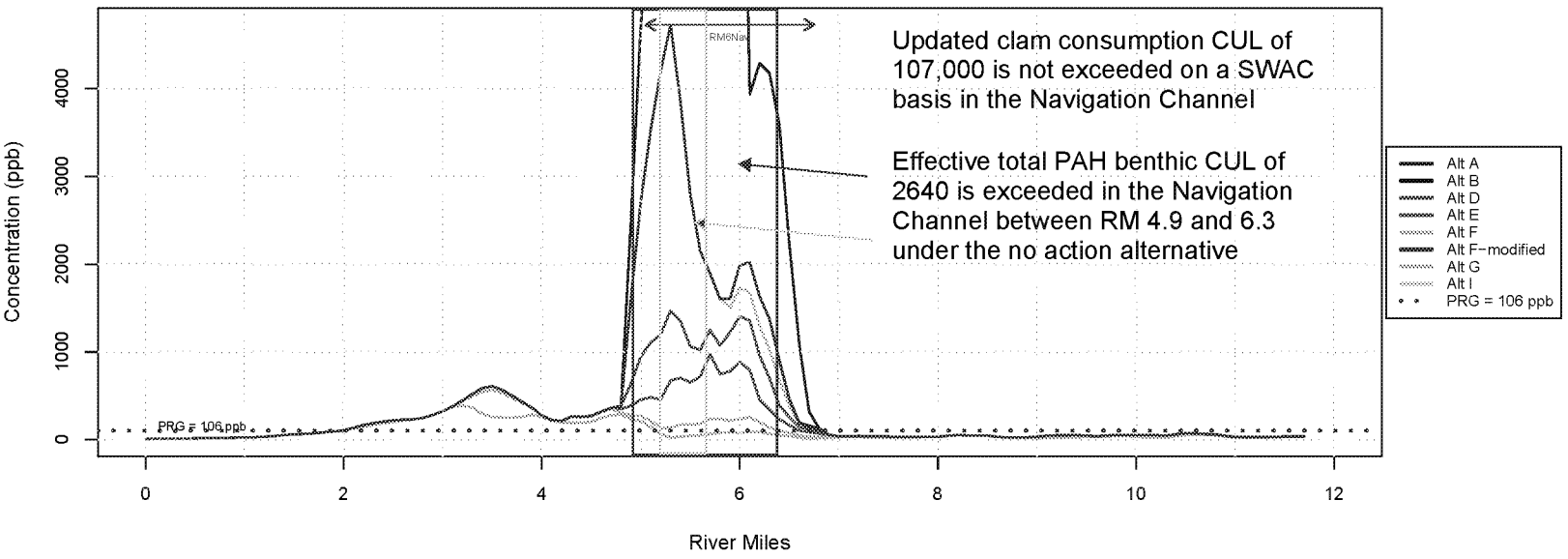
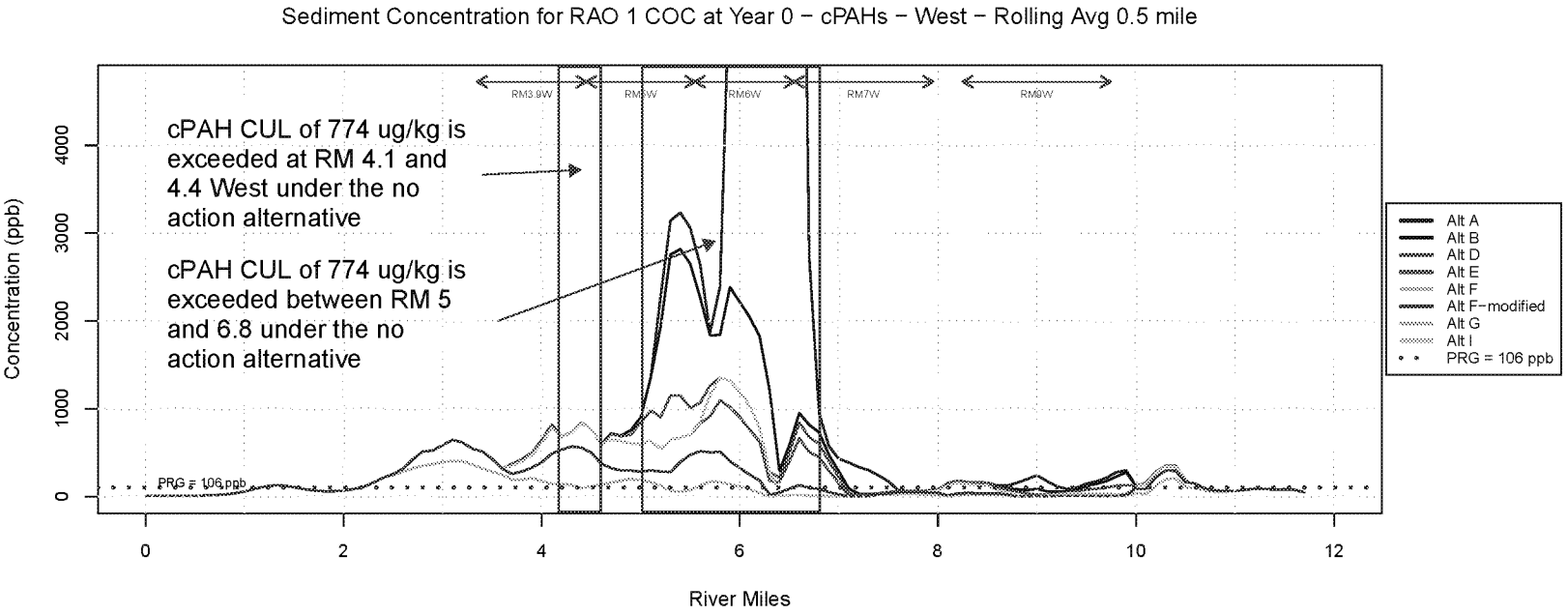


Figure D.10−1c. RAO1 COC Concentration (Year 0) − cPAHs



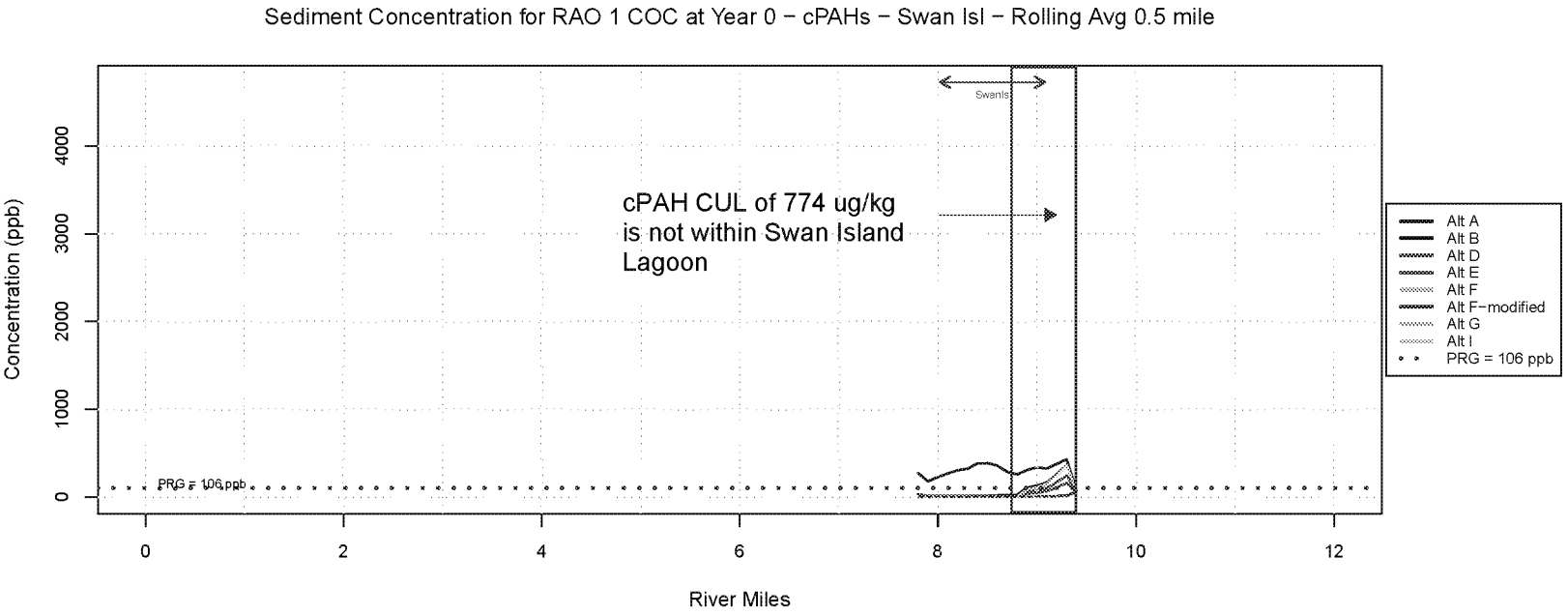


Figure 10.1−c(Continued). RAO1 COC Concentration (Year 0) − cPAHs

Evaluation of Current Total PAH RALs relative to PAH Cleanup Levels

Overall Question: If the total carcinogenic PAH (cPAH) cleanup level is elevated from 12 µg/kg to 774 µg/kg would remediation of PAHs above the current RAL result in remediation of areas of the site that do not pose risk relative to the following risk based thresholds?

1) Remediation of areas that do not pose risk relative to the cPAH CUL of 774 µg/kg
2) Remediation of areas that do not pose risk relative to the total PAH CUL of 23,000 µg/kg
3) Remediation of areas that do not pose risk relative to the other direct contact CULs
4) Remediation of areas that do not pose risk relative to the RAO 2 CULs

This evaluation focuses on areas that only require remediation based on an exceedance of the Site-Wide total PAH RAL of 13,000 µg/kg and the total PAH Navigation Channel RAL of 170,000 µg/kg as depicted on Figure 1. Each question and answer is presented in detail below:

Question 1:

Remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg may result in the remediation of nearshore sediments with cPAH concentrations that do not exceed the updated direct contact cPAH CUL of 774 µg/kg on a SWAC basis. The cPAH CUL of 774 µg/kg is not applicable to the Navigation Channel because the human health direct contact exposure pathway is not considered complete within the Navigation Channel.

Answer:

To evaluate whether remediation of sediments that do not pose a risk, areas that only require remediation due to the presence of PAHs were identified and summarized on Figure 2 and below:

RM 2.8 East: RM 2.8 East does not exceed F RAL for TCDD, PeCDD, PeCDF, or DDx. A portion of this areas exceeds the F RAL for PCBs. The maximum cPAH concentration on a rolling river mile SWAC basis is 379 µg/kg. As a result this area does not exceed updated cPAH CUL of 774 µg/kg under the no action alternative. As a result remediation of PAHs is not required and remedial efforts should focus exclusively on PCBs.

Terminal 4: Contaminated sediments within Terminal 4 do not exceed the F RAL for TCDD, PeCDD, PeCDF or DDx. However, the majority of Slip 1 exceeds F RAL for PCBs except for small area near mouth of slip. Within Slip 3, The F RAL for PCBs is exceeded in a small portion of SE corner of the slip. Total cPAH concentrations between RM 4.3 and 4.9 exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis and range between 1,250 and 4,960 µg/kg.

Cathedral Park: Contaminated sediments offshore of Cathedral Park do not exceed the F RAL for TCDD, PeCDD, PeCDF or DDx. However, some areas of contamination exceed the F RAL for PCBs. Total cPAH concentrations slightly exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis at RM 5.5 (791 µg/kg) and 5.8 (784 µg/kg).

RM 6. 1 to 6.4 East: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. The maximum cPAH concentration is 768 µg/kg (RM 6.1) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 9.3 Swan Island Lagoon: This area does not exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs although the F RAL is exceeded for PCBs and PeCDD elsewhere within Swan Island Lagoon. The maximum cPAH concentration is 432 µg/kg (RM 9.31) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 10 – 11.6 East: This area exceeds the F RAL for PCBs and for DDx and PeCDD in isolated areas. There are three isolated exceedances of the PCB F RAL in this reach. The maximum cPAH concentration is 436 µg/kg (RM 10.3) on a rolling river mile SWAC basis. As a result, the total the cPAH CUL of 774 µg/kg is not exceeded in this area.

RM 3.8 – 5 West: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF or DDx. PCBs exceed the F RAL in a few small, isolated locations. Total cPAH concentrations slightly exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis at RM 4.1 (822 µg/kg) and 5.8 (841 µg/kg).

RM 5.1 – 5.6 West: This area does not the exceed F RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. Total cPAH concentrations exceed the cPAH CUL of 774 µg/kg on a rolling river mile SWAC basis throughout this entire reach with cPAH concentrations ranging between 905 and 3,230 µg/kg.

RM 5.8 – 6.8 West (GASCO): This area also exceeds the F RAL for DDX and PCBs. The cPAH CUL of 774 is exceeded on a rolling river mile SWAC basis throughout this entire reach with cPAH concentrations ranging between 960 and 40,100 µg/kg.

RM 5 – 6.5 Navigation Channel: This area does not exceed the B RAL for TCDD, PeCDD, PeCDF, DDx or PCBs. The maximum cPAH concentration is 19,400 ug/kg on a rolling river mile SWAC basis which does not exceed the updated cPAH clam consumption CUL of 107,600 µg/kg. However, the total PAH CUL of 23,000 is exceeded on a point basis throughout this reach.

Consideration of Question 1 focused on areas that require remediation due to the presence of PAHs only. As summarized in Table 1 and Figure 2, areas that still exceed the direct contact cPAH CUL of 774 µg/kg as measured on a rolling river mile SWAC basis include Cathedral Park, Terminal 4, GASCO and isolated areas of PAH contamination between RM 3.8 and 5 on the west side of the Willamette River. Areas that exceed the F RAL for PAHs but do not exceed the do not exceed direct contact cPAH CUL of 774 µg/kg include RM 2.8 East, RM 6.1 – 6.4 East, Swan Island Lagoon, and RM 10 – 11.6 East. It should be noted that all areas with the exception of Cathedral Park exceed the benthic total PAH CUL of 23,000 µg/kg. In addition, some areas such as Cathedral Park, RM 6.1 – 6.4 East, the upper end of Swan Island Lagoon and certain areas between RM 3.8 and 5 West, may be subject to the beach sediment cleanup level of 85 µg/kg. Regarding the Navigation Channel, the clam consumption cPAH CUL of 107,600 µg/kg is not exceeded as measured on a rolling river mile SWAC basis. However, the benthic total PAH CUL of 23,000 µg/kg is exceeded within the Navigation Channel between RM 5 and 6.5 and is well below the applicable total PAH RAL of 170,000 µg/kg.

Question 2:

Remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg will result in the remediation of PAHs that that do not exceed 23,000 µg/kg total PAH CUL for protection of the benthic community and may result in the remediation of contaminated sediments that do not represent a risk to the benthic community

Answer:

Based on a comparison of Figure 3.4-8 (Total PAH RAL Contours) with Figure 4.1-1 (Benthic Risk Area exceeding RAO 5 PRGs) from the Portland Harbor FS, it can be demonstrated that remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg will not result in the remediation of contaminated sediments that do not pose a risk to the benthic community. Remediation of navigation channel sediments above the total PAH RAL of 170,000 µg/kg would not result in the remediation of contaminated sediments that SWAC basis.

Question 3:

Remediation of nearshore sediments above the site-wide total PAH RAL of 13,000 may result in the remediation of sediments that do not pose a risk to human health through the direct contact human health exposure pathway.

Answer:
Direct contact CULs are exceeded for PCBs and 2,3,7,8-TCDD under the no action alternative. The PCB direct contact CUL is achieved throughout the site through cleanup above the Alternative B RALs while the 2,3,7,8-TCDD direct contact CUL is achieved throughout the site through cleanup above the Alternative E RALs. As a result, remediation of cPAHs above 13,000 µg/kg is not required to address direct contact risk associated with other COCs.

Question 4:

Remediation of nearshore sediments above the site-wide total PAH RAL of 13,000 may result in the remediation of sediments that do not pose a risk to human health through the human health fish consumption exposure pathway.

Answer:

Total PCBs exceed the background based fish consumption CUL of 9 µg/kg throughout the site while total DDX exceeds the fish consumption CUL through the majority of the site. In addition, the various dioxin CULs are exceeded at a range of locations. In particular, the PeCDF fish consumption CUL is exceeded in areas that may be affected by the change in PAH CUL such as Terminal 4, Cathedral Park, and scattered areas of PAH contamination along the west side of the river.

Table 1
Summary of Areas Requiring Remediation Due to PAHs only

Reach	CPAH exceeds 774 µg/kg on Rolling RM SWAC Basis?	CPAH exceeds 107,600 µg/kg on Rolling RM SWAC Basis?	Maximum cPAH Rolling River Mile SWAC Concentration	Total PAH exceeds 23,000 µg/kg on point by point basis?	Maximum total PAH concentration
RM 2.8 East	No	No	379 µg/kg	Yes	228,000 µg/kg
Terminal 4	Yes	No	4,960 µg/kg	Yes	561,000 µg/kg
Cathedral Park	Yes *	No	791 µg/kg	No	11,700 µg/kg
RM 6.1 – 6.4 East	No *	No	768 µg/kg	Yes	78,570 µg/kg
RM 9.3 Swan Island	No *	No	431 µg/kg	Yes	100,200 µg/kg
RM 10 – 11. 6 East	No	No	436 ug/kg	Yes	79,400 µg/kg
RM 3.8 – 5 West	Yes *	No	841 µg/kg	Yes	92,250 µg/kg
RM 5.8 – 6.8 West	Yes	No	40,100 µg/kg	Yes	62,400,000 µg/kg
RM 5 – 6.5 Nav	NA	No	19,400 µg/kg	Yes	6,414,000 µg/kg

* These reaches include or are adjacent to areas identified as recreation beach use areas in the Portland Harbor baseline human health risk assessment.

Evaluation of Current Total PAH RALs relative to PAH Cleanup Levels

Overall Question: If the total carcinogenic PAH (cPAH) cleanup level is elevated from 12 µg/kg to 774 µg/kg would remediation of PAHs above the current RAL result in remediation of areas of the site that do not pose risk relative to the following risk based thresholds?

1) Remediation of areas that do not pose risk relative to the cPAH CUL of 774 µg/kg
2) Remediation of areas that do not pose risk relative to the total PAH CUL of 23,000 µg/kg
3) Remediation of areas that do not pose risk relative to the other direct contact CULs
4) Remediation of areas that do not pose risk relative to the RAO 2 CULs

This evaluation focuses on areas that only require remediation based on an exceedance of the Site-Wide total PAH RAL of 13,000 µg/kg and the total PAH Navigation Channel RAL of 170,000 µg/kg as depicted on Figure 1. Each question and answer is presented in detail below:

Question 1:

Remediation of near shore sediments above the site-wide total PAH RAL of 13,000 µg/kg may result in the remediation of nearshore sediments with cPAH concentrations that do not exceed the updated direct contact cPAH CUL of 774 µg/kg on a SWAC basis. The cPAH CUL of 774 µg/kg is not applicable to the Navigation Channel because the human health direct contact exposure pathway is not considered complete within the Navigation Channel.

Answer:

To evaluate whether remediation of sediments that do not pose a risk, areas that only require remediation due to the presence of PAHs were identified and summarized on Figure 2 and below:

RM 2.8 East: RM 2.8 East does not exceed F RAL for TCDD, PeCDD, PeCDF, or DDx. A portion of this areas exceeds the F RAL for PCBs. The maximum cPAH concentration on a rolling river mile SWAC basis is 379 µg/kg. As a result this area does not exceed updated cPAH CUL of 774 µg/kg under the no action alternative. As a result remediation of PAHs is not required and remedial efforts should focus exclusively on PCBs.

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Question 2:

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Answer:

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Question 3:

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Answer:
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Question 4:

Remediation of nearshore sediments above the site-wide total PAH RAL of 13,000 may result in the remediation of sediments that do not pose a risk to human health through the human health fish consumption exposure pathway.

Answer:

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RM 5.8 – 6.8 West	Yes	No	40,100 µg/kg	Yes	62,400,000 µg/kg
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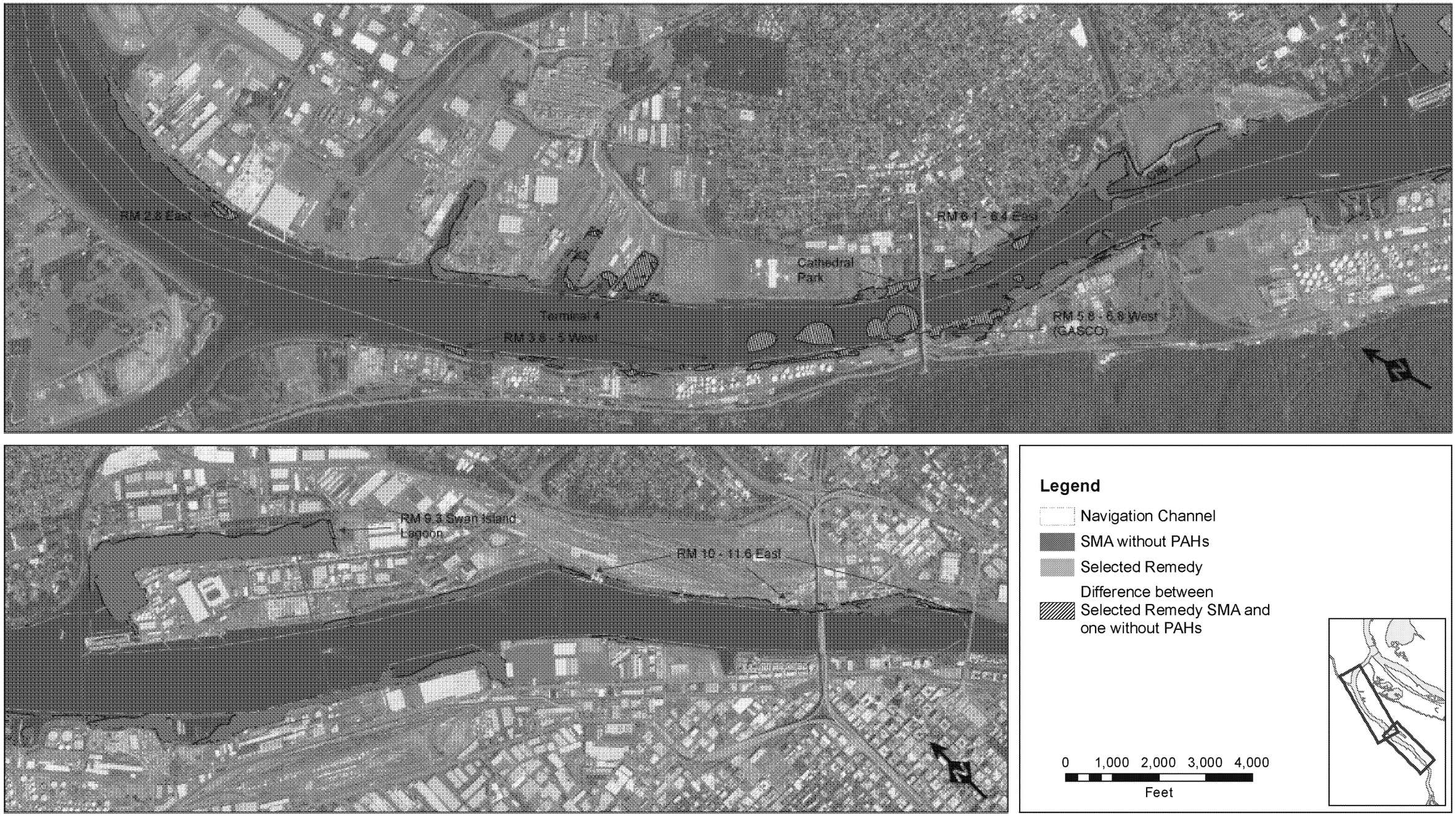
* These reaches include or are adjacent to areas identified as recreation beach use areas in the Portland Harbor baseline human health risk assessment.



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1 Selected Remedy Footprint comparison

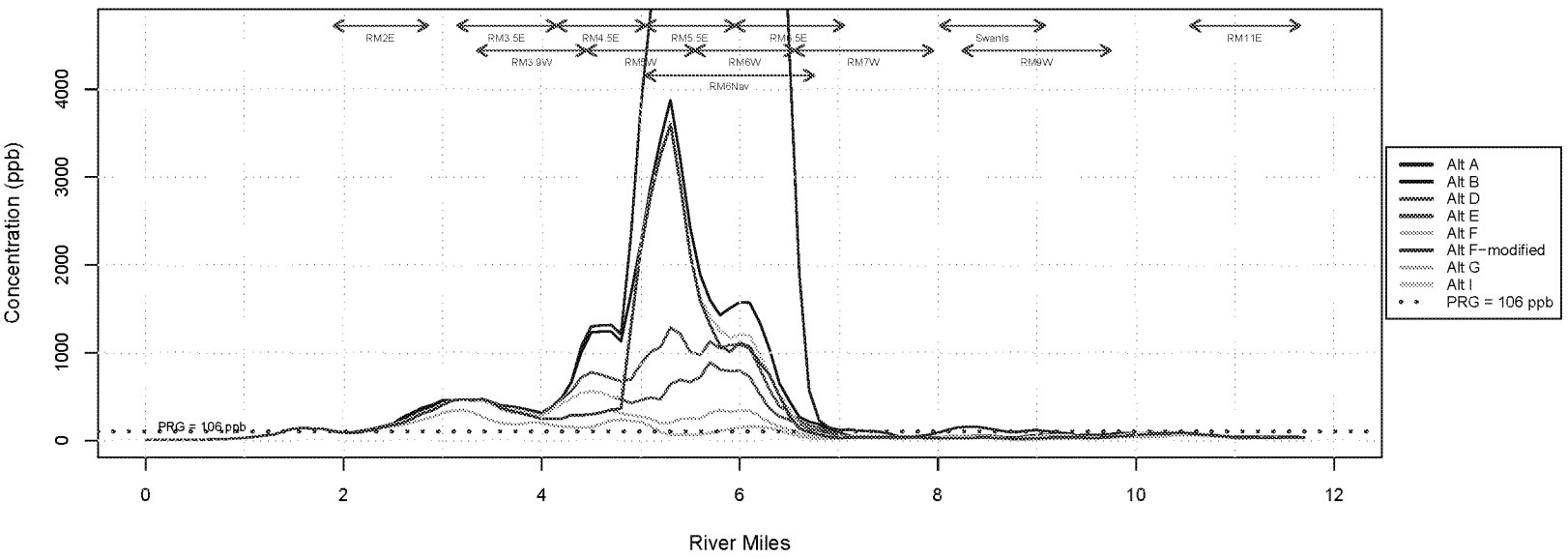
Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\PAH analysis\FigX-X_SMA-Selected-Remedy-minus-PAHs.mxd

Date: 12/2/2017

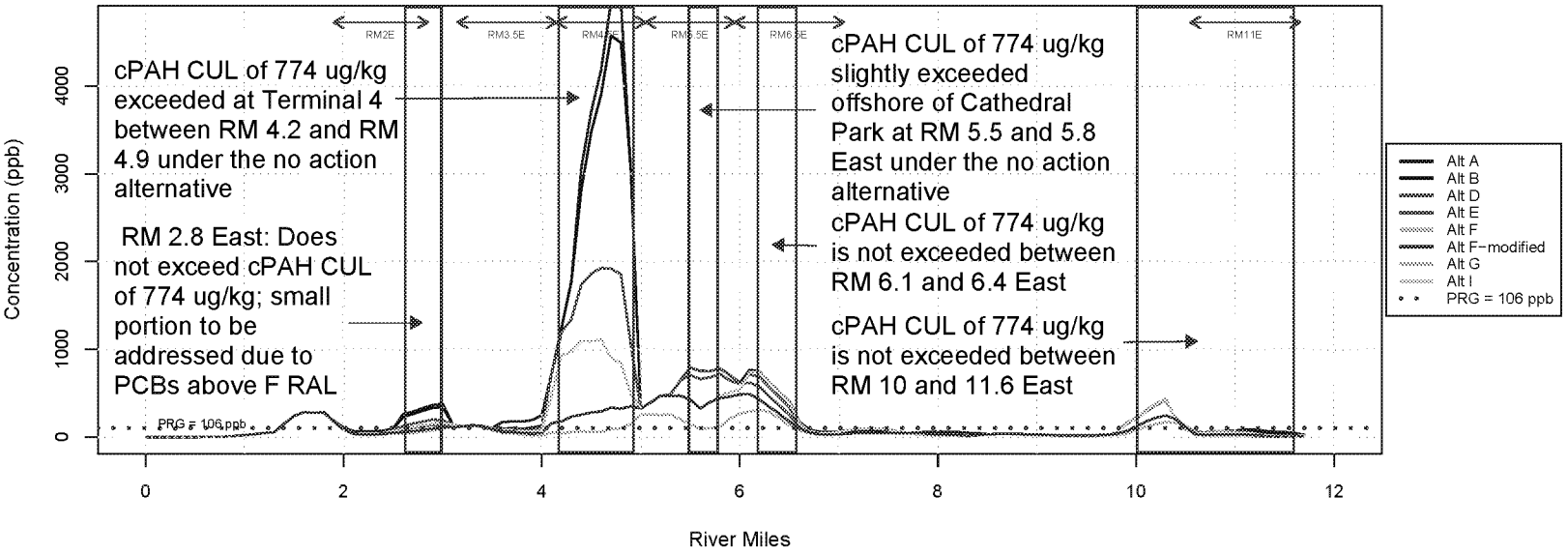
Figure 2

CPAH Rolling River Mile Plots

Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − Site − Rolling Avg 0.5 mile



Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − East − Rolling Avg 0.5 mile



Sediment Concentration for RAO 1 COC at Year 0 − cPAHs − Nav Channel − Rolling Avg 0.5 mile

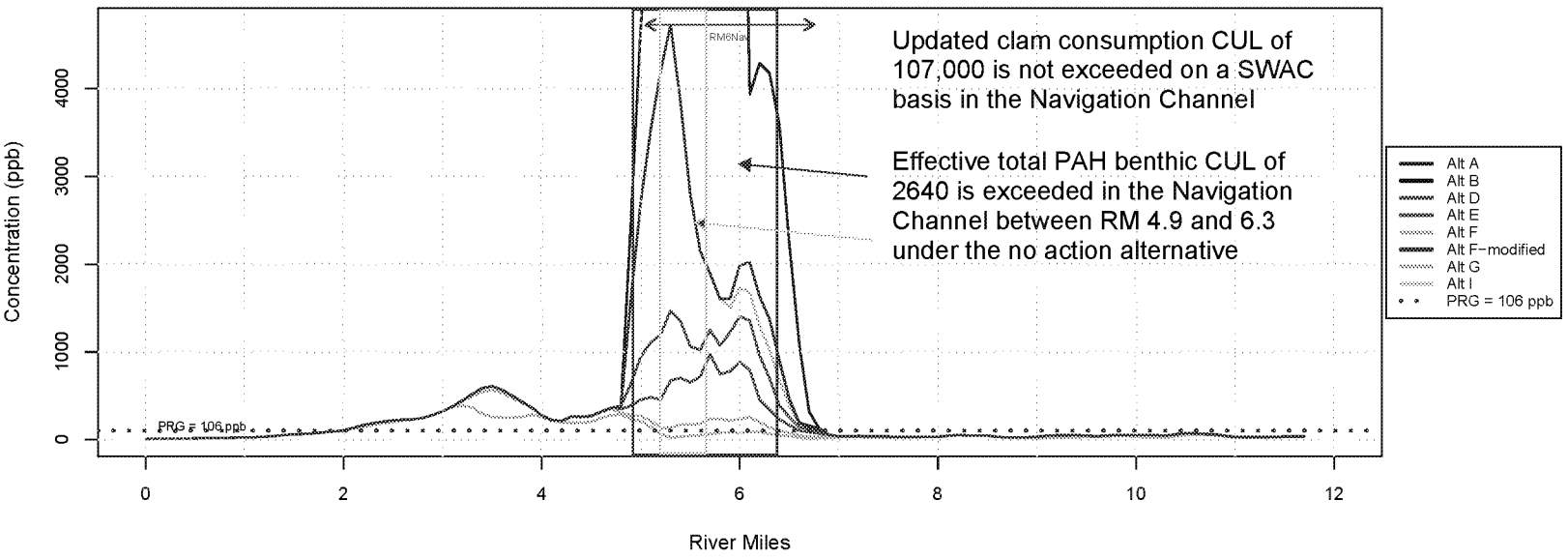
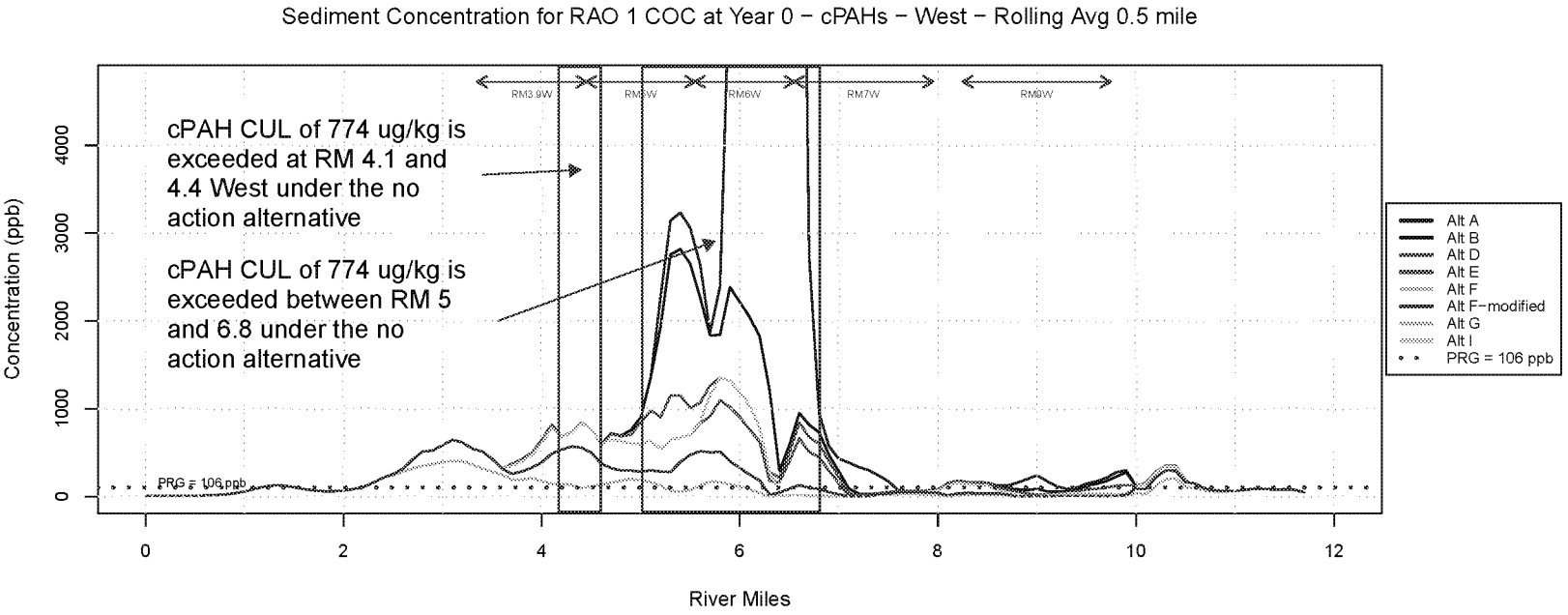


Figure D.10−1c. RAO1 COC Concentration (Year 0) − cPAHs



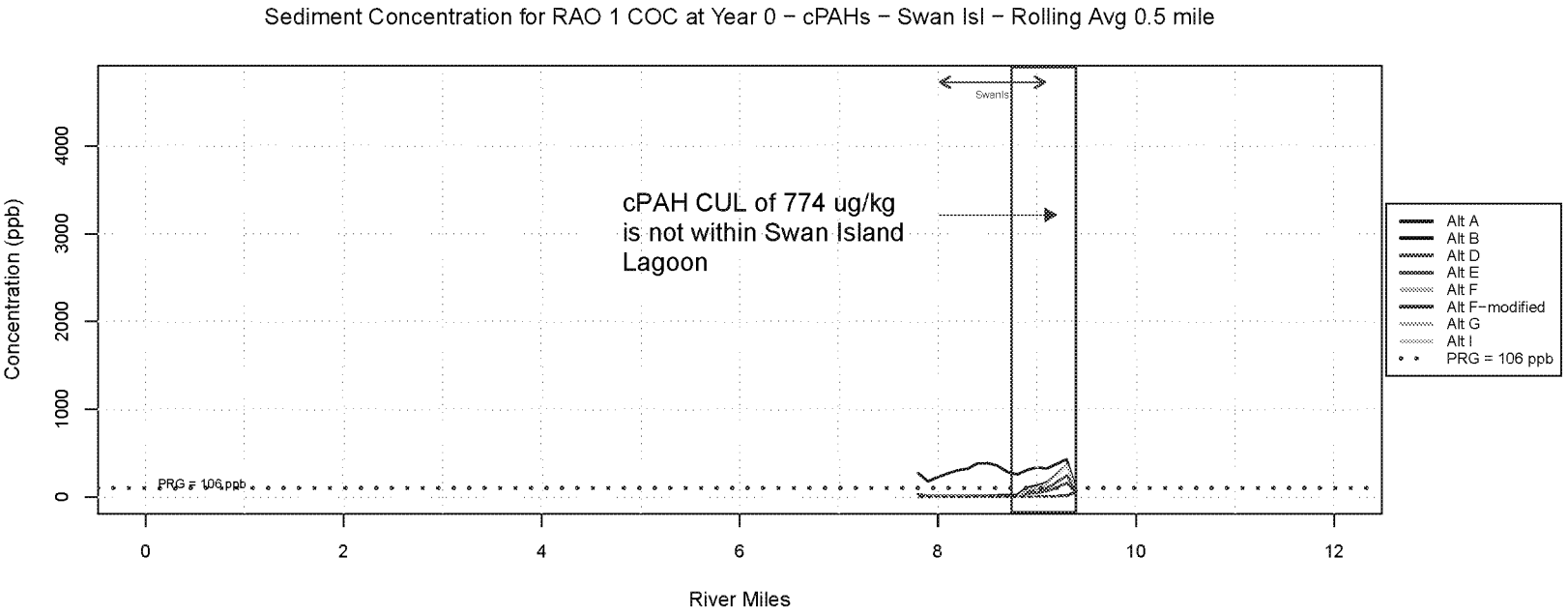
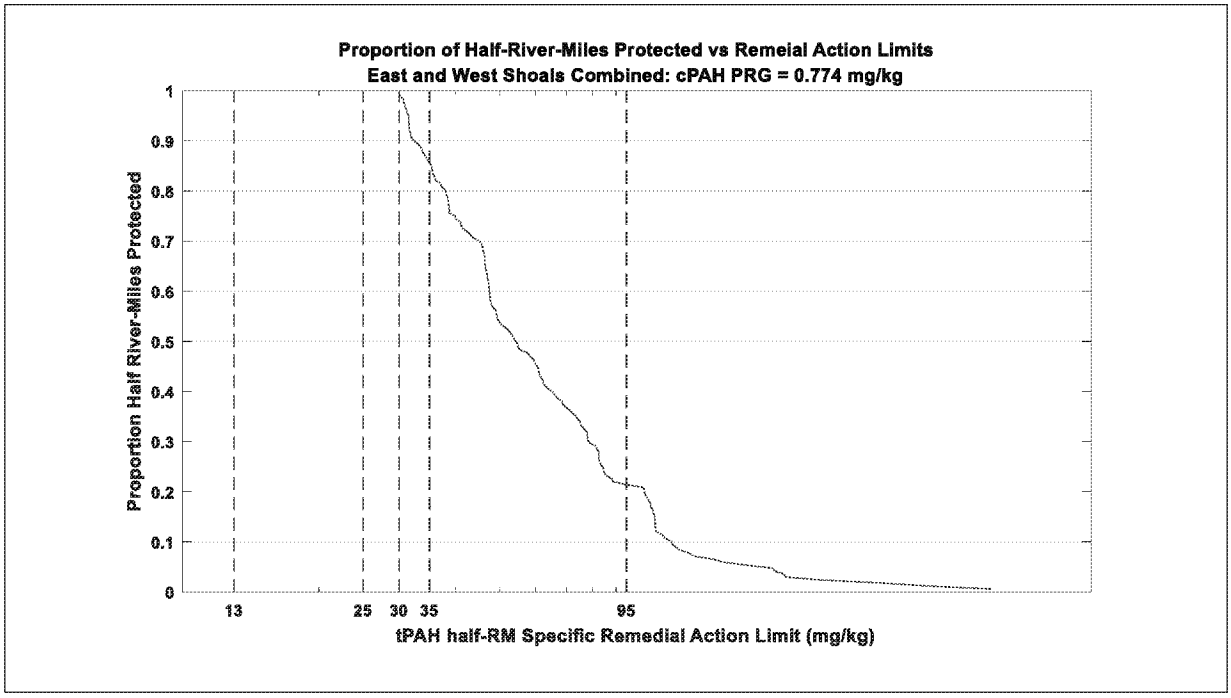
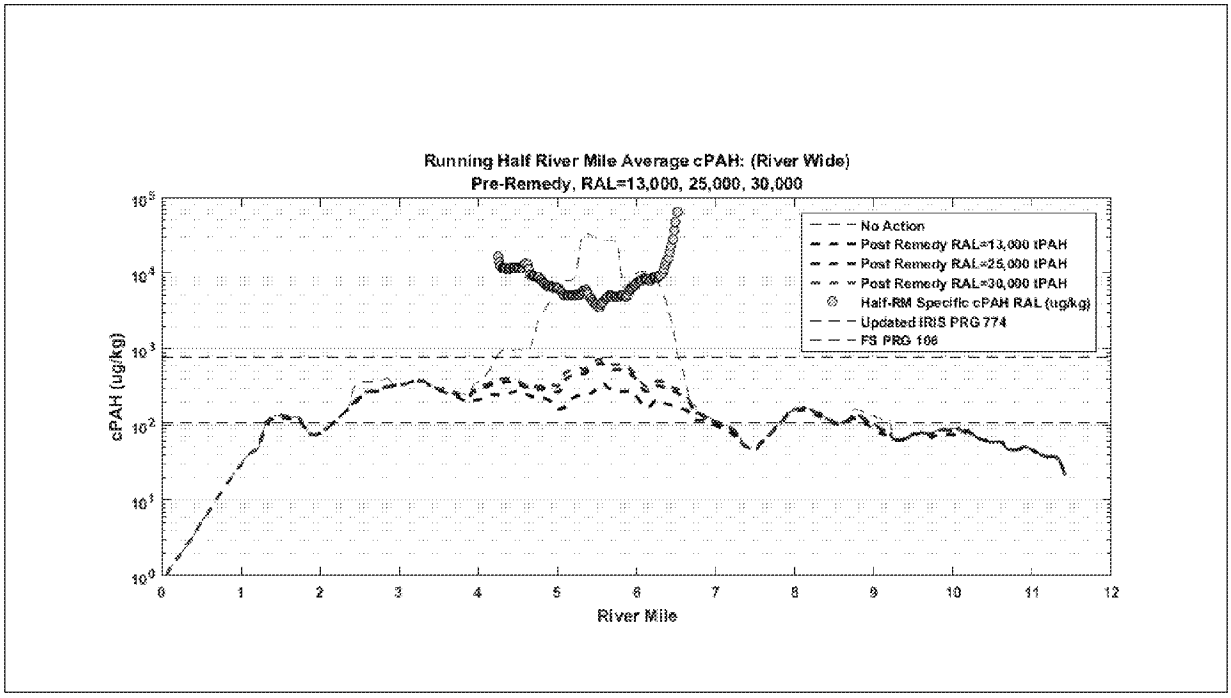
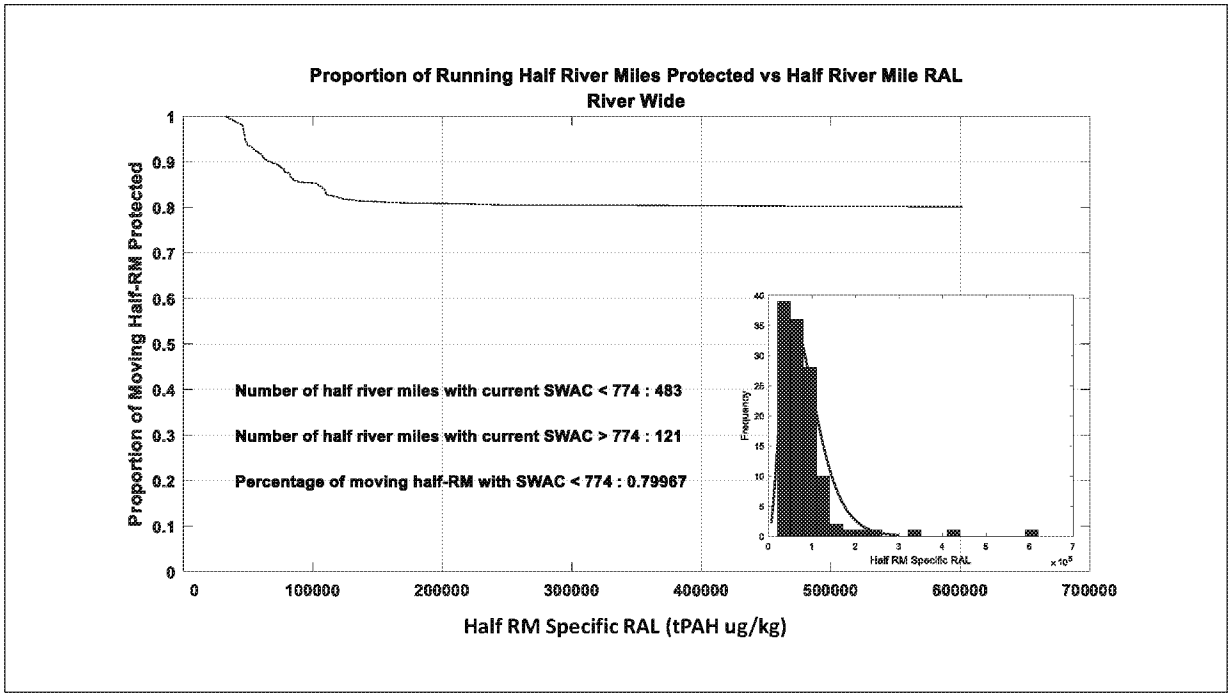
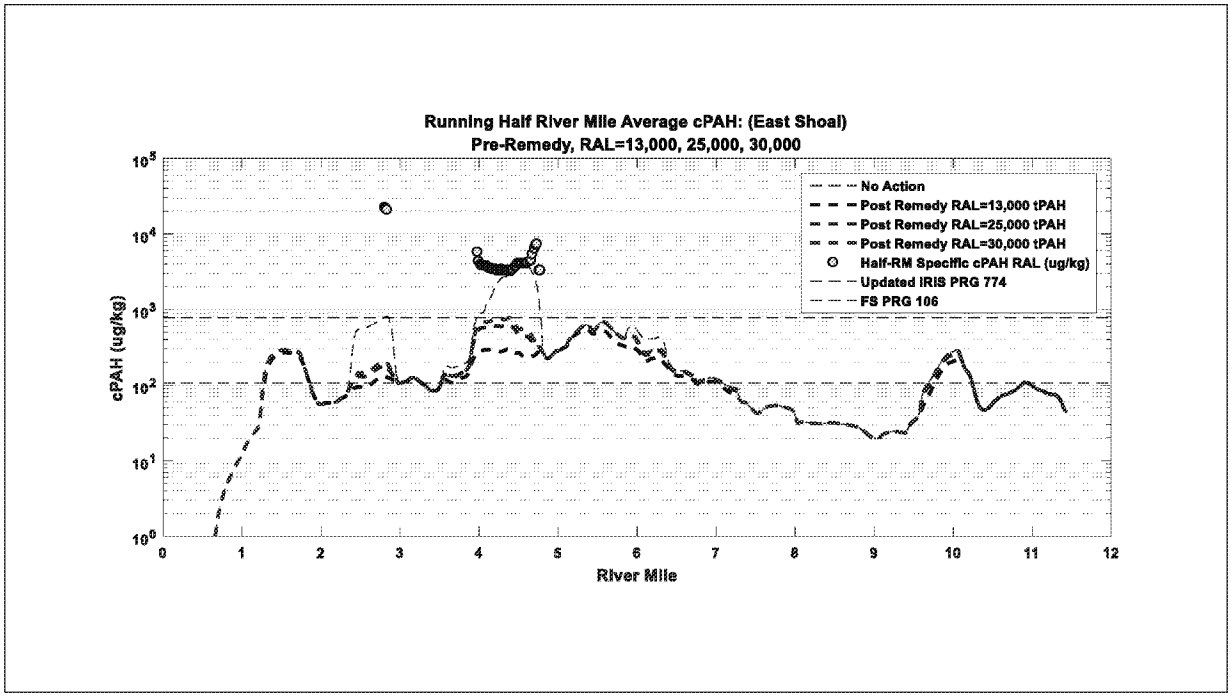


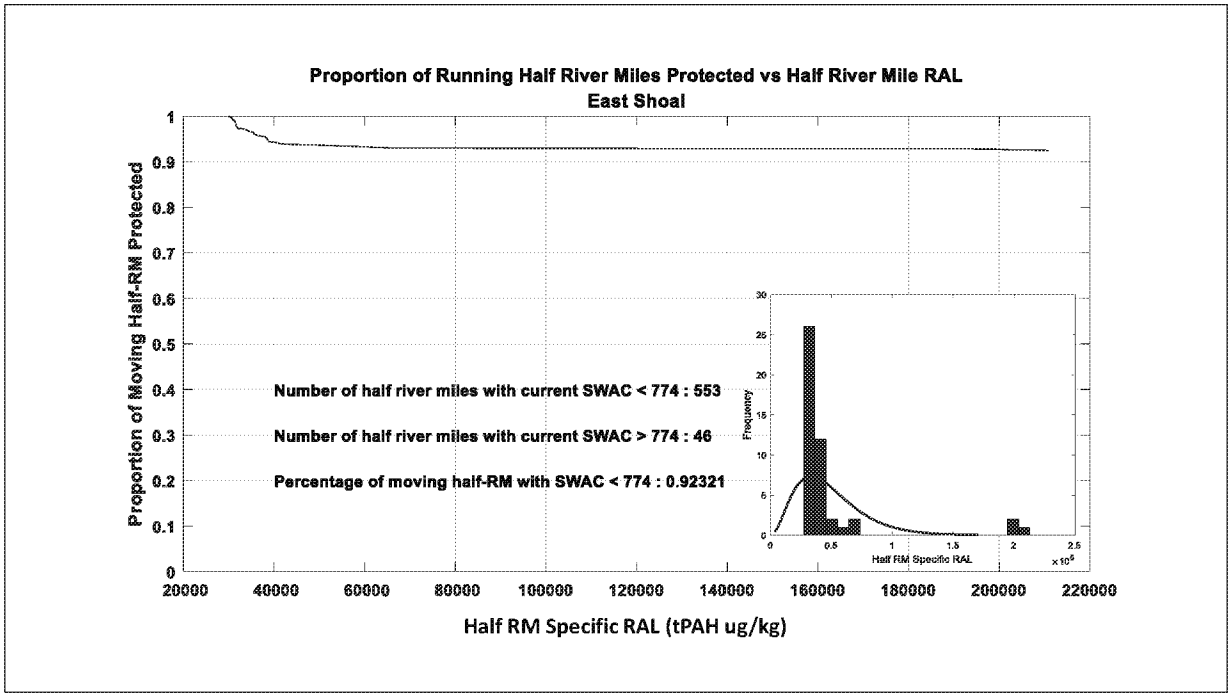
Figure 10.1−c(Continued). RAO1 COC Concentration (Year 0) − cPAHs

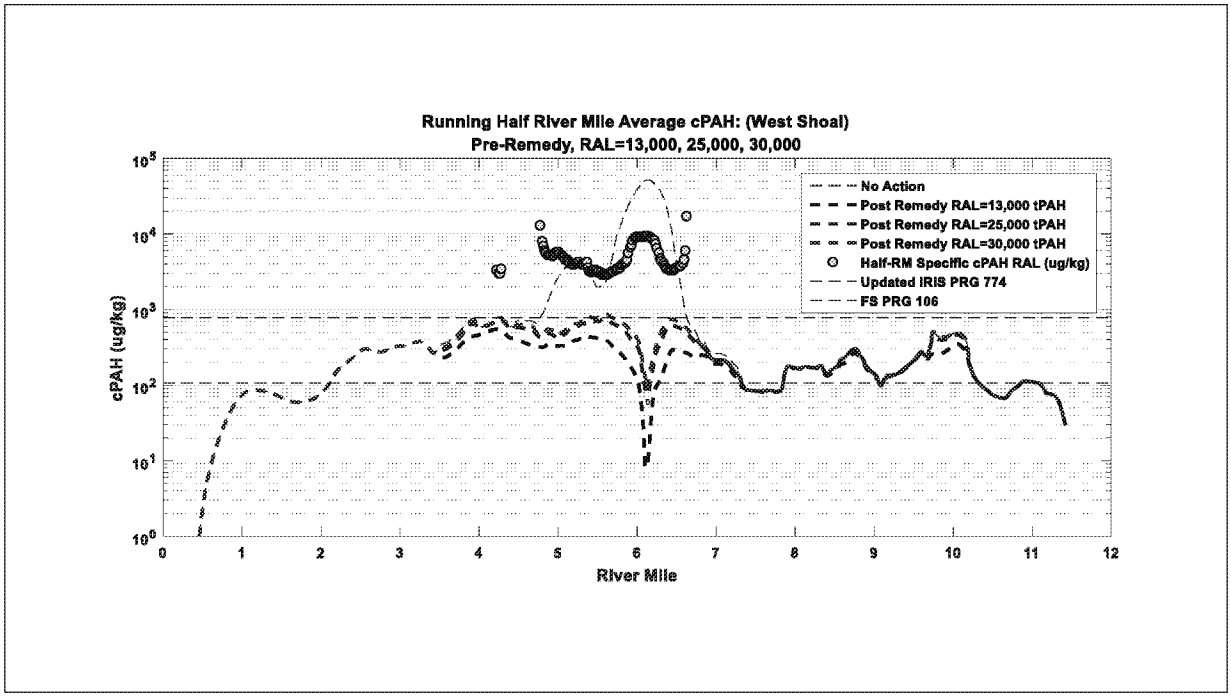

Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)

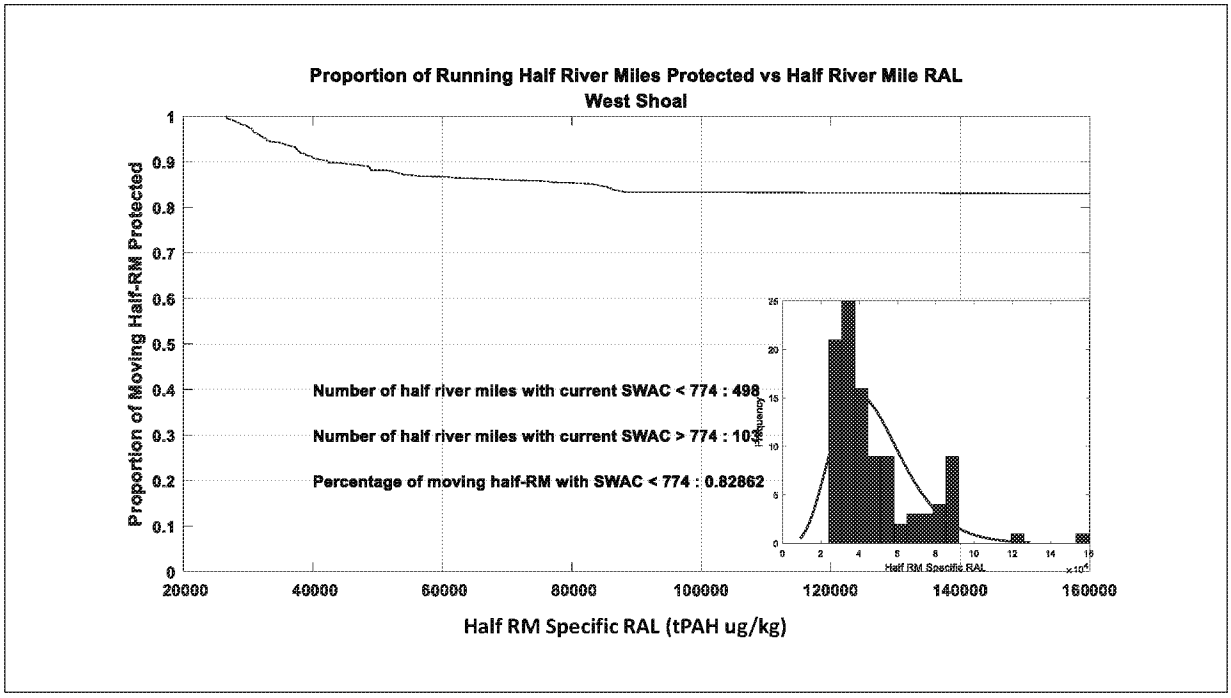

Running Half River Mile Average cPAH: (River Wide)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Half-RM Specific cPAH RAL (ug/kg)
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

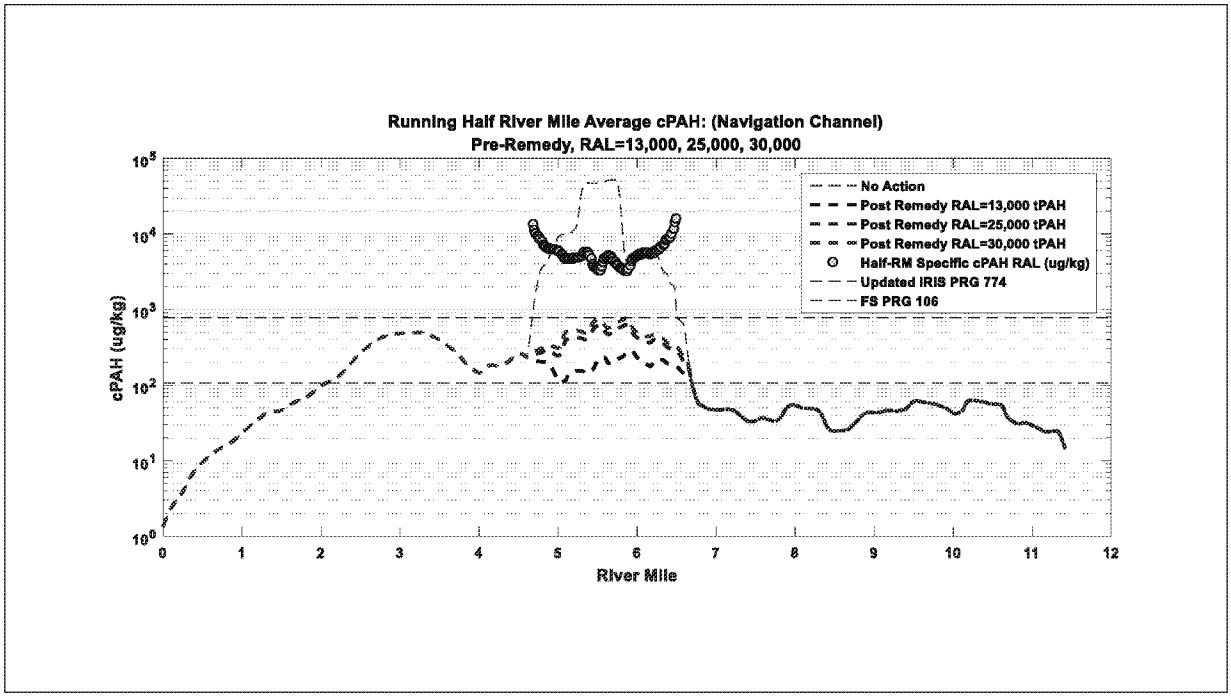

Proportion of Running Half River Miles Protected vs Half River Mile RAL
River Wide
Proportion of Moving Half-RM Protected
Half RM Specific RAL (tPAH ug/kg)
Number of half river miles with current SWAC < 774 : 483
Number of half river miles with current SWAC > 774 : 121
Percentage of moving half-RM with SWAC < 774 : 0.79967
Frequency
Half RM Specific RAL

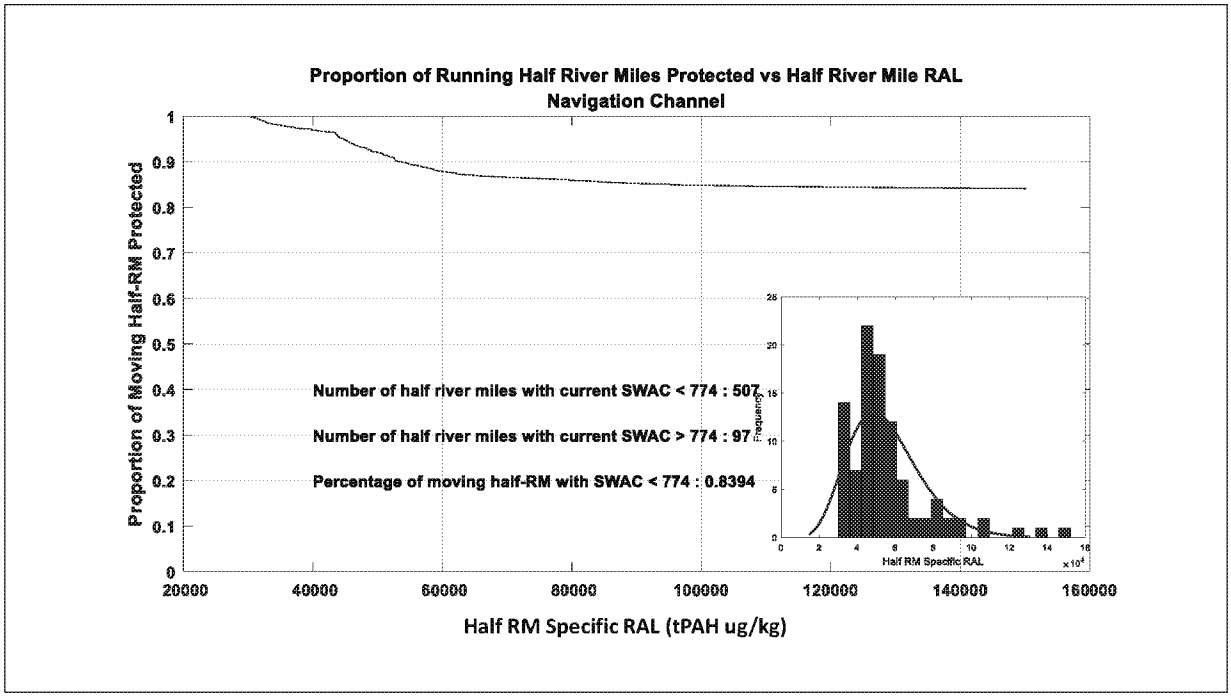

Running Half River Mile Average cPAH: (East Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Half-RM Specific cPAH RAL (ug/kg)
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

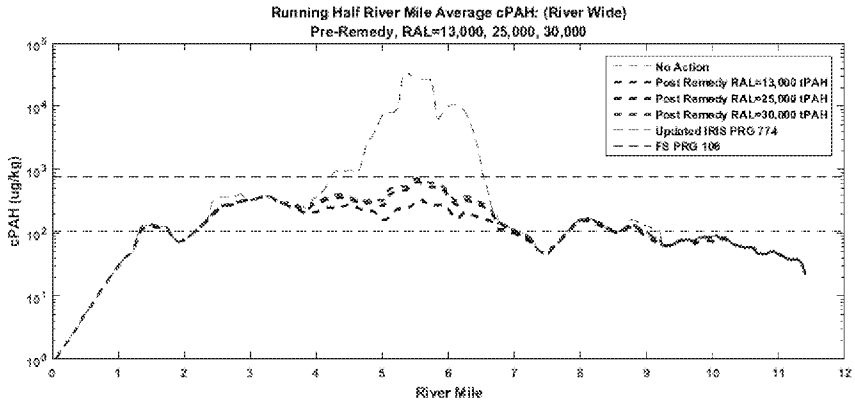

Proportion of Running Half River Miles Protected vs Half River Mile RAL
East Shoal
Proportion of Moving Half-RM Protected
Number of half river miles with current SWAC < 774 : 553
Number of half river miles with current SWAC > 774 : 46
Percentage of moving half-RM with SWAC < 774 : 0.92321
Frequency
Half RM Specific RAL
Half RM Specific RAL (tPAH ug/kg)

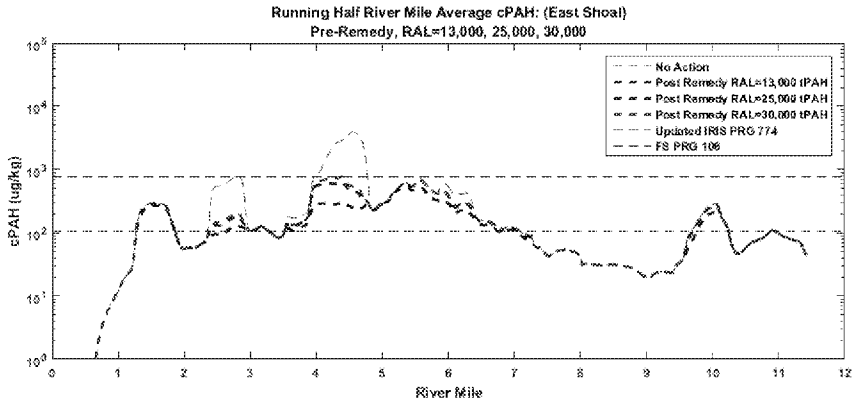

Running Half River Mile Average cPAH: (West Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Half-RM Specific cPAH RAL (ug/kg)
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

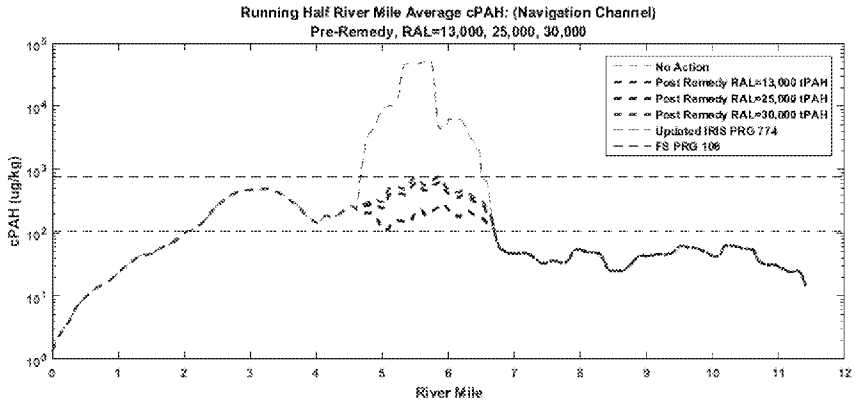

Proportion of Running Half River Miles Protected vs Half River Mile RAL
West Shoal
Proportion of Moving Half-RM Protected
Half RM Specific RAL (tPAH ug/kg)
Number of half river miles with current SWAC < 774 : 498
Number of half river miles with current SWAC > 774 : 10
Percentage of moving half-RM with SWAC < 774 : 0.82862
Frequency
Half RM Specific RAL

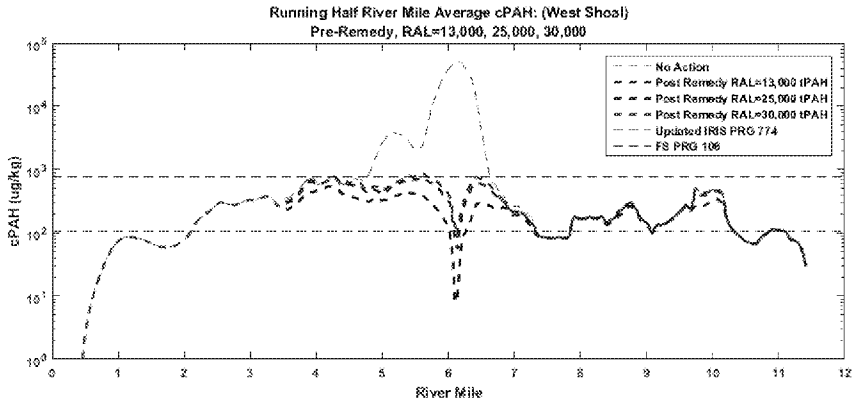

Running Half River Mile Average cPAH: (Navigation Channel)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Half-RM Specific cPAH RAL (ug/kg)
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile


Proportion of Running Half River Miles Protected vs Half River Mile RAL
Navigation Channel
Proportion of Moving Half-RM Protected
Half RM Specific RAL (tPAH ug/kg)
Number of half river miles with current SWAC < 774 : 507
Number of half river miles with current SWAC > 774 : 97
Percentage of moving half-RM with SWAC < 774 : 0.8394
Frequency
Half RM Specific RAL


Running Half River Mile Average cPAH: (River Wide)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile


Running Half River Mile Average cPAH: (East Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile


Running Half River Mile Average cPAH: (Navigation Channel)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile


Running Half River Mile Average cPAH: (West Shoal)
Pre-Remedy, RAL=13,000, 25,000, 30,000
No Action
Post Remedy RAL=13,000 tPAH
Post Remedy RAL=25,000 tPAH
Post Remedy RAL=30,000 tPAH
Updated IRIS PRG 774
FS PRG 106
cPAH (ug/kg)
River Mile

Evaluation of Potential Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

Working Draft – September 5, 2017

ED_002671A_00023329-00001

Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- Requires evaluation of whether a RAL change is necessary based on change in CULs
  - Would current RAL require remediation of sediments that do not pose a risk to human health or the environment?

Cleanup Level (CUL)

- Cleanup levels are the long-term contaminant concentrations that need to be achieved by the remedy to meet the RAOs
- May be risk-based or ARAR-based
- Developed for all COCs on a media-specific basis and specified in Table 17 of ROD
- Two sediment CULs were selected CPAHs
  - Nearshore sediments: 12 µg/kg (based on direct contact exposure scenario)
  - Navigation Channel sediments: 3950 µg/kg (based on clam consumption exposure)

Principal Threat Waste (PTW)

- NCP expectation to use treatment to address the principal threats posed by a site, wherever practicable
- Highly toxic PTW was identified based on a 10^{-3} cancer risk consistent with EPA guidance
  - Highly toxic PTW will be addressed through capping or dredging
  - Highly toxic PTW thresholds are generally below nearshore sediment RALs but above navigation channel RALs
  - Specified in Table 21 of ROD
- PTW consisting of non-aqueous phase liquid (NAPL) or material that cannot be reliably contained has been identified in areas with elevated levels of PAHs

Remedial Action Levels

- RALs were developed by plotting post construction surface weighted average concentrations (SWACs) against acres remediated
- RALs were used to establish remedial alternatives in FS and define areas where capping and/or dredging will be conducted - Sediment Management Areas (SMAs)
- RALs are set above the CUL because they consider the ability to achieve CULs over time through MNR
- Separate RALs established in Portland Harbor ROD for Navigation Channel and Nearshore sediments
  - Nearshore sediments: 13,000 µg/kg
  - Navigation Channel sediments: 170,000 µg/kg

Total PAH and Effective CPAH RALs

- RALS were developed for total PAHs
- Total PAHs can be converted to CPAHs
- Effective CPAH RALs were developed for comparison purposes

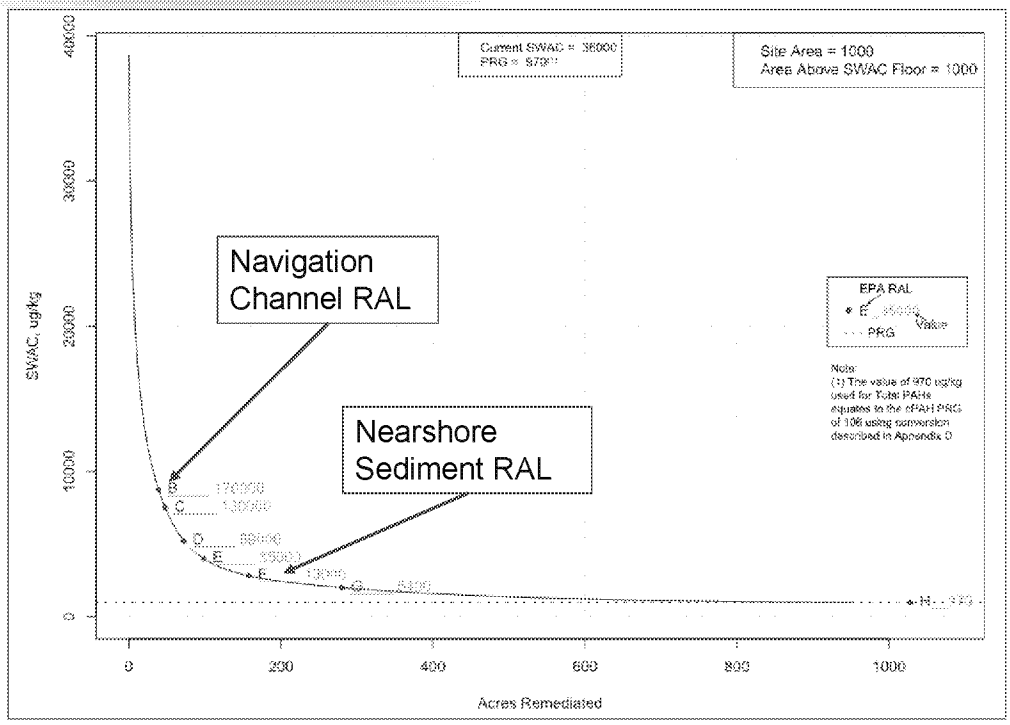
$$TotalPAHs = (BaP - Eq)^m \times 10^b$$

where:

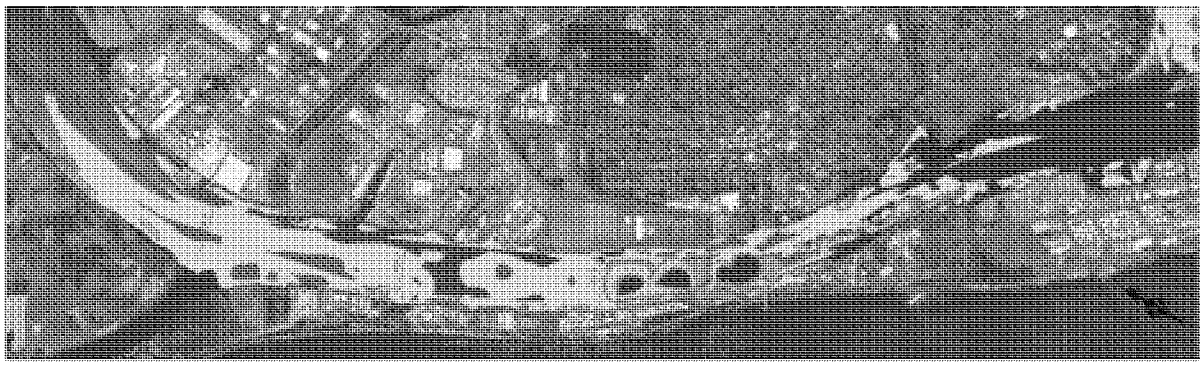
m = 0.984 and b = 0.996.

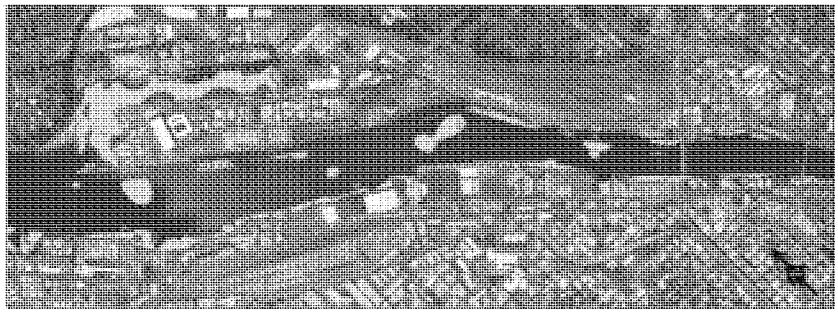
Alternative	RAL	
	Effective CPAH	Total PAHs
Alternative B	20,105	170,000
Alternative C	15,307	130,000
Alternative D	8,041	69,000
Alternative E	4,034	35,000
Alternative F	1,474	13,000
Alternative G	604	5,400
Alternative H	106	975
NWN Proposed Nearshore RAL	10,772	92,000
NWN Proposed Navigation Channel RAL	540,000	4,000,000

Total PAH RAL Curve



Total PAH Remedial Footprints





Legend

Total PAH EPA RALs

- RAL B (>170,000 ug/kg)
- RAL C (>130,000 ug/kg)
- RAL D (>89,000 ug/kg)
- RAL E (>35,000 ug/kg)
- RAL F (>13,000 ug/kg)
- RAL G (>5,400 ug/kg)
- RAL H (>970 ug/kg)

0 1,000 2,000 3,000 4,000
Feet

CPAH Slope Factor Induced Revisions

- CPAH Slope Factor
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Change in CPAH Sediment Cleanup Levels (CULs) and Target Tissue Levels
  - Direct contract sediment cleanup levels increase by a factor of 7.3
  - Clam consumption target tissue levels increase by a factor of 7.3
  - Clam consumption sediment cleanup levels increase from 3,950 µg/kg to 107,600 µg/kg due to non-linear relationship between clam tissue and sediment
- Change in Principle Threat Waste Thresholds
  - Principle threat waste threshold is based on direct contact risk and increases by a factor of 7.3 from 106,000 µg/kg to 774,000 µg/kg

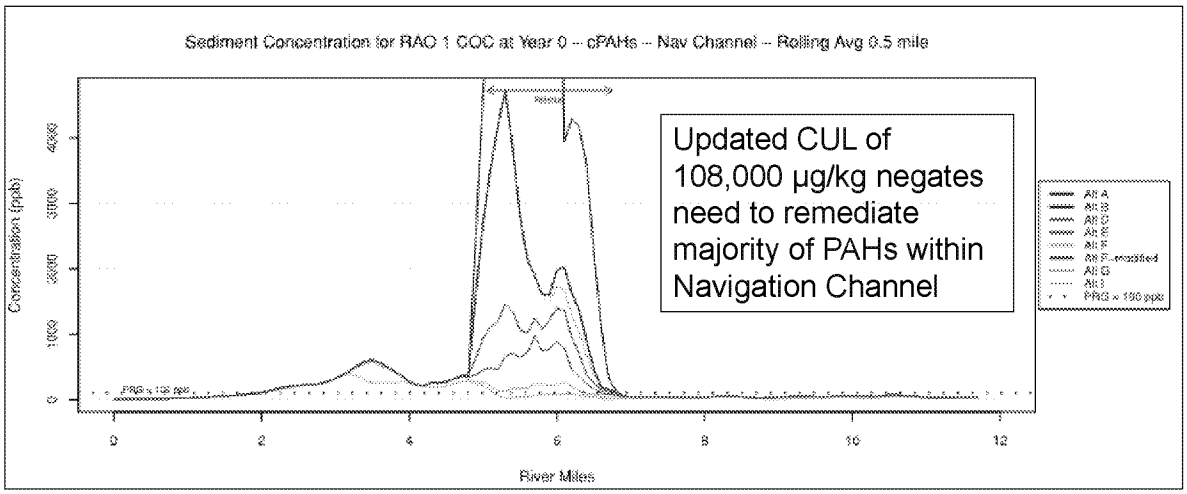
CUL and PTW Threshold Change Summary

Scenario	Application Area	ROD Value	Updated Value
Direct Contact Sediment CUL	Beach Areas and Nearshore Sediment	12 µg/kg	85 µg/kg
Clam Consumption Tissue Target Level	Navigation Channel Sediment	7.1 µg/kg	51.6 µg/kg
Clam Consumption Sediment CUL	Navigation Channel Sediment	3,950 µg/kg	107,600 µg/kg
Highly Toxic PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg

Potential Remedial Footprint Revision Navigation Channel

- Navigation Channel remedial footprint specified in ROD is based on highly toxic PTW threshold and B RAL
  - PTW threshold = 106,000 µg/kg CPAHs
  - Navigation Channel RAL = 170,000 µg/kg total PAHs
- Revising CPAH CUL to 107,600 µg/kg and PTW threshold to 774,000 µg/kg eliminates remediation of most PAH contamination within Navigation Channel
  - Total remedial footprint reduced from 365 to 339 acres
  - Reduction in dredging volume by 133,000 to 177,000 cy
  - Reduction in present value remedial costs by $22M from $1,054M to $1,032M

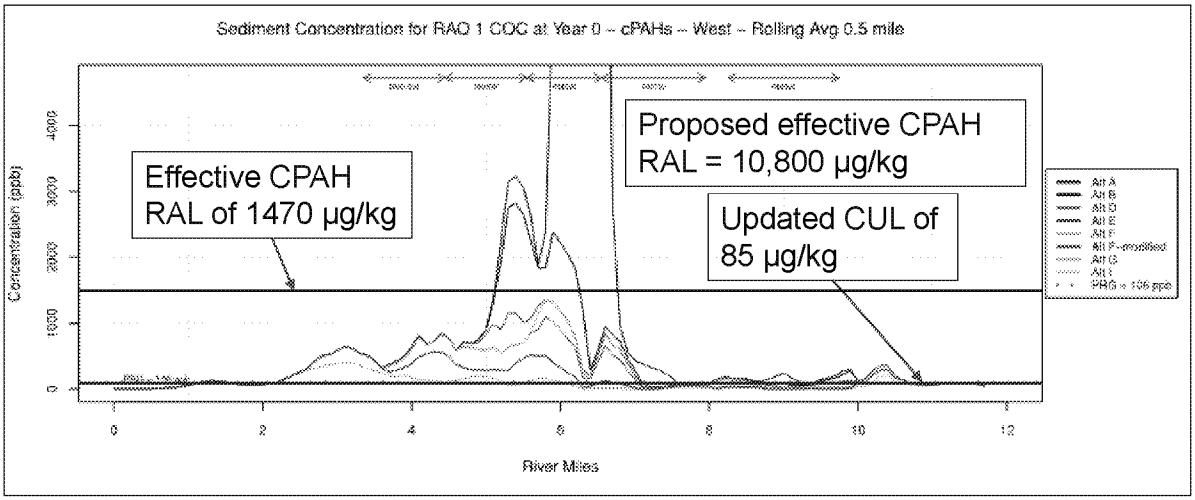
CPAHs – Navigation Channel



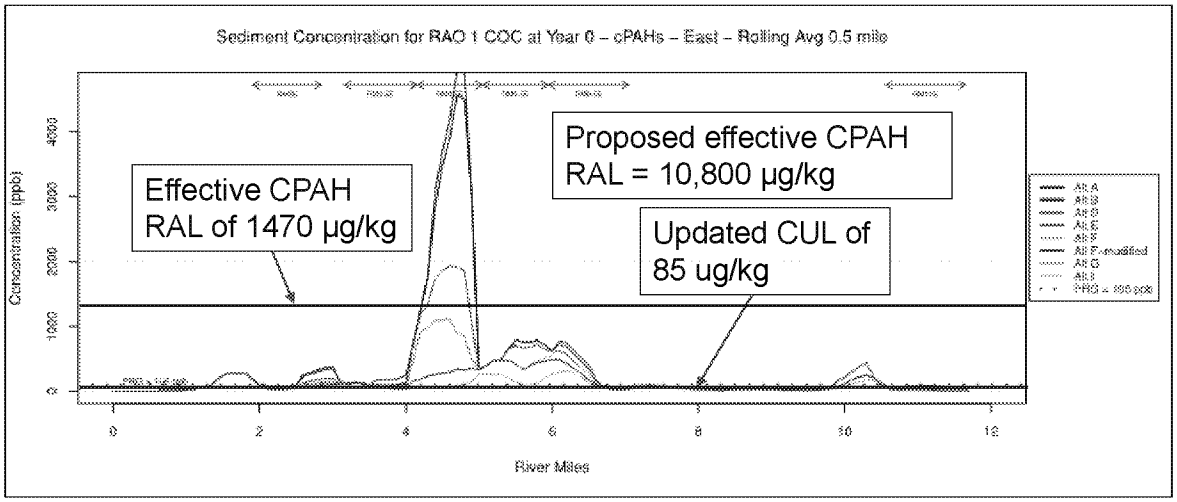
Potential Remedial Footprint Revision Nearshore Area

- Remedial footprint specified in ROD is based on total PAH RAL of 13,000 RAL µg/kg
- Northwest Natural Memo proposed nearshore RAL revision in BAP memo based on proportionality analysis:
  - CPAHs: 10,800 µg/kg; Total PAHs: 92,000 µg/kg
- Change in nearshore remedial footprint not required due to change in slope factor
  - Updated CUL and PTW thresholds do not eliminate need to remediate nearshore PAHs to reduce risk
  - NWN Proposed RAL would eliminate remediation of the majority of PAH contaminated sediments

CPAHs – Nearshore West



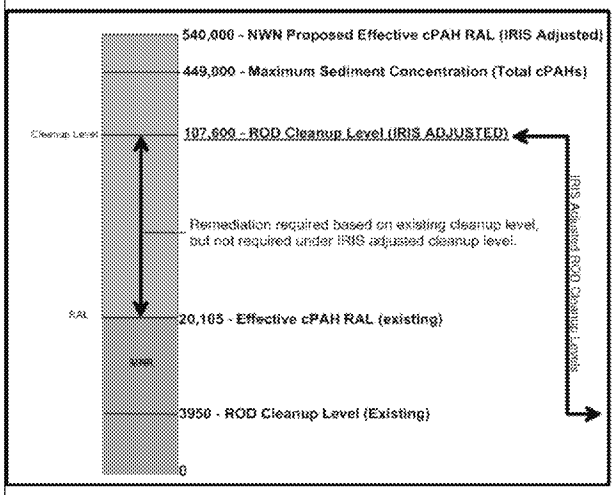
CPAHs – Nearshore East



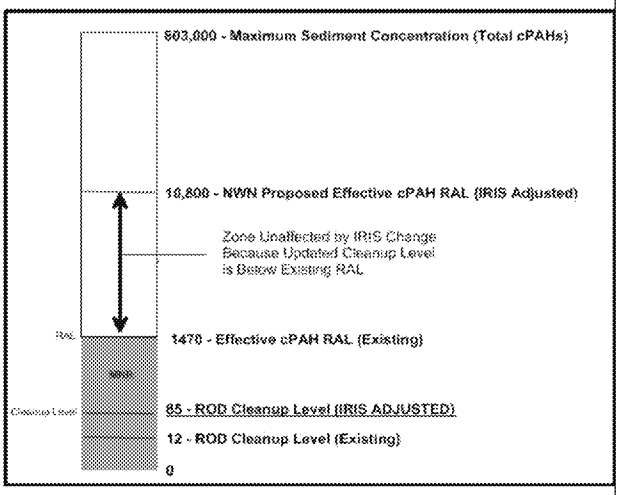
Clean-up Level and RAL Change Summary

RULE: RALs SHOULD NOT BE REVISED UNLESS THEY ARE BELOW CLEANUP LEVEL

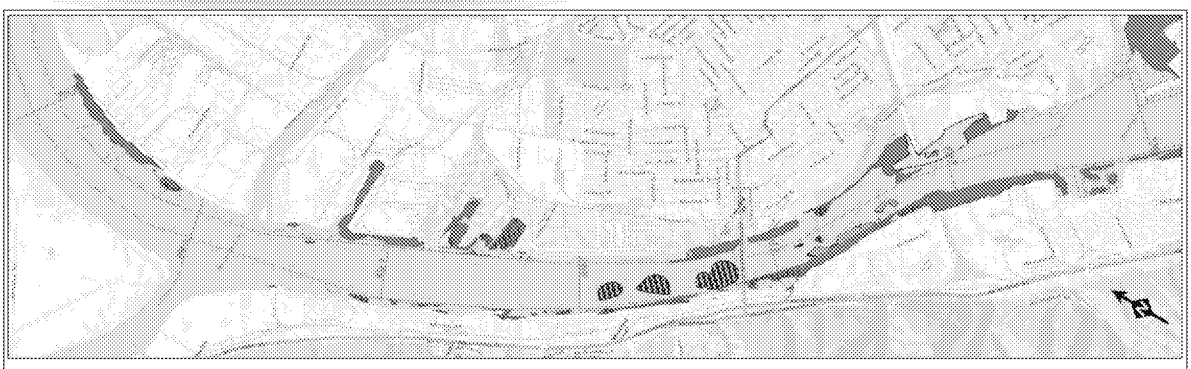
Navigation Channel = B RAL

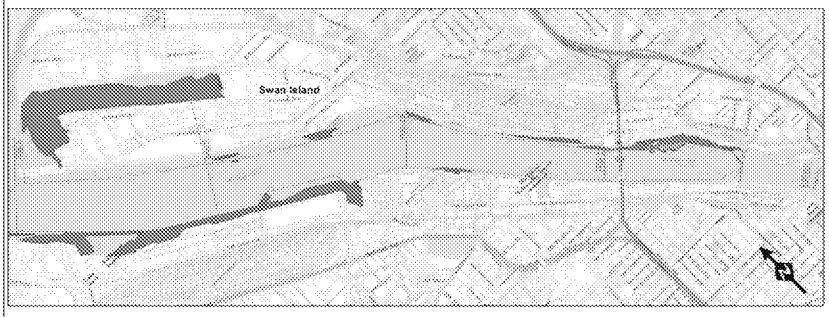


Nearshore Area = F RAL



Potential Remedial Footprint Revision





Legend

Navigation Channel

SMA

Navigational Channel

Remedial Footprint as Presented in Portland Harbor Record of Decision

Portion of RCSD remedial footprint addressed based on updated benzo(a)pyrene cancer slope factor

Nearshore

Remedial Footprint as Presented in Portland Harbor Record of Decision

Portion of RCSD remedial footprint addressed based on updated benzo(a)pyrene cancer slope factor

0 1,000 2,000 3,000 4,000

Feet

Sediment Management Area from the Record of Decision and Potential Sediment Management Area Revision due to Updated Benzo(a)pyrene Cancer Slope Factor

Portland Harbor Superfund Site

Proposed Change Summary

- The updated BAP cancer slope factor provides a basis for increasing risk based cleanup levels, target tissue levels for clams and highly toxic PTW thresholds
- Potential RAL Changes
  - Revising Navigation Channel remedial footprint is appropriate based on updated CUL
    - Current TPAH RAL of 170,000 equates to a CPAH RAL of 20,105 µg/kg which is below updated navigation channel CUL of 107,600 µg/kg
    - Revised CPAH PTW threshold of 774,000 µg/kg is not exceeded in the Navigation Channel
  - Revising Nearshore RAL is not required based on updated CUL
    - Current TPAH RAL of 13,000 equates to a CPAH RAL of 1,474 which is above updated nearshore CUL of 85 µg/kg
    - Nearshore average concentrations are above 85 µg/kg in areas requiring remediation

Proposed RAL Change Implications

- Revising the Navigation Channel remedial footprint will:
  - Reduce the remedial footprint from 365 to 339 acres
  - Reduce the Navigation Channel dredging volume by 133,000 to 177,000 cy
  - Reduce in present value remedial costs by $22M
- Revising the Nearshore remedial footprint will:
  - Reduce the nearshore remedial footprint by 30 acres
  - Reduce nearshore dredging volume by 91,000 to 121,000 cy
  - Reduce the present value remedial cost by $61M
- Reducing the remedial footprint will reduce the area remediated to address benthic risk
  - Navigation Channel: 25 acres reduction (38 to 13 acres)
  - Nearshore Area: 35 acres reduction (302 to 267 acres)

Proposed RAL Change Implications

- Reducing remedial footprint may limit the ability of the remedy to meet CPAH water quality standards
  - Increased PAH load observed between RM 6.3 and RM 3.9
- Eliminating the remedial footprint in the Navigation Channel may prevent removal of NAPL/NRC PTW consistent with ROD
  - Elevated levels of PAHs indicative of NAPL detected in Navigation Channel
- Revising TPAH RAL may affect FS alternative evaluation
  - RALs served as the basis for developing and evaluation remedial alternatives in the FS
- Revising RAL may be more difficult to implement administratively than adjusting risk based thresholds

Message

From: Gail Fricano [GFricano@indecon.com]
Sent: 9/26/2017 3:38:17 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
CC: 'courtney@crag.org' [courtney@crag.org]; 'Julie Weis (JWeis@hk-law.com)' [JWeis@hk-law.com]; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; 'Matthew Johnson (MatthewJohnson@ctuir.org)' [MatthewJohnson@ctuir.org]; 'Alanna Nanegos (AlannaNanegos@ctuir.org)' [AlannaNanegos@ctuir.org]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; 'Jen Graham (jennifer.graham@ctwsbnr.org)' [jennifer.graham@ctwsbnr.org]; 'holly.partridge@grandronde.org' [holly.partridge@grandronde.org]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; 'Josh Newton' [jn@karnopp.com]; Rita Cabral [RCabral@indecon.com]; Rachel DelVecchio [RDelVecchio@indecon.com]
Subject: Five Tribes comments on BaP update
Attachments: Five Tribes Comments on NWN BaP memo 26Sept2017.pdf

Hi Sean,

Attached are comments on behalf of the Five Tribes on the topic of benzo(a)pyrene cancer slope factor update and its potential implications on Portland Harbor Superfund Site cleanup levels and remedial action levels.

As always, we appreciate the opportunity to provide feedback on this important project.

Best wishes,

Gail

Gail French Fricano
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www.indecon.com

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 8/24/2017 6:40:39 PM
To: Blischke, Eric [blischkee@cdmsmith.com]
CC: Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Stephanie Ebright (EBRIGHT.STEPHANIE@EPA.GOV) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]
BCC: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Cami Grandinetti (Grandinetti.Cami@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]
Subject: RE: BaP sf deliberative
Attachments: RE: BaP

Deliberative Process / Ex. 5

S

Sean Sheldrake, Unit Diving Officer, RPM
EPA Region 10, 1200 Sixth Ave., Suite 900; Mailstop DOC-01
Seattle, WA 98101
206.553.1220 desk
206.225.6528 cell
http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

Over 47 years of scientific diving in support of EPA's mission

-----Original Message-----
From: Blischke, Eric [mailto:blischkee@cdmsmith.com]
Sent: Thursday, August 24, 2017 9:46 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Scott Coffey <coffeyse@cdmsmith.com>
Subject: RE: BaP

I am available at that time. In the meantime, I have looked at some of the PAH SW data. There are limited samples for the purpose of evaluating PAH loading in the RM 5 - 7 area of the site and much of the data was collected using peristaltic pumps with a lot of non-detected values.

The best data would be the transects at RM 6.3 and RM 3.9 which were collected using XAD samplers (dissolved and total) over a range of flow conditions. This data was used in the PH FS to develop loading estimates. The loading estimates show an increase in load between RM 6.3 and RM 3.9 for PAHs under all flow conditions. Thus, I think that Kevin has a point based on empirical data collected during the PH RI.

I am attaching the PAH loading figures and a SW sample location map from the RI.

Eric
-----Original Message-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Thursday, August 24, 2017 9:25 AM
To: PARRETT Kevin <kevin.parrett@state.or.us>
Cc: Blischke, Eric <blischkee@cdmsmith.com>; Coffey, Scott <CoffeySE@cdmsmith.com>

Subject: Re: BaP

Sure Kevin- I have 1-2 today, booked tomorrow other than during your EQc meeting- Monday can work too.

I'll ask Eric to check a time that works for you.

S

Sean Sheldrake
Unit Diving Officer/ RPM
206.225.6528

Sent from my iPhone

> On Aug 24, 2017, at 7:01 AM, PARRETT Kevin <kevin.parrett@state.or.us> wrote:
>
> Hi Sean. Could we talk more about BaP? Maybe you, Eric and me.
>
> -Kevin

Message

From: Blischke, Eric [blischkee@cdmsmith.com]
Sent: 8/24/2017 4:46:24 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
CC: Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
Subject: RE: BaP
Attachments: PH_SW_Sample_Locations.pdf; PAH_Portland Harbor Contaminant Loading Figures.pdf

I am available at that time. In the meantime, I have looked at some of the PAH SW data. There are limited samples for the purpose of evaluating PAH loading in the RM 5 - 7 area of the site and much of the data was collected using peristaltic pumps with a lot of non-detected values.

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To: PARRETT Kevin <kevin.parrett@state.or.us>
Cc: Blischke, Eric <blischkee@cdmsmith.com>; Coffey, Scott <CoffeySE@cdmsmith.com>
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Sean Sheldrake
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> On Aug 24, 2017, at 7:01 AM, PARRETT Kevin <kevin.parrett@state.or.us> wrote:
>
> Hi Sean. Could we talk more about BaP? Maybe you, Eric and me.
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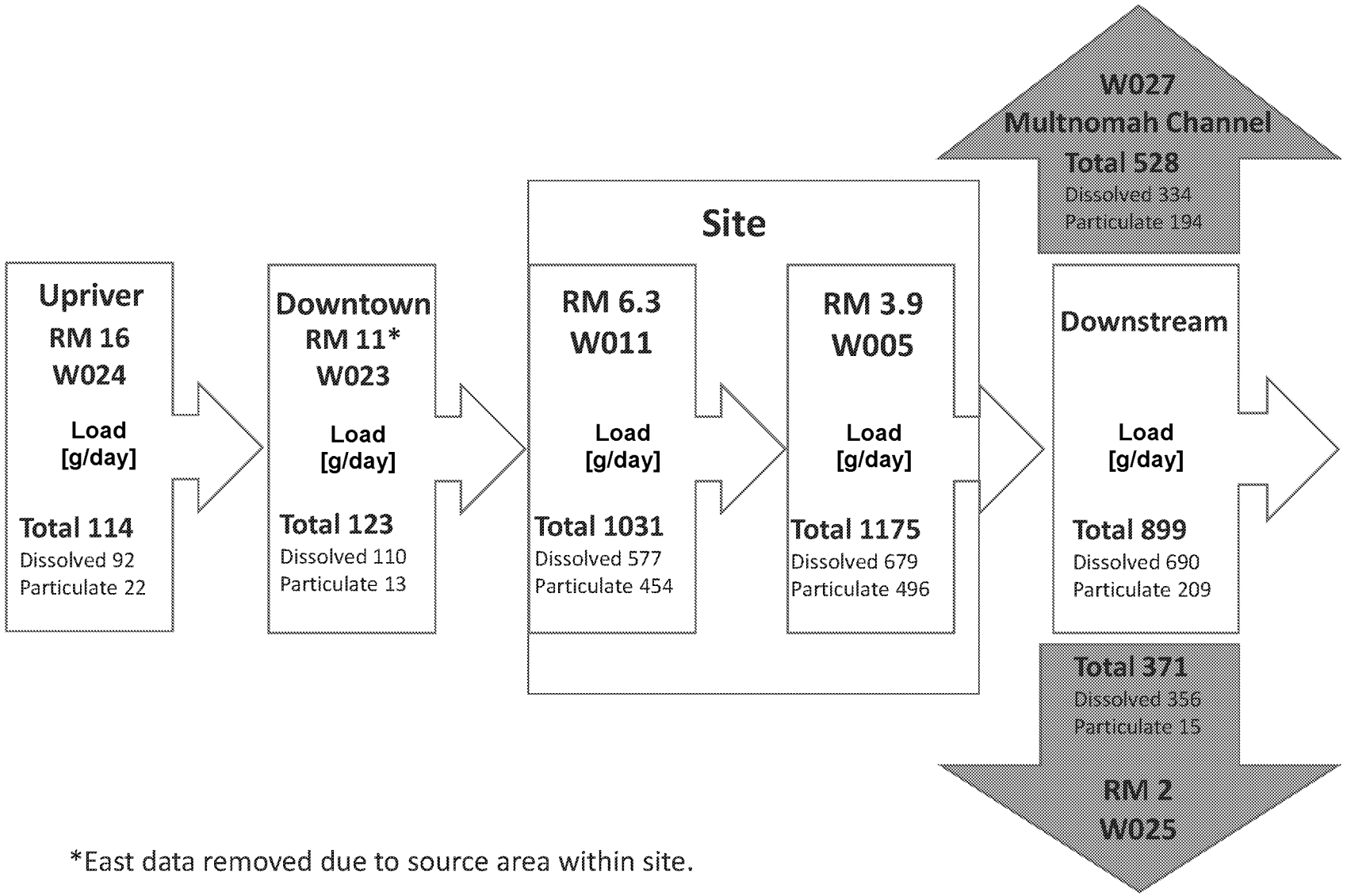
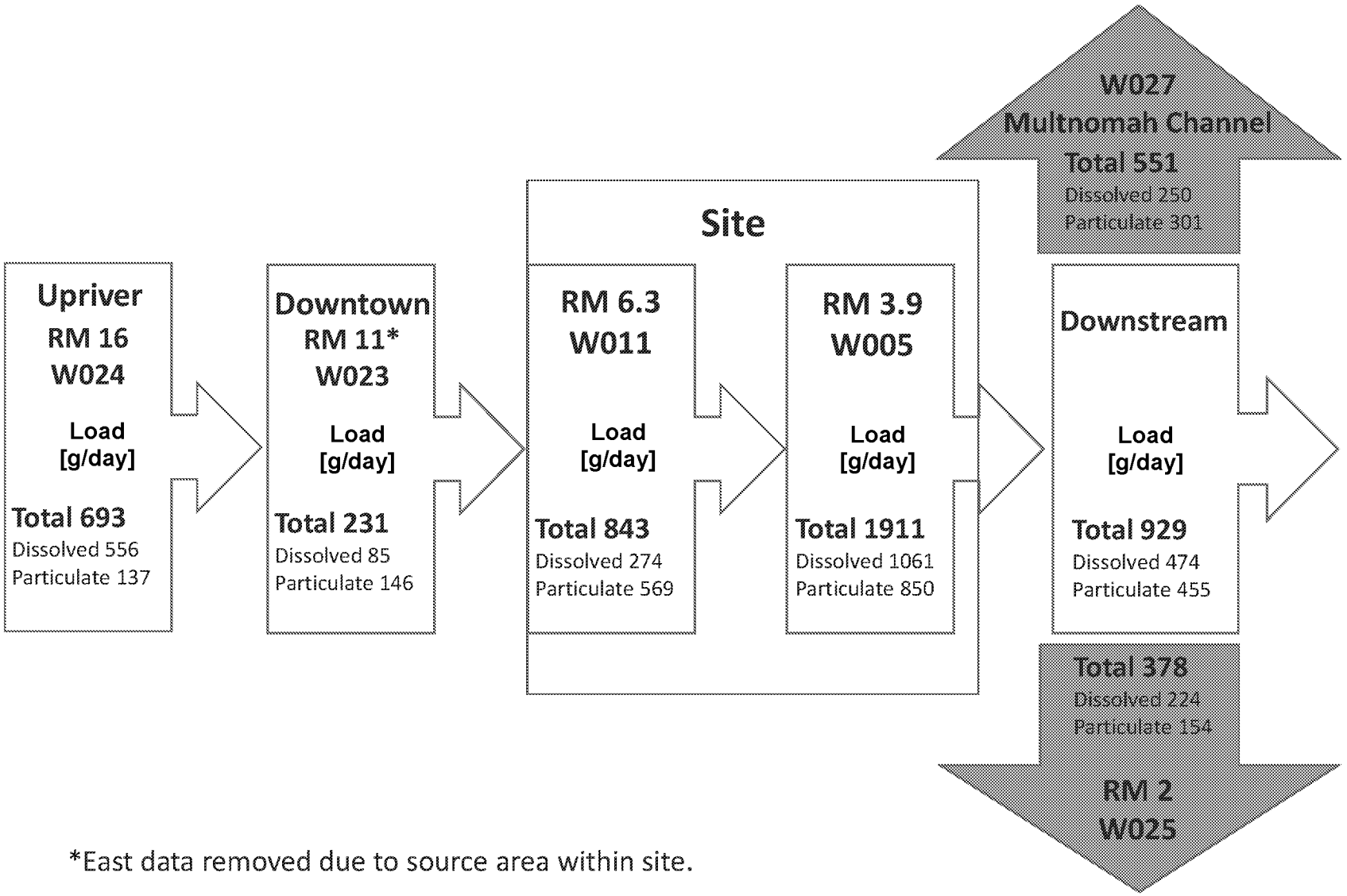


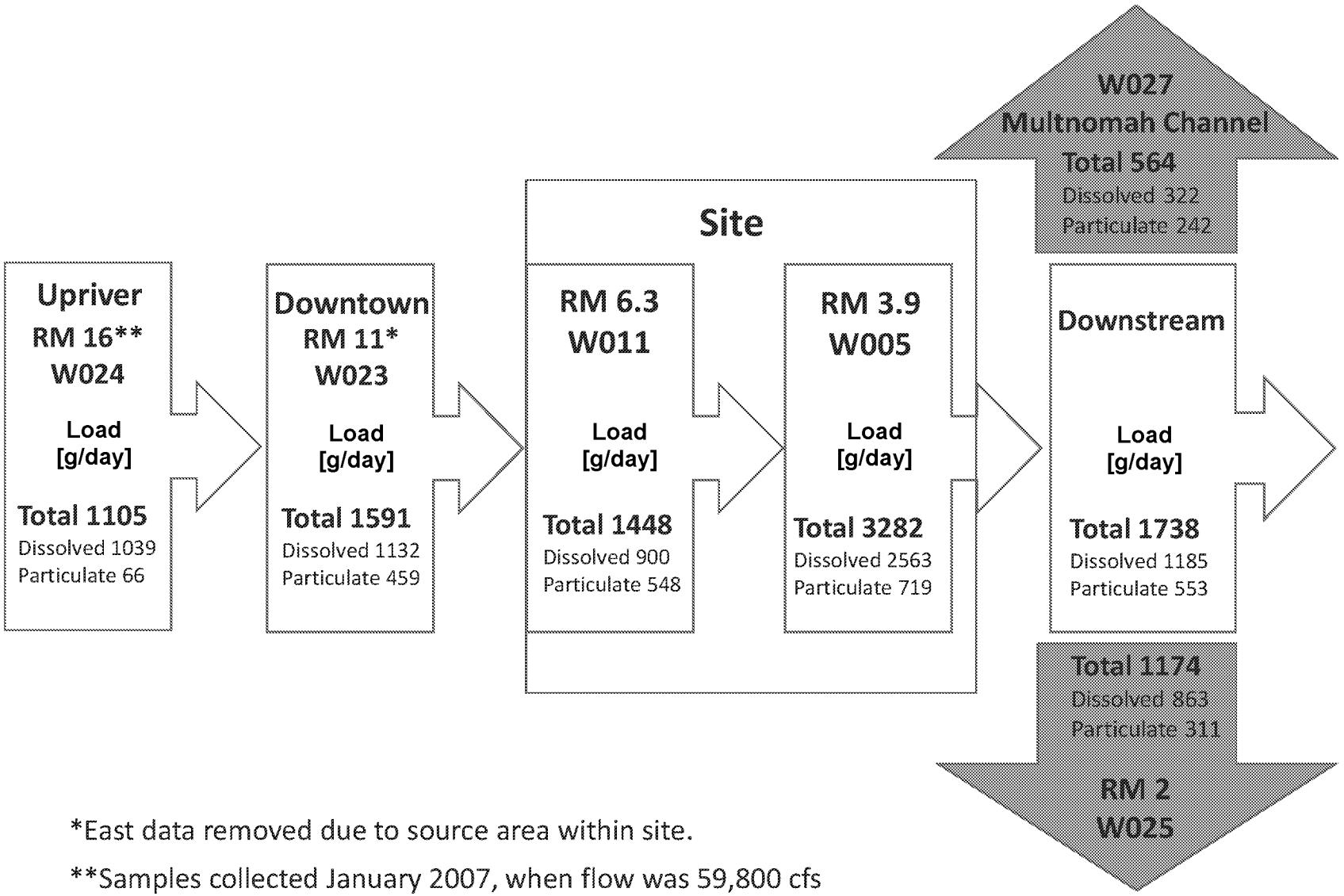
*East data removed due to source area within site.

Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

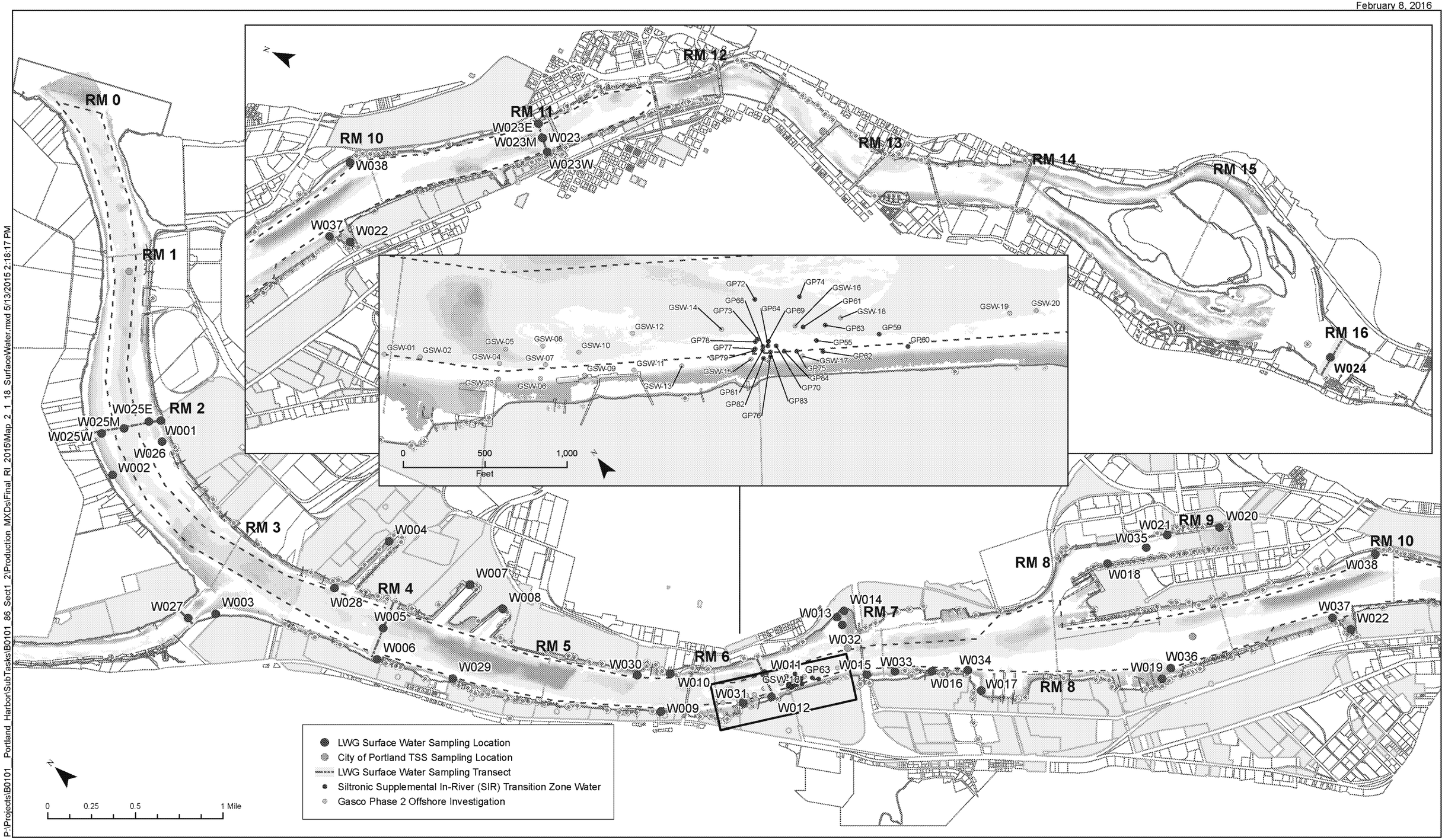
Figure 1.2-23b Portland Harbor Superfund Site PAH Loading Stormwater Flow (Nov 2006) 23,000 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs



P:\Projects\B0101_Portland_Harbor\SubTasks\B0101_86_Sect1_2\Production_MXDs\Final_RI_2015\Map_2_1_18_SurfaceWater.mxd 5/13/2015 2:18:17 PM

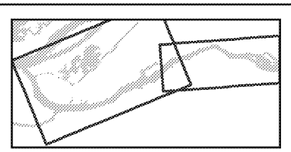
FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS.
Channel & River Miles: US Army Corps of Engineers.
Bathymetric Information: David Evans and Associates, Inc.

Map Features
- River Miles
- Docks and Structures
- Navigation Channel

Outfalls
- Outfall
- Dock Drain
- Roof Drain

- River Edge +13 ft NAVD
- Upland ECSI Sites (2008)
- Waterfront Taxlots

2004 Bathymetry NAVD 88 (ft)
- High : 10.4
- Low : -90.6



Map 2.1-18
Portland Harbor RI/FS
Remedial Investigation Report
Surface Water Sampling Locations

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/29/2018 3:37:43 PM
To: Gail Fricano [GFricano@indecon.com]
CC: Julie Weis (JWeis@hk-law.com) [JWeis@hk-law.com]; joepitt@ctuir.org; Alanna Nanegos (AlannaNanegos@ctuir.org) [AlannaNanegos@ctuir.org]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Matthew Johnson (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; holly.partridge@grandronde.org; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Josh Newton [jn@karnopp.com]; Jen Graham (jennifer.graham@ctwsbnr.org) [jennifer.graham@ctwsbnr.org]; MLW@karnopp.com; courtney@crag.org; Rita Cabral [RCabral@indecon.com]; Rachel DelVecchio [RDelVecchio@indecon.com]
BCC: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
Subject: Re: EPA's proposal re: IRIS update (sf)

Gail, understood. Thank you for the clarification. Since the January 11 briefing is not necessarily our final decision I will make it clear during briefings what the Five Tribes support and notify you if there are any changes. In my view having the tribes' position available for the briefings is how our process should work and I very much appreciate this timely feedback.

S

Sean Sheldrake
Unit Diving Officer/ RPM
206.225.6528

Sent from my iPhone

> On Jan 29, 2018, at 5:25 AM, Gail Fricano <GFricano@indecon.com> wrote:
>
> Hi Sean,
>
> Regarding my email below, the Five Tribes also want to convey that we support making the IRIS-related changes via an ESD. We do not want to see the ROD re-opened through a ROD amendment.
>
> And just to clarify, by saying that we support the EPA proposal, I am referring to the proposal EPA presented on the January 11 webinar (materials attached). If EPA modifies this proposal in any way, we would need to evaluate the modified proposal to determine whether we support it.
>
> Thank you.
>
> Gail
>
>
> Gail French Fricano
> Senior Associate
> IEc
> Industrial Economics, Incorporated
> 2067 Massachusetts Ave. Cambridge, MA 02140
> 617.354.0074 x114
> www.indecon.com<http://www.indecon.com/>
>

>
>
> From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
> Sent: Thursday, January 25, 2018 12:53 PM
> To: Gail Fricano
> Cc: Rita Cabral
> Subject: RE: EPA's proposal re: IRIS update (sf)
>
> Gail,
>
> Thank you very much for relaying that support on behalf of the Five Tribes. It's very helpful to know at this point, and I think receiving such a memo in coming weeks should work in conjunction with our briefings relaying that support verbally, if that's okay with the Five Tribes.
>
> I'll emphasize that this support doesn't waive any current or future consultation requests.
>
> S
>
> Sean Sheldrake, Unit Diving Officer, RPM
> EPA Region 10, 1200 Sixth Ave., Suite 900; Mailstop DOC-01
> Seattle, WA 98101
> 206.553.1220 desk
> 206.225.6528 cell
> http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor
> [FB icon]<https://www.facebook.com/EPADivers>[scidive_round]<https://www.epa.gov/scientific-diving>[flickr icon for signature block]<https://www.flickr.com/photos/usepagov/sets/72157629017469667/with/14530254926/>
> Over 48 years of scientific diving in support of EPA's mission
>
> From: Gail Fricano [mailto:GFricano@indecon.com]
> Sent: Thursday, January 25, 2018 5:16 AM
> To: Sheldrake, Sean <sheldrake.sean@epa.gov<mailto:sheldrake.sean@epa.gov>>
> Cc: Rita Cabral <RCabral@indecon.com<mailto:RCabral@indecon.com>>
> Subject: EPA's proposal re: IRIS update
>
> Hi Sean,
>
> I met with the Five Tribes yesterday, and we agreed that IEc would draft a memo indicating support for EPA's proposal regarding the IRIS update. Because we are scrambling to get you comments on the FSPs, we won't be able to get to the memo for another couple weeks, but I did want to give you notice that it is coming. The memo will focus on the technical aspects of EPA's proposal, and the Five Tribes reserve the right to request consultation regarding the process surrounding the proposal, including EPA's interactions with the TCT.
>
> Please let me know if you have any big concerns about the timing of our memo.
>
> Thank you.
>
> Gail
>
> Gail French Fricano
> Senior Associate
> IEc
> Industrial Economics, Incorporated
> 2067 Massachusetts Ave. Cambridge, MA 02140
> 617.354.0074 x114
> www.indecon.com<http://www.indecon.com/>
>
> <image004.png>
> <image006.png>
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> <Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx>
> <CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx>

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 10/13/2017 2:28:34 PM
To: Laura Shira [shil@yakamafish-nsn.gov]
CC: tosm@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4d19bc819dc94480a3fdff61d793ac8d-tosm@yakamafish-nsn.gov]; Robert Dexter [dexb@yakamafish-nsn.gov]; rose@yakamafish-nsn.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=10632210cc74427893d7af49016f744b-rose@yakamafish-nsn.gov]; Tom Zeilman [tzeilman@qwestoffice.net]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
BCC: Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Stephanie Ebright (EBRIGHT.STEPHANIE@EPA.GOV) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; coffeyse@cdmsmith.com; Blischke, Eric [blischkee@cdmsmith.com]; Laura Knudsen (Knudsen.Laura@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]
Subject: RE: YN Comments on NW Natural's proposal to modify PAH CULs and RALs within the Portland Harbor ROD (sf)
Attachments: 2017-10-12_ YNcomments_proposed changes to PH ROD by NWNatl_cPAH CUL RAL....docx; 2017-09_NW Natl Proposed ROD changes.xlsx

Thank you Laura for these thoughtful comments from the YN. We will consider these comments as we move forward with internal briefings on the issue and I hope to work out with you and the TCT meaningful check in points before EPA reaches any final decision(s). In the meantime, would you mind sharing YN's comments directly with the TCT?

S

Sean Sheldrake, Unit Diving Officer, RPM
EPA Region 10, 1200 Sixth Ave., Suite 900; Mailstop DOC-01
Seattle, WA 98101
206.553.1220 desk
206.225.6528 cell
http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

Over 47 years of scientific diving in support of EPA's mission

---

From: Laura Shira [mailto:shil@yakamafish-nsn.gov]
Sent: Thursday, October 12, 2017 4:29 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: tosm@yakamafish-nsn.gov; Robert Dexter <dexb@yakamafish-nsn.gov>; rose@yakamafish-nsn.gov; Tom Zeilman

<tzeilman@qwestoffice.net>; Zhen, Davis <Zhen.Davis@epa.gov>
Subject: YN Comments on NW Natural's proposal to modify PAH CULs and RALs within the Portland Harbor ROD

Hi Sean.

Please see Yakama Nation's memorandum outlining technical comments on the proposed changes to the Portland Harbor ROD.

Also attached is a table summarizing what I could decipher from their proposal. I have to admit, it was a little difficult to follow their numbers at times. Once this issue is ready to be further vetted through TCT, a more understandable summary visual would help provide clarity.

Regards,

Laura Klasner Shira, P.E.
Environmental Engineer
Yakama Nation Fisheries
PO Box 151, Toppenish, WA 98948
509.985.3561 mobile

COLUMBIA RIVER - Honor.Protect.Restore

MEMORANDUM

Yakama Nation Fisheries

Columbia River
Honor. Protect. Restore.

OFFICE
P.O. Box 151
401 Fort Road
Toppenish, WA 98948

PHONE
(509) 865-3581

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shil@yakamafish-nsn.gov

WEB
Yakamafish-nsn.gov

October 12, 2017

To: Sean Sheldrake, United States Environmental Protection Agency (EPA)
From: Laura Shira, P.E., Environmental Engineer
Re: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site

This memo provides technical comments and concerns on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" from Anchor QEA and Pearl Legal Group, to NW Natural. NW Natural advocates for increasing cleanup levels (CULs) and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) within the Record of Decision (ROD) at the Portland Harbor Superfund Site (site) based on EPA's January 19, 2017 updates to the benzo(a)pyrene (BaP) cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS).

Although we acknowledge changes to IRIS as science-based, the Yakama Nation has significant concerns about the effects of the proposed changes on the project schedule and the protectiveness of the cleanup. With the limited information we have been presented it is impossible to evaluate the merits of the back-of-the envelope calculations provided by NW Natural. If EPA is considering making changes to the CULs and/or RALs, that process must include an analysis of the pros and cons of these changes with respect to overall project timeline, budgets, and protectiveness; and an in-depth evaluation of how any changes to the ROD resulting from these recommendations will address human and ecological risk at the Portland Site. Modifying the CULs and RALs as suggested would constitute a major change to the ROD. In fact, NW Natural's proposal suggests that modified RALs could potentially decrease the area actively cleaned up by greater than 10% (from 355 acres to as little as 304 acres). The Yakama Nation urges EPA to maintain RALs set in the ROD and keep on schedule for in-water cleanup. However, if EPA is considering changing the PAH RALs, or any changes that would require a change to the ROD including an Explanation of Significant Differences or amendment, the Yakama Nation requires meaningful engagement as prescribed in the 2001 Memorandum of Understanding (MOU) and EPA must offer government to government consultation on proposed changes before a decision is made.

At this point, without adequate information to review, we offer the following preliminary comments.

<u>Technical and Procedural Comments</u>:

The Yakama Nation supports the technical comments submitted on behalf of the Five Tribes by IEc on September 26, 2017. Below are our technical comments:

1. A change to the RALs or even CULs would warrant a change to the ROD which would significantly delay the cleanup schedule, likely by several years. The impacts of significant delays and their associated costs should be considered if this is the path EPA chooses to take.
    a. The water quality standards in the ROD are Federal and State standards that have been promulgated under the Clean Water Act. Until these standards are changed via a formal rule making process the water quality criteria used for CULs and RALs developed in the ROD are applicable or relevant and appropriate requirements and must stand as is.
    b. The update to the IRIS database may affect the water quality standards in future rule making processes but so will other factors that have yet to be determined.
2. In addition, the update to RALs or CULs is not as simple as plugging in a new cancer slope factor for BaP. All of the risks for all COCs associated with each area will need to be re-evaluated to ensure the remedy is protective of human health and the environment. For example:
    a. The revised IRIS data do not affect or consider ecological risk. Proposed changes to the navigation channel CUL and RAL must also consider ecological risk.
    b. NW Natural's proposed sediment CUL and RAL would need to be evaluated to determine whether they are likely to achieve surface water cleanup levels within porewater and the water column.
    c. NW Natural's two approaches to calculating the proposed CULs and RALs are not consistent with EPA's surface-weighted average concentration (SWAC) methodology presented in the ROD.
    d. If the proposed CUL and/or RAL changes are considered, sediment management areas (SMAs) would need to be re-evaluated to determine the extent to which areas formerly considered PAH risk-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs), non-aqueous phase liquid (NAPL), not reliably contained (NRC), and/or principal threat waste (PTW).

A change in the RAL or CUL would not be a quick process and would likely introduce much uncertainty to where the Portland Harbor remedy is headed. It is likely PRPs would want to delay any work until EPA made a final decision of RALs and CULs, if it chooses to revise either. We must reiterate any change the ROD will require meaningful involvement with the Yakama Nation and EPA must offer to consult on its proposal before it makes a final decision. Because of the gravity of this issue the proposal must be supported by in-depth scientifically sound evaluation that will explain if and how the change to the BaP cancer slope factor will truly justify a significant reduction in the active remediation at the facility or if other factors such as ecological risks and ARARs will negate any major reduction active remediation.

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 10/4/2018 8:41:13 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
Subject: Fwd: IRIS - Portland Harbor
Attachments: 2018-10-02 NW Natural ESD White Paper.pdf; ATT00001.htm

Sent from my iPhone

Begin forwarded message:

> **From:** "Laws, Elliott" <ELaws@crowell.com>
> **Date:** October 3, 2018 at 2:09:10 PM EDT
> **To:** "Woolford.James@epa.gov" <Woolford.James@epa.gov>
> **Cc:** Robert Wyatt <rjw@nwnatural.com>
> **Subject: IRIS - Portland Harbor**
>
> Jim please see the attached memo to you from Bob Wyatt.

Message

From: Bilbrey, Sheryl [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=45612DBA9A7F4A718D12E27FEEC7590F-BILBREY, SH]
Sent: 4/16/2018 3:08:11 PM
To: Hladick, Christopher [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b82d04419c42423a97bd7624a3a09908-Hladick, Ch]; Pirzadeh, Michelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ae309e0a52a42cd847709b39bc2239a-Pirzadeh, Michelle]
CC: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
Subject: FW: CONFIDENTIAL - Summary of NWN Meeting with OECA
Attachments: Portland Harbor Map Provided By NWN 4-10-18.jpg

From: Mackey, Cyndy
Sent: Friday, April 13, 2018 1:31 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>; Bilbrey, Sheryl <Bilbrey.Sheryl@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>
Cc: Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Patterson, Kenneth <Patterson.Kenneth@epa.gov>; Woolford, James <Woolford.James@epa.gov>
Subject: RE: CONFIDENTIAL - Summary of NWN Meeting with OECA

Two additional issue that were discussed:

(1) NWN mentioned that there is potential for recontamination in performing in "early actions". In this discussion, NWN expressed concern that Arkema design is not proceeding (AOC terminated) and that this could delay NWN's ability to implement remedy action at its facility due to the significant potential for recontamination.

(2) NWN also mentioned PAH issues and provided a map that showed areas (in yellow) that "are already protective of human health based on IRIS update". Ecological risk factors were not mentioned and very little time was spent discussing the PAH issues.

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
1200 Pennsylvania Ave., N.W. (Room-WJC 5206) Washington, DC 20460
202 564-8206 (Direct Line)
202 564-5110 (Office Line)
202 591-6184(Office Cell)

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---

From: Mackey, Cyndy
Sent: Friday, April 13, 2018 3:51 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>; Bilbrey, Sheryl <bilbrey.sheryl@epa.gov>; Grandinetti, Cami <grandinetti.cami@epa.gov>; Lori Cora <Cora.Lori@epa.gov>
Cc: Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Patterson, Kenneth <patterson.kenneth@epa.gov>
Subject: CONFIDENTIAL - Summary of NWN Meeting with OECA

CONFIDENTIAL

All

Below is a brief summary of an OECA meeting with NW Natural Representatives that took place in DC on April 10, 2018.

EPA participants were Susan Bodine, Cyndy Mackey, Jim Woolford, Nick Falvo and Allyn Stern (by phone). Other participants were Elliott Laws, Tom Imeson, Patty Dost, Bob Wyatt and "Marty".

NW Natural representatives stated that they wanted to introduce themselves to Susan and to share their willingness to proceed with RD-RA at the Gasco facility. They stated that they are committed to a Harbor-wide CD process and to continued participation in the allocation process. They then shared that they are concerned about the timeline for RD-RA negotiations and are skeptical the allocation will be completed by December 2019. Given these concerns, they asked EPA to be open to the possibility of localized areas for remedy implementation and specifically stated that are prepared to enter into a CD for the Gasco site with a cash out component for the remainder of the site.

Susan encouraged them to work with the other PRPs and told them that EPA is not interested in breaking up the site into units, at this time. OECA expressed interest in seeing a site-wide approach to the cleanup and expressly stated that any work area breakouts would result in "work" covenants, not site-wide covenants. When pushed to meet again, OECA indicated that any further discussion prior to receipt of a PRP response to the Special Notice Letters seems like it would be premature and counter-productive.

Happy to discuss further, if needed.

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
1200 Pennsylvania Ave., N.W. (Room-WJC 5206) Washington, DC 20460
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202 564-5110 (Office Line)
202 591-6184(Office Cell)

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---

From: Zhen, Davis
Sent: Friday, April 13, 2018 2:00 PM
To: Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>
Subject: Quick summary needed for RA on recent meeting with Bodine

Hi Cyndy and Allyn,

In my briefing with Chris yesterday, he was surprised to hear that NWN had a meeting with Susan Bodine earlier in the week and asked for a quick summary of the meeting. Since I am not part of the meeting, could either of you get him a short write up? Thank you.

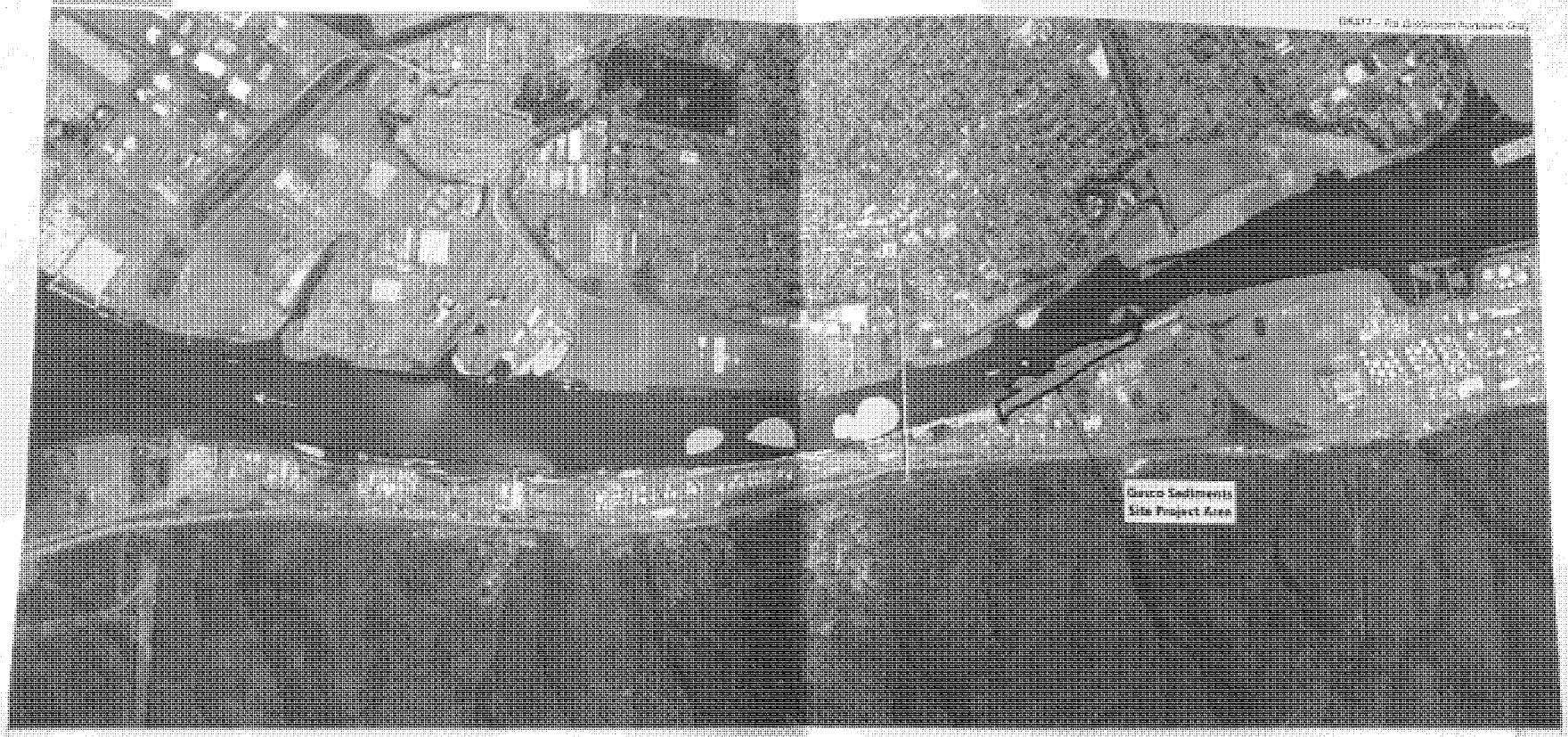
Thanks,

****

Davis Zhen, Manager
Site Cleanup Unit 2

Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

DRAFT



LEGEND:

- Navigation Channel
- Existing Remediation Caps
- IRIS Update Remedial Cleanup Area
- Areas That Are Already Protective of Human Health Based on IRIS Update

NOTE(S):

1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 Oregon State Plane North, Intl. Feet.
3. Aerial imagery from City of Portland 2018.

ANCHOR QEA

Figure 1

Impacts to ROD SMA Boundaries via Application of BaP IRIS Update

Portland Harbor Record of Decision Review

Gesco Sediments Cleanup Area

Message

From: Bodine, Susan [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=8C2CC6086FCC44C3BE6B5D32B262D983-BODINE, SUS]
Sent: 11/30/2018 2:04:44 PM
To: Bailey, Ethel [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9b33dd651fa04119be02b7b6b151ff91-Bailey, Ethel]
Subject: FW: Materials for Portland Harbor trip
Attachments: PortlandHarborMap_Upland Properties.pdf; Portland Harbor Remediation Areas.pdf; itinerary december PDX.docx; PH_Remedial-Design_FAQ_References_Final.pdf; 12-4-2018 PH messages clean.docx; 12-5 meeting agenda and TPs.docx; Press Availability Messages 12-5 brief.docx; Community Meeting Q&A and participant list.docx; PH Superfund Site 12.4 Mtng Run of Show (Final Draft 11.29.2018).pdf

Please print

From: Mackey, Cyndy
Sent: Friday, November 30, 2018 9:03 AM
To: Bodine, Susan <bodine.susan@epa.gov>; Starfield, Lawrence <Starfield.Lawrence@epa.gov>
Subject: FW: Materials for Portland Harbor trip

FYI

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
1200 Pennsylvania Ave., N.W. (Room-WJC 5206) Washington, DC 20460
202 564-8206 (Direct Line)
202 564-5110 (Office Line)
202 591-6184(Office Cell)

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From: Grandinetti, Cami
Sent: Thursday, November 29, 2018 7:48 PM
To: Cook, Steven <cook.steven@epa.gov>; Woolford, James <Woolford.James@epa.gov>; Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Breen, Barry <Breen.Barry@epa.gov>; Hladick, Christopher <hladick.christopher@epa.gov>; Pirzadeh, Michelle <Pirzadeh.Michelle@epa.gov>; Holsman, Marianne <Holsman.Marianne@epa.gov>; Bilbrey, Sheryl <bilbrey.sheryl@epa.gov>; Zhen, Davis <Zhen.Davis@epa.gov>; Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Sheldrake, Sean <sheldrake.sean@epa.gov>; Ingemansen, Dean <Ingemansen.Dean@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>; Hilosky, Nick <Hilosky.Nick@epa.gov>; Brooks, Becky <Brooks.Becky@epa.gov>; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Clark, Josie <Clark.Josie@epa.gov>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Young, Hunter <Young.Hunter@epa.gov>
Subject: Materials for Portland Harbor trip

Greetings everyone—Attached to this email are several attachments to prepare you for our meetings next week in Portland. I apologize there are so many—I wanted to keep them all in one place for you.
I have listed the items below—the highlighted ones are those with our messages and the itinerary should give you information about what is happening when. Let me know if you have any questions and please distribute to those I missed with my apologies. See you next week in Portland!

Chris and Sheryl—I have hard copies printed out for you and will drop at your desks.

Attached are the following items:

1. Portland Harbor Remediation Areas Map (showing cap/dredge/enhanced recovery areas of the site)
2. Portland Harbor Map (showing upland source areas)
3. Itinerary for December 3-6
4. Remedial Design FAQs (in very small print—sorry!)
5. 12-4 messages and flow for EPA speakers
6. 12-5 agenda with imbedded messages for EPA speakers
7. Press availability messages
8. Community Meeting Q&A and participant list
9. PH Superfund Site Run-of-Show (details of set up and flow of 12-4 meeting)

Cami Grandinetti
Program Manager, Remedial Cleanup Program
US EPA
1200 6th Avenue, Suite 155, ECL-123
Seattle, Wa. 98101
(206) 553-8696 (desk)
(206) 390-8890 (cell)

Proposed Agenda for EPA Participation at PCI Group Meeting
December 5, 2018 (10:30 am – 12:30 pm)

10:30-10:35 Welcome and Brief Update on Status of PCI Group Process - PCI Group Co-Chairs

10:45-11:15 Opening Remarks and Update on Current Activities at the Site

a. EPA's Explanation of Significant Differences for cPAHs *(Sheryl Bilbrey)*

- ESD released for public comment on October 22 and the comment period ends December 21. The ESD adjusts the cleanup levels and the nearshore RAL for cPAHs based on updated toxicity information.
- There is another public meeting on December 12 at Revolution Hall in SE Portland at 6:00 pm. Details can be found on our website.
- We are happy to answer questions about the ESD but if you have any comments, please submit them to Laura Knudsen at EPA and visit the website.

b. Utilization of Pre-RD Sampling Results and Analysis *(Sheryl Bilbrey)*

- EPA is looking at how and where to incorporate these into remedial designs.
- We expect the data will be used to finalize your allocation, as you said it was necessary to complete that work.
- Additionally, this information will be used as part of our ongoing sampling to define our "baseline" conditions, which will be used to evaluate how well our remedy is performing. Remember, most of this remedy relies on natural recovery.

c. Status of Various Early Action/Remedial Design Projects *(Sheryl Bilbrey)*

- EPA is working on full design in areas off 11East, at NW Natural, and 30% design at Terminal 4.
- We appreciate these parties stepping up to the plate but we only have about 10% of the river areas requiring cleanup under design.
- We want design and construction to occur on similar timelines to avoid a large time lag between those that go first and those that go last.

d. Next Steps for Identifying and Negotiating Additional Remedial Design Projects *(Allyn Stern)*

- EPA is willing to negotiate a small number of agreements to conduct full design at the site, but too many agreements will be too time consuming, resource intensive, and difficult to coordinate.
- We have a model Remedial Design AOC and SOW that we're going to use. We will not be using the AOC that was negotiated for the pre-RD work.

e. Source Control/Sufficiency Assessment *(Sheryl Bilbrey)*

- Source control work has made substantial progress and we're working closely with our state partners on ensuring that sufficient source control has occurred prior to implementing cleanup.
- Since the State of Oregon is the lead for source control, they need to be part of any in-depth discussions on this topic.
- If the PCI group has specific information indicating areas where they believe source control is not under control or in process of getting under control, EPA and the State need that information.

11:15 – 11:45 Flexibility in Decision Tree and ROD *(Sheryl Bilbrey)*

- EPA isn't planning to reiterate what we said yesterday unless you want us to. We could jump to Q&A.

11:45 – 12:30 Post Pre-RD Timeline and Process – *(Chris Hladick and Steven Cook)*

(Topics requested to cover: Remedial Design AOC Process, Remedial Action Consent Decrees – number and timing, Timing in relation to PCI Group Allocation Process, Additional Sampling Activities, Non-Participating large PRPs)

- In our March 2018 letter, we informed you that EPA had planned to initiate consent decree negotiations at the end of 2019, but we also wanted a significant amount of remedial design to be conducted prior to that time.
- As we said yesterday, we ask that you organize yourselves and step forward to conduct 100% Remedial Design for 100% of the Site.
- Full design will require additional sampling.
- We are looking for parties who will undertake remedial design to come forward by the end of January 2019 to negotiate agreements and to complete negotiations of such agreements by the end of June 2019.

- We prefer that parties step forward to do this work and avoid our need to use enforcement tools but those may be necessary if design work is further delayed.
- We know that the allocation process is proceeding, but that process seems to be on a very long path.
- Allocation can and should proceed on a parallel path with full design so that there is no delay in work at the site.
- Allocation can and should proceed quickly so that consent decree negotiations can begin.

Closing Remarks – *(Chris and Steven)*

- Thank you for the good conversation we've had today and your ongoing commitment to cleaning up the Portland Harbor site.
- Cleanup helps pave the way for important economic development in this critical area.
- *May want to reiterate any main points if it seems appropriate:*
    - We are asking for full design throughout the site, with a response/proposal by end of January and completed Remedial Design negotiations by the end of June
    - Remedial Design work will occur under EPA's model AOC and Scope of Work for Remedial Design, not the pre-RD AOC
    - We are moving forward to implement the existing cleanup decision and not interested in revisiting risk assessments or remedy decisions
    - Allocation can and should move forward more quickly
- We look forward to working with you through design and construction.

Message

From: Fonseca, Silvina [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D77D07BE7386476380B9193170946863-FONSECA, SILVINA]
Sent: 11/29/2018 4:57:46 PM
To: Brooks, Becky [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6f369a2ef33e4a87af349210a3915a57-BBrooks]; Hilosky, Nick [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=39e1182ac8cd4709ae0787ca4a068d2d-NHilosky]
Subject: FW: Updated Meeting Schedule for Week of 12/3
Attachments: Agenda for Week of December 3 rev.docx; Proposed-Agenda for EPA Participation at 12-5-18 PCI Group Meeting Portland Harbor Superfund Site JWR 11 27 18.docx

Becky and Nick,

See attached the Agenda for the week and the agenda for the 5th. Let me know if you have any further questions.

Silvina Fonseca
Special Assistant
Office of the Administrator
U.S. Environmental Protection Agency
Desk: 202.564.1955
Cell: 202.306.6844

From: Zhen, Davis
Sent: Tuesday, November 27, 2018 2:04 PM
To: Woolford, James <Woolford.James@epa.gov>; Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Fonseca, Silvina <Fonseca.Silvina@epa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Bilbrey, Sheryl <Bilbrey.Sheryl@epa.gov>; Holsman, Marianne <Holsman.Marianne@epa.gov>; Hladick, Christopher <hladick.christopher@epa.gov>; Ingemansen, Dean <Ingemansen.Dean@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>
Cc: Pirzadeh, Michelle <Pirzadeh.Michelle@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>
Subject: Updated Meeting Schedule for Week of 12/3

Hi everyone,

Attached is the revised schedule for next week. Please note the following:

1. The tour will be on land (2 vehicles)
2. The Richard Whitman (ODEQ) meeting will be with Chris and Steven only
3. We are waiting for confirmation from Steven on press availability on 12/5

Thanks,

****

Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

Agenda for Week of December 3 (TENTATIVE)

12/3 Travel Day

12/4

8 – 11am	Portland Harbor Site Tour			
11 – 12pm	Final check-in for all EPA staff (Bonneville Federal Bldg)			
1 – 4 pm	Meeting with all PRPs (Bonneville Federal Bldg)			
	Agenda			
	1:00	Welcome	EPA	
	1:05	Ground Rules	Facilitator (Triangle)	
	1:15	Purpose the Meeting, EPA's position (quick Q/As)	EPA	
	1:30	Technical presentation/Discussion	EPA	
	2:30	Break (Chris' Arrival)		
	2:45	Reaffirm EPA's position?	EPA RA	
	2:50	Technical Presentation/Discussion cont'd	EPA	
	4:00	Adjourn		
4:30	*River Mile 11 East Meeting (tentative)*			

12/5

8:00 – 9:00	Richard Whitman/DEQ (TBD)	Co-regulator ***Steven, Chris and Richard Only***
9:15 – 10:15	*Yakama Nation (tentative)*	
10:30 – 1pm	PCI (Downtown Hilton)	PRPs/Allocation Group
1 – 2 pm	Meeting with Congressional Staff (Oregon Ops Office)	
2:00 – 3:00	Meeting with Northwest Natural (Oregon Ops Office)	PRP/AOC respondent
3:00 – 4:00	*Press Availability (tentative)*	
4:00 – 5:00	Community Leader Meet & Greet (Oregon Ops Office)	
5:00 – 6:00	*Five Tribes (tentative or on 12/6)*	
6:00	Debrief from PRP meetings	

12/6

8:30 – 9:30	*Five Tribes (tentative or on 12/5)*	
9:30 – 10:30	Port (Oregon Ops Office)	PRP/AOC respondent
11 – 12pm	City/State (City Hall)	PRP/Local Gov't ** EPA senior managers only?*

DRAFT

Proposed Agenda for EPA Participation at PCI Group Meeting
December 5, 2018 (10:30 am – 12:30 pm)

1. Welcome and Brief Update on Status of PCI Group Process - PCI Group Co-Chairs (10:30 am – 10:35 am *approximate*)

2. Opening Remarks and Update on Current Activities at the Site - EPA Representative(s) (10:45 am – 11:15 am *approximate*)
    a. EPA's Proposed Explanation of Impact of Significant Differences (ESD) regarding PAHs
    b. Utilization of Pre RD Sampling Results and Analysis
    c. Status of Various Early Action/Remedial Design Projects
    d. Next Steps for Identifying and Negotiating Additional Remedial Design Projects
    e. Source Control/Sufficiency Assessment
        - Q (from PCI Group) & A (from EPA)

3. Flexibility in Decision Tree and ROD - EPA Representative(s) (11:15 am – 11:45 am *approximate*)
        - Q (from PCI Group) & A (from EPA)

4. Post Pre-RD Timeline and Process - EPA Representative(s) (11:45 am – 12:30 pm *approximate*)
    a. Remedial Design AOC Process
    b. Remedial Action Consent Decrees – number and timing
    c. Timing in relation to PCI Group Allocation Process
    d. Additional Sampling Activities
    e. Non-Participating PRPs
        - Q (from PCI Group) & A (from EPA)

5. Closing Remarks – EPA Representatives

Message

From: Zhen, Davis [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=2A43E2DDFD444ABBB0329C0A17D06EC9-ZHEN, DAVIS]
Sent: 9/4/2018 2:58:07 PM
To: Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]
Subject: RE: site mtgs next week on JIm's calendar - action required
Attachments: R10 Portland Harbor 9.2018.docx

Karl, see highlighted updates.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

From: Gustavson, Karl
Sent: Tuesday, September 4, 2018 7:47 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Zhen, Davis <Zhen.Davis@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>
Subject: FW: site mtgs next week on JIm's calendar - action required

Hi,

I just got a request (below) from Jim for an update to the PH site sheet (attached).

I believe he has meetings with NWN and PoP.

They didn't provide a deadline, but I'm guessing by Friday would be best. If there's any way I can help, please let me know.

Cheers,

Karl

From: Lowery, Brigid
Sent: Tuesday, September 04, 2018 10:07 AM
To: Ammon, Doug <Ammon.Doug@epa.gov>; Lapachin, Jyl <Lapachin.Jyl@epa.gov>; Hovis, Jennifer <Hovis.Jennifer@epa.gov>; Libelo, Laurence <Libelo.Laurence@epa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Fitz-James, Schatzi <Fitz-James.Schatzi@epa.gov>

Cc: Gartner, Lois <Gartner.Lois@epa.gov>
Subject: site mtgs next week on JIm's calendar - action required

Jim has meetings next week with the PRPs on Portland Harbor and Hudson River. Would you please take a look at the latest hot sites sheets for these two sites and update in preparation for the meetings. Thursday for Hudson please and Friday for Portland Harbor. Lois – did I get that order correct?

Brigid Lowery | Acting Director | Assessment and Remediation Division (ARD)
Office of Superfund Remediation and Technology Innovation (OSRTI)
Office of Land and Emergency Management| U.S. EPA
703-603-8752

Superfund Site: PORTLAND HARBOR

Updated as of 6/27/2018

OSRTI Lead: Regional Lead: Sean Sheldrake/Davis Zhen Alternate: Laura Knudsen

Check one: Is the SEMS Site Schedule Current? [X] Yes [ ] No
Is the Site Profile Page Current? [X] Yes [ ] No

Attach Related Information

Current Priority Issue(s):

Deliberative Process / Ex. 5

Upcoming Milestones:

- ASAOCs
  - Willamette Cove (w/State of Oregon, City of Portland, Port of Portland, and Feds)
  - Institutional Control Framework (w/ State of Oregon and City of Portland)
  - Arkema

Site History:

The Portland Harbor Site was listed on the National Priorities List in December 2000 covering approximately 10-mile stretch of the Willamette River that has been contaminated by over 100 years of industrial activities. There are high levels of PCBs, dioxins/furans, and other contaminants presenting unacceptable risk to human health and the environment that require cleanup in the Willamette River. Contaminant levels are high in river sediments and in the fish that reside in the harbor. The Oregon Health Authority has posted fish advisories along the river advising people not to eat resident fish.

EPA conducted an extensive search identifying approximately 150 PRPs. Several years ago, EPA contributed resources to help convene a third-party allocation process that has involved approximately 90 PRPs who are attempting to reach agreement on their relative shares of responsibility for the cleanup. EPA is not a party to the allocation, but federal PRPs, represented by the U.S. Department of Justice, have been participating in the allocation process. Ten parties performed the Remedial Investigation (RI) and Feasibility Study (FS) under an Administrative Order on Consent with EPA. These were completed in 2016.

During the years of investigation at the Site, EPA worked closely with the Oregon Department of Environmental Quality (DEQ), six Federally Recognized Tribes, natural resource agencies, and community groups. We also communicated regularly with elected officials.

EPA issued the Proposed Plan in June 2016, held a 90-day public comment period, and issued the Record of Decision (ROD) in January 2017. The selected remedy requires active remediation (dredging, capping and enhanced natural recovery) of 394 acres of sediment (out of a total of 2190 acres in the site) and 23,305 lineal feet of riverbank. Under the selected remedy, 1774 acres are left to monitored natural recovery. Institutional controls will be needed to advise people about the safety of eating fish and to protect sediment caps that will be installed during Remedial Action. The selected remedy is estimated to cost $1.05 billion dollars in present value and will take approximately 13 years to complete construction of the Remedial Action.

After the ROD is signed, EPA worked with our regulatory partners and stakeholders to develop parameters for a Site-wide sampling plan so that we may begin working with PRPs to update Site data and begin early actions where appropriate. We also expect the Site-wide sampling plan to further the allocation process. The estimated timeline for Site cleanup is 1-2 years for Pre-Remedial Design and Baseline Sampling, 2-3 years for Remedial Design, and 13 years for Remedial Action. EPA is also working closely with our state and local partners on updates to fish advisories and developing an education and outreach program to communicate with the public regarding risks from consumption of contaminated fish.

EPA has worked closely with the Oregon Department of Environmental Quality (ODEQ) on Portland Harbor. The State concurred on the ROD and ODEQ is playing a key role in overseeing activities related to the cleanup. DEQ has the lead responsibility to protect the remedy by addressing upland sources of contamination as well as sources located upstream in the "Downtown Reach" area of the Willamette River. At the time of the issuance of the ROD, DEQ had identified 495 commercial and industrial properties within the upland area, and of these sites, DEQ screened 171 sites for further evaluation. DEQ's goal is to control all upland sources prior to the initiation of the in-river cleanup so that recontamination will not occur in areas subject to the ROD. DEQ and EPA are coordinating closely and EPA may work on these areas where appropriate. Conversely, where appropriate, DEQ will be the co-lead for in-water cleanup in some areas of the site.

Public Interest:

- High level of public interest in cleaning up the site as soon as possible.

Prior Site Status:

- Pending proposed ESD on cPAH risk updates that slightly reduce the cleanup footprint (in progress).

These updates should not exceed 2 pages.

Portland Harbor Community Leaders Meet & Greet with Senior EPA Leaders
Tuesday, February 5th (2019) | 3pm – 4:30pm
EPA Oregon Operations Office | 805 SW Broadway, Suite 500 (5th floor)

Proposed Agenda, Topics and Questions:

I. 3:00pm – 3:10pm: Introductions

- Senior Leader EPA Introductions
  - **Steven Cook**, EPA Deputy Assistant Administrator for the Office of Land and Emergency Management
  - **Michelle Pirzadeh**, EPA Deputy Administrator for Region 10
  - **Jim Woolford**, EPA Director for the Office of Superfund Remediation and Technology Innovation
  - **Cyndy Mackey**, EPA Director for the Office of Site Remediation and Enforcement
  - **Sheryl Bilbrey**, EPA Region 10 Director for the Office of Environmental Cleanup
- Community leader introductions
- Quick overview of ground rules (Laura Knudsen, EPA)

II. 3:10pm – 4:00pm: Discussion of initial questions heard from community leaders

1. **Q: Communication:** In general, having more transparency in the overall cleanup process would be great. Prior to EPA's Proposed Plan for Portland Harbor being released, regular meetings with community leaders and EPA senior leadership occurred. We would like to have regular meetings with EPA senior leaders and community leaders again. How could this happen?
   - **Talking Points:** Where possible, EPA will schedule community meetings with senior leaders, as we have this week, on an ad-hoc basis.
2. **Q: Coordination with TCT:** How can some information sharing occur between the Technical Coordinating Team (TCT) and community leaders?
   - **Talking Points:** This is already occurring as part of the EPA quarterly public forums. Additionally, EPA provides regular community involvement updates on the TCT meetings.
3. **Q: How will EPA be training community members to work on the cleanup & when will this happen?**
   - **Talking Points:** The Superfund Jobs Training Initiative (Super JTI) is a very successful EPA program that we intend to implement at Portland Harbor. EPA will work with both the local community and PRPs to implement Super JTI for the Portland Harbor cleanup. EPA plans to start educating community members and PRPs about SuperJTI this year and work with all interested groups to determine when to start the first SuperJTI program.
4. **Q: Alternative Technologies for Clean-Up:** How could community members get involved with alternative technologies during the Portland Harbor cleanup?
   - **Talking Points:** EPA may consider alternative technologies (including additives, thermal treatment, and geophysical mapping) during the remedial design phase of the Superfund process, if appropriate. EPA will keep community members informed of any alternative technologies that may be utilized.
5. **Q: EPA's Future Expectations for Portland Harbor:** Please describe your expectations for the Portland Harbor once the cleanup work has been completed. Please discuss not only human health and safety, but also the health and well-being of the plants and animals that live in the river and along its banks.
   - **Talking Points:** EPA expects to implement the cleanup as efficiently as possible so that contamination levels are reduced as soon as possible (as soon as monitored natural recovery will allow). This may be a decades long process. EPA will update community members as monitoring occurs to track the progress of achieving cleanup goals in the ROD.

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6. **Q: Probability of Future Cleanup Delays:** EPA staff and the public are currently devoting a lot of time and attention to the Explanation of Significant Differences related to Benzo[a]pyrene (BaP). Not much time has passed since the Record of Decision was finalized. It took many years to complete that part of the process and the public wants to see Portland Harbor cleaned up. To what extent can we expect to see the cleanup sidetracked because of external considerations such as the new value for BaP?
    - **Talking Points:** EPA plans to move forward with ROD implementation expeditiously. While we can't forecast what issues or changes may come up that will influence the cleanup, we will continue to move forward expeditiously even as any new issues arise.
7. **Q: Air Monitoring During Construction:** Is there a possibility that air monitoring (especially for PCB volatilization) could occur during active construction/dredging?
    - **Talking Points:** Yes. While it is unlikely that PCB volatilization will occur during the Portland Harbor cleanup, some air monitoring will occur during construction to make sure that PCB volatilization is not a concern.
8. **Q: Long-term Storage of Removed Contamination:** Some community members are concerned not just with the in-water cleanup work but also the long-term storage of contaminated material once it has been removed from the Site during remedial action. Are there any updates on EPA's thinking about long-term storage of contaminated waste and where it would go?
    - **Talking Points:** EPA does not decide on the location where contaminated materials are sent. However, EPA does ensure that contaminated materials go to a permitted landfill in good standing on all its permits. Any permitted landfill in good standing could be acceptable to EPA, provided carbon footprint issues are also addressed (e.g. use of barges instead of trucks for hauling).
9. **Q: Additional Remedial Baseline Sampling**: At the last EPA and community leaders meeting, community members expressed concern that only smallmouth bass were being sampled under the Pre-Remedial Design Baseline Sampling Agreement. When and how is EPA going to work on collecting additional baseline sampling information (collecting more species) as detailed in the EPA's initial June 2017 baseline sampling plan?
    - **Talking Points:** EPA is planning another round of baseline sampling which may include additional species.
10. **Q: Explanation of Significant Differences:** Please provide an update on when the final ESD will be released and how EPA will be responding to public comments that were submitted on the ESD?
    - **Talking Points:** Following our review of public comments received, we anticipate completing the final ESD before the end of the calendar year. EPA has received over 1,000 public comments on the proposed ESD. EPA is working on a responsiveness summary to be released with the final ESD that will include our responses to the public comments.
    - **Note:** Please review the "Additional Issues Heard from the Community" section on page 3 for additional concerns (and talking points) from the community that may come up during the discussion of the ESD.

III. 4:00pm – 4:25pm: Other questions from community leaders

IV. 4:25pm – 4:30pm: Wrap-up and last thoughts

Additional Concerns Heard from the Community:

Explanation of Significant Differences (ESD): During the government shutdown, some community groups have said that (though it is not confirmed) **Senator Jeff Merkley** submitted questions about EPA's proposed ESD for the Portland Harbor Superfund Site to **EPA Acting Administrator Wheeler**. These questions may come up during the February 5th meeting with community leaders. The text and community questions that may have been submitted to the Senator and Acting Administrator are included below with suggested talking points:

In 2017, EPA adopted a cleanup plan for the Portland Harbor Superfund Site. In response to input from the affected community and Tribes, EPA increased the amount of dredging of contaminated sediments compared to what would have occurred under the preferred alternative, which would reduce the health risks from eating fish and shellfish from the river. EPA did so based on a balancing of the statutory factors and Superfund's preference for long-term treatment that protects public health. The amount of dredging is directly correlated to the cancer and other health risks to people who eat fish and shellfish from the river. It is also directly correlated to the length of time EPA will rely on warnings not to eat fish or shellfish or to enter contaminated beaches. In response to intense lobbying from two responsible parties, EPA is now proposing to weaken the cleanup standards based on a new estimate of cancer risks from one contaminant – benzo-a-pyrene, a polycyclic aromatic hydrocarbon or PAH.

While EPA has released its proposed Explanation of Significant Differences (ESD) for a 60-day public comment period, which ended in late December 2018, it did not provide the public with the full record or a full analysis of the effects of weakening the cleanup standards. Will you commit to a transparent and participatory process that will provide the public the following information and an opportunity to submit additional public comments before deciding whether to adopt an ESD weakening the cleanup standards:

1. *The submissions and meeting records of lobbying from the responsible parties for weakening the cleanup standards;*
2. *Scientific studies on the cumulative and synergistic effects of PAHs and EPA's review of whether they undermine its proposal to weaken the cleanup standards based solely on new estimates of benzo-a-pyrene's cancer risk;*
3. *Estimates of the number of fish and shellfish that could be safely eaten at the end of the active cleanup, as well as the length of time fish consumption advisories and beach closures would be required, if the cleanup standards are weakened.*
4. *The results of the baseline monitoring for the Superfund site.*

Suggested talking points:

- The ESD to adjust the Benzo(a)pyrene (BaP) cleanup levels and remedial action levels (RALs) is based on new science. Through EPA evaluation and peer-reviewed studies, EPA has determined that BaP is less toxic. As a result, we have adjusted the final cleanup levels for BaP/PAHs. In a similar way, EPA would respond to new science that overwhelmingly shows that this chemical, or any other, were more toxic.
- EPA provided multiple opportunities and materials for community members to learn about the proposed ESD, including a fact sheet, two in-person information sessions, and one online webinar that was also recorded and posted to the EPA Portland Harbor website.
- Unfortunately, EPA cannot take additional public comments on the proposed ESD because we need to move forward with preparing the final ESD. EPA is carefully evaluating the over 1,000 public comments we received.
- **Providing submissions/meeting records of lobbying:** The appendix of EPA's proposed ESD included correspondence from responsible parties regarding the Benzo(a)pyrene change. Beyond that, a Freedom of Information Act (FOIA) request would need to be submitted.
- **Providing scientific studies on cumulative and synergistic effects of PAHs:** EPA does not generally consider synergistic effects of one chemical interacting with other chemicals because this is not part of the

standard risk assessment practice. However, EPA does add health risk impacts from multiple contaminants to evaluate total risk. While this is not a synergistic evaluation, it does adjust assessed risk based on multiple contaminants.

- **Providing estimates of the number of fish and shellfish that could be safely eaten at the end of the active cleanup and length of time fish consumption advisories and beach closures would be required if the cleanup standards are weakened:** This ESD pertains to polycyclic aromatic hydrocarbons (PAHs). However, Polychlorinated Biphenyls (PCBs) are the main risk driver for fish tissue contamination. As a result, EPA does not anticipate that the ESD will impact fish consumption advisories. Additionally, EPA does not anticipate that the ESD will have any additional impact to beach closures than what was already accounted for in the final cleanup plan (or Record of Decision).
- **Providing the results of the baseline monitoring for the Superfund Site:** The baseline monitoring for the Superfund Site is not complete yet, but these results will be publicly shared once this work is done and has been reviewed and approved by EPA. EPA is planning to provide an update on the baseline sampling work with the Pre-Remedial Design Group once the results are ready to be shared.

Community Leaders - Anticipated Attendees

#	Organization(s)	Contact Name(s)	Organization Background & Notes
1	Portland Harbor Community Advisory Group (CAG) **Jackie is also with the University Park Neighborhood Association*	• Jackie Calder* (Chair) • *Michael Pouncil (tentative)*	The Portland Harbor CAG's mission is to ensure a Portland Harbor Cleanup that restores, enriches, and protects the environment for fish, wildlife, human health, and recreation, through community participation. The CAG is comprised of individuals from neighborhood associations, environmental, health, recreation, and business groups, and concerned citizens. The CAG has worked closely with the community, EPA, the Oregon DEQ, the Lower Willamette Group, City of Portland, Port of Portland, and the Tribes affected by the Superfund Site.
2	Portland Harbor Community Coalition (PHCC)	• Cassie Cohen (Leader) • *Donovan Smith (tentative)* • *Alejandra Ruiz (tentative)*	The Portland Harbor Community Coalition (or PHCC) is a group of individual community members and organizations representing the most-impacted groups (Native Americans, African-Americans/Black, immigrants, and houseless) in the billion-dollar Portland Harbor Superfund cleanup.
3	Audubon Society of Portland *(Tentative due to Oregon State legislative session)*	• Bob Sallinger (Conservation Director)	The Audubon Society of Portland has been involved with the cleanup site for many years because the cleanup aligns with its mission to 'promote understanding, enjoyment, and protection of native birds, other wildlife and their habitats.'
4	Willamette Riverkeeper *(Tentative due to Oregon State legislative session)*	• Travis Williams (Executive Director)	Willamette Riverkeeper has also been involved with Portland Harbor for many years and Travis has led the Willamette Riverkeeper since June 2000 (the year that Portland Harbor was listed on Superfund NPL). The mission of Willamette Riverkeeper is to protect and restore the Willamette River.
5	Willamette River Advocacy Group **Amyl is also with the St. Johns Neighborhood Assoc.*	• Amyl Freeberg* (Executive Director)	This group, based in Portland's St. Johns neighborhood is becoming more involved with the Portland Harbor Superfund Site. This group has just recently been awarded EPA's Technical Assistance Grant (TAG) for the Portland Harbor Superfund Site.

6	Occupy St. Johns	• Laura Feldman	Occupy St. Johns is a group of social and environmental community activists who live in North Portland who have been advocating for the Superfund Site cleanup, affordable housing, houseless issues, campaign finance, fair banking practices, and more.
7	Sierra Club* **Works with PHCC*	• Steve Goldstein	The Oregon Sierra Club is a non-profit member-supported, public interest organization that promotes conservation of the Oregon natural environment by influencing public policy decisions—legislative, administrative, legal, and electoral.
8	League of Women Voters	• Debbie Aiona • *Marion McNamara (tentative)*	The League of Women Voters® of Oregon (LWVOR) is a grassroots, nonpartisan political non-profit organization that encourages informed and active participation in government in order to build better communities statewide. LWVOR's purposes are to influence public policy through education and advocacy and to provide support for League members and the League organization.
9	Right 2 Dream Too* **Works with PHCC*	• Ibrahim Mubarak (Co-Founder)	Right To Dream Too (R2DToo) is a nonprofit organization operating a space that provides refuge and a safe space to rest or sleep undisturbed for Portland's unhoused community who cannot access affordable housing or shelter. We exist to awaken social and politcal groups to the importance of safe undisturbed sleep. Our purpose is to create a place where unhoused people can rest or sleep without being rousted by police or private security and without being under the threat of violence.
10	Village Coalition – The City Repair Project	• *Mila Repa Franzoni (tentative)*	City Repair is a participating member of the Village Coalition (VC). VC is a network of advocates, activists, and houseless villages and individuals committed to combating homelessness from many sides of the issue - from designing villages and sleeping pods, to changing negative perspectives, and to find land and partner organizations to facilitate safe shelter creation.
11	Iraqi Society* **Works with PHCC*	• Representative will attend	An association representing Iraqi immigrants, refugees, and Iraqi-Americans. Assists with resettlement.
12	Somali American Council of Oregon (SACOO)	• Musse Olol (Chairman)	The mission of the Somali American Council of Oregon (SACOO) is to empower the Somali community by enhancing relationships between members of the community and between the community and state wide and/or federal agencies while also promoting cultural expression and diversity. In partnership with existing Somali community organizations, SACOO conducts outreach and promotes dialog on public policy issues and is dedicated to improving our community an environment by creating of hope and unity. We promise to work tirelessly to improve conditions in our community and affect positive change in the world around us.
13	Sauvie Island Grange	• Lacen Horter	The Grange is a family fraternal, community service organization with roots in agriculture. We promote a rural quality of life and encourage community activities through involvement. We are the voice of our community and country regarding education, agriculture and environment.

14	Linnton Neighborhood Association* **Darise is also with the CAG*	• Darise Weller*	Historic Linnton combines the best of Portland. Nestled along the Willamette River and Forest Park, its gateway location — five miles northwest of downtown and three miles southeast of Sauvie Island — makes it a natural haven for people who appreciate a strong sense of place, civic pride, and quirky isolation. Winner of the 2005 Spirit of Portland Award, the community of Linnton is proud of its neighborhood involvement. Our residents include a diverse mix of professionals, artists and salt-of-the-earth working folks who champion unity, independence and a rustic spirit. Set along NW St. Helens Road, its boundaries cover more than 4,000 acres that combine industrial land along the riverbank and 300 homes tucked into ancient basalt flows. Because of its east-facing hillside geography, views of the St. Johns Bridge and the Cascade mountains are always a glance away.
15	Cathedral Park Neighborhood Association	• Doug Larson	The neighborhood started with the dedication of Cathedral Park in 1980 and the city of Portland encouraging the formation of neighborhood associations in the 1980s. Nine residents of the area got together to form the association in 1987 as a watchdog group in response to vandalism and bad behavior that was taking a toll on the Park. The boundaries of the neighborhood were somewhat arbitrary. The Willamette River was the south boundary, the cut the east boundary, Weyerhaeuser Ave to the west and Ivanhoe street to the north. Eight of the nine original founders still live around the Park.
16	Portland Northeast Coalition of Neighborhoods	• Jessica Rojas (Community & Environmental Engagement Manager)	Northeast Coalition of Neighborhoods (NECN) increases neighborhood livability through highly inclusive civic engagement and grassroots community building. NECN believes in creating healthy communities by engaging citizens to become directly involved in determining how their neighborhood evolves, and giving them the tools to have their voices heard by policy makers. Our primary areas of focus are civic engagement, issue advocacy, volunteer leadership development and community project support.
17	Oregon Tradeswomen* **Works with PHCC*	• *Amy James Neel (Director of Training) (Tentative)*	Oregon Tradeswomen is dedicated to promoting success for women in the trades through education, leadership, and mentorship. Founded in 1989 as a small support group led by four tradeswomen (an elevator constructor, two carpenters and an operating engineer), the organization was reorganized as Oregon Tradeswomen, a 501 (c)(3) non-profit, in 1999. Oregon Tradeswomen was founded on the principles that women deserve and can attain economic self-sufficiency through pursuing careers in the building, mechanical, electrical, and utility trades while helping and encouraging the trades industry build up a diverse workforce.
19	Kenton Neighborhood Association	• *Tyler Roppe (Chair) (Tentative)*	The mission of the Kenton Neighborhood Association (KNA) is to support our community by advocating and promoting diversity, sustainability and livability of all neighbors.
20	East European Coalition	• Vadim Riskin (President)	The East European Coalition is a non-profit organization created to unite the Eastern European Communities in Oregon and SW Washington and promote Eastern European culture.

21	Overlook Neighborhood Association Hazelnut Grove	• Alexandra Degher (Sustainability Chair)	The Overlook Neighborhood Association (OKNA) includes approximately 3,800 homes, 5,800 people, a thriving industrial area and several business associations. Everyone who lives, owns property or who works within the boundaries of Overlook is part of OKNA.
22	Native American Youth and Family Center (NAYA)	• *Sky Waters (Community Prosperity Manager) (Tentative)*	NAYA is a family of numerous tribes and voices who are rooted in sustaining tradition and building cultural wealth. We provide culturally-specific programs and services that guide our people in the direction of personal success and balance through cultural empowerment. Our continuum of lifetime services create a wraparound, holistic healthy environment that is Youth Centered, Family Driven, Elder Guided
23	BlueGreen Alliance	• *Ranfis Giannettino Villatoro (Oregon State Policy Coordinator) (Tentative)*	The BlueGreen Alliance in Oregon has a local membership of labor, environmental, and community organizations working towards shared goals at the local and state levels. We seek to work together productively and proactively to advance solutions to climate change and other environmental challenges in ways that create and maintain quality jobs and that build a stronger, fairer economy.
24	Confluence Environmental Center	• James Holt (Executive Director)	Confluence Environmental Center's mission is to bring together streams of thought, action and people to make the environmental movement more robust, inclusive and effective. We launched operations in September of 2011 as a project of the Palouse-Clearwater Environmental Institute (PCEI) and in January 2012 received 501(c)3 tax exempt status.

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 4/20/2018 1:32:36 PM
To: Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; Clark, Josie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3fcebabe64354cf9923c18e21fea44c8-Clark, Jocelyn]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]
Subject: FW: DEQ Comments on ESD (confidential)
Attachments: Portland_Harbor_DRAFT ESD_2018-04-10 DEQtoEPA_4.18.17.pdf

fyi

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Cc: MCCLINCY Matt <Matt.MCCLINCY@state.or.us>; NOVAK Madi <Madi.NOVAK@state.or.us>
Subject: DEQ Comments on ESD

Sean and Scott-
Thank you both for a very productive meeting yesterday. We're looking forward to further discussions on in-water/source control overlays along the banks in our meeting next week. In the meantime, DEQ has compiled a number of mostly editorial comments on EPA's proposed ESD. We still have a couple folks who are planning to review, but I wanted to get you these initial thoughts sooner than later. We'll plan to get any remaining comments to you by end of next week. Please let me know if that works with your schedule.

As always, feel free to give me a call if you have questions.
Thanks!

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DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES

Portland Harbor Superfund Site

Portland, Oregon

U.S. Environmental Protection Agency Region 10

Seattle, Washington

April 2018

TABLE OF CONTENTS

1.0 INTRODUCTION 8

1.1 Site Name and Location 8

1.2 Lead and Support Agencies 8

1.3 Statement of Purpose 8

1.4 Administrative Record 9

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY 10

2.1 Site History 10

2.2 Summary of Contamination 11

2.3 Selected Remedy in the ROD 15

3.0 BASIS FOR THE PROPOSED ESD 19

3.1 Changes to the Sediment Cleanup Levels, Target Tissue Levels, and Highly Toxic PTW Thresholds 20

3.2 Changes to Total PAH Remedial Action Level 22

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES 26

5.0 SUPPORT AGENCY COMMENTS 29

6.0 STATUTORY DETERMINATIONS 30

7.0 PUBLIC PARTICIPATION COMPLIANCE 30

8.0 REFERENCES 30

DRAFT

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Appendices

Appendix A Supporting Documentation and Information

- A1 Updated Record of Decision Tables 17 and 21
- A2 Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018
- A3 Discussion and Response to August 2, 2017 NW Natural Memo titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor", March 2, 2018
- A4 Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017
- A5 TCT Meeting Materials, January 11, 2018
- A6 9-7-17 Email from Kevin Parrett (DEQ), Subject: PH Benthic Risk - 8-23-17.pptx
- A7 9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx
- A8 Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017
- A9 Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017
- A10 Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017
- A11 Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017

Appendix B Errata Memorandum

Appendix C Oregon Department of Environmental Quality Letter Supporting EPA's Explanation of Significant Differences

Appendix D Five Tribes Letter Supporting EPA's Explanation of Significant Differences

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List of Figures

ESD Figure 1 Site Area

ESD Figure 2 Principal Threat Waste

ESD Figure 3 Total PAH Remedial Action Level Contours

ESD Figure 4a Running Half River Mile Average cPAH (West)

ESD Figure 4b Running Half River Mile Average cPAH (East)

ESD Figure 5 Proportion of Half-River Miles Protected vs. Remedial Action Levels

ESD Figure 6 Total PAH RAL Curve

ESD Figure 7 Natural Recovery Summary Score

ESD Figure 8 Revised Remedial Footprint Summary

ESD Figure 9a RAO 1 Risk Level – RM Basis (West)

ESD Figure 9b RAO 1 Risk Level – RM Basis (East)

ESD Figure 9c RAO 1 Risk Level – RM Basis (Swan Island Lagoon)

ESD Figure 10a RAO 2 Risk Level – RM Basis (West)

ESD Figure 10b RAO 2 Risk Level – RM Basis (East)

ESD Figure 10c RAO 2 Risk Level – RM Basis (Navigation Channel)

ESD Figure 10d RAO 2 Risk Level – RM Basis (Swan Island Lagoon)

ESD Figure 10e RAO 2 Hazard Index Child – RM Basis (West)

ESD Figure 10f RAO 2 Hazard Index Child – RM Basis (East)

ESD Figure 10g RAO 2 Hazard Index Child – RM Basis (Navigation Channel)

ESD Figure 10h RAO 2 Hazard Index Child – RM Basis (Swan Island Lagoon)

ESD Figure 10i RAO 2 Hazard Index Infant – RM Basis (West)

ESD Figure 10j RAO 2 Hazard Index Infant – RM Basis (East)

ESD Figure 10k RAO 2 Hazard Index Infant – RM Basis (Navigation Channel)

ESD Figure 10l RAO 2 Hazard Index Infant – RM Basis (Swan Island Lagoon)

ESD Figure 11 RAO 6 Hazard Index – SDU Basis

ESD Figure 12 Human Health Beach Exposure Risk Summary

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List of Tables

ESD Table 1 Carcinogenic PAH Cleanup Levels and Highly Toxic PTW Thresholds

ESD Table 2 RAO 1 Risk Summary – RM Basis

ESD Table 3 RAO 2 Risk and Hazard Index Summary – RM Basis

ESD Table 4 RAO 5 Benthic Risk Summary

ESD Table 5 RAO 6 Fish and Wildlife Risk Summary

ESD Table 6 RAO 3 and 7 Surface Water Reduction Summary

ESD Table 7 RAO 4 and 8 Percent Groundwater Plume Area Addressed

ESD Table 8 Percentage Contaminated River Bank Addressed by Each Alternative

ESD Table 9 Human Health Beach Exposure Risk Summary

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ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
BaP	benzo(a)pyrene
BaPeq	benzo(a)pyrene equivalent
BEHP	bis(2-ethylhexyl)phthalate
bml	below mud line
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CRD	Columbia River datum
CSF	cancer slope factor
CUL	cleanup level
CWA	Clean Water Act
cy	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DDx	DDT+DDD+DDE
DEQ	Oregon Department of Environmental Quality
dioxins	polychlorinated dibenzo-p-dioxins
DMM	disposed material management
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FMD	future maintenance dredge
FS	feasibility study
ft	feet
mg/kg	milligram per kilogram
mg/kg-day	milligram per kilogram per day
MGP	manufactured gas production
MNR	monitored natural recovery
MOU	memorandum of understanding
NAPL	non-aqueous-phase liquid
NCP	National Contingency Plan
NPL	National Priorities List
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
PTW	principal threat waste
RAL	remedial action level

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RAO	remedial action objective
RM	river mile
ROD	Record of Decision
SDU	sediment decision unit
Site	Portland Harbor Superfund Site
SMA	sediment management area
SWAC	surface area weighted average concentration
TBT	tributyltin
tribes	Native American tribes
USC	United States Code
µg/kg	microgram per kilogram
%	percent

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DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES PORTLAND HARBOR SUPERFUND SITE

April 2018

1.0 INTRODUCTION

1.1 Site Name and Location

The Portland Harbor Superfund Site (the Site), as listed on the National Priorities List (NPL) (Superfund Site ID#: ORSFN1002155), includes an in-river and an upland portion. The Site was listed on the NPL in December 2000 mainly due to concerns about contamination in the sediments and the potential risks to human health and the environment from consuming the fish. The Site is in Multnomah County, Oregon, and is an urban and industrial section of the City of Portland that runs along the river north of, and downstream of, the central downtown area. The in-river portion of the Site covers approximately 2,190 acres and extends from river mile (RM) 1.9 (upriver end of the Port of Portland's Terminal 5) to RM 11.8 (near the Broadway Bridge) and is shown on the proposed Explanation of Significant Differences (proposed ESD) Figure 1.

1.2 Lead and Support Agencies

The lead agency for the in-river portion of the Site is the United States Environmental Protection Agency (EPA), in consultation with the support agency, the Oregon Department of Environmental Quality (DEQ). After listing the Site on the NPL, EPA entered into a 2001 Memorandum of Understanding (MOU) with DEQ, six federally recognized Native American tribes (tribes), two other federal agencies, and one other state agency.[1] Under the MOU, DEQ is the lead agency for addressing contamination in the upland portions of the Superfund site, and EPA is the support agency.

1.3 Statement of Purpose

The Record of Decision (ROD), which documents the selected in-river remedy, was signed on January 3, 2017 (EPA 2017a). The Selected Remedy is summarized in Section 2.3 below. This proposed ESD includes changes to the remedy to the Selected Remedy and the reasons for such changes that are significant but not fundamental changes. This proposed ESD is issued in accordance with §117(c) of the Comprehensive Environmental Response, Compensation, and

[1] Government parties that signed the MOU include DEQ, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Grand Ronde Community of Oregon, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Nez Perce Tribe, the National Oceanic and Atmospheric Administration, the U.S. Department of the Interior (National Marine Fisheries Service and U.S. Fish and Wildlife Service), and the Oregon Department of Fish and Wildlife.

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Liability Act (CERCLA), 42 United States Code (USC) §9617(c), and the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) §300.435(c)(2)(i).

The purpose of the proposed ESD is to document changes to the sediment cleanup levels (CULs) and target tissue level for shellfish for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) measured as benzo(a)pyrene equivalents (BaPeq). This proposed ESD also documents a change to the remedial action level (RAL) for total polycyclic aromatic hydrocarbons (PAHs) for areas of the Site outside of the Navigation Channel.

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA, 2017b). The toxicological review was prepared under the auspices of EPA's Integrated Risk Information System (IRIS) program and developed a revised oral cancer slope factor based on a review of publicly available studies. IRIS is an EPA database containing human health risk information. Consistent with EPA guidance (EPA 1989), information in IRIS supersedes all other sources of toxicity information for conducting human health risk assessments under CERCLA. The toxicological review modified the oral cancer slope factor (CSF) for benzo(a)pyrene (BaP) from 7.3 to 1 milligram per kilogram per day (mg/kg-day). The CSF change means that BaP is less toxic for people who come into contact with or ingest BaP than previously analyzed.

Given this new toxicity information, EPA has determined that modifying the cPAH (BaPeq) CULs and total PAH RAL for contaminated sediments outside the Navigation Channel will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by approximately $35 million. Supporting information and analysis for this proposed ESD are contained in figures and tables included in Appendix A.

For completeness and expediency, this ESD also includes an Errata Memorandum dated April 3, 2018 as Appendix B. The Errata Memorandum documents minor corrections to various tables, figures and text items in the Portland Harbor ROD and are not considered significant differences.

1.4 Administrative Record

This proposed ESD and supporting documents will become part of the Site Administrative Record file, in accordance with the NCP, §300.825. The EPA Portland Harbor website is the main repository for all administrative records for the Site: https://www.epa.gov/superfund/portland-harbor The proposed ESD and supporting documents will be available at the following locations:

Multnomah County Central Library
801 SW 10th Avenue
Portland, OR 97205
(503) 988-5123
Monday 10 am–8 pm

St. Johns Library
7510 N. Charleston Avenue
Portland, OR 97203
(503) 988-5123
Monday, Tuesday 12 pm–8 pm

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Tuesday, Wednesday 12 pm–8 pm
Thursday, Friday, Saturday 10 am–6 pm
Sunday 10 am–5 pm

Kenton Library
8226 N. Denver Avenue
Portland, OR 97217
(503) 988-5123
Monday, Tuesday 12 pm–8 pm
Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Superfund Records Center
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-4494 or (800) 424-4372
Monday through Friday 9 am–4 pm

Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Oregon Operations Office
805 SW Broadway
Suite 500
Portland, OR 97205
(503) 326-3250
Monday through Friday 9 am–4 pm

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

2.1 Site History

The Willamette River is the 19th largest river in the United States and one of 14 American Heritage Rivers in the country. It flows into the larger Columbia River, which eventually flows into the Pacific Ocean. Even though the Willamette River is nearly 100 river miles from the Pacific Ocean, there are tidal influences within the Site, and it is a large and dynamic river.

Since the late 1800s, the Portland Harbor section of the lower Willamette River has been extensively modified to accommodate a vigorous shipping industry. Modifications include redirection and channelization of the main river, draining seasonal and permanent wetlands in the lower floodplain, and dredging to maintain the navigation channel, access to docks, and wharf facilities. Constructed structures, such as wharfs, piers, floating docks, and pilings, are common in Portland Harbor where urbanization and industrialization are most prevalent.

The federal navigation channel, with an authorized depth of -40 feet (ft) Columbia River datum (CRD), extends from the confluence of the lower Willamette River with the Columbia River to RM 11.6. In 1999, Congress authorized the Willamette River to be deepened to -43 ft; however, this has not yet occurred. Swan Island Lagoon was created in the 1930s when dredge spoils were used to fill in part of the channel and connect Swan Island to the mainland.

While the harbor area is heavily industrialized, it is located within a region characterized by commercial, residential, recreational, and agricultural uses. Land use along the lower Willamette River includes marine terminals, manufacturing and other commercial operations, public

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facilities, parks, and open spaces. In addition to industrial activities, the Willamette River and surrounding watershed historically offered access to abundant natural resources in the river and on land. Many of these resources are still present such as fish, marine mammals, waterfowl, land mammals, and native plants.

The Willamette River is also important to many tribes. Fish are among the resources most frequently utilized by the tribes in the Portland Basin and the Willamette Valley. Culturally significant species include salmonids, lamprey (eels), eulachon (smelt), and sturgeon. Native people also fished for a variety of other resident species, including mountain whitefish, chiselmouth, northern pikeminnow, peamouth, and suckers. Tribes have reserved hunting, fishing (particularly salmon and sturgeon species), and certain gathering rights through Treaties with the United States.

2.2 Summary of Contamination

Sources of Contamination

Historically, contaminants from many facilities entered the river system from different activities, including but not limited to ship building and repair; ship dismantling; wood treatment and lumber milling; storage of bulk fuels; manufactured gas production (MGP); chemical manufacturing and storage; metal recycling, production, and fabrication; steel mills, smelters, and foundries; and electrical production and distribution. These activities resulted in direct discharges from upland areas through stormwater and wastewater outfalls; releases and spills from commercial operations occurring over the water; municipal combined sewer overflows; and indirect discharges through overland flow, bank erosion, groundwater, and other nonpoint sources. In addition, contaminants from offsite sources have reached the Site through surface water and sediment transport from upstream and through atmospheric deposition. Operations that continue today along the river banks include bulk fuel storage, barge building, ship repair, automobile scrapping, recycling, steel manufacturing, cement manufacturing, operation and repair of electrical transformers (including electrical substations), and many smaller industrial operations.

Contaminants of Concern

The human health and ecological risk assessments identified 64 contaminants of concern (COCs) that contribute a significant amount of risk to the human and ecological receptors. COCs by media are listed in Tables 1 through 5 in Appendix II of the ROD. A subset of all COCs, called focused COCs, was developed to simplify analysis and evaluation of remedial alternatives. The focused COCs include polychlorinated biphenyls (PCBs), PAHs, dioxins and furans, and DDx, which represents collectively dichlorodiphenyltrichloroethane (DDT) and its primary breakdown products dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethene (DDE).

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Principal Threat Waste

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

PTW was identified based on cancer risk (highly toxic) or non-aqueous phase liquid (NAPL) within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment. A capping model was used to determine whether there were concentrations of PTW that could not be reliably contained.

Contaminated Media

The environmental media contaminated by COCs include surface sediment (0 to 30 centimeters [cm] below mud line [bml]), subsurface sediment (below 30 cm bml), suspended sediment, surface water, groundwater, biota, and river banks. The surface sediment sample interval (0 to 30 cm bml) is designed to capture that portion of the sediment column that has the potential to be disturbed or transported under typical annual conditions. River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. The following nature and extent of contamination discussion focuses on sediments, surface water, and river banks. A full description of site contamination is included in Section 6 of the ROD.

Nature and Extent of Contamination

Surface and Subsurface Sediment

Contamination in subsurface sediment was identified as deep as 17 ft bml in the navigation channel and 19 ft bml in the sediment future maintenance dredge (FMD) areas. FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. In the intermediate region, defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD, the maximum depth of contamination was estimated to be 34 ft bml, but most contamination was less than 10 ft. In the shallow region, defined as shoreward of the riverbed elevation of 4 ft below mean low water, the maximum depth of contamination was estimated to be 33.5 ft bml. Based on contaminant distribution trends, some general patterns emerged among subsets of different contaminants that reflect fate and transport processes at the Site as well as the relative importance of regional versus site sources, as described below. Additional details are included in the ROD (EPA 2017a).

Sediment contaminant concentrations were greatest in nearshore areas. Concentrations of contaminants were generally higher in nearshore and off-channel areas such as slips,

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embayments, and shallow areas, and near some known or suspected sources, as compared to sediments in the navigation channel, Multnomah Channel, and downstream areas.

Organic contaminant concentrations were greater in subsurface sediments. Concentrations of organic contaminants tended to be higher in subsurface sediments than in surface sediments. Concentrations of total PCBs, total DDx, total PAHs, hexachlorobenzene, total chlordanes, aldrin and dieldrin, gamma-hexachlorocyclohexane (Lindane), lead, and tributyltin (TBT) were higher in subsurface than in surface sediments, indicating that historical inputs were likely greater than current inputs. Subsurface contamination was detected as deep as 34 ft. In contrast, arsenic, copper, chromium, mercury, and zinc did not have large concentration ranges and generally showed similar levels in surface and subsurface sediments. Other exceptions included areas where higher surface sediment concentrations appeared to be associated with ongoing Site sources, low rates of sediment deposition, and physical sediment disturbance (e.g., from boat scour).

Regional inputs exhibited uniform concentrations across the area. Contaminants that may have been derived predominantly from regional or upstream inputs showed widespread surface sediment distributions without distinct, isolated areas of higher concentrations. Examples of this were arsenic, chromium, and mercury, which occurred at relatively low concentrations throughout the Site with no apparent strong concentration gradients.

Areas of high concentrations were present throughout the Site and generally were located near likely upland sources. A number of contaminants exhibited relatively high sediment concentrations in distinct areas offshore of known or likely sources. These areas were separated by large areas with relatively lower concentrations lacking obvious concentration gradients. Contaminants that exhibited this trend included total PCBs, dioxins, bis(2-ethylhexyl)phthalate (BEHP), butylbenzyl phthalate, pentachlorophenol, hexachlorobenzene, total chlordanes, Lindane, copper, zinc, and TBT.

Some contaminants had areas of high concentrations that were more common in the lower (downstream) half of the Site. Total DDx and total PAHs exhibited elevated concentrations in some locations of the river. Concentrations of certain metals were correlated to sediment grain size. A comparison of metals concentrations to the distributions of percent fines in the Site showed that where sediments were comprised of less than 40 percent (%) fines, chromium and copper concentrations were relatively low (above RM 10, between RM 5 and 7, and in the Multnomah Channel; RI Map 3.1-3). A similar, but less pronounced, correspondence existed between sandy sediments and zinc concentrations.

Multiple contaminants co-occurred. In most areas of the Site, multiple COCs are comingled. At all of the highest surface sediment concentration areas, more than one contaminant is found. This degree of contaminant co-occurrence reflects the variety of sources to the in-river portion of the Site and the history of upland Site development, including wastewater and stormwater conveyance systems and industrial and commercial activities.

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Surface Water

Concentrations of contaminants in surface water vary spatially and with river flow. Surface water concentrations in the Site were generally higher than those entering the upstream boundary of the Site (at RM 16) under all flow conditions. The highest contaminant concentrations in surface water within the Site were found near known sources where concentrations in sediment were also highest, such as the areas adjacent to the Gasco and Arkema facilities (RM 6 through RM 7.5W). Surface water samples collected at the downstream end of the Site (RM 2 and Multnomah Channel) showed higher concentrations of PCBs, dioxin/furans, DDx, BEHP, chlordanes, and aldrin than concentrations of these contaminants entering the Site from upstream. This pattern indicates that contamination from the Site is being transported to the Columbia River.

River Banks

River banks are defined as the area from the top of bank down to the river. Contaminants detected in river bank material at levels that pose a risk to human health, the environment, or for recontamination to any implemented remedy, include the focused COCs and other contaminants. The ROD (EPA 2017a) provides a detailed summary of river bank contaminants on the east and west sides of the river.

Remedial Action Objectives

The remedial action objectives (RAOs) for the Portland Harbor Superfund Site, listed in Section 9 of the ROD, are media-specific goals for protecting human health and the environment. The CULs for COCs associated with these RAOs are identified in Table 17 in the ROD. CULs are the long-term contaminant concentrations that need to be achieved by the remedial alternatives to meet RAOs. The nine RAOs developed to address the human health and ecological risks posed by the contamination at the Site are presented below.

Human Health RAOs

- RAO 1 – Sediment: Reduce cancer and non-cancer risks to people from incidental ingestion of and dermal contact with COCs in sediment and beaches to exposure levels that are acceptable for fishing, occupational, recreational, and ceremonial uses
- RAO 2 – Biota: Reduce cancer and non-cancer risks to acceptable exposure levels (direct and indirect) for human consumption of COCs in fish and shellfish
- RAO 3 – Surface Water: Reduce cancer and non-cancer risks to people from direct contact (ingestion, inhalation, and dermal contact) with COCs in surface water to exposure levels that are acceptable for fishing, occupational, recreational, and potential drinking water supply
- RAO 4 – Groundwater: Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for human exposure

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Ecological RAOs

- RAO 5 – Sediment: Reduce risk to benthic organisms from ingestion of and direct contact with COCs in sediment to acceptable exposure levels
- RAO 6 – Biota (Predators): Reduce risks to ecological receptors that consume COCs in prey to acceptable exposure levels
- RAO 7 – Surface Water: Reduce risks to ecological receptors from ingestion of and direct contact with COCs in surface water to acceptable exposure levels
- RAO 8 – Groundwater: Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for ecological exposure

Human Health and Ecological RAO

- RAO 9 – River Banks: Reduce migration of COCs in river banks to sediment and surface water such that levels are acceptable in sediment and surface water for human health and ecological exposures

2.3 Selected Remedy in the ROD

Key components of the Selected Remedy are described below. A full description of the Selected Remedy is provided in the ROD.

EPA's remedial strategy for the in-river portion of the Site is to address all contaminated media and complete exposure pathways that pose unacceptable risk to human health or the environment, including sediment, biota, surface water, groundwater, and river banks. The Selected Remedy utilizes a combination of technologies to address contaminated sediment. The same technologies will be used in adjacent river banks if determined the river banks should be remediated in conjunction with the sediment action. Although the Selected Remedy does not directly address surface water, EPA anticipates that taking action on sediment and river banks, in conjunction with control of upland sources conducted under DEQ authority, will reduce contaminants concentrations in all media to acceptable levels and reduce ongoing source of contaminants to Multnomah Channel and the Columbia River.

The Selected Remedy addresses all areas where contaminant concentrations exceed the CULs through a combination of dredging, capping, enhanced natural recovery (ENR), monitored natural recovery (MNR), and institutional controls. CULs were selected after evaluating concentrations protective of human health or the environment from the risk assessment, applicable or relevant and appropriate requirements (ARARs), and background values. Sixty-four COCs found in sediment, surface water, groundwater, and tissue were identified. For each contaminant and in all media such as sediments and surface water, the lowest number protective of human health or the environment was selected unless the available background value was

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higher, in which case the background value was selected. Table 17 in the ROD provides the CULs and tissue targets as well as the basis for the selected number. The CULs for the Site are expected to reduce unacceptable risk within the river by setting standards for sediment, biota, surface water, groundwater, and river banks. Remediation of the sediment will reduce loading and resuspension of contamination to surface water, which collectively will reduce fish and shellfish exposure to the contamination.

Areas to be capped or dredged called Sediment Management Areas (SMAs) are defined by remedial action levels (RALs) and PTW for the Selected Remedy (Table 21 in the ROD). SMAs for the Selected Remedy are shown on Figure 30 in the ROD. The SMAs represent areas with contaminant concentrations in surface sediment where natural recovery is not occurring or is not likely to be effective in reducing concentrations of COCs within a reasonable time frame. RALs are contaminant-specific sediment concentrations of focused COCs used to define areas for more active cleanup and will reduce contaminant concentrations and risks more effectively than ENR or MNR from current site wide average concentrations. Technology assignments and the approximate areas that will be remediated through dredging, capping, ENR, and areas where COC concentrations will be reduced through MNR are shown on Figures 31a-e in the ROD.

The COCs used to define the SMA boundaries are PCBs, total PAHs, DDx and selected dioxin/furan congeners. These focused COCs encompass the majority of the spatial extent of contaminants posing the majority of the risks as identified in the baseline risk assessments. In the Feasibility Study (FS), RALs were developed by considering the volume or acreage of material that would be addressed to achieve reductions of contaminant concentrations (and therefore risk) throughout the Site. The relationships between RAL concentrations and resulting site-wide spatially-area weighted average concentrations (SWACs) or "RAL curves" were developed by plotting acres remediated against the post remediation surface weighted average surface sediment concentration. A range of RALs consisting of seven different concentrations bracketing the distribution of contamination were selected for each focused COC. The selected RALs are a function of the distribution of surface sediment data at the Site and reflect uncertainties in the distribution of contamination and the interpolation method utilized.

Each remedial alternative evaluated in the FS has a different set of sediment RALs. The lowest RALs are in Alternative H; therefore, the areas that are capped and/or dredged increase in acres from Alternatives B through H. A summary of RALs for the focused COCs used to develop Alternatives B through H are presented in Table 18 in the ROD.

The Selected Remedy applies Alternative F RALs to nearshore sediments and Alternative B RALs to the federally authorized navigation channel. Total PAH RAL contours are shown on proposed ESD Figure 3. PAHs, RALs were based on total PAHs rather than cPAHs because total PAHs were selected as a focused COC for the Site. The relationship between total PAHs and cPAHs is presented in Appendix D of the FS. The total PAH RALs for the Selected Remedy are 13,000 µg/kg for nearshore sediments and 170,000 µg/kg for the federally authorized navigation channel.

The Selected Remedy in the ROD includes a total constructed area of 394 acres of sediment and 23,305 lineal feet of river bank and allows 1,774 acres of sediment to naturally recover. The Selected Remedy includes 365.4 acres of capping and dredging contaminated sediment and 28.2 acres of ENR. Of that, approximately 215.2 acres of sediment will be dredged to varying depths. Additionally, 23,305 lineal feet of river bank are assumed to be excavated and covered with either an augmented reactive cap or an engineered cap using beach mix or vegetation after excavating approximately 123,000 cubic yards (cy) of contaminated material from river banks. The dredged material removed from the Site will be managed under disposed material management (DMM) scenario 2, with approximately 3,017,000 cy of contaminated sediment and 123,000 cy of soil sent to offsite disposal facilities. Material testing will be used to determine the appropriate disposal facility, Subtitle D or C. Ex-situ treatment is assumed for approximately 191,500 cy of sediment and river bank soil prior to disposal and is based on complying with federal and state regulations and the 2004 dispute decision on MGP waste. The need for, and extent of, ex-situ treatment will be based on the offsite disposal requirements and material testing during design and construction. It is assumed that all other dredged material will not require treatment prior to disposal.

The various river areas and their remedy components are discussed in detail below. The final technology assignment will be identified in the remedial design after collection of additional sampling data. The technology assignment will be identified as indicated in the decision tree on Figure 28 in the ROD.

Navigation Channel

The Selected Remedy in the federally authorized navigation channel includes dredging to avoid constructing a cap or residual layer within the authorized dredge depth. Contaminated sediment will be dredged to the depth of the Alternative B RAL concentrations or PTW concentrations shown in Table 21 in the ROD, whichever is lower. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging and include the surrounding area that may have been impacted by dredge residuals. If RALs are not achieved or PTW is present below the feasible depth limit of the excavation technology, as approved by EPA, a cap is assumed to be placed after dredging. Navigation and maintenance dredge depth requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the authorized depth of the navigation channel, including an over dredge allowance/buffer zone. Implementing the Selected Remedy in the navigation channel will need to consider, and be coordinated with, cleanup conducted in the rest of the Site to minimize recontamination. This cleanup may occur at the same time or later than the other cleanup actions.

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Future Maintenance Dredge Areas

FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. Contaminated sediment will be dredged to the depth of the sitewide RAL concentrations shown in Table 21 in the ROD or to a depth required to allow placement of a cap or backfill sufficient to be effective over the long term. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. A reactive residual layer (sand plus activated carbon) is assumed after dredging if PTW that can be contained lies below the feasible limits of excavation. Maintenance dredge depth requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the maintained depth, including an over dredge allowance or buffer zone.

Intermediate Region

The intermediate region is defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet Clean Water Act (CWA) (Section 404) and federal floodway requirements as well as climate change impacts. In the intermediate region, contaminated sediment will be dredged to the depth required to achieve RALs (see Table 21 in the ROD) and remove PTW or to a depth required to allow placement of cap or backfill material sufficient to be effective over the long term. The elevation of the top of the cap will be no higher than the pre-design elevation to avoid impacts to the floodway. EPA estimates the dredging depth required to accommodate a cap will generally be 5 feet. The final depth will be determined in remedial design. Where RAL concentrations are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. In the intermediate regions, residual layers will consist of sand (amended with activated carbon if determined to be appropriate) to prevent the transport and release of contaminants from dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. During design and construction, the final elevation of capped and dredged areas will be considered such that the leave surface of the constructed remedy is appropriate for the post-construction use of each specific area. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. If appropriate to protect sensitive species, a habitat layer will be incorporated into the constructed remedy.

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Shallow Region

The shallow region is defined as shoreward of the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet CWA (Section 404) and federal floodway requirements as well as climate change impacts. Contaminated sediment in this area will be dredged to the depth required to remove all NAPL or PTW that cannot be reliably contained (see Table 21 in the ROD) unless it is present below the feasible depth limit of excavation technology in which case it will be capped. Where PTW is not present but the depth of excavation to achieve RAL concentrations is greater than 5 feet, the area will be dredged to 5 feet with placement of a cap and backfilled to grade. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. In the shallow regions, a habitat layer, such as beach mix, will be used for the final layer of clean cover in both residual management areas and capped areas to bring the surface back to the original (pre-dredge) elevation and to maintain the natural habitat.

River Bank Region

River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. Remediation of contaminated river banks is included in the Selected Remedy where it is determined that it should be conducted in conjunction with the in-river actions and to protect the remedy (Figure 9 and Table 21 in the ROD). Other river banks may be included in the remedial action if contamination contiguous with contaminated river sediment is found during remedial design sampling. Engineered caps or vegetation with beach mix will be placed as the final cover based on area-specific designs, which will account for appropriate slope according to the programmatic or site-specific Biological Opinion, as appropriate. NAPL or PTW that cannot be reliably contained, if present, will be fully excavated and not capped unless it is present below the depth limit of excavation technology, as approved by EPA. In those locations, a significantly augmented cap will be constructed below the habitat layer. The state may also undertake actions at some river banks that are the subject of this ROD to expedite source control of contaminated upland areas, as necessary. Those actions will be consistent with the Selected Remedy and meet CERCLA requirements.

3.0 BASIS FOR THE PROPOSED ESD

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA 2017b). The updated toxicological review modified the oral CSF for BaP from 7.3 to 1 mg/kg-day resulting in a lower risk estimate associated with exposure to BaP and other cPAHs. Given that humans have less cancer risk from exposure to BaP, the modified CSF has potential implications for the risk-based human health CULs, target tissue levels, and highly toxic PTW thresholds for cPAHs measured as BaPeq selected in the January 3, 2017 ROD (EPA 2017a).

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CULs for cPAHs were calculated using a CSF to achieve a 1 x 10^{-6} cancer risk level and the PTW thresholds were set at a 1 x 10^{-3} level based on the CUL[2].

Although not directly related to a CSF or a measurement of risk, EPA evaluated potential implications of the BaP slope factor change on the total PAH RALs selected in the ROD to determine whether any areas slated for active cleanup primarily or solely due to cPAH risk from direct contact with contaminated sediments or shellfish consumption no longer presented risk or may no longer require active cleanup. However, while undertaking this review, EPA also considered the effect of these changes on other human health and ecological RAOs. In particular, EPA evaluated impacts to surface water CULs and whether ecological risks presented by PAHs, carcinogenic or not, would be adequately addressed if changes to cPAH CULs and/or the total PAH RALs were implemented.

3.1 Changes to the Sediment Cleanup Levels, Shellfish Target Tissue Levels, and Highly Toxic PTW Thresholds

Human health sediment CULs and shellfish target tissue levels as well as the highly toxic PTW threshold for PAHs in the ROD are based on cPAHs. As a result, the change in the CSF for BaP has a direct effect on the risk-based sediment CULs and target tissue levels for cPAHs. These changes are summarized below.

cPAH Direct Contact Sediment CULs

The Portland Harbor baseline human health risk assessment included in the *Final Remedial Investigation Report* (RI Report – EPA 2016a) evaluated a range of direct contact exposure scenarios for beach sediment and in-water sediment. Potentially exposed populations evaluated under the beach exposure scenarios included dockside workers, transients, recreational beach users, high frequency fishers, and tribal fishers. Potentially exposed populations evaluated under the in-water sediment exposure scenarios included in-water workers, high frequency fishers, tribal fishers, diver wet suit, and diver dry suit.

Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in an increase in the direct contact sediment CUL specified in the ROD by a factor of 7.3. The ROD selected a cPAH (BaPeq) sediment CUL of 12 micrograms per kilogram (µg/kg) for nearshore sediments based on the recreational beach sediment exposure scenario. The ROD applied the cPAH recreational beach sediment CUL to all nearshore sediments outside the navigation channel. EPA evaluated whether

[2] Risks are probabilities that usually are expressed in scientific notation (e.g., 1 x 10^{-6}). An excess lifetime cancer risk of 1 x 10^{-6} indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10^{-4} to 10^{-6} established in the NCP. EPA's goal of protection for cancer risk is 10^{-6}, and risks greater than 10^{-4} typically will require remedial action. Highly toxic PTW is generally based a 10^{-3} risk level.

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a sediment CUL based on the tribal fisher exposure scenario should be applied to nearshore sediments outside of the navigation channel where recreational beach exposures are not expected to occur. The in-water sediment preliminary remediation goal (PRG) based on the tribal fisher exposure scenario is 106 µg/kg. Increasing the in-water sediment PRG of 106 µg/kg by a factor of 7.3 results in a revised nearshore sediment PRG and CUL of 774 µg/kg.

cPAH Shellfish Consumption Target Tissue Levels

The ROD included target tissue levels for cPAHs in shellfish tissue of 7.1 µg/kg based on the shellfish consumption exposure scenario, herein after referred to as shellfish target tissue levels. Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in a proportional increase in the target tissue level from 7.1 to 51.6 µg/kg. This target tissue level would apply to shellfish tissue throughout the Site.

cPAH Shellfish Consumption Sediment Cleanup Levels

The ROD selected a shellfish consumption sediment CUL of 3,950 µg/kg based on human consumption of clams. The shellfish consumption sediment CUL for cPAHs of 3,950 µg/kg is applicable to the entire Site, whereas the direct contact sediment CUL is only applicable to nearshore sediment areas because direct contact exposure pathways are not considered to be complete within the navigation channel at the Site.

For the shellfish consumption sediment CUL, the target tissue level increases by a factor of 7.3. However, the relationship between cPAH (BaPeq) shellfish (clam) tissue levels and sediment levels is a non-linear relationship represented by the following equation presented in Appendix B of the FS (EPA 2016b):

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue}) - (\ln(f_{lipid}) - \ln(CF) + 2.47)}{0.6} + ln(f_{oc}) \quad \text{(Equation 1)}$$

Where:

PRG_{sed} = Risk-based sediment preliminary remediation goal, dry weight (µg/kg)
C_{tissue} = Risk-based acceptable tissue concentration, wet weight (µg/kg)
CF = Correction factor of 2.3
F_{oc} = Fraction organic carbon, dry weight (0.0171)
F_{lipid} = Fraction of lipid in shellfish (clam) tissue, wet weight (0.22

Because of the non-linear relationship between bulk sediment BaP concentrations and shellfish (clam) tissue BaP concentrations, revising the acceptable tissue concentration from 7.1 to 51.6 µg/kg and solving for PRG_{sed} increases the shellfish consumption cPAH sediment CUL from 3,950 to 107,600 µg/kg.

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cPAH Principal Threat Waste Thresholds

The ROD (EPA 2017a) identified the presence of PTW at the Site. PTW types identified include source material in the form of NAPL, highly toxic material based on a 1 x 10^{-3} risk level, and material that is not reliably contained. The presence of NAPL and not reliably contained PTW associated with PAH contamination is unaffected by the BaP slope factor change. However, the highly toxic PTW threshold for cPAHs of 106,000 µg/kg increases by a factor of 7.3 to 774,000 µg/kg due to the BaP slope factor change.

As noted above, PTW types identified at the Site include source material in the form of NAPL, highly toxic material based on a 1 x 10^{-3} risk level, and material that is not reliably contained. Increasing the highly toxic PTW threshold from 106,000 to 774,000 µg/kg will limit the presence of highly toxic PTW at the Site. Areas of PTW are shown on proposed ESD Figure 2.

Application of Sediment Cleanup Levels

The ROD established a cPAH CUL of 12 µg/kg for nearshore sediments based on a recreational beach exposure scenario that included both child and adult exposures. The ROD also established a sediment CUL of 3,950 µg/kg applicable to the navigation channel based on the clam consumption exposure scenario.

EPA has re-evaluated application of the nearshore sediment CUL based on the recreational beach exposure scenario and determined that two cPAH direct contact CULs should apply to nearshore sediments. The updated cPAH direct contact beach CUL of 85 µg/kg will apply to recreational beaches based on existing or reasonably anticipated future use. EPA also developed a cPAH direct contact CUL of 774 µg/kg based on the tribal fisher exposure scenario. The cPAH direct contact tribal fisher CUL for in-water sediment of 774 µg/kg will apply to the remainder of nearshore sediments (including non-recreational beach areas). The updated cPAH shellfish consumption CUL of 107,600 µg/kg will apply to the federally authorized navigation channel. This change does not affect the sediment CUL for any other COC at the Site.

Changes to the direct contact sediment CULs, the shellfish consumption target tissue level, the shellfish consumption sediment CUL, and highly toxic PTW threshold for cPAHs (BaPeq) are summarized in proposed ESD Table 1.

3.2 Changes to Total PAH Remedial Action Level

EPA evaluated whether a change to the total PAH RALs for the Selected Remedy was appropriate based on the change to the BaP CSF. This evaluation considered both the total PAH nearshore sediment RAL of 13,000 µg/kg and the total PAH navigation channel RAL of 170,000 µg/kg. The navigation channel RAL is applicable to all contaminated sediments within the

federally authorized navigation channel while the nearshore RAL is applicable to all sediments outside the navigation channel.

The evaluation considered whether the Selected Remedy RALs would result in the remediation of PAH contaminated sediment that no longer poses unacceptable risk to human health due to the BaP CSF change based on an evaluation of post construction risk. The evaluation also considered whether a change in the total PAH RAL would affect the ability of the remedy to attain all other RAOs specified in the ROD. The evaluation considered both the tribal fisher and recreational beach exposure scenarios (RAO 1) and other RAOs where PAHs are identified as a COC (RAOs 2, 3, 5 and 7). The evaluation did not consider groundwater RAOs (RAOs 4 and 8) since these will be dependent on engineered caps applied along with the adequacy of source control actions.

Nearshore Total PAH RAL

cPAH Direct Contact In-water Sediment Risk (RAO 1): Updating the direct contact cPAH sediment CUL from 106 µg/kg to 774 µg/kg without adjustment of the nearshore total PAH RAL will result in the remediation of some sediments that do not exceed 774 µg/kg as measured on a one-half rolling river mile SWAC basis. As shown on proposed ESD Figures 4a and 4b, one-half rolling river mile SWACs, if the Alternative F total PAH RAL is used, would exceed 774 µg/kg between approximately RM 4.8 and 6.6 in nearshore sediments along the west shore of the Willamette River (West Shoal) and between approximately RM 3.9 and 4.9 along the east shore of the Willamette River (East Shoal).

EPA conducted an evaluation to determine the percentage of nearshore half-river miles protected based on a range of total PAH RALs. This evaluation is consistent with the direct contact residual risk evaluation presented in Appendix IV of the Portland Harbor ROD. EPA evaluated increasing the total PAH RAL for the Selected Remedy of 13,000 µg/kg by a factor of 7.3 to 95,000 µg/kg (the factor of 7.3 represents the magnitude of the change to the BaP CSF). As is shown in proposed ESD Figure 5, a total PAH RAL of 95,000 µg/kg will protect 22% of nearshore half-river miles. Figure 5 also shows that a total PAH RAL of 30,000 µg/kg will protect 100% of the nearshore half-river mile by achieving the updated direct contact cPAH CUL of 774 µg/kg as measured on one-half rolling river mile SWACs throughout the Site. Based on the results of this evaluation, EPA determined that revising the nearshore total PAH RAL from 13,000 µg/kg to 30,000 µg/kg was appropriate.

cPAH Direct Contact Beach Exposure (RAO 1): In general, the remedial footprint for the Selected Remedy as presented in the ROD does not include beach areas. The exception to this is a beach area near Linnton at approximately RM 4.8 along the east bank of the Willamette River (Beach 04B024) and a beach area near Cathedral Park at approximately RM 5.9 along the west bank of the Willamette River (Beach 05B018). The baseline human health risk assessment (EPA 2016a) determined that the risk associated with these beaches was 4×10^{-5} and 1×10^{-5}, respectively. Updated risk estimates based on the BaP CSF change are 5×10^{-6} and 1×10^{-6}, respectively. These risk estimates are within EPA's risk range and do not need to be addressed

through active remediation. In addition, it is expected that risks to human health in beach areas will be further reduced through natural recovery processes. As a result, revising the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg will not significantly affect the ability of the remedy to protect recreational beach users. Long-term monitoring will be performed to verify that the Selected Remedy is protective of recreation beach exposures.

cPAH Shellfish Consumption Risk (RAO 2): As noted above, the BaP CSF change will increase the shellfish consumption cPAH sediment CUL from 3,950 to 107,600 µg/kg. However, this concentration is not exceeded on a rolling river mile basis within the Site. As a result, this CUL is already met at the Site based on existing data so no RAL is needed to address human health risks associated with this exposure.

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the selected remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): The total PAH sediment CUL for benthic risk as presented in Table 17 of the ROD is 23,000 µg/kg. The Selected Remedy is estimated to address 72% of benthic risk areas based on 10 times unacceptable benthic risks at the end of construction with the remainder to be addressed through MNR. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, PAHs in sediment present unacceptable risk to the benthic community. Therefore, changes in total PAH RALs must be evaluated to determine the effect on the attainment of RAO 5 and the CUL. Because the revised total PAH RAL of 30,000 µg/kg is only slightly above the total PAH CUL for protection of the benthic community of 23,000 µg/kg, increasing the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg will have a minimal effect on attainment of RAO 5 or the post-construction metric of 10 times the benthic risk CUL.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

Based on its evaluation, EPA determined that the nearshore RAL should be revised from 13,000 to 30,000 µg/kg to avoid remediation of PAH-contaminated sediments that no longer pose a risk to human health for direct contact based on the changes to the nearshore sediment cPAH CUL. EPA has also determined that increasing the total PAH RAL from 13,000 to 30,000 µg/kg will not have a significant effect on the ability of the remedy to protect recreational beach users or to attain RAOs 2, 3, 5, or 7. The total PAH RAL curve utilizing the revised total PAH RAL is shown on proposed ESD Figure 6. The change in the remedial footprint associated with this change is estimated to be 17 acres.

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Navigation Channel RAL

EPA evaluated whether the change in BaP CSF necessitated revising the total PAH RAL of 170,000 µg/kg applicable to the navigation channel. This evaluation considered the effect of the RAL change on post-construction risk estimates and whether the change would affect attainment of the RAOs established for the Site. The evaluation focused on RAOs 3, 5, and 7. The evaluation did not consider RAO 1 because the human health direct contact exposure pathway is considered incomplete within the navigation channel and did not consider RAO 2 because the cPAH shellfish consumption sediment CUL is not exceeded on a SWAC basis within the navigation channel.

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Increasing the total PAH near-shore RAL above 170,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): As noted above, the total PAH sediment CUL, as presented in the ROD, is 23,000 µg/kg. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, changes in total PAH RALs must be evaluated to determine the effect on attainment of RAO 5. The total PAH RAL applicable to the navigation channel of 170,000 µg/kg is well above the total PAH CUL for protection of the benthic community of 23,000 µg/kg. As a result, any evaluation in changes to the navigation channel RAL must consider the effectiveness of MNR to achieve the total PAH CUL.

As shown on proposed ESD Figure 3, the total PAH navigation channel RAL is exceeded within the navigation channel only between approximately RM 5.1 and RM 6.6. An evaluation of natural recovery processes at the Site determined that the navigation channel between RM 5 and RM 7 is generally not conducive to natural recovery. A multiple line of evidence natural recovery framework considered changes in sediment bed elevation based on two bathymetric surveys conducted in May 2003 and January 2009, the consistency in changes in sediment bed elevation based on five bathymetric surveys conducted between January 2002 and January 2009, sediment grain size, the potential for propeller wash induced erosion, the ratio of subsurface to surface sediment concentrations, and the erosion potential associated with wind and vessel wake generated waves. The results of this multiple line of evidence natural recovery framework are shown on proposed ESD Figure 7. Areas that are conducive to natural recovery are scored as +1, whereas areas where natural recovery is unlikely to be effective are scored as -1. Areas where natural recover is neither favorable nor unfavorable are scored as 0. As shown on proposed ESD Figure 7, natural recovery processes are generally unfavorable within the navigation channel between RM 5.1 and RM 6.6. As a result, increasing the navigation channel RAL above 170,000 µg/kg may limit the ability of the remedy to achieve the total PAH CUL of 23,000 µg/kg over time.

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Based on its evaluation, EPA determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5). This is because the selected total PAH RAL of 170,000 µg/kg is well above the total PAH CUL and the lack of natural recovery processes within the navigation channel between RM 5 and RM 7 where the total PAH RAL is exceeded.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Increasing the R sing the total PAH nears e RAL above 170,000 µg/kg to will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES

This section describes the significant differences between the Selected Remedy presented in the Portland Harbor ROD and the proposed changes to the Selected Remedy resulting from proposed change in sediment CULs, shellfish target tissue levels, and highly toxic PTW thresholds for carcinogenic PAHs and remedial action levels for total PAHs.

Summary of Significant Changes

EPA has considered the effect of the change in the CSF for BaP on the Selected Remedy for the Site and evaluated the effect of the changes on the ability of the remedy to attain the RAOs established in the ROD and the cost of the remedy. The following changes to the remedy are being made to the Selected Remedy and other expected outcomes from the changes are summarized below:

- Update the beach sediment CUL for cPAHs from 12 to 85 µg/kg. This sediment cleanup level is based on the recreational beach exposure scenario as described in Sections 8.1.2.3 and 8.1.4.1 of the ROD and applicable to recreational beach sediments only based upon existing or reasonably anticipated future use.
- Include a direct contact sediment CUL for cPAHs of 774 µg/kg applicable to nearshore sediments (see ROD Table 17 in Appendix A). This sediment CUL is based on the tribal n direct contact exposure scenario and applicable to all near nearshore sediments, except for recreational beach areas.
- Update the shellfish consumption sediment CUL for cPAHs from 3,950 to 107,600 µg/kg. This sediment CUL is based on a subsistence fisher exposure scenario and applicable to the entire Site.
- Update the target tissue level for cPAHs in shellfish tissue from 7.1 to 51.6 µg/kg. This target tissue level for shellfish is based on a subsistence fisher exposure scenario and applicable to the entire Site.
- Update the highly toxic PTW threshold for cPAHs from 106,000 to 774,000 µg/kg. This PTW threshold is applicable to the entire Site.

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- Update the total PAH RAL applicable to sediments outside the navigation channel from 13,000 to 30,000 µg/kg.
- For beaches where recreational use is possible based on existing and reasonably anticipated land use and any sediment CULs are significantly exceeded, signage or other educational institutional controls may be used until CULs are achieved.

All other elements of the Selected Remedy remain unchanged, including the surface water and groundwater CULs, total PAH sediment CULs, and total PAH RALs applicable to navigation channel sediments. EPA has determined that these changes will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by approximately $35 million. A discussion of changes in scope, performance, and cost is summarized below.

SMA Footprint Changes

Revising the remedial action level for total PAHs from 13,000 to 30,000 µg/kg results in a change to the remedial footprint for the Selected Remedy as depicted on proposed ESD Figure 8. Although this change is based solely on PAHs, post-construction concentrations and risk estimates for other COCs at the Site are also affected. Changes are limited to areas where cleanup is driven solely by PAHs and includes Terminal 4, the west side of the Willamette River between RM 4 and RM 7, the upper portion of Swan Island Lagoon, and the east side of the Willamette River between RM 2.5 and RM 3. The amount of PTW addressed by the remedy is unchanged.

RAO Evaluation

Sediment RAOs

RAO 1 (Human Health Direct Contact): The changes in post-construction risk estimates resulting from this change are presented in proposed ESD Table 2 and on proposed ESD Figures 9a through 9c. RAO 1 post-construction risk estimates are presented on a ½ rolling river mile basis. For RAO 1, direct contact risk, the greatest change in the post-construction risk, occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 6×10^{-7} to 1×10^{-6}, whereas at RM 4.5 East, post-construction risks are estimated to increase from 2×10^{-6} to 3×10^{-6}. Because direct contact non-cancer risk is acceptable, changes in non-cancer hazard indices were not calculated.

RAO 2 (Human Health Shellfish Ingestion): The changes in post-construction risk estimates are presented in proposed ESD Table 3 and on proposed ESD Figures 10a through 10l. RAO 2 post-construction risk estimates are presented on a rolling river mile basis. For RAO 2, shellfish consumption risk, the greatest change in the post-construction risk occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 2×10^{-5} to 4×10^{-5}, whereas at RM 4.5 East, post-construction risks are estimated to increase from 8×10^{-5}

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to 1 x 10^{-4}. Post-construction non-cancer hazard indices quotients also increase. The largest estimated hazard index increases are from 0.8 to 1.7 for a child and from 25 to 48 for an infant at RM 6.5.

RAO 5 (Benthic Organisms): The changes in post-construction benthic risk estimates are presented in proposed ESD Table 4. For RAO 5, revising the total PAH RAL will reduce the percentage of the Site achieving 10 times the benthic risk CULs from 72% to 69% of the Site following construction.

RAO 6 (Fish and Wildlife Prey Consumption): The changes in post-construction fish and wildlife prey consumption are presented on a sediment decision unit (SDU) basis in proposed ESD Table 5 and on proposed ESD Figure 11. The maximum changes were observed in SDU 4.5 East and SDU 6 West. The total hazard index increased from 1.2 to 1.5 for both SDU 4.5 East and SDU 6 West.

Surface Water and Groundwater RAOs

RAOs 3 and 7 (Human Health and Aquatic Life Surface Water): The changes in post-construction reductions in surface water concentration are summarized in proposed ESD Table 6. Reductions in surface water concentrations associated with the Selected Remedy were estimated in the ROD to range between 26% and 91%, depending on the chemical following construction. Revised reductions are expected to range between 25% and 91%, depending on the chemical following construction. In all cases, changes in the reduction in surface water concentrations are 1% or less. For example, reductions in cPAH surface water concentrations were estimated as 78% for the Selected Remedy. Based on the changes to the Selected Remedy, the reduction in cPAH surface water concentrations is estimated as 77%. It is estimated that all surface water COC concentrations will be reduced to 10 times the CULs. Consistent with the ROD, it is expected that CULs (both risk-based and ARAR-based surface water levels) will be achieved over time through a combination of in-river cleanup with source control actions within the Site and actions taken to address toxic media within the watershed.

RAOs 4 and 8 (Human Health and Aquatic Life Groundwater): The area of groundwater plumes addressed by the in-water portion of the updated remedy following construction is estimated to be reduced from 39% to 32% as shown in proposed ESD Table 7. Consistent with the ROD, the remainder of the contaminated groundwater will be dependent on the adequacy of source control actions.

River Banks and Principal Threat Waste

The lineal feet of river bank addressed by the updated remedy is estimated to be reduced from 23,305 to 22,592 lineal feet as shown on proposed ESD Table 8. This represents a reduction from 78% to 75% of contaminated river banks. Consistent with the ROD, the remaining river

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bank areas are expected to be addressed through other cleanup actions (i.e., upland source control measures).

No change to the amount of PTW addressed by the updated remedy is expected.

Human Health Beach Exposure

In addition to changes in post construction risk, changes in the results of the human risk assessment associated with the change in the CSF for BaP were also evaluated for the human health direct contact beach exposure scenario. Beach areas at the Portland Harbor site were evaluated for dockworkers, transients, recreational beach users and tribal, high frequency and low frequency fishers. The evaluation focused on the exposure scenario that presents the maximum risk for each beach area (tribal fisher or dockworker). The evaluation shows that human health risk estimates beach exposure risk estimates decline between 0 and 5[illegible] depending on the contribution of cPAHs to the total risk at each beach area. The results of this evaluation are shown in proposed ESD Table 9 and Figure 12.

Remedial Quantities and Cost

EPA evaluated the changes in remedial quantities and cost associated with changing the total PAH RAL applicable to nearshore sediments outside the navigation channel. EPA determined that this change would reduce the total nearshore remedial footprint by 17 acres, reduce the capping area by 8 acres, and reduce the dredging volume by 43,800 cy. This results in a decrease in the present value cost for the Selected Remedy of approximately $35 million. This represents a 3.4% decrease in the overall present value cost of the Selected Remedy. Cost assumptions are included in Appendix A.

5.0 SUPPORT AGENCY COMMENTS

Change "accepted" to "agrees to"

DEQ has reviewed and accepted the modifications to the CULs for cPAH (BaPeq) and RALs for total PAHs for the Selected Remedy. The support agency letter of concurrence is included in Appendix C of this proposed ESD.

The Five Tribes support EPA's approach regarding updating CULs and RALs in response to the BaP revision in a proposed ESD. The Five Tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon. The letter of concurrence is included in Appendix D of this proposed ESD.

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6.0 STATUTORY DETERMINATIONS

The Selected Remedy for the Portland Harbor Superfund Site, as modified by this proposed ESD, continues to satisfy the statutory requirements of CERCLA §121, 43 USC 9621 to protect human health and the environment, comply with federal and state requirements that are applicable or relevant and appropriate to the remedial action, are cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

7.0 PUBLIC PARTICIPATION COMPLIANCE

The public participation requirements set out in the NCP, 40 CFR §300.435(c)(2), have been met by adding the ESD and supporting information to the administrative record established under §300.815. EPA will publish a notice that briefly summarizes the final ESD, including the reasons for such differences in a major local newspaper of general circulation. EPA also recognized that there is strong community interest in the Portland Harbor Superfund Site and that there was a need for additional public participation opportunities regarding the proposed ESD. As a result, the proposed ESD and supporting administrative record were made available to the public through a 30-day public comment period. In addition, EPA held a public meeting to discuss the changes to the Selected Remedy in the proposed ESD.

8.0 REFERENCES

Environmental Protection Agency (EPA). 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002. December.

EPA. 2016a. *Final Remedial Investigation Report, Portland Harbor Remedial Investigation Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. February 8.

EPA. 2016b. *Draft Final Portland Harbor Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. June.

EPA. 2017a. *Record of Decision for the Portland Harbor Superfund Site*, Portland, Oregon. January 3.

EPA. 2017b. *Toxicological Review of Benzo[a]pyrene*. Integrated Risk Information System, National Center for Environmental Assessment, Office of Research and Development. Washington, DC. January 19.

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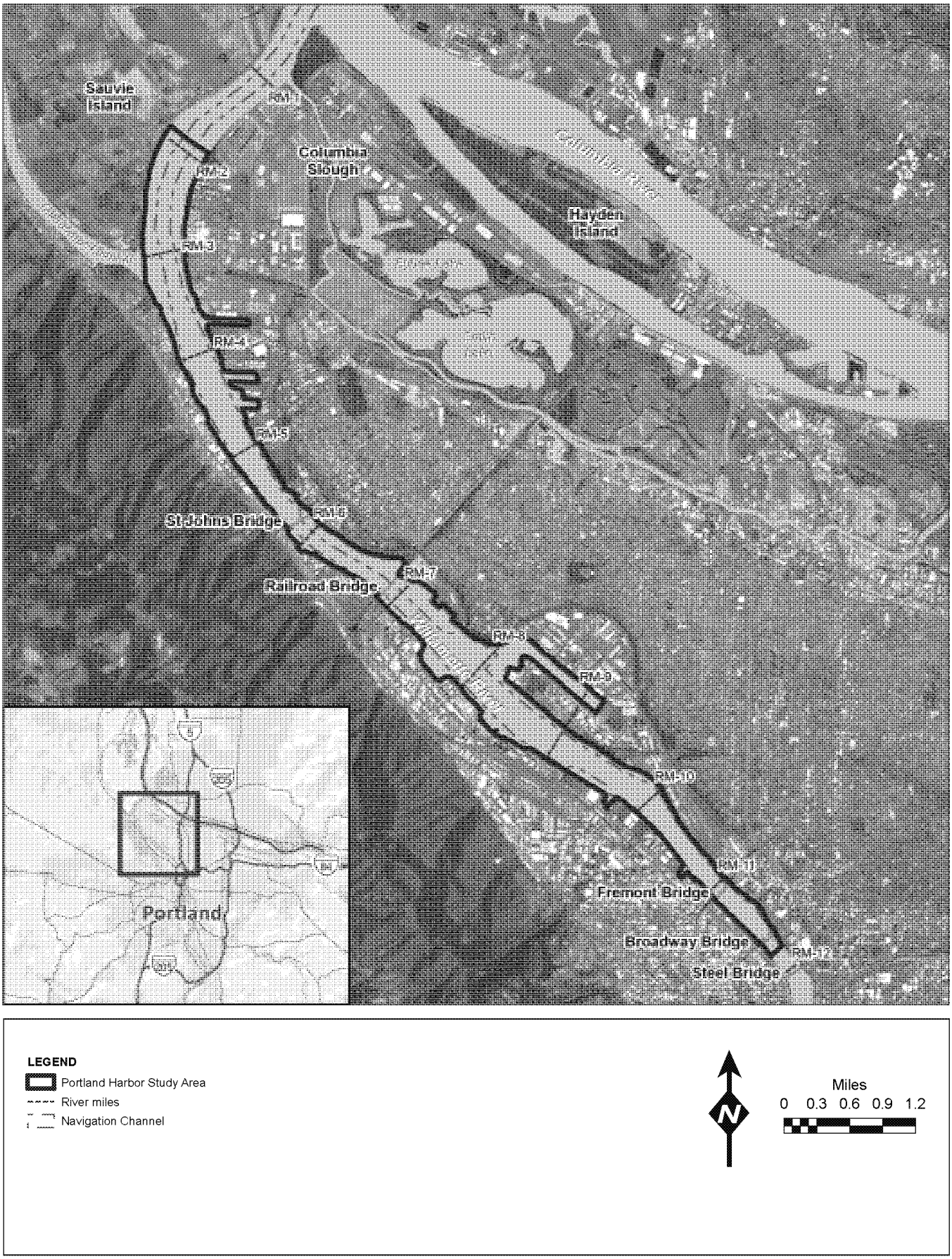
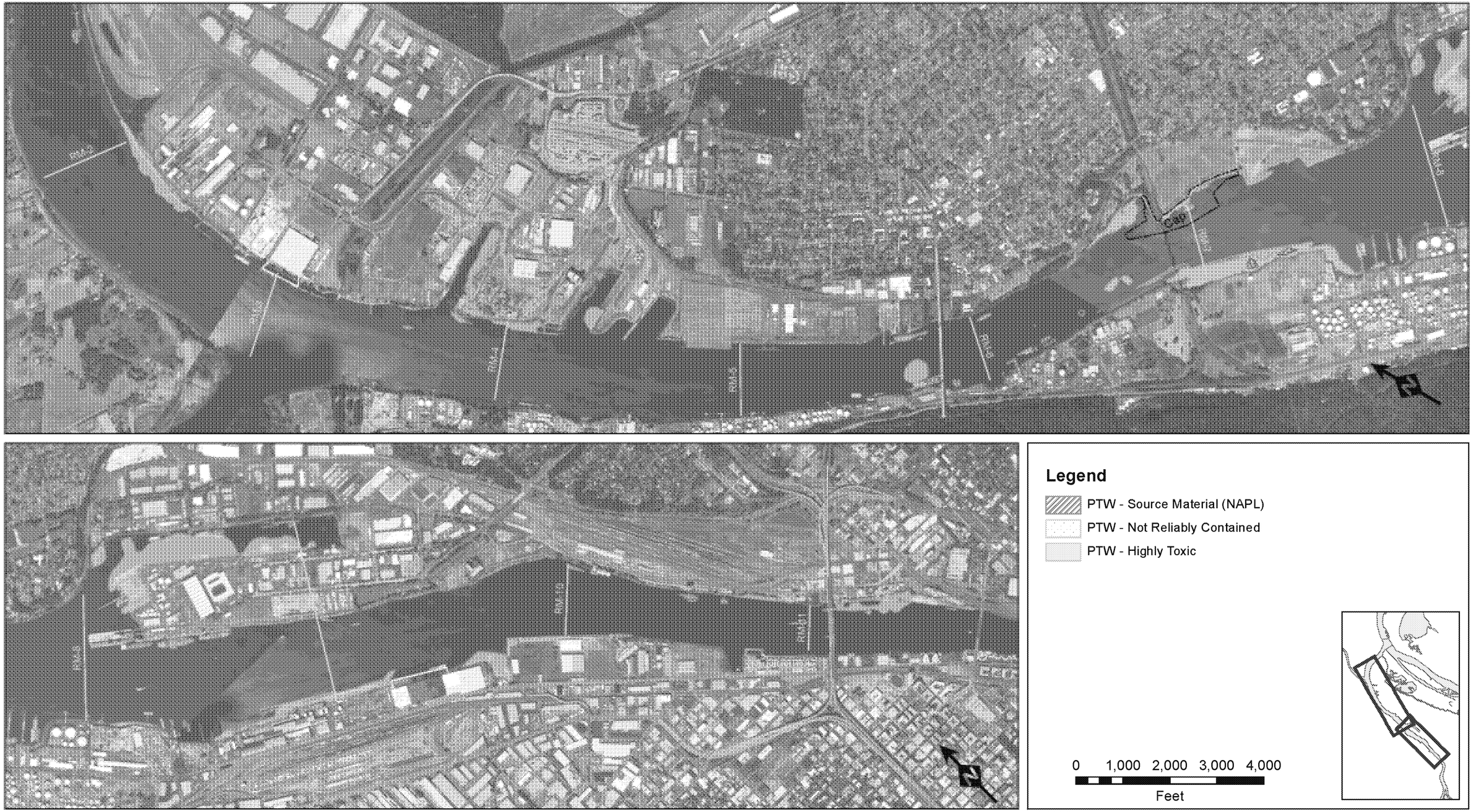
Figures



ESD Figure 1. Site Area

Portland Harbor Superfund Site



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ESD Figure 2. Principal Threat Waste

Portland Harbor Superfund Site

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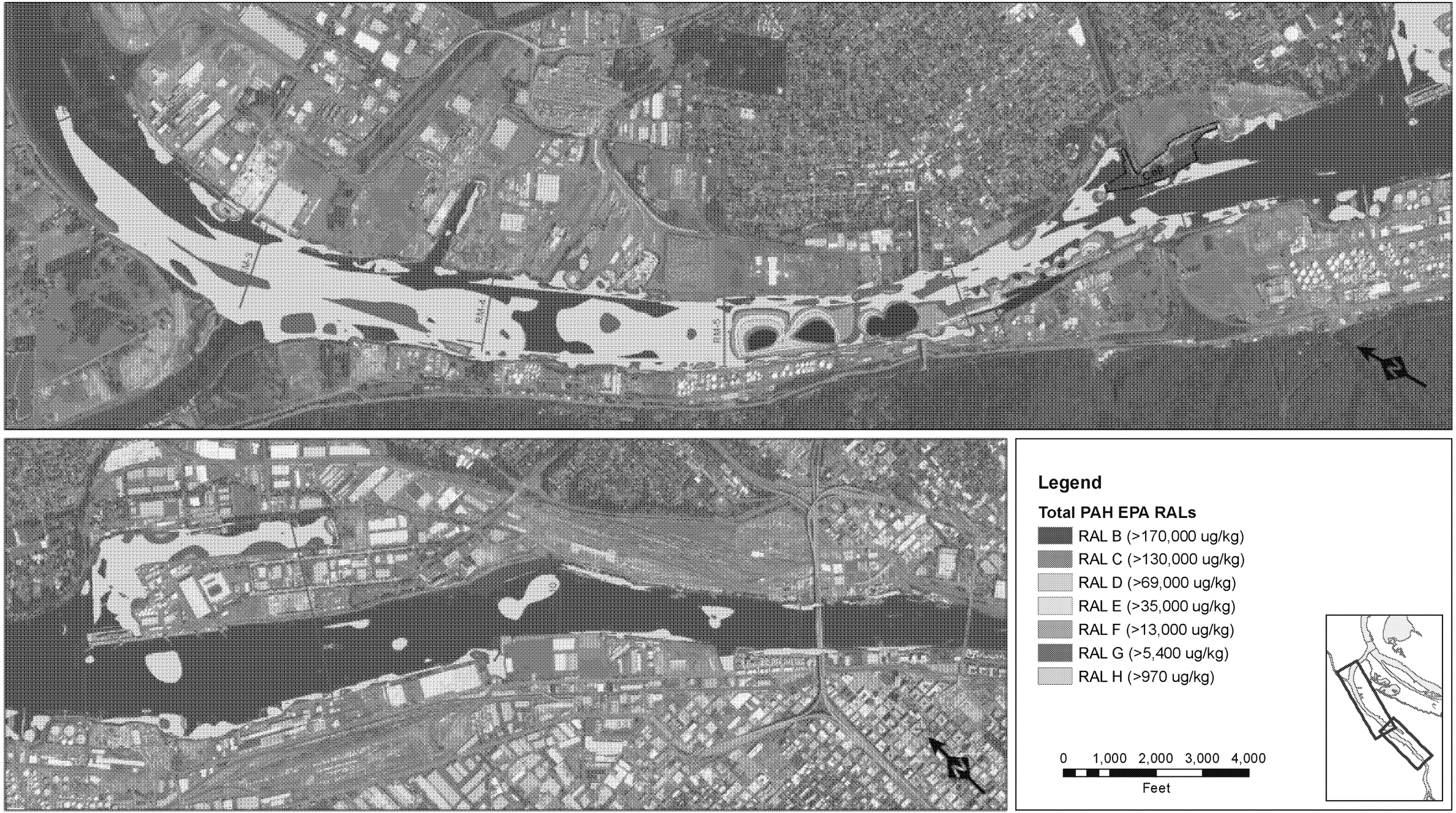
Date: 12/2/2016



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

ESD Figure 3. Total PAH Remedial Action Level Contours

Portland Harbor Superfund Site

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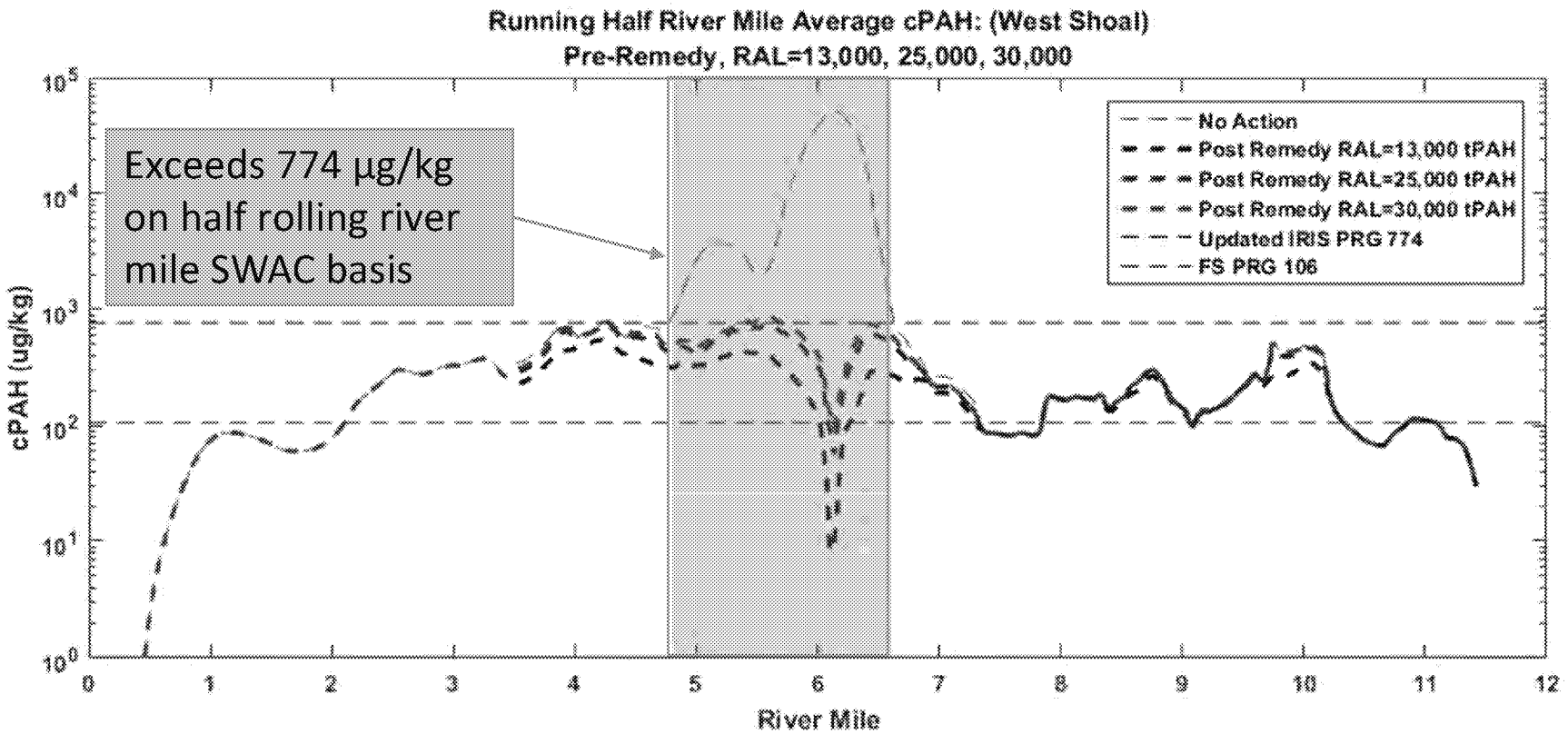
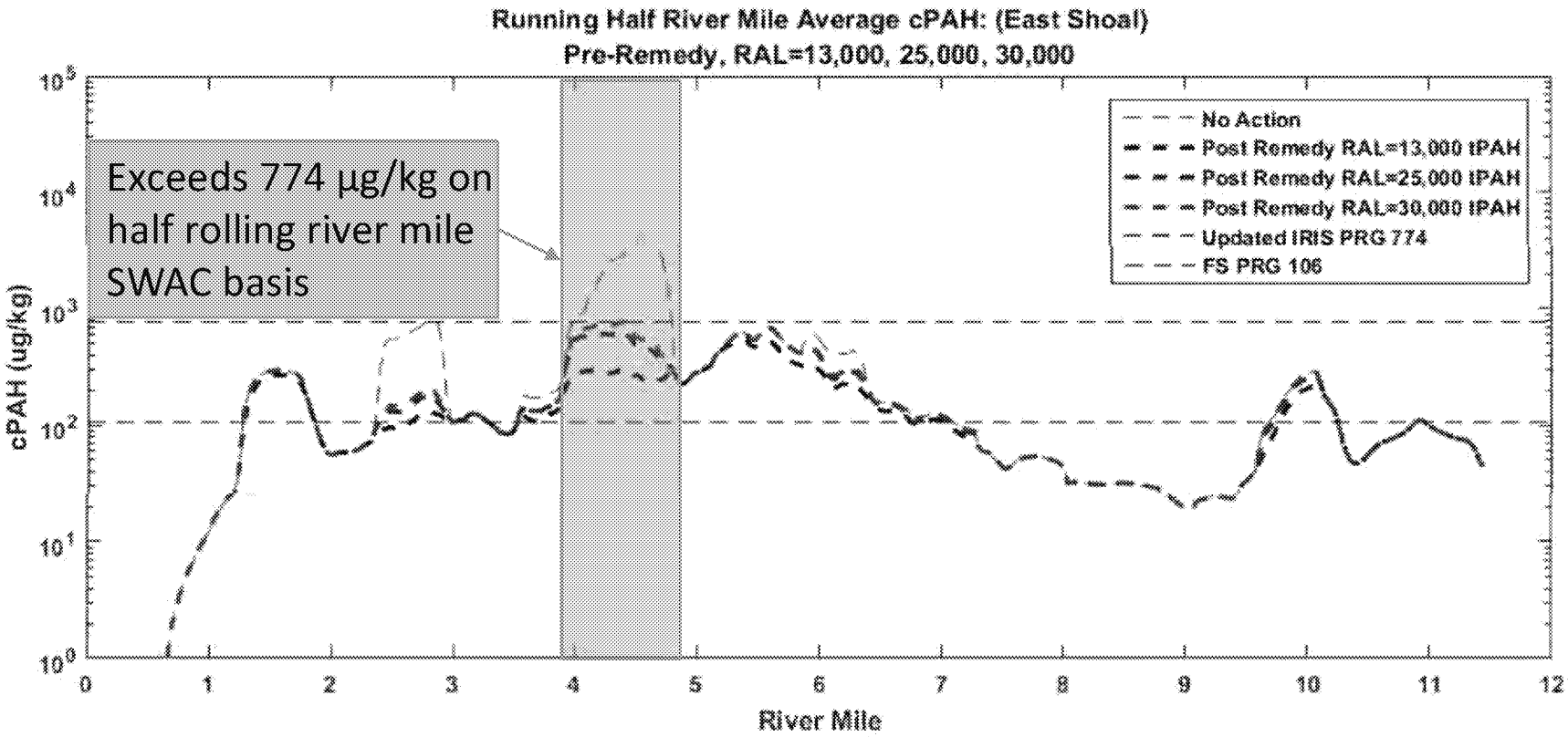
Date: 3/20/2018



Note: cPAH half rolling river mile SWAC was estimated assuming cleanup above tPAH RAL for each scenario

ESD Figure 4a. Running Half Mile Average cPAH (West)

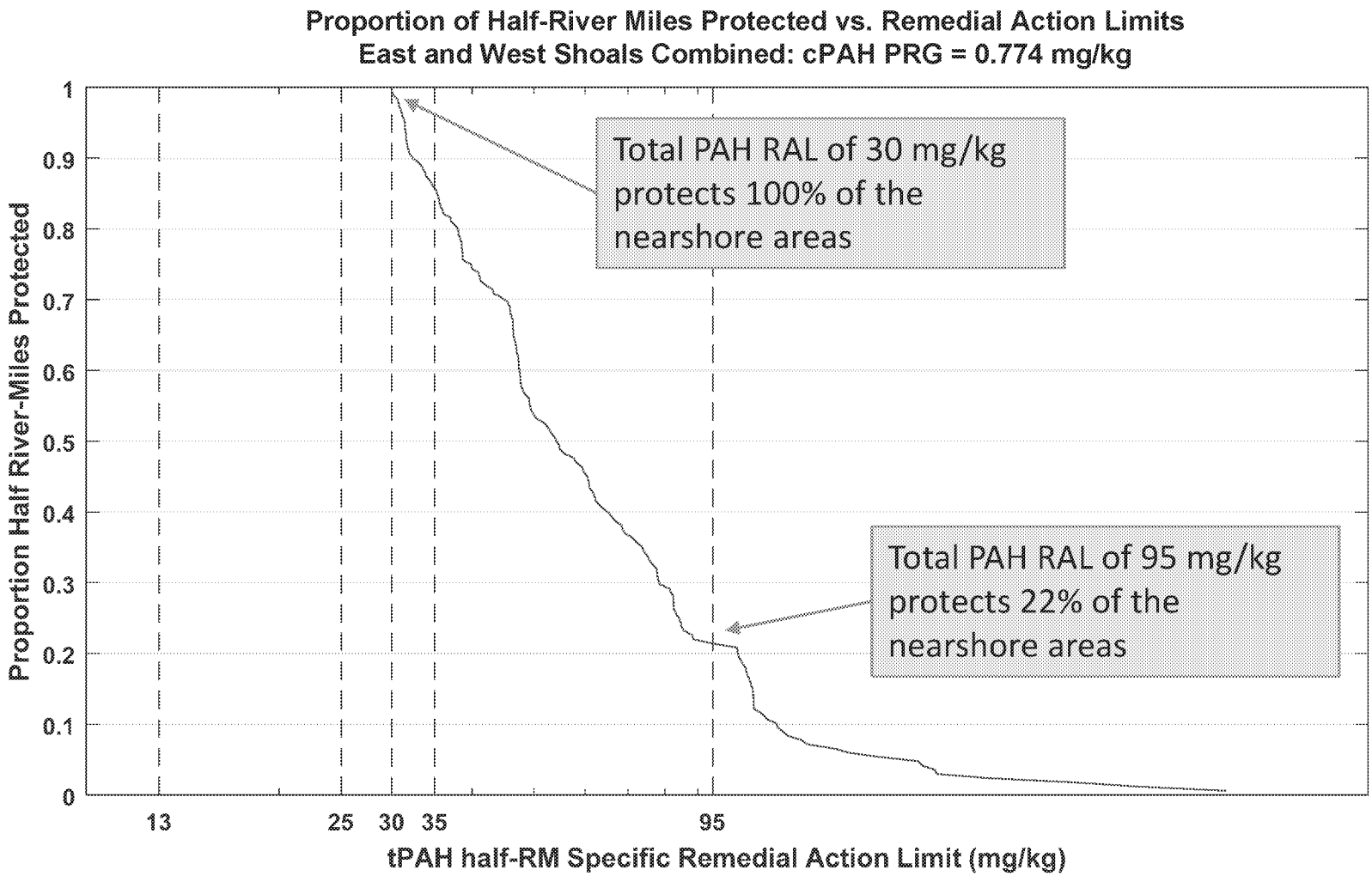
Portland Harbor Superfund Site



Note: cPAH half rolling river mile SWAC was estimated assuming cleanup above tPAH RAL for each scenario

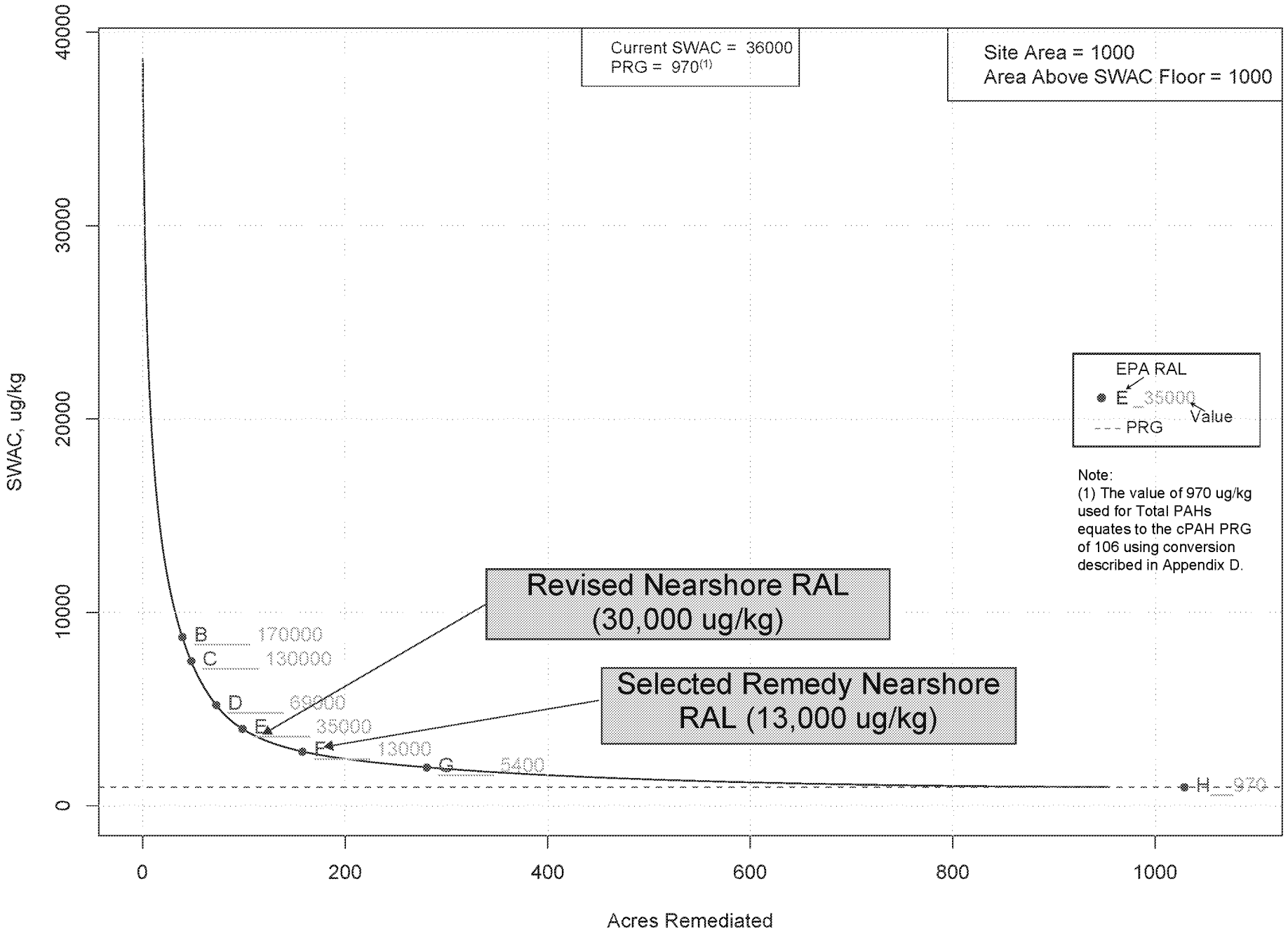
ESD Figure 4b. Running Half Mile Average cPAH (East)

Portland Harbor Superfund Site



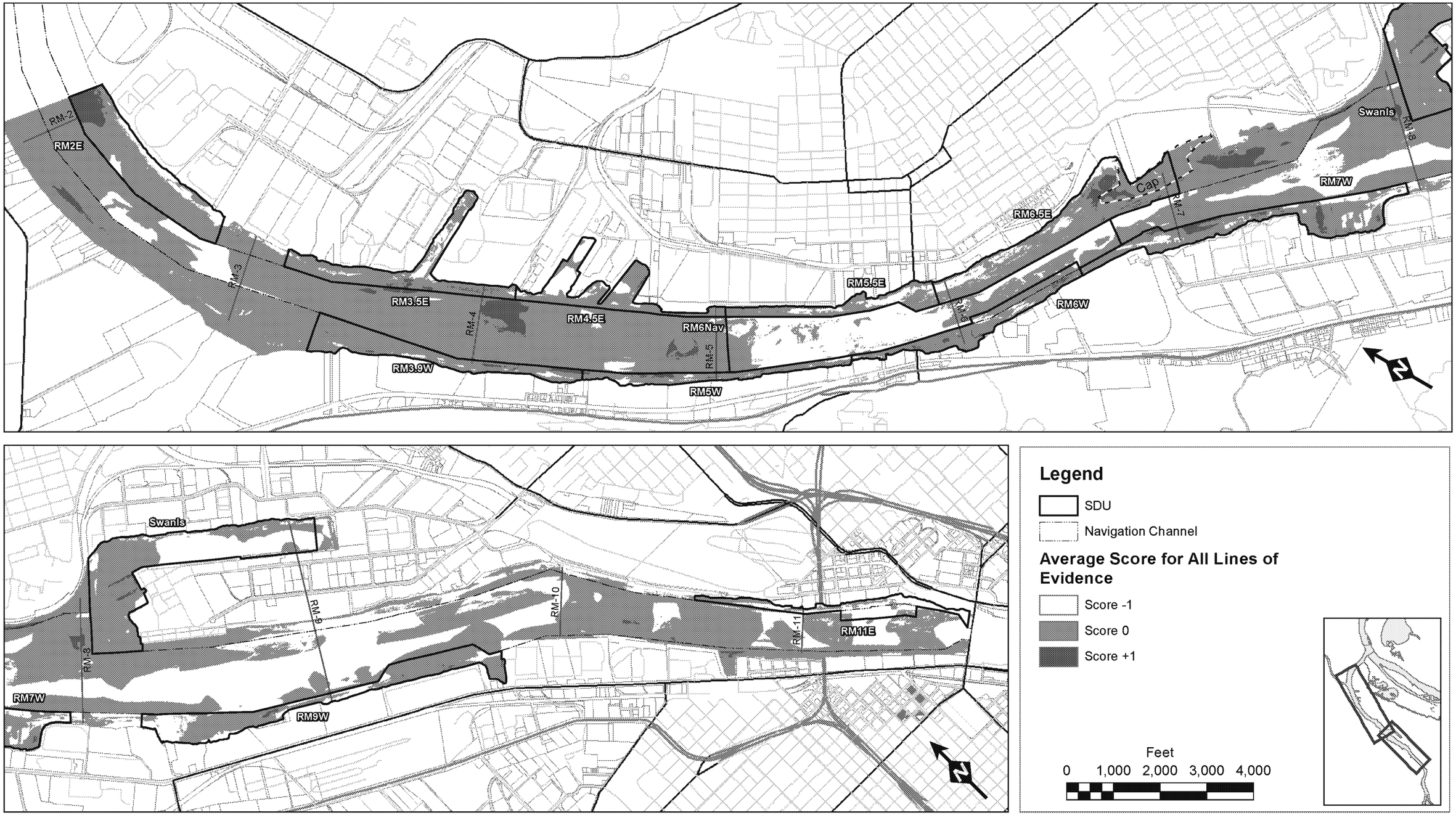
ESD Figure 5. Proportion of Half-River Miles Protected vs. Remedial Action Levels

Portland Harbor Superfund Site



ESD Figure 6. Total PAH RAL Curve

Portland Harbor Superfund Site

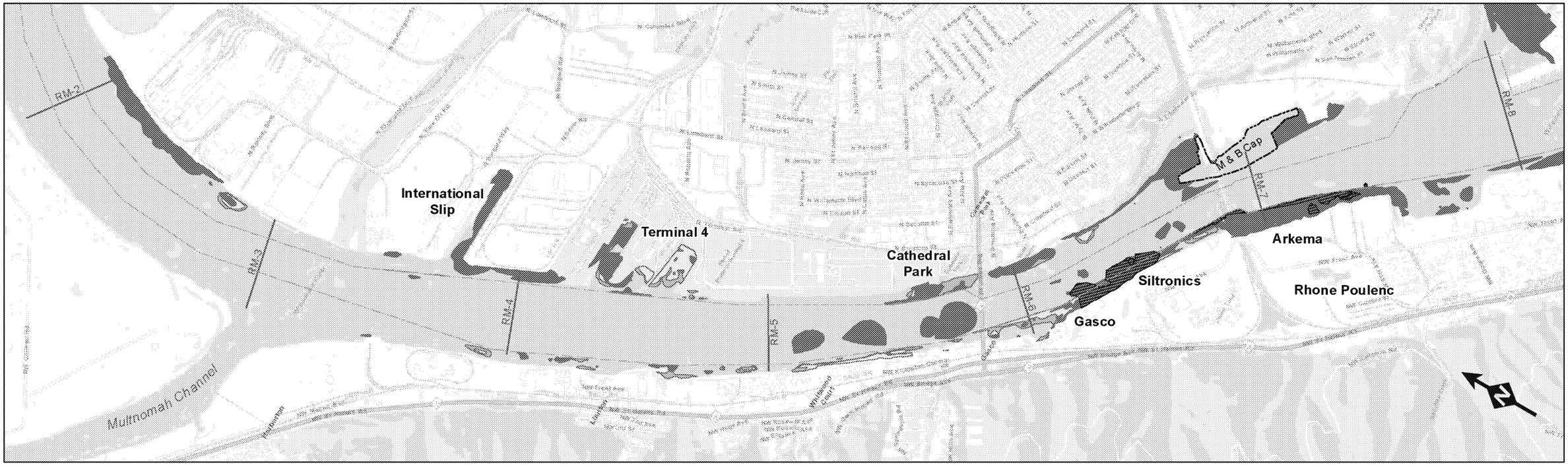


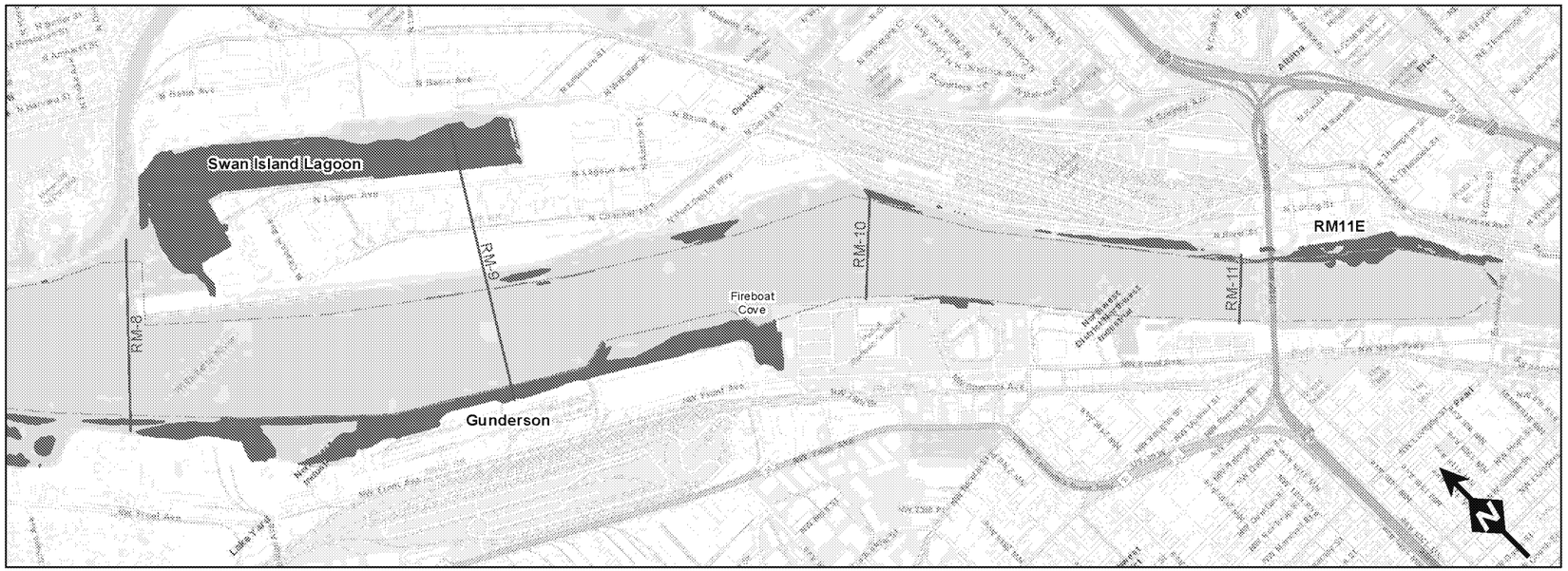
ESD Figure 7. Natural Recovery Summary Score

Portland Harbor Superfund Site

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Appendix D\FigureD8-x_MNR-Scoring.mxd, Created by: MLF

Date: 5/23/2016

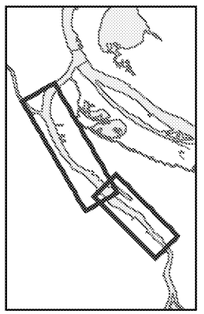




Legend

- Remedial footprint for focused COCs other than PAHs (including PTW)
- Remedial footprint for PAHs in Nearshore Area – 30 mg/kg RAL
- Remedial footprint for PAHs in Nearshore Area – 13 mg/kg RAL
- Remedial Footprint for PAHs in Navigation Channel – 170 mg/kg RAL
- PTW (NRC/NAPL)
- Navigation Channel

0 1,000 2,000 3,000 4,000
Feet



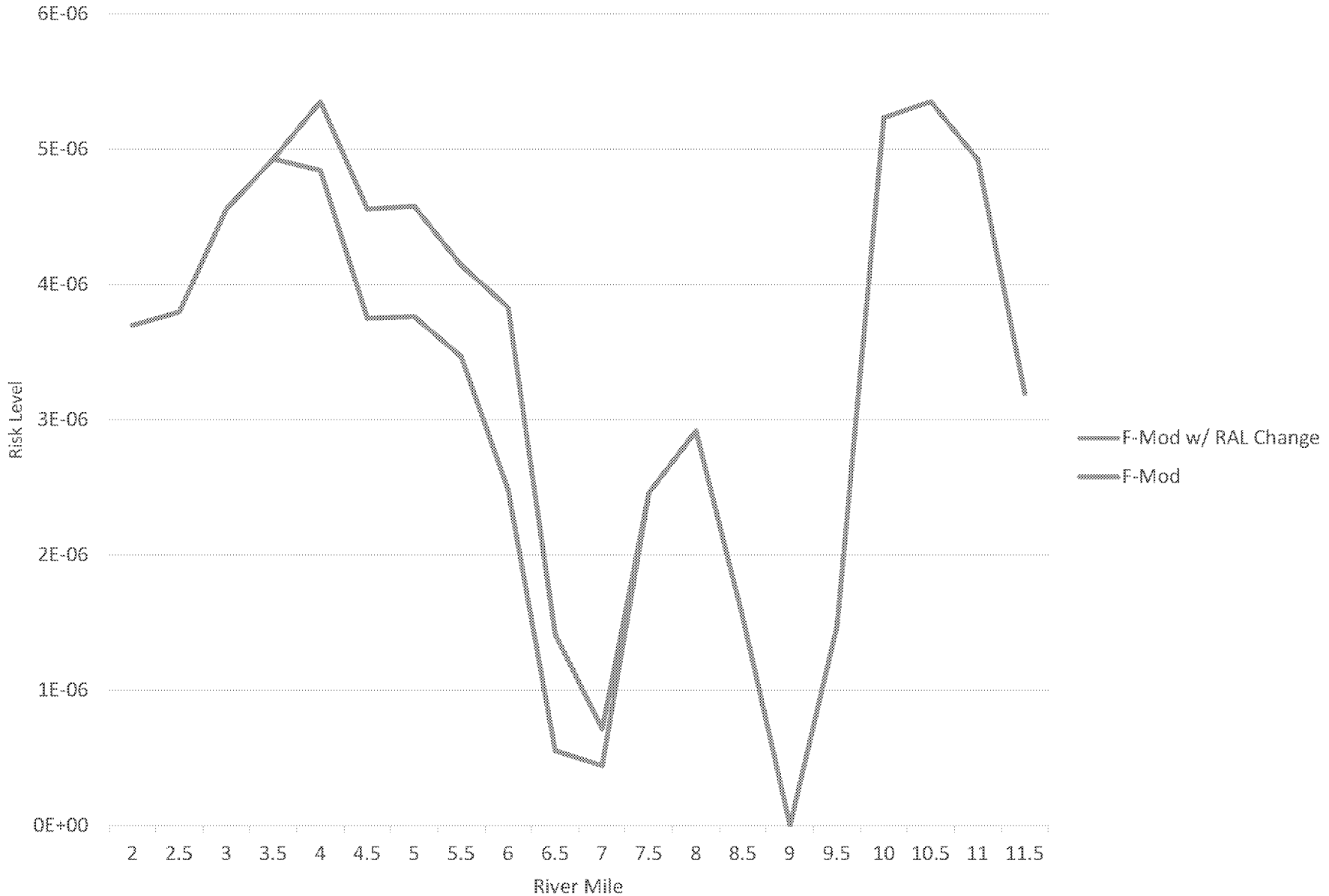
Source Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

ESD Figure 8. Revised Remedial Footprint Summary

Portland Harbor Superfund Site

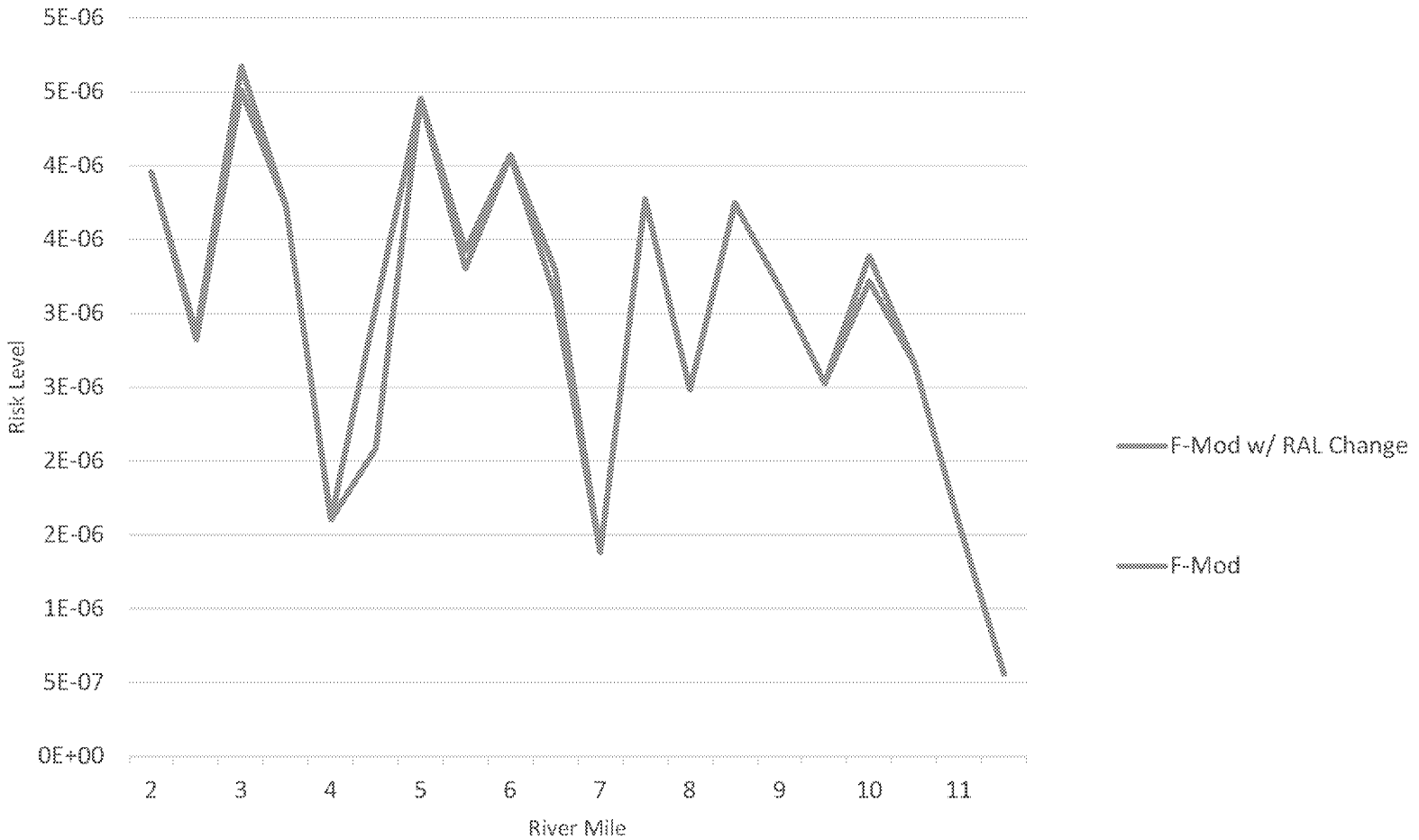
Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\ESD\Fig-8_RevisedRemedialFootprint.mxd

Date: 4/3/2018



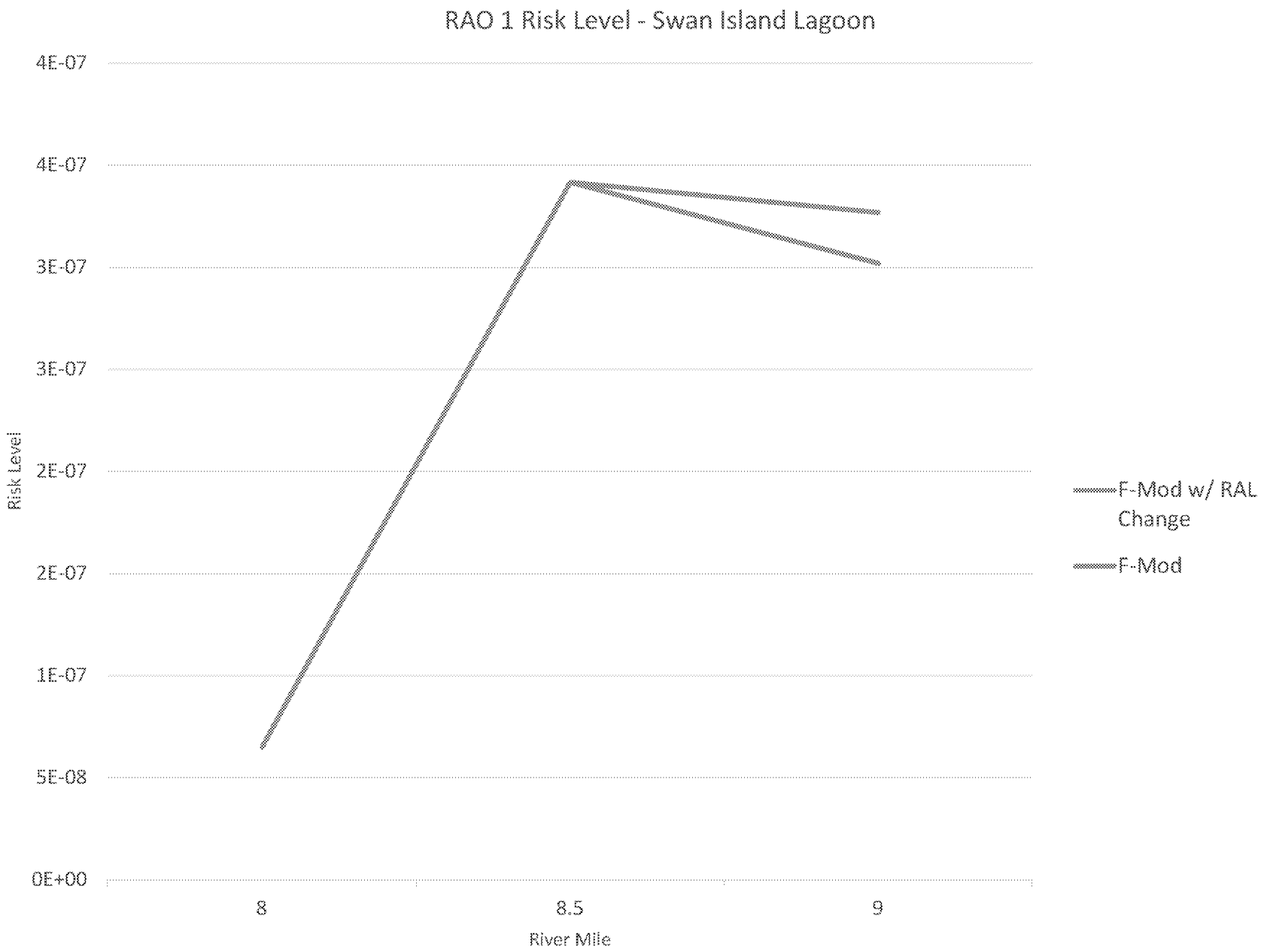
ESD Figure 9a. RAO 1 Risk Level - RM Basis (West)

Portland Harbor Superfund Site



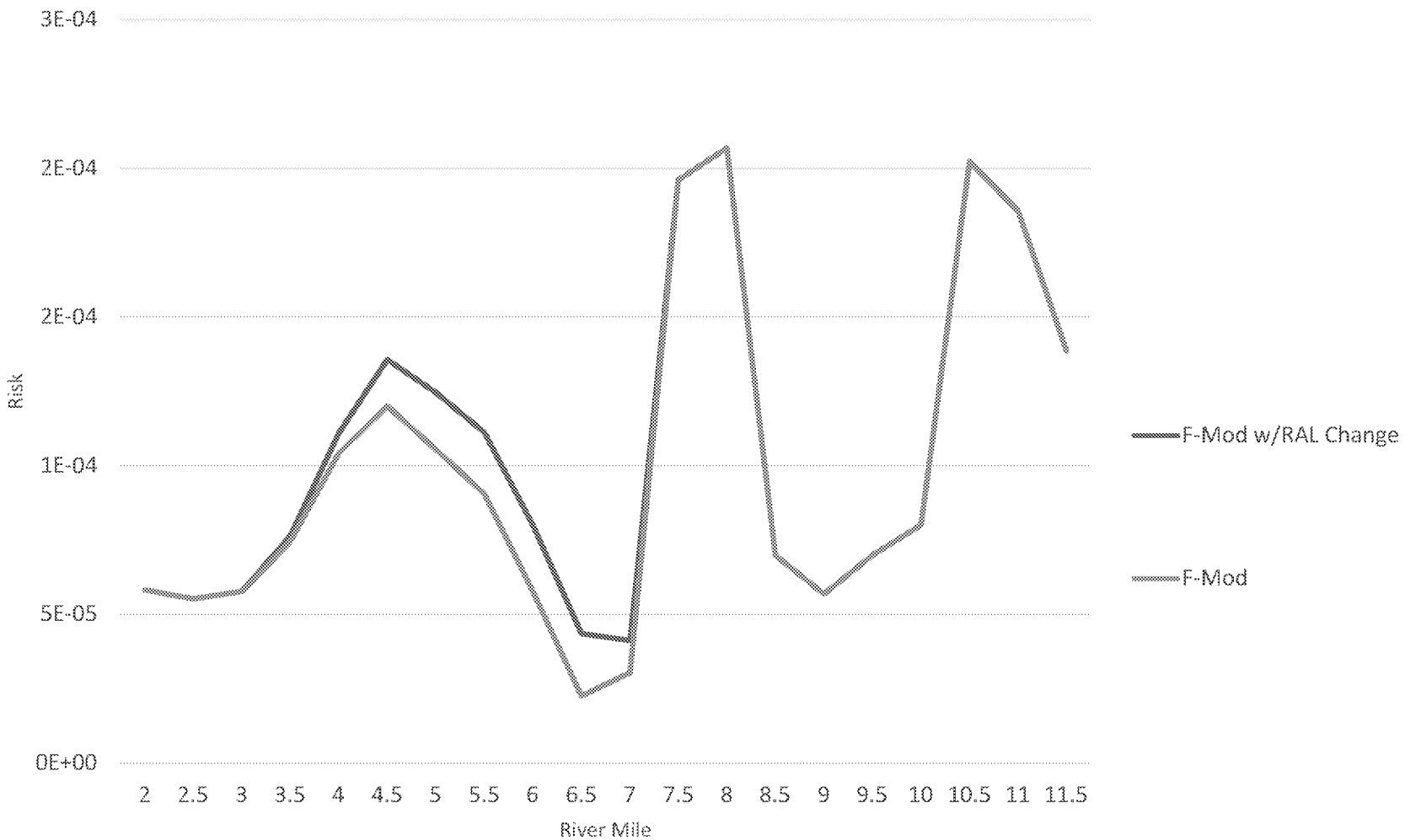
ESD Figure 9b. RAO 1 Risk Level - RM Basis (East)

Portland Harbor Superfund Site



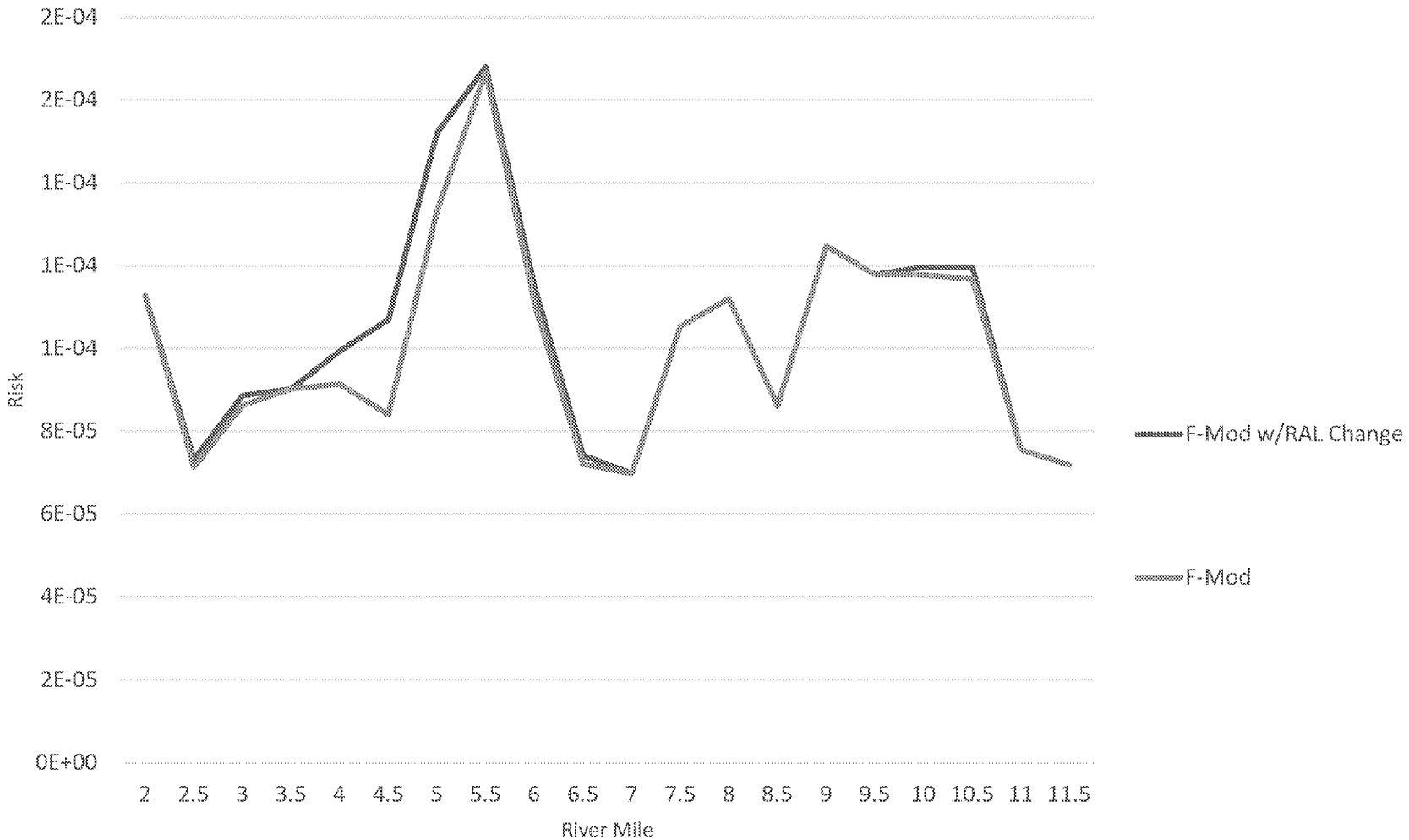
ESD Figure 9c. RAO 1 Risk Level - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



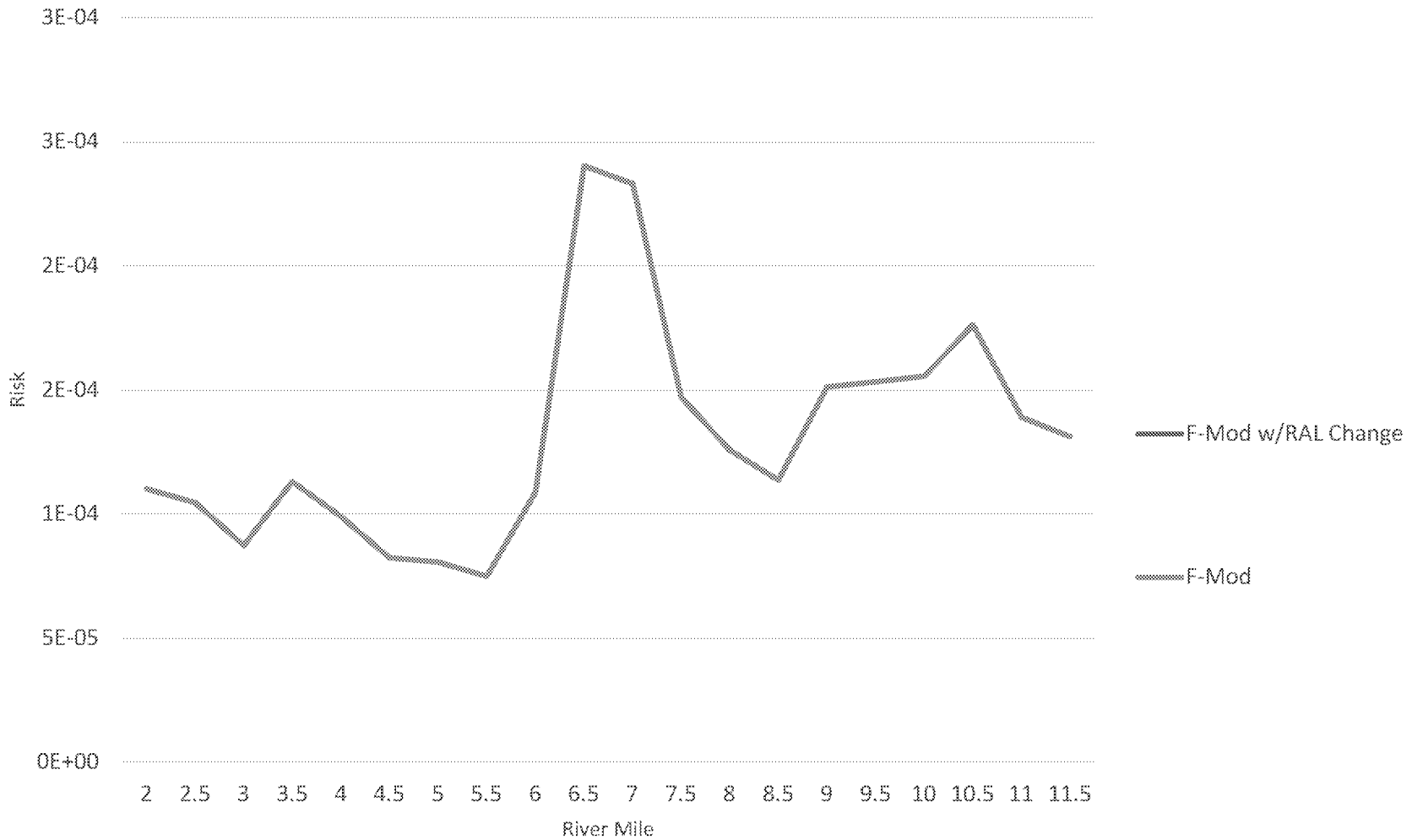
ESD Figure 10a. RAO 2 Risk Level - RM Basis (West)

Portland Harbor Superfund Site



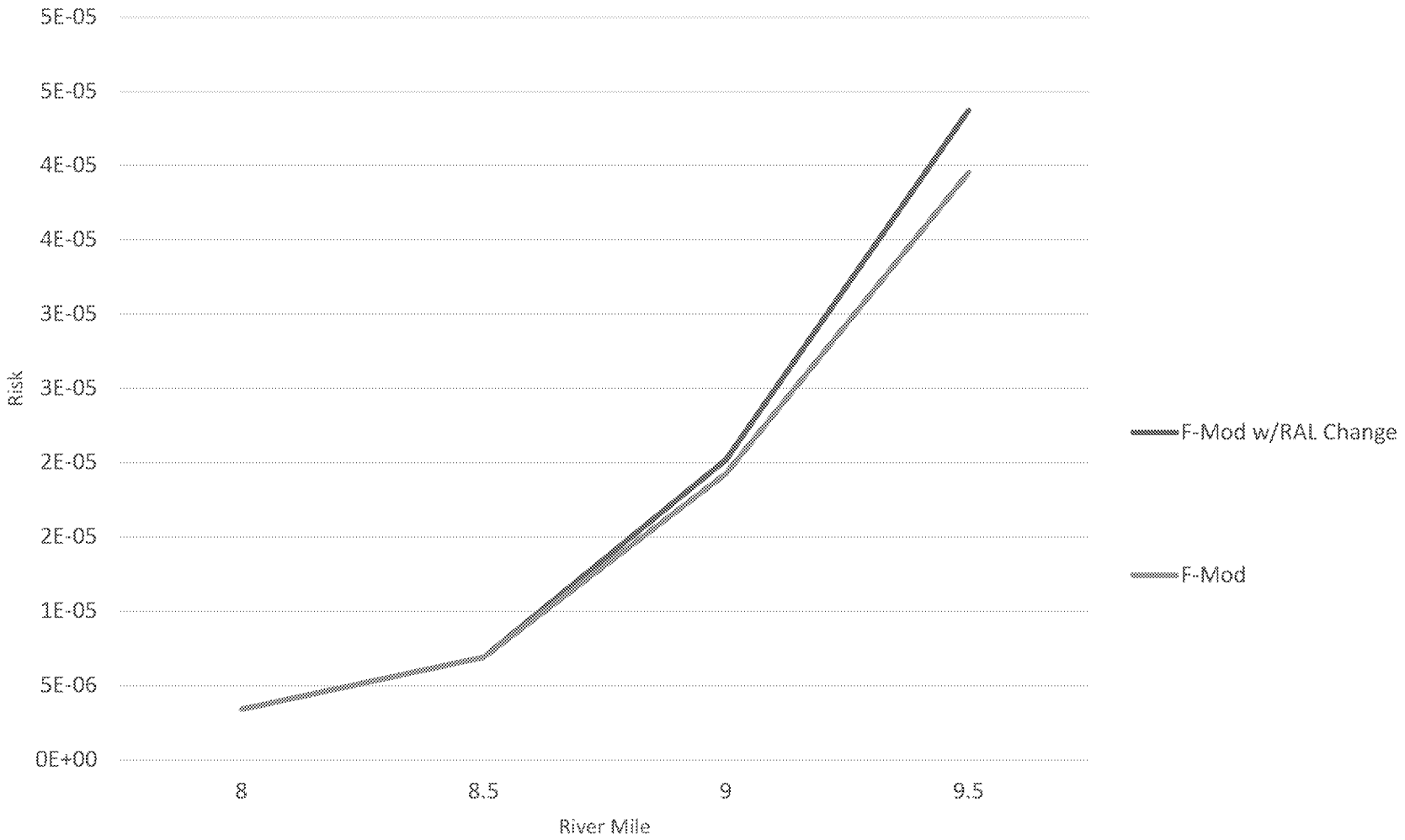
ESD Figure 10b. RAO 2 Risk Level - RM Basis (East)

Portland Harbor Superfund Site



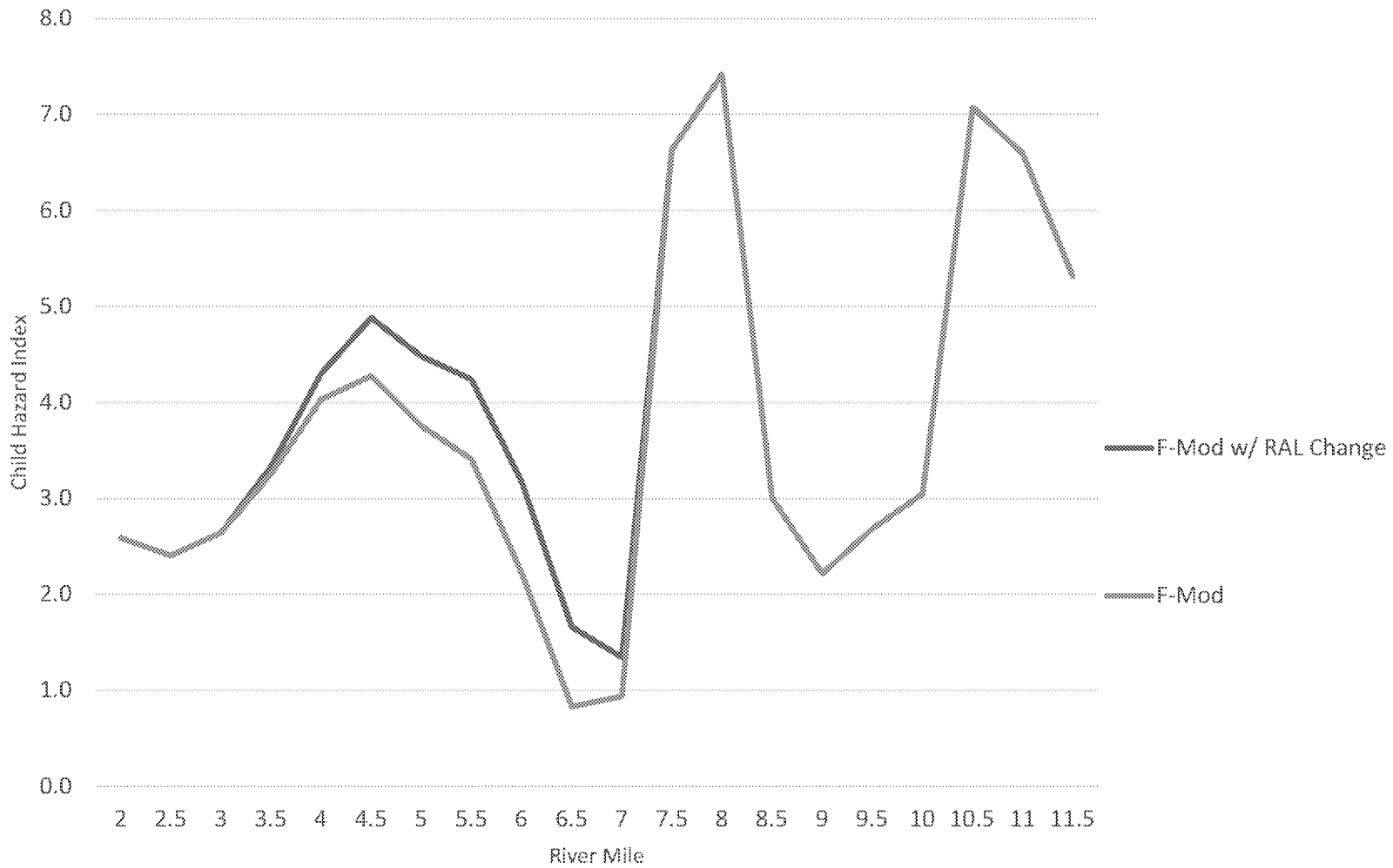
ESD Figure 10c. RAO 2 Risk Level - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



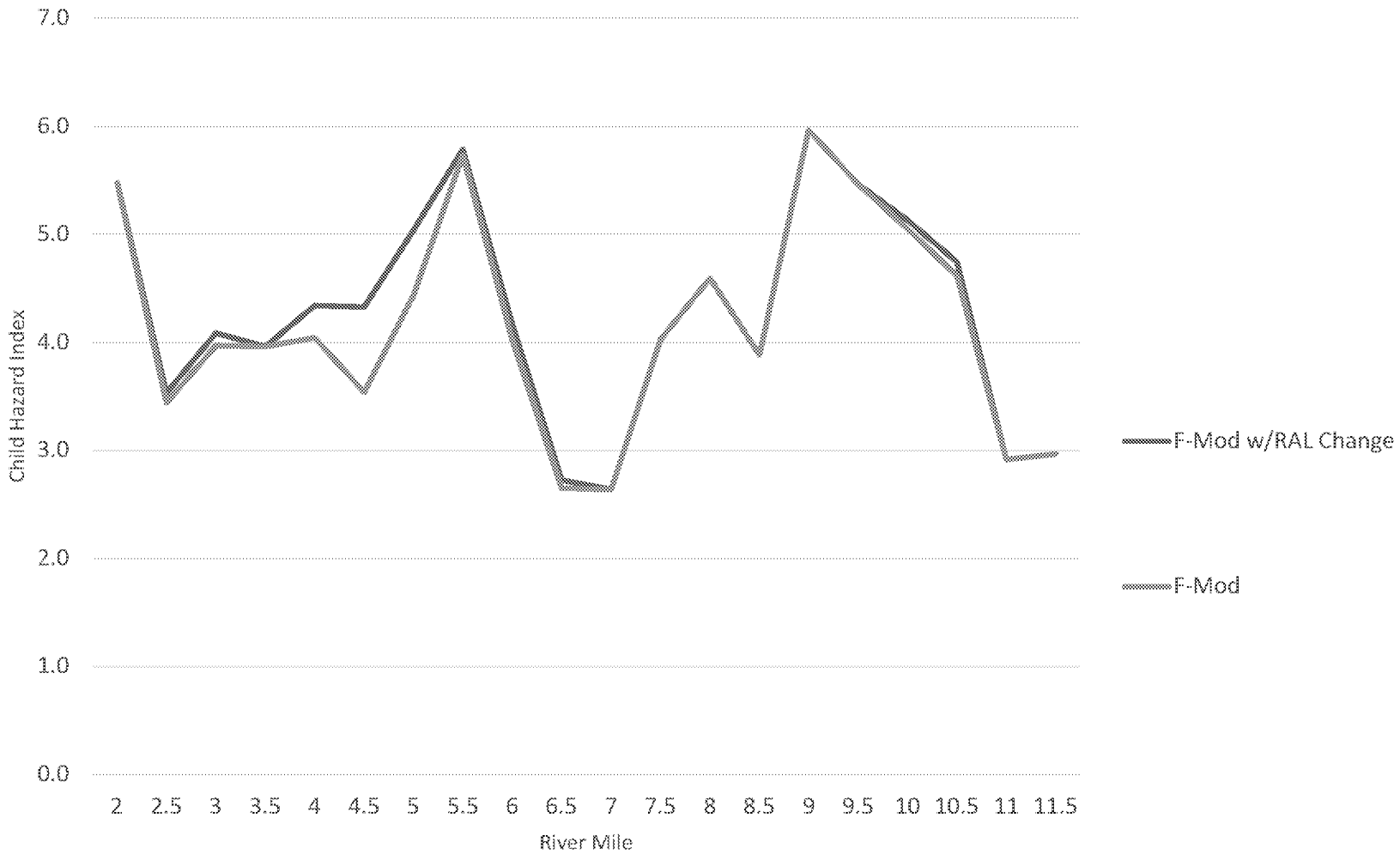
ESD Figure 10d. RAO 2 Risk Level - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



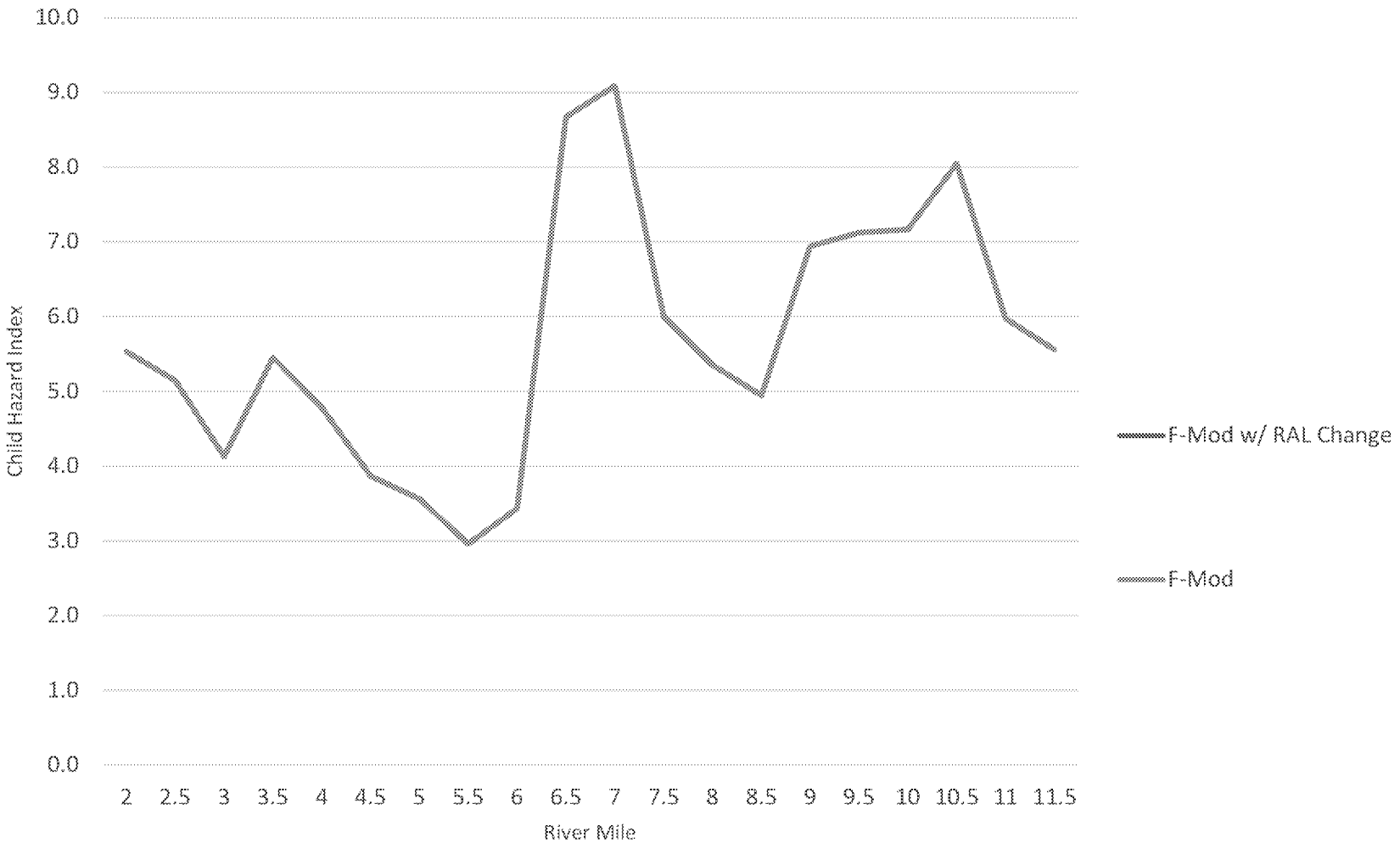
ESD Figure 10e. RAO 2 Hazard Index Child - RM Basis (West)

Portland Harbor Superfund Site



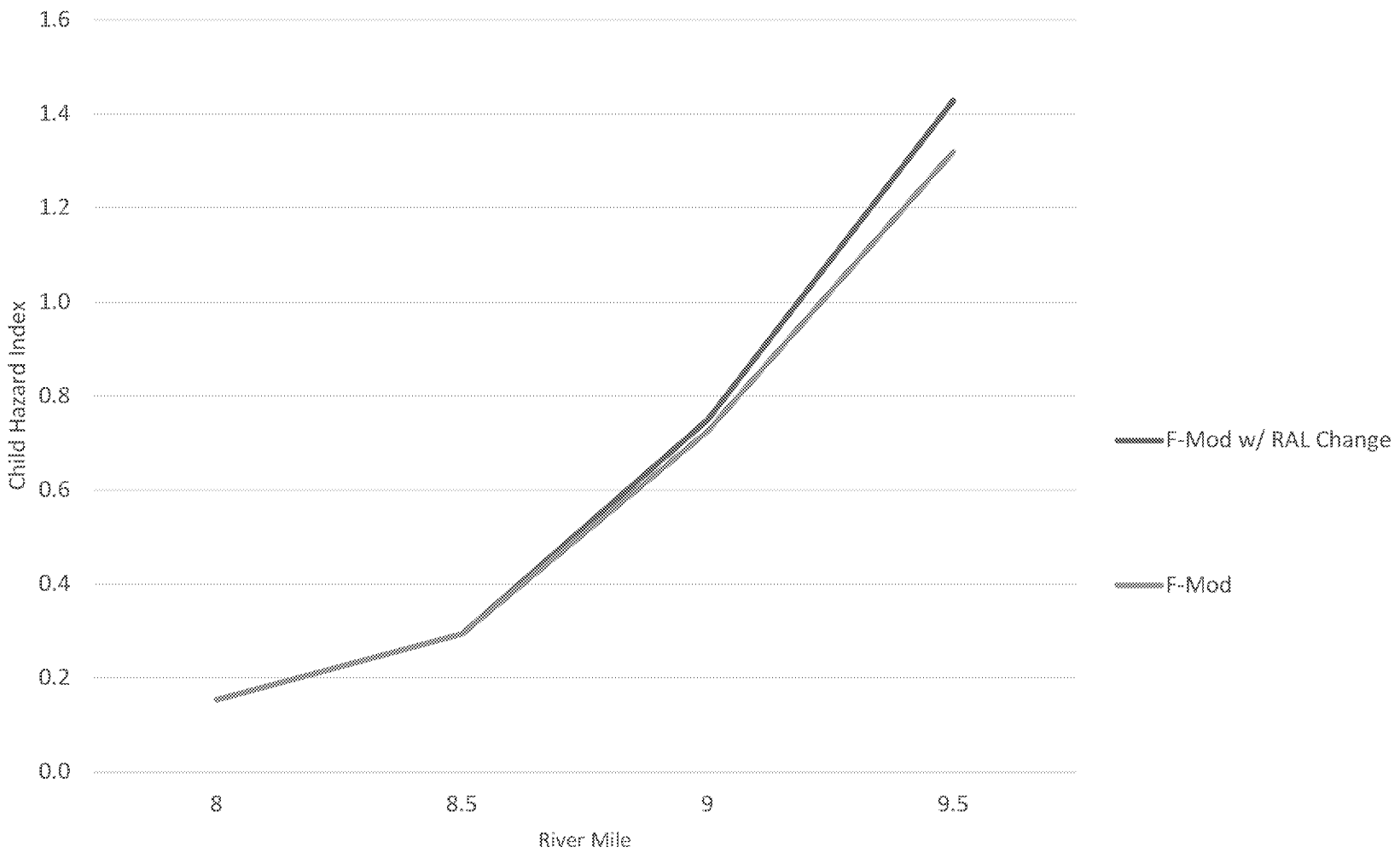
ESD Figure 10f. RAO 2 Hazard Index Child - RM Basis (East)

Portland Harbor Superfund Site



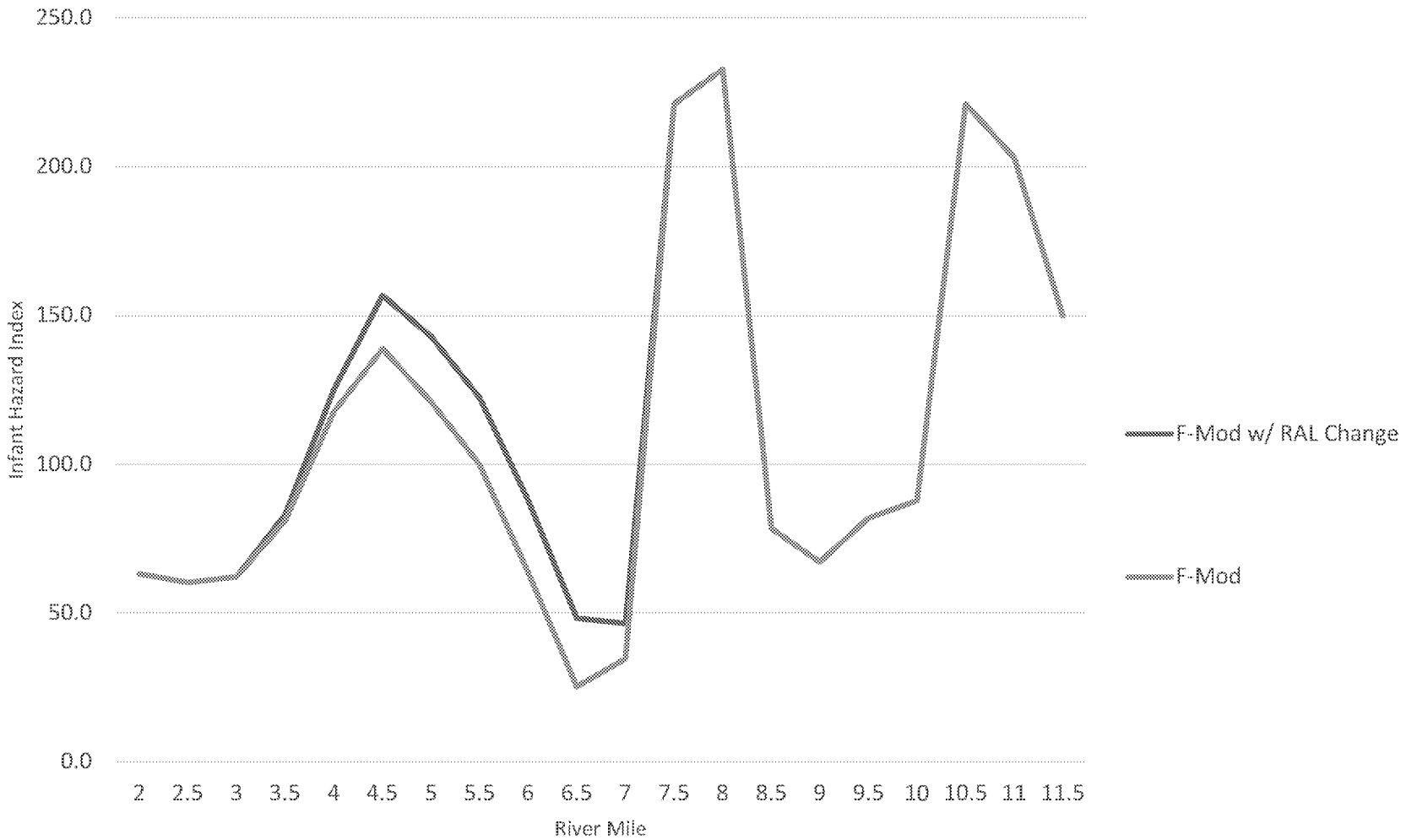
ESD Figure 10g. RAO 2 Hazard Index Child - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



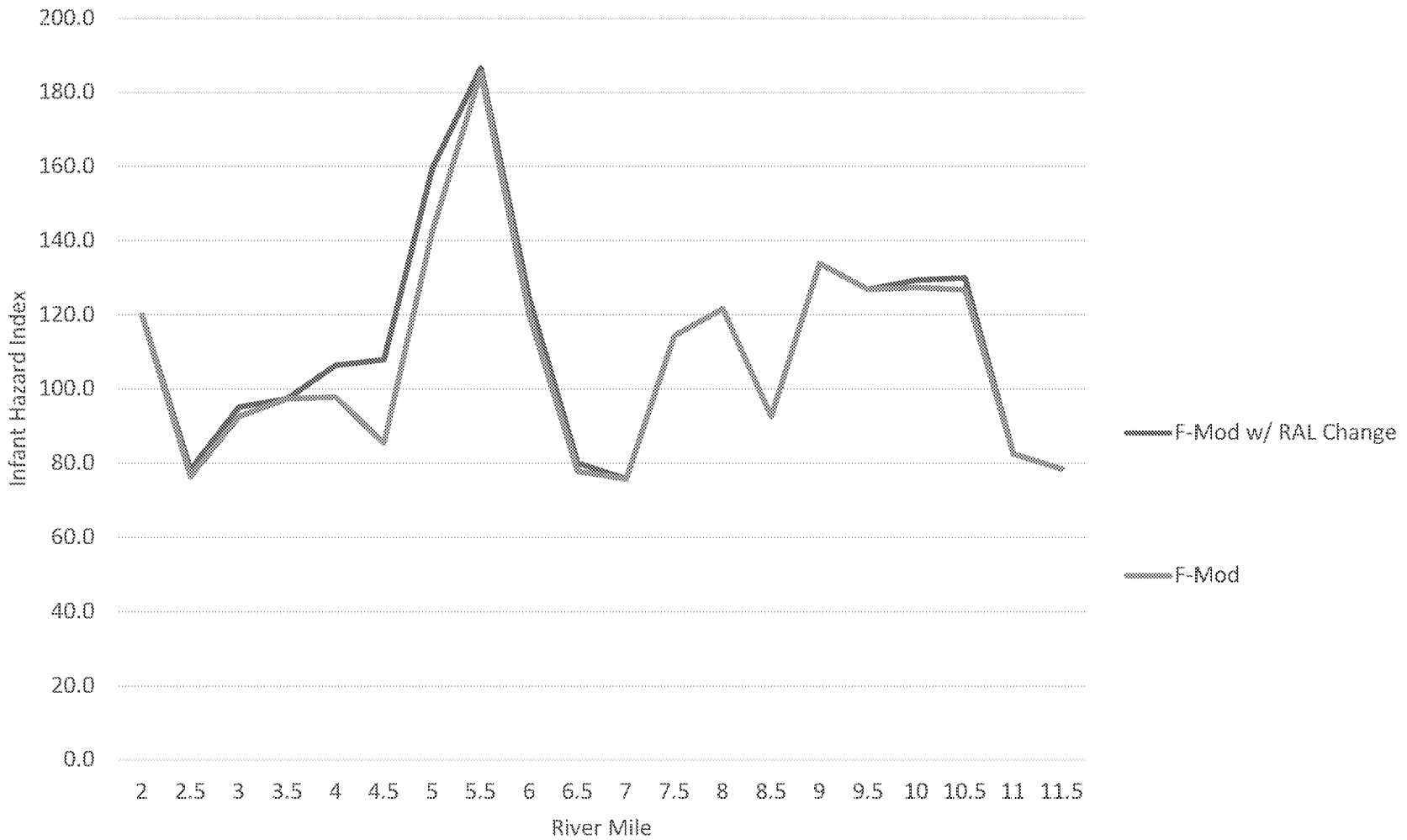
ESD Figure 10h. RAO 2 Hazard Index Child - RM Basis (Swan Island Lagoon)

Portland Harbor Superfund Site



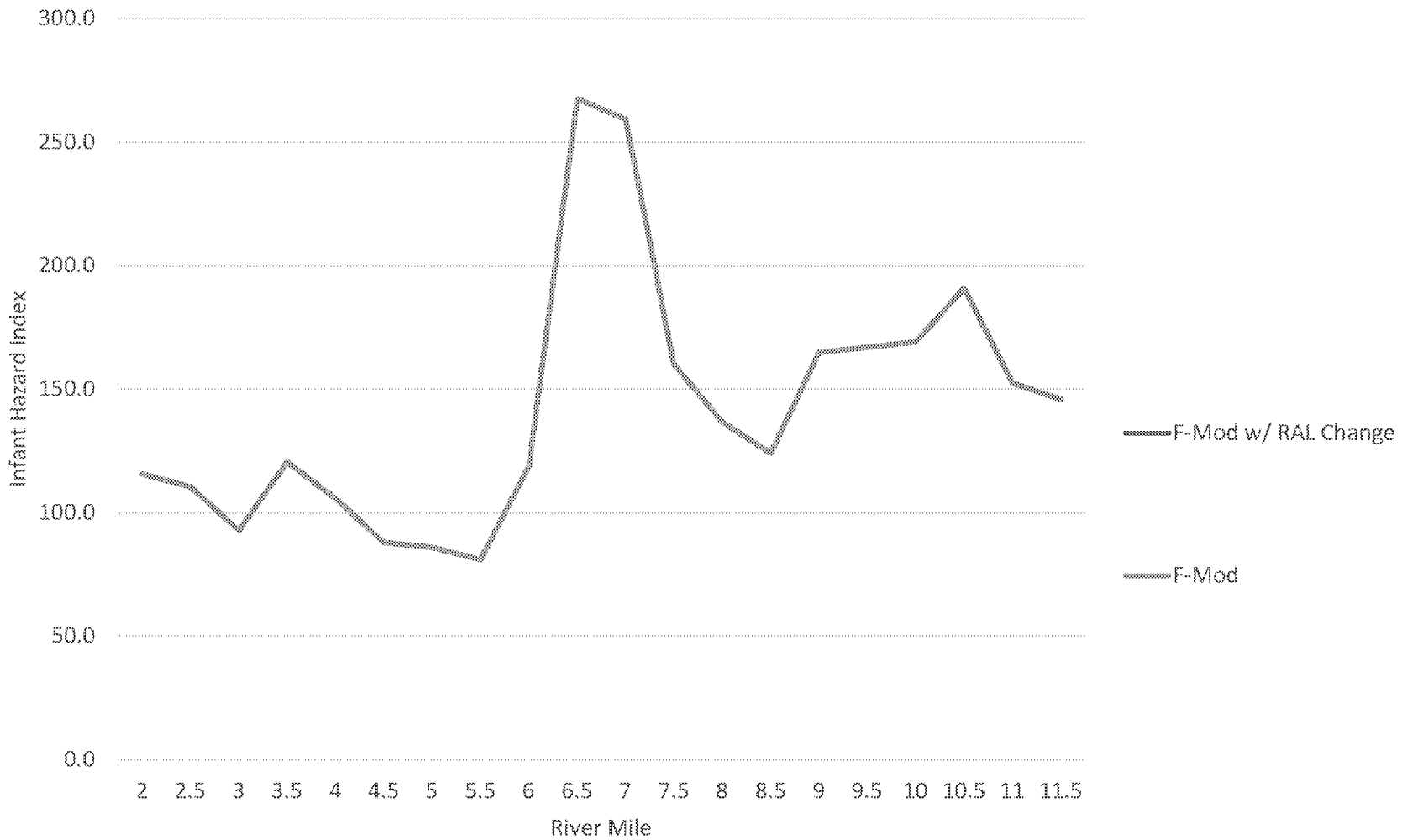
ESD Figure 10i. RAO 2 Hazard Index Infant- RM Basis (West)

Portland Harbor Superfund Site



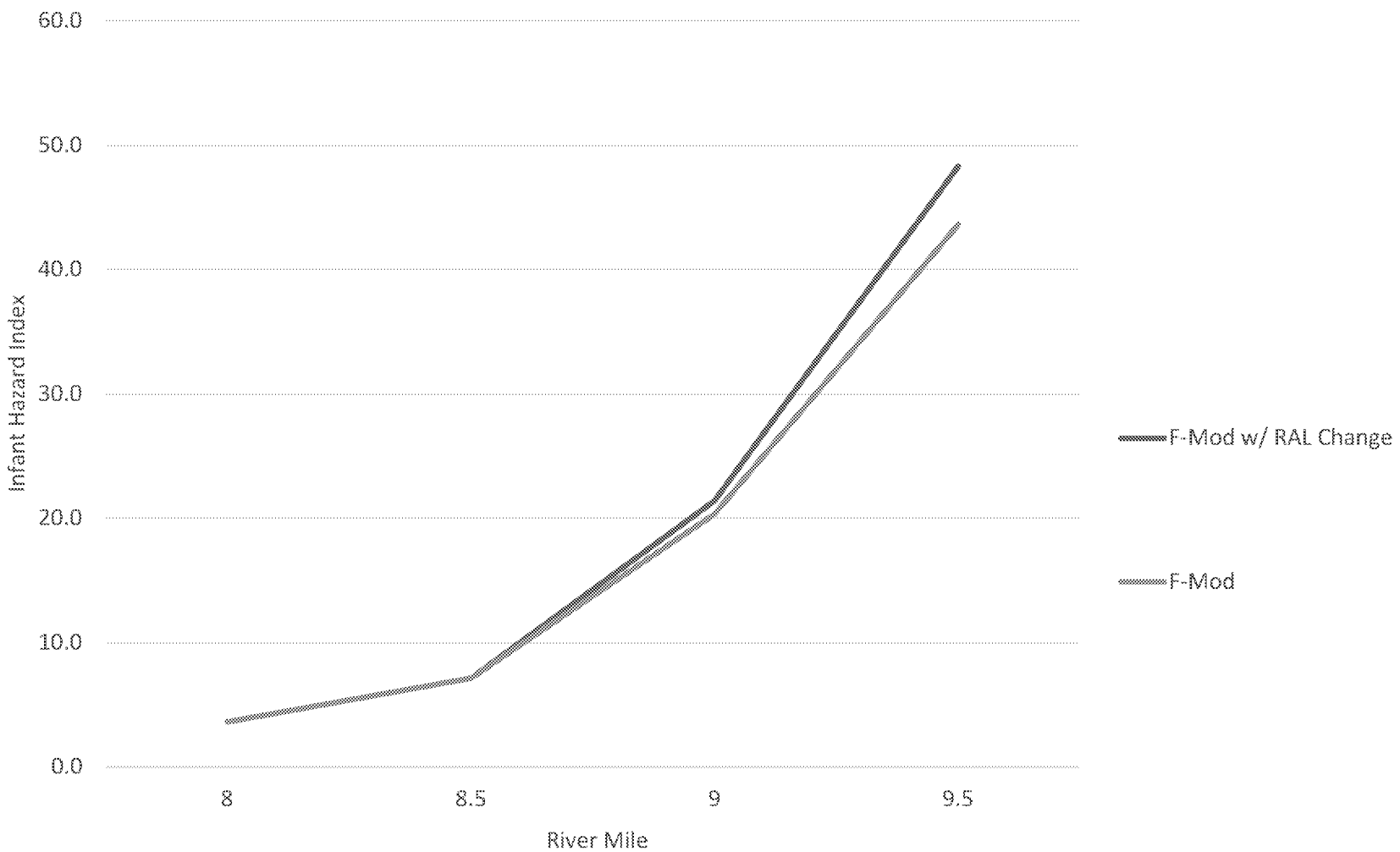
ESD Figure 10j. RAO 2 Hazard Index Infant - RM Basis (East)

Portland Harbor Superfund Site



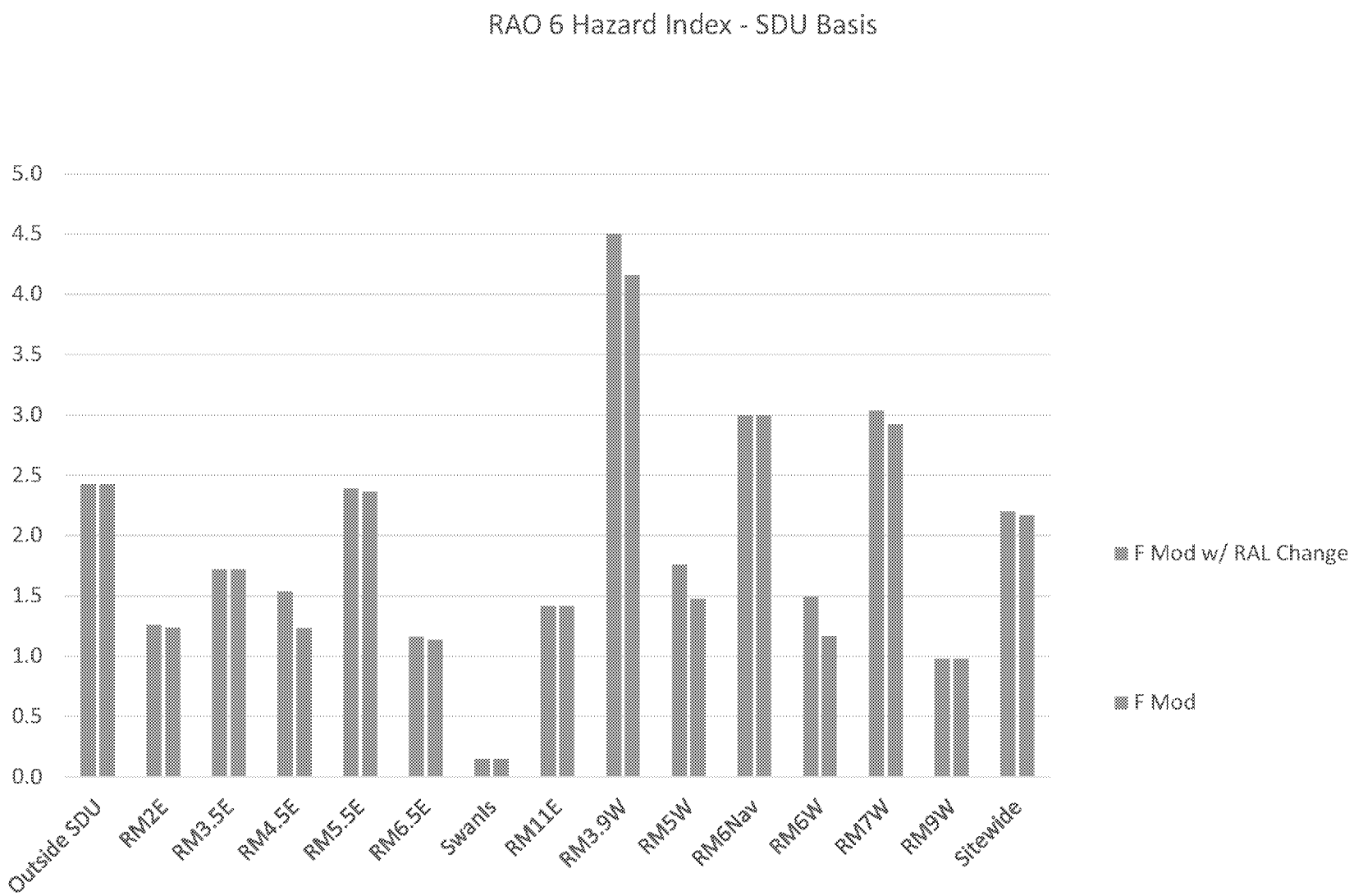
ESD Figure 10k. RAO 2 Hazard Index Infant - RM Basis (Navigation Channel)

Portland Harbor Superfund Site



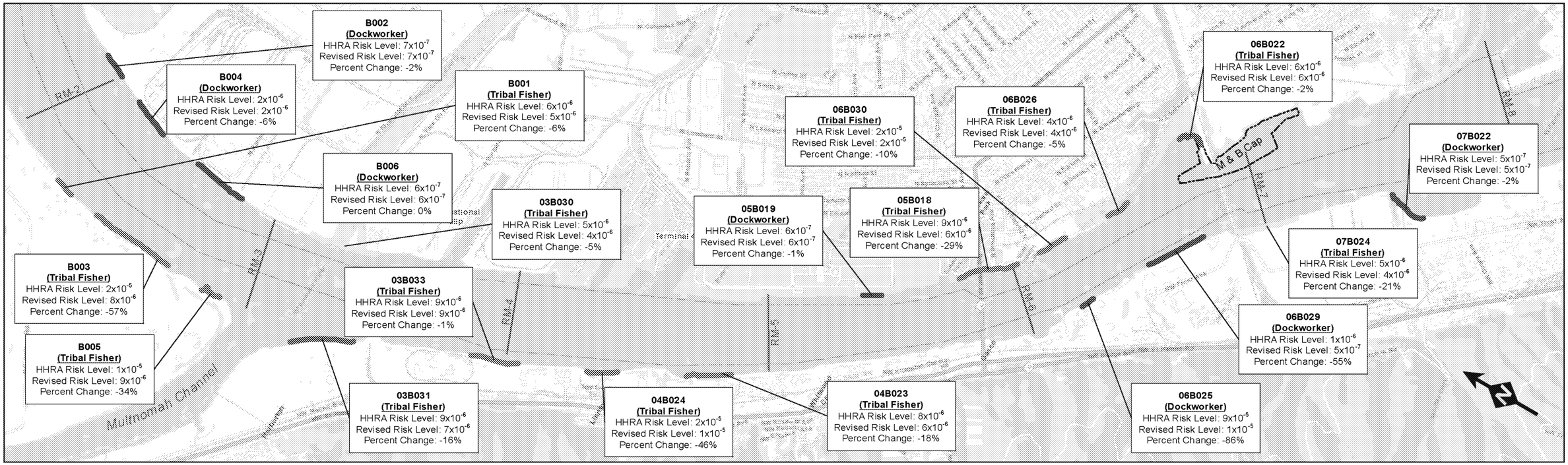
ESD Figure 10l. RAO 2 Hazard Index Infant - RM Basis (Swan Island Lagoon)

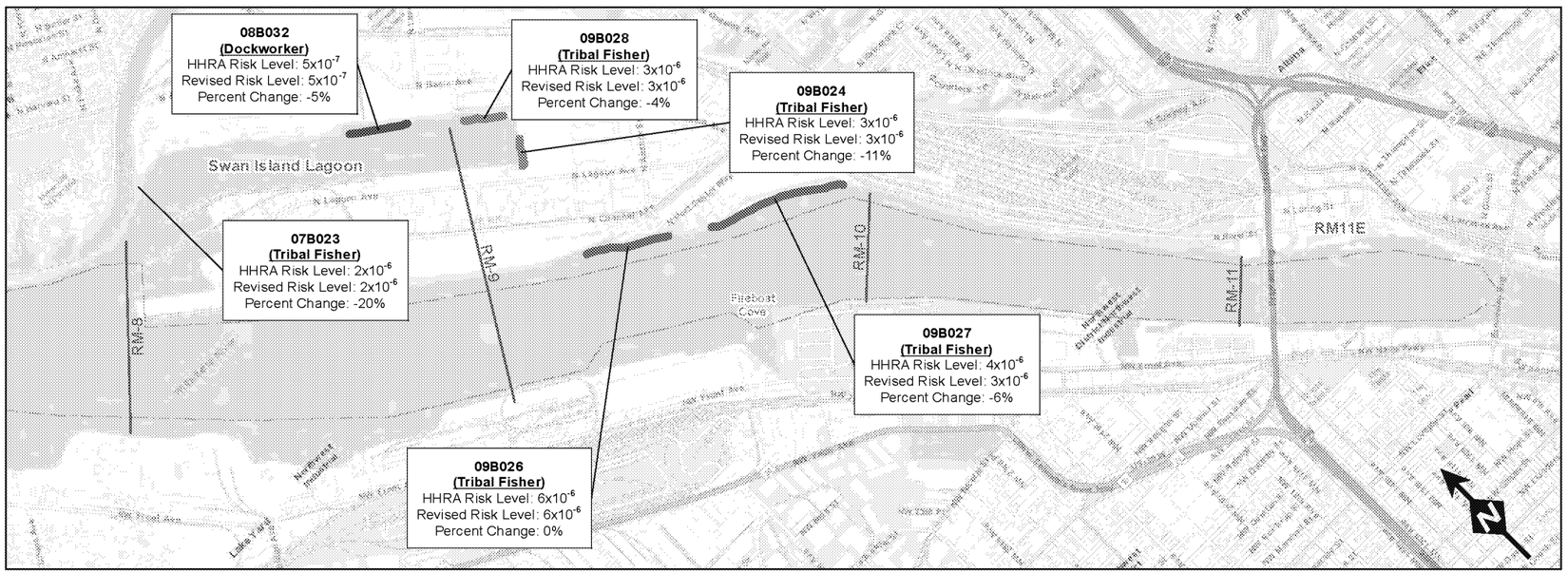
Portland Harbor Superfund Site



ESD Figure 11. RAO 6 Hazard Index - SDU Basis

Portland Harbor Superfund Site



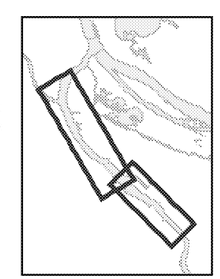


Legend

Human Health Beach Exposure Scenarios Evaluated[1]

- Dockside Worker
- Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Transient and Tribal, High Frequency and Low Frequency Fisher
- Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher
- Navigation Channel

Note:
1 - Maximum risk level presented for each beach location. HHRA risk levels are taken from the baseline human health risk assessment (EPA 2016a). Revised risk levels are based on the revised cancer slope factor for Benzo(a)Pyrene.



0 1,000 2,000 3,000 4,000
Feet

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ESD Figure 12. Human Health Beach Exposure Risk Summary

Portland Harbor Superfund Site

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Post ROD Phase\ESD\ESD-Figure-12_HH-Beach-Exposure-Risk-Summary.mxd

Date: 4/9/2018

Tables

ESD Table 1. cPAH (BaPeq) CUL and Highly Toxic PTW Thresholds
Portland Harbor Superfund Site
Portland, OR

Scenario	Application Area	ROD Value	Updated Value [1]
Direct Contact Sediment CUL	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact Sediment CUL	Nearshore sediment (excluding beach areas)	Not provided	774 µg/kg
Clam Consumption Tissue Target Level	Navigation Channel Sediment	7.1 µg/kg	51.6 µg/kg
Clam Consumption Sediment CUL	Navigation Channel Sediment	3,950 µg/kg	107,600 µg/kg
Highly Toxic PTW Threshold	Sitewide	106,000 µg/kg	774,000 µg/kg

[1] Updated Value is based on change in BaP CSF from 7.3 to 1 mg/kg-day.

ESD Table 2. RAO 1 Risk Summary - RM Basis
Portland Harbor Superfund Site
Portland, OR

COC	River Mile	Alternative								
		East			West			Swan Island		
		F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change
Total	2	4×10^{-6}	4×10^{-6}	0%	4×10^{-6}	4×10^{-6}	0%			
	2.5	3×10^{-6}	3×10^{-6}	1%	4×10^{-6}	4×10^{-6}	0%			
	3	5×10^{-6}	5×10^{-6}	4%	5×10^{-6}	5×10^{-6}	0%			
	3.5	4×10^{-6}	4×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	4	2×10^{-6}	2×10^{-6}	0%	5×10^{-6}	5×10^{-6}	11%			
	4.5	3×10^{-6}	2×10^{-6}	46%	5×10^{-6}	4×10^{-6}	22%			
	5	4×10^{-6}	4×10^{-6}	0%	5×10^{-6}	4×10^{-6}	22%			
	5.5	3×10^{-6}	3×10^{-6}	4%	4×10^{-6}	3×10^{-6}	20%			
	6	4×10^{-6}	4×10^{-6}	0%	4×10^{-6}	2×10^{-6}	54%			
	6.5	3×10^{-6}	3×10^{-6}	6%	1×10^{-6}	6×10^{-7}	156%			
	7	1×10^{-6}	1×10^{-6}	0%	7×10^{-7}	4×10^{-7}	61%			
	7.5	4×10^{-6}	4×10^{-6}	0%	2×10^{-6}	2×10^{-6}	0%			
	8	2×10^{-6}	2×10^{-6}	0%	3×10^{-6}	3×10^{-6}	0%	6×10^{-8}	6×10^{-8}	0%
	8.5	4×10^{-6}	4×10^{-6}	0%	2×10^{-6}	2×10^{-6}	0%	3×10^{-7}	3×10^{-7}	0%
	9	3×10^{-6}	3×10^{-6}	0%	0	0	n/a	3×10^{-7}	3×10^{-7}	8%
	9.5	3×10^{-6}	3×10^{-6}	0%	1×10^{-6}	1×10^{-6}	0%			
	10	3×10^{-6}	3×10^{-6}	5%	5×10^{-6}	5×10^{-6}	0%			
	10.5	3×10^{-6}	3×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	11	2×10^{-6}	2×10^{-6}	0%	5×10^{-6}	5×10^{-6}	0%			
	11.5	6×10^{-7}	6×10^{-7}	0%	3×10^{-6}	3×10^{-6}	0%			

ESD Table 3. RAO 2 Risk and Hazard Index Summary - RM
Basis Portland Harbor Superfund Site
Portland, OR

		Alternative											
		East			Nav Channel			West			Swan Island		
COC	River Mile	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change	F-Mod w/ RAL Change	F-Mod	Change
Total Cancer Risk	2	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%			
	2.5	7×10^{-5}	7×10^{-5}	2%	1×10^{-4}	1×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%			
	3	9×10^{-5}	9×10^{-5}	3%	9×10^{-5}	9×10^{-5}	0%	6×10^{-5}	6×10^{-5}	0%			
	3.5	9×10^{-5}	9×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	8×10^{-5}	7×10^{-5}	2%			
	4	1×10^{-4}	9×10^{-5}	9%	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	6%			
	4.5	1×10^{-4}	8×10^{-5}	27%	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	13%			
	5	2×10^{-4}	1×10^{-4}	14%	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	18%			
	5.5	2×10^{-4}	2×10^{-4}	1%	7×10^{-5}	7×10^{-5}	0%	1×10^{-4}	9×10^{-5}	23%			
	6	1×10^{-4}	1×10^{-4}	4%	1×10^{-4}	1×10^{-4}	0%	8×10^{-5}	6×10^{-5}	39%			
	6.5	7×10^{-5}	7×10^{-5}	3%	2×10^{-4}	2×10^{-4}	0%	4×10^{-5}	2×10^{-5}	93%			
	7	7×10^{-5}	7×10^{-5}	0%	2×10^{-4}	2×10^{-4}	0%	4×10^{-5}	3×10^{-5}	35%			
	7.5	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	8	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	3×10^{-6}	3×10^{-6}	0%
	8.5	9×10^{-5}	9×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	7×10^{-5}	7×10^{-5}	0%	7×10^{-6}	7×10^{-6}	0%
	9	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	6×10^{-5}	6×10^{-5}	0%	2×10^{-5}	2×10^{-5}	5%
	9.5	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%	7×10^{-5}	7×10^{-5}	0%	4×10^{-5}	4×10^{-5}	11%
	10	1×10^{-4}	1×10^{-4}	2%	2×10^{-4}	2×10^{-4}	0%	8×10^{-5}	8×10^{-5}	0%			
	10.5	1×10^{-4}	1×10^{-4}	2%	2×10^{-4}	2×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	11	8×10^{-5}	8×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	2×10^{-4}	2×10^{-4}	0%			
	11.5	7×10^{-5}	7×10^{-5}	0%	1×10^{-4}	1×10^{-4}	0%	1×10^{-4}	1×10^{-4}	0%			
Total Non-Cancer Risk (Child)	2.5	4	3	3%	5	5	0%	2	2	0%			
	3	4	4	3%	4	4	0%	3	3	0%			
	3.5	4	4	0%	5	5	0%	3	3	2%			
	4	4	4	7%	5	5	0%	4	4	7%			
	4.5	4	4	22%	4	4	0%	5	4	14%			
	5	5	4	14%	4	4	0%	4	4	19%			
	5.5	6	6	1%	3	3	0%	4	3	24%			
	6	4	4	4%	3	3	0%	3	2	43%			
	6.5	3	3	3%	9	9	0%	2	1	100%			
	7	3	3	0%	9	9	0%	1	1	43%			
	7.5	4	4	0%	6	6	0%	7	7	0%			
	8	5	5	0%	5	5	0%	7	7	0%	0	0	0%
	8.5	4	4	0%	5	5	0%	3	3	0%	0	0	0%
	9	6	6	0%	7	7	0%	2	2	0%	1	1	3%
	9.5	5	5	0%	7	7	0%	3	3	0%	1	1	8%
	10	5	5	2%	7	7	0%	3	3	0%			
	10.5	5	5	3%	8	8	0%	7	7	0%			
	11	3	3	0%	6	6	0%	7	7	0%			
	11.5	3	3	0%	6	6	0%	5	5	0%			
Total Non-Cancer Risk (Infant)	2	120	120	0%	116	116	0%	63	63	0%			
	2.5	78	76	2%	110	110	0%	60	60	0%			
	3	95	93	3%	93	93	0%	62	62	0%			
	3.5	97	97	0%	121	121	0%	83	81	3%			
	4	106	98	9%	106	106	0%	125	118	6%			
	4.5	108	85	26%	88	88	0%	157	139	13%			
	5	160	143	12%	86	86	0%	143	121	18%			
	5.5	187	185	1%	81	81	0%	122	100	23%			
	6	124	120	4%	119	119	0%	88	64	38%			
	6.5	80	78	3%	268	268	0%	48	25	91%			
	7	76	76	0%	259	259	0%	46	35	34%			
	7.5	114	114	0%	160	160	0%	221	221	0%			
	8	122	122	0%	137	137	0%	233	233	0%	4	4	0%
	8.5	93	93	0%	124	124	0%	78	78	0%	7	7	0%
	9	134	134	0%	165	165	0%	67	67	0%	21	20	5%
	9.5	127	127	0%	167	167	0%	82	82	0%	48	44	11%
	10	129	127	2%	169	169	0%	88	88	0%			
	10.5	130	127	2%	191	191	0%	221	221	0%			
	11	82	82	0%	153	153	0%	203	203	0%			
	11.5	78	78	0%	146	146	0%	150	150	0%			

ESD Table 4. RAO 5 Benthic Risk Summary

Portland Harbor Superfund Site

Portland, OR

Alternative	Benthic Risk*	10x Benthic Risk	100x Benthic Risk
F Mod w/ RAL Change	25%	69%	90%
F Mod	27%	72%	90%
Change	-1%	-3%	0%

*Benthic risk area within Site = 1,289 acres

ESD Table 5. RAO 6 Fish and Wildlife Risk Summary
Portland Harbor Superfund Site
Portland, OR

SDU	Alternative		
	F Mod w/ RAL Change	F Mod	Difference
Outside SDU	2.4	2.4	0%
RM2E	1.3	1.2	2%
RM3.5E	1.7	1.7	0%
RM4.5E	1.5	1.2	25%
RM5.5E	2.4	2.4	1%
RM6.5E	1.2	1.1	2%
SwanIs	0.1	0.1	0%
RM11E	1.4	1.4	0%
RM3.9W	4.5	4.2	8%
RM5W	1.8	1.5	19%
RM6Nav	3.0	3.0	0%
RM6W	1.5	1.2	28%
RM7W	3.0	2.9	4%
RM9W	1.0	1.0	0%
Sitewide	2.2	2.2	1%

ESD Table 6. RAO 3 and 7 Surface Water Reduction Summary
Portland Harbor Superfund Site
Portland, OR

Contaminant of Concern	Surface Water Reduction		
	F-Mod w/RAL change	F-Mod	Change
PCB	72%	72%	0%
cPAH	77%	78%	-1%
DDD	67%	68%	-1%
DDE	58%	59%	-1%
DDT	85%	85%	0%
TCDD TEQ	91%	91%	0%
Arsenic	25%	26%	-1%
BEHP	55%	55%	-1%
Chlordanes	50%	51%	-1%

ESD Table 7. RAO 4 and 8 Percent Groundwater Plume Area Adressed

Portland Harbor Superfund Site

Portland, OR

	Alternative		
	F Mod w/ RAL Change	**F Mod**	**Change**
% Reactive Cap within SMA	15%	21%	-7%
% Reactive residual layer within SMA	17%	17%	0%
Total % groundwater plume Area Adressed	32%	39%	-7%

*Groundwater plume area within Site = 243 acres

*Groundwater plume area within Site = 243 acres

ESD Table 8. Percentage Contaminated River Bank Addressed by Each Alternative
Portland Harbor Superfund Site
Portland, OR

Alternative	Feet Contaminated River Bank Addressed	Total Feet Contaminated River Bank	Contaminated River Bank Addressed
F Mod w/RAL change	22,592	30,048	75%
F Mod	23,305	30,048	78%
Change	713	0	-2%

ESD Table 9. Human Health Beach Exposure Risk Summary
Portland Harbor Superfund Site
Portland, OR

Beach Sample	Exposure Scenarios Evaluated	Exposure Scenario with Maximum Risk	Maximum HHRA Risk *	Maximum Revised Risk **	Percent Change in Risk Level
B001	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	5.E-06	-6%
B002	Dockworker	Dockworker	7.E-07	7.E-07	-2%
B003	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	8.E-06	-57%
B004	Dockworker	Dockworker	2.E-06	2.E-06	-6%
B005	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	1.E-05	9.E-06	-34%
B006	Dockworker	Dockworker	6.E-07	6.E-07	0%
03B030	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	5.E-06	4.E-06	-5%
03B031	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	7.E-06	-16%
03B033	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	9.E-06	-1%
04B023	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	8.E-06	6.E-06	-18%
04B024	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	1.E-05	-46%
05B018	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	9.E-06	6.E-06	-29%
05B019	Dockworker	Dockworker	6.E-07	6.E-07	-1%
06B022	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	6.E-06	-2%
06B025	Dockworker	Dockworker	9.E-05	1.E-05	-86%
06B026	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	4.E-06	4.E-06	-5%
06B029	Dockworker	Dockworker	1.E-06	5.E-07	-55%
06B030	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-05	2.E-05	-10%
07B022	Dockworker	Dockworker	5.E-07	5.E-07	-2%
07B023	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	2.E-06	2.E-06	-20%
07B024	Transient and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	5.E-06	4.E-06	-21%
08B032	Dockworker	Dockworker	5.E-07	5.E-07	-5%
09B024	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	3.E-06	3.E-06	-11%
09B026	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	6.E-06	6.E-06	0%
09B027	Transient, Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	4.E-06	3.E-06	-6%
09B028	Recreational Beach User and Tribal, High Frequency and Low Frequency Fisher	Tribal Fisher	3.E-06	3.E-06	-4%

Notes:
* As presented in the Portland Harbor Baseline Human Health Risk Assessment
** Revised risk estimates take into account the updated cancer slope factor for Benzo(a)Pyrene

Appendix A

Supporting Documentation and Information

DRAFT

Appendix A1

Updated Record of Decision Tables 17 and 21

DRAFT

ROD Table 17. Summary of Cleanup Levels or Targets by Media - Updated for ESD

	Surface Water (1)			Groundwater (2)			River Bank Soil/Sediment (3)			Fish Tissue (4)		
Contaminant	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**	**Unit**	**Conc.**	**Basis**
Aldrin	µg/L	0.00000077	A				µg/kg	2	R	µg/kg	0.06	R
Arsenic	µg/L	0.018	A	µg/L	0.018	A	mg/kg	3	B	mg/kg	0.001	R
Benzene				µg/L	0.44	A						
BEHP	µg/L	0.2	A				µg/kg	135	R	µg/kg	72	R
Cadmium				µg/L	0.091	A/R(5)	mg/kg	0.51	R			
Chlordanes	µg/L	0.000081	A				µg/kg	1.4	R	µg/kg	3	R
Chlorobenzene				µg/L	64	R						
Chromium	µg/L	100	A	µg/L	11	A						
Copper	µg/L	2.74	A	µg/L	2.74	A/R	mg/kg	359	R			
Cyanide				µg/L	4	A						
DDx	µg/L	0.01	R	µg/L	0.001	A	µg/kg	6.1	R	µg/kg	3	R
DDD	µg/L	0.000031	A	µg/L	0.000031	A	µg/kg	114	R			
DDE	µg/L	0.000018	A	µg/L	0.000018	A	µg/kg	226	R			
DDT	µg/L	0.000022	A	µg/L	0.000022	A	µg/kg	246	R			
1,1-Dichloroethene				µg/L	7	A						
cis-1,2-Dichloroethene				µg/L	70	A						
Dieldrin							µg/kg	0.07	R	µg/kg	0.06	R
2,4-Dichlorophenoxyacetic acid				µg/L	70	A						
Ethylbenzene	µg/L	7.3	R	µg/L	7.3	R						
Hexachlorobenzene	µg/L	0.000029	A							µg/kg	0.6	R
Lindane							µg/kg	5	R			
Lead				µg/L	0.54	A/R	mg/kg	196	R			
Manganese				µg/L	430	R						
MCPP	µg/L	16	R									
Mercury							mg/kg	0.085	R	mg/kg	0.03	A
Pentachlorophenol	µg/L	0.03	A	µg/L	0.03	A				µg/kg	2.5	R
Perchlorate				µg/L	15	A						
PBDEs										µg/kg	26	R
PCBs	µg/L	0.0000064	A	µg/L	0.014	A/R	µg/kg	9	B	µg/kg	0.25 (6)	R
PAHs							µg/kg	23000	R			
cPAHs (BaP eq)	µg/L	0.00012	A	µg/L	0.00012	A	µg/kg	774 (7)	B	µg/kg	51.6	R
Acenaphthene				µg/L	23	R						
Acenaphthylene												
Anthracene				µg/L	0.73	R						
Benzo(a)anthracene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(a)pyrene	µg/L	0.00012	A	µg/L	0.00012	A						
Benzo(b)fluoranthene	µg/L	0.0012	A	µg/L	0.0012	A						
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene	µg/L	0.0013	A	µg/L	0.0013	A						
Chrysene	µg/L	0.0013	A	µg/L	0.0013	A						
Dibenz(a,h)anthracene	µg/L	0.00012	A	µg/L	0.00012	A						
Fluoranthene												
Fluorene												
Indeno(1,2,3-c,d)pyrene	µg/L	0.0012	A	µg/L	0.0012	A						
2-Methylnaphthalene												
Naphthalene	µg/L	12	R									
Phenanthrene												
Pyrene												
Dioxins/Furans (2,3,7,8-TCDD eq)	µg/L	0.0000000005	A									
1,2,3,4,7,8-HxCDF							µg/kg	0.0004	B	µg/kg	0.00008	R
1,2,3,7,8-PeCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
2,3,4,7,8-PeCDF							µg/kg	0.0003	B	µg/kg	0.00003	R
2,3,7,8-TCDF							µg/kg	0.00040658	R	µg/kg	0.00008	R
2,3,7,8-TCDD							µg/kg	0.0002	B	µg/kg	0.000008	R
Tetrachloroethene				µg/L	0.24	A						
Toluene				µg/L	9.8	R						
TPH-Diesel							mg/kg	91	R			
Aliphatic Hydrocarbons C10-C12				µg/L	2.6	R						
Tributyltin	µg/L	0.063	A				µg/kg	3080	R			
Trichloroethene				µg/L	0.6	A						
2,4,5-TP (Silvex)				µg/L	50	A						
Vanadium				µg/L	20	R						
Vinyl Chloride				µg/L	0.022	A						
Xylenes				µg/L	13	R						
Zinc	µg/L	36.5	R	µg/L	36.5	R	mg/kg	459	R			

Notes:
(1) Surface Water Cleanup Levels - RAOs 3 and 7
(2) Groundwater Cleanup Levels - RAOs 4 and 8
(3) Sediment Cleanup Levels - RAOs 1 and 5
(4) Fish Tissue Targets - RAOs 2 and 6
(5) A/R indicates that the ARARs-based number and the risk-based number are the same.
(6) The tissue target is a risk-based number and does not represent background levels. Additional data will be collected to determine background fish tissue concentrations for PCBs during design and construction of the Selected Remedy.
(7) The cleanup level for cPAHs of 774 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment exclusive of beaches and navigation channel sediments. The cleanup level applicable to beach sediments is 85 µg/kg and the cleanup level applicable to the navigation channel is 107,600 µg/kg and is based on human consumption of clams.

Abbreviations:
2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex
ARAR - applicable or relevant and appropriate requirement
B - Background-based number
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
C - carbon

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations (continued):
Conc - concentration
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - hexachlorodibenzofuran
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbon
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
R - risk-based number
RAO - remedial action objective
TCDD - tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

ROD Table 21. Sediment RALs and PTW Thresholds for Selected Remedy - Updated for ESD

Contaminants	Site Wide RALs[1] (µg/kg)	PTW Thresholds [2] (µg/kg)	Navigation Channel RALs (µg/kg)
Focused COCs			
PCBs	75	200	1,000
Total PAHs	30,000	NA	170,000
2,3,7,8-TCDD	0.0006	0.01	0.002
1,2,3,7,8-PeCDD	0.0008	0.01	0.003
2,3,4,7,8-PeCDF	0.2	0.2	1
DDx	160	7,050	650
Additional Contaminants			
2,3,7,8-TCDF	NA	0.6	NA
1,2,3,4,7,8-HxCDF	NA	0.04	NA
cPAHs (BaP Eq)	NA	774,000	NA
Chlorobenzene	NA	>320	NA
Naphthalene	NA	>140,000	NA

Notes:
1 – Site wide includes all areas of the Site except the navigation channel. FMD areas are subject to these RALs.
2 – PTW thresholds are based on highly toxic PTW values (10^{-3} risk) except chlorobenzene and naphthalene, which are threshold values for not reliably contained PTW.

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

Appendix A2

Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018

CDM Smith

Memorandum

To: *Sean Sheldrake, U.S. Environmental Protection Agency (EPA) Region 10*

From: *Scott Coffey and Gary Hazen, CDM Federal Programs Corporation*

Date: *February 23, 2018*

Subject: *Evaluation of Cost Impacts to Alternative F Modified from Changes Documented in the Explanation of Significant Difference, Portland Harbor Superfund Site*

Introduction

CDM Federal Programs Corporation (CDM Smith) has been tasked to provide an evaluation of the cost impacts from changes to Alternative F Modified from the January 2017 Portland Harbor Superfund Site Record of Decision (ROD) (EPA 2017) as documented in the accompanying Explanation of Significant Difference (ESD). The changes include modifying the total polycyclic aromatic hydrocarbon (TPAH) remedial action level (RAL) for nearshore sediments (RAL F) from 13,000 µg/kg to 30,000 µg/kg. This effort is hereafter referred to as the "ESD cost evaluation".

Purpose and Intended Uses

The intended use of the ESD cost evaluation is to provide a ROD-level cost estimate revision of Alternative F Modified using the modifications as documented in the ESD. The results of these changes in terms of cost to the revised Alternative F Modified, hereafter referred to as "Alternative F Modified with RAL Change", are compared to the original Alternative F Modified costs presented as part of the ROD. This ESD cost evaluation is intended to provide EPA with an evaluation of the cost impacts from the proposed modifications to support the development of the ESD.

Methodology and Cost Guidance

The ESD cost evaluation was developed based on the same methodology and guidance as described in Appendix IV, Appendix G *(Methodology and Organization of Selected Remedy Cost Estimate)* of the ROD. As detailed in that appendix, these costs are expected to have an accuracy between -30% to +50% of actual cost, based on the scope presented in the ROD. They are prepared solely to facilitate relative comparisons between alternatives for remedy selection purposes, not for establishing project budgets or negotiating Superfund enforcement settlements.

The ESD cost evaluation focuses on changes as documented in ESD. These changes include the modification of the TPAH RALs for only the nearshore areas. The nearshore areas include shallow, intermediate, and future maintenance dredge (FMD) areas. The RALs for the navigation channel were not modified; therefore, quantities and costs for navigation channel areas remained the same as Alternative F Modified from the ROD.

New quantities were developed for Alternative F Modified with RAL Change based on the changes described in the ESD. These quantities were independently derived for this evaluation and were not previously presented in the ROD.

Key Assumptions for the Cost Evaluation

Key assumptions for the ESD cost evaluation include:

1. This evaluation assesses changes as documented in the ESD, including modifications to the TPAH RAL for nearshore sediments (RAL F).

2. The modifications presented in the ESD resulted in small reductions in the quantities of sand, AquaGate, armor, beach mix, and dredging volumes as well as structures impacted (i.e. docks and piles).

3. The estimated construction duration for Alternative F Modified with RAL Change was kept consistent with the construction duration for Alternative F Modified in the ROD cost estimate. As noted in the previous bullet, quantity reductions were relatively small; therefore, the quantity reductions would not likely change the number of years required for construction.

4. Costs for the Alternative F Modified with RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate

5. All other costs estimate assumptions unrelated to the quantity modifications were kept consistent with what was presented in the ROD cost estimate.

Conclusions

As shown in Table 1, the modifications to quantities based on the changes documented in the ESD would decrease the present value cost from Alternative F Modified as presented in the ROD by approximately $35 million (3.4 percent decrease) when modifications are applied across the entire site.

Organization

The ESD cost evaluation is organized into the following components:

a. Overview – Evaluation of Cost Impacts to Alternative F Modified from Changes Documented in the Explanation of Significant Difference, Portland Harbor Superfund Site

   This is the memorandum you are currently reading that summarizes the approach to developing the ESD cost evaluation.

b. Cost Comparison of Alternative F Modified from the ROD to Revised Alternative F Modified with RAL Change (Table A1)

c. Detailed Cost Estimate Summary – Alternative F Modified with RAL Change (Table A2)

References

EPA. 2017. Record of Decision, Portland Harbor Superfund Site. January 3.

Table A1 - Cost Comparison of Alternative F Modified from the ROD to Revised Alternative F Modified with RAL Change

EXPLANATION OF SIGNIFICANT DIFFERENCES COST SUMMARY

Site: Portland Harbor Superfund Site
Location: Portland, Oregon
Phase: Explanation of Significant Differences (-30% to +50%)
Base Year: 2016

Alternative	Total Capital Cost	Total Periodic Cost	Total Non-Discounted Cost	Present Value Cost
F Modified[1] (2017 ROD)	$1,184,607,000	$524,028,000	$1,708,635,000	$1,054,200,000
F Modified w/RAL Change[2]	$1,145,793,000	$504,654,000	$1,650,447,000	$1,018,830,000
Cost Difference[3]	***-$38,814,000***	***-$19,374,000***	***-$58,188,000***	***-$35,370,000***
Percent Difference[4]	***-3.3%***	***-3.7%***	***-3.4%***	***-3.4%***

Notes:

[1] - Costs for Alternative F Modified (2017 ROD) represent the costs presented for Alternative F Modified in the Portland Harbor Superfund Site ROD (EPA 2017).

[2] - Costs for Alternative F Modified w/RAL Change represent Alternative F Modified with adjustments made as documented in the accompanying Explanation of Significant Differences (EPA 2018).

[3] - Represents the cost difference between Alternative F Modified w/RAL Change and the Alternative F Modified from the ROD.

[4] - Represents the percent difference between Alternative F Modified w/RAL Change and the Alternative F Modified from the ROD.

Costs for Alternative F Modified w/RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate.

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Institutional Controls	1	LS	$3,623,355	$3,623,355
SUBTOTAL				$3,623,355
Contingency (Scope and Bid)	15%			$543,503
SUBTOTAL				$4,166,858
Project Management	2%			$83,337
Remedial Design	2%			$83,337
Construction Management	3%			$125,006
TOTAL				$4,458,538
TOTAL CAPITAL COST				**$4,459,000**

MONITORED NATURAL RECOVERY CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	1,819	AC	$3,686	$6,703,954
SUBTOTAL				$6,703,954
Contingency (Scope and Bid)	20%			$1,340,791
SUBTOTAL				$8,044,745
Project Management	5%			$402,237
Remedial Design	8%			$643,580
Construction Management	6%			$482,685
TOTAL				$9,573,247
TOTAL CAPITAL COST				**$9,573,000**

TECHNOLOGY ASSIGNMENTS MEASURES CAPITAL CONSTRUCTION COSTS: (Assumed to be Incurred During Years 0 through 12)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Mobilization / Demobilization	1	LS	$13,881,000	$13,881,000
Transload Facility Development	1	LS	$15,651,213	$15,651,213
Debris Removal and Disposal	377	AC	$13,107	$4,941,343
Obstruction Removal and Relocation	1	LS	$20,308,861	$20,308,861
Erosion/Residual Control Measures	1	LS	$27,166,335	$27,166,335
Dredging of Contaminated Sediments (Open Water)	2,694,951	CY	$24.53	$66,107,148
Dredging of Contaminated Sediments (Confined)	122,831	CY	$31.10	$3,820,044
Excavation of Riverbanks	119,071	CY	$5.19	$617,978
Dewatering and Water Treatment for Dredging Operations	1	LS	$12,450,462	$12,450,462
Subtitle C/TSCA Disposal (Handling, Transportation, Treatment of Select PTW Materials, and Disposal)	358,891	TON	$191	$68,536,125
Subtitle D Disposal (Handling, Transportation, and Disposal)	4,465,403	TON	$111	$494,570,473
Mitigation	53	AC	$1,070,827	$56,753,831
Sand Placement for Technology Assignments	874,434	CY	$33.80	$29,555,683
Beach Mix Placement for Technology Assignments	66,031	CY	$73.04	$4,822,649
Armor Placement for Technology Assignments	139,983	CY	$72.06	$10,087,157
Reactive/GAC Placement for Technology Assignments	1	LS	$50,696,074	$50,696,074
Geofabric for Riverbanks	24.7	AC	$14,311	$353,488
Organoclay Mat Placement for Technology Assignments	174,300	SF	$6.39	$1,113,777
SUBTOTAL				$881,433,641
Contingency (Scope and Bid)	20%			$176,286,728
SUBTOTAL				$1,057,720,369
Project Management	2%			$21,154,407
Remedial Design	2%			$21,154,407
Construction Management	3%			$31,731,611
TOTAL				$1,131,760,794
TOTAL CAPITAL COST				**$1,131,761,000**

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

SITE-WIDE MONITORING AND MONITORED NATURAL RECOVERY PERIODIC COSTS: (Assumed to be Incurred at Years 2, 4, 6, 8, 10, 14, 18, 22, 26, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Monitored Natural Recovery (MNR) for MNR/Enhanced Natural Recovery (ENR) and Broadcast GAC Areas	1,819	AC	$3,686	$6,703,954
Site-Wide Monitoring	1	LS	$957,659	$957,659
Cap Area Monitoring and Reactive Layer Monitoring	1	LS	$27,961,876	$27,961,876
SUBTOTAL				$35,623,489
Contingency (Scope and Bid)	20%			$7,124,698
SUBTOTAL				$42,748,187
Project Management	2%			$854,964
Technical Support	5%			$2,137,409
TOTAL				$45,740,560
TOTAL PERIODIC COST				**$45,741,000**

LONG TERM OPERATIONS AND MAINTENANCE PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Long-Term Maintenance for Capping, ENR, and In Situ Treatment	1	LS	$4,908,126	$4,908,126
SUBTOTAL				$4,908,126
Contingency (Scope and Bid)	20%			$981,625
SUBTOTAL				$5,889,751
Project Management	5%			$294,488
Technical Support	10%			$588,975
TOTAL				$6,773,214
TOTAL PERIODIC COST				**$6,773,000**

INSTITUTIONAL CONTROLS PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
Evaluating and Updating Institutional Controls	1	LS	$626,873	$626,873
SUBTOTAL				$626,873
Contingency (Scope and Bid)	10%			$62,687
SUBTOTAL				$689,560
Project Management	5%			$34,478
Technical Support	10%			$68,956
TOTAL				$792,994
TOTAL PERIODIC COST				**$793,000**

5-YEAR SITE REVIEW PERIODIC COSTS: (Assumed to be Incurred at Years 5, 10, 15, 20, 25, & 30)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL
5-Year Site Review	1	LS	$243,687	$243,687
SUBTOTAL				$243,687
Contingency (Scope and Bid)	10%			$24,369
SUBTOTAL				$268,056
Project Management	5%			$13,403
Technical Support	10%			$26,806
TOTAL				$308,265
TOTAL PERIODIC COST				**$308,000**

Table A2 - Detailed Cost Estimate Summary

Alternative **F Modified w/RAL Change**

Summary of Present Value Analysis - Alternative F Modified w/ RAL Change

Year[1]	Capital Costs	Periodic Costs	Total Annual Expenditure[2]	Discount Factor (7.0%)	Present Value[3]
0	$96,974,538	$0	$96,974,538	1.0000	$96,974,538
1	$87,401,538	$0	$87,401,538	0.9346	$81,685,477
2	$87,401,538	$45,741,000	$133,142,538	0.8734	$116,286,693
3	$87,401,538	$0	$87,401,538	0.8163	$71,345,875
4	$87,401,538	$45,741,000	$133,142,538	0.7629	$101,574,442
5	$87,401,538	$7,874,000	$95,275,538	0.7130	$67,931,459
6	$87,401,538	$45,741,000	$133,142,538	0.6663	$88,712,873
7	$87,401,538	$0	$87,401,538	0.6227	$54,424,938
8	$87,401,538	$45,741,000	$133,142,538	0.5820	$77,488,957
9	$87,401,538	$0	$87,401,538	0.5439	$47,537,697
10	$87,401,538	$53,615,000	$141,016,538	0.5083	$71,678,706
11	$87,401,538	$0	$87,401,538	0.4751	$41,524,471
12	$87,401,538	$0	$87,401,538	0.4440	$38,806,283
13	$0	$0	$0	0.4150	$0
14	$0	$45,741,000	$45,741,000	0.3878	$17,738,360
15	$0	$7,874,000	$7,874,000	0.3624	$2,853,538
16	$0	$0	$0	0.3387	$0
17	$0	$0	$0	0.3166	$0
18	$0	$45,741,000	$45,741,000	0.2959	$13,534,762
19	$0	$0	$0	0.2765	$0
20	$0	$7,874,000	$7,874,000	0.2584	$2,034,642
21	$0	$0	$0	0.2415	$0
22	$0	$45,741,000	$45,741,000	0.2257	$10,323,744
23	$0	$0	$0	0.2109	$0
24	$0	$0	$0	0.1971	$0
25	$0	$7,874,000	$7,874,000	0.1842	$1,450,391
26	$0	$45,741,000	$45,741,000	0.1722	$7,876,600
27	$0	$0	$0	0.1609	$0
28	$0	$0	$0	0.1504	$0
29	$0	$0	$0	0.1406	$0
30	$0	$53,615,000	$53,615,000	0.1314	$7,045,011
TOTALS:	$1,145,793,000	$504,654,000	$1,650,447,000		$1,018,829,457

TOTAL PRESENT VALUE OF ALTERNATIVE F MODIFIED WITH RAL CHANGE [4] **$1,018,830,000**

Notes:

[1] Alternative F Modified with RAL Change is expected to require cost expenditures for perpetuity since some contamination addressed by the remedy within the sediment bed and associated riverbank soils would remain in-place that do not allow for unrestricted use or unlimited exposure to human or ecological receptors. However, the period of analysis was assumed to be 30 yrs beyond the start of construction in Year 0.

[2] Total annual expenditure is the total cost per year with no discounting.

[3] Present value cost by year is the total annual expenditure discounted by a factor for that year representing the 7.0% real discount rate recommended by "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

[4] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs for Alternative F Modified w/RAL Change were developed based on the same methodology and guidance as described in Appendix IV, Appendix G (Methodology and Organization of Selected Remedy Cost Estimate) of the ROD.

Costs presented for the selected remedy are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

Percentages used for contingency and professional/technical services costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000. Modifications to the percentages applied for contingency and professional/technical services are documented in Appendix IV, Appendix G of the ROD.

The estimated construction duration for the Alternative F Modified w/RAL Change was kept consistent with the construction duration for Alternative F Modified in the ROD cost estimate.

Costs for Alternative F Modified w/RAL Change are based on 2016 cost sources with no escalation included, which is consistent with the ROD cost estimate.

Abbreviations:

AC Acre
CY Cubic Yard
LS Lump Sum
QTY Quantity
SF Square Foot
TON Ton

Appendix A3

Discussion and Response to August 2, 2017 NW Natural Memo, March 2, 2018

DRAFT

Discussion and Response to August 2, 2017 NW Natural Memo titled "*USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor*"

March 2, 2018

Introduction and Purpose

On January 19, 2017, the U.S. Environmental Protection Agency (EPA) released an updated Toxicological Review of Benzo(a)pyrene (USEPA 2017a). The updated toxicological review modified the oral cancer slope factor for benzo(a)pyrene (BaP) from 7.3 per milligram per kilogram-day $(mg/kg\text{-}day)^{-1}$ to 1 $(mg/kg\text{-}day)^{-1}$. The change in the cancer slope factor has potential implications for the risk-based human health cleanup levels (CULs), target tissue levels, and risk-based highly toxic principal threat waste (PTW) thresholds for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) measured as BaP equivalents (BaP Eq) selected in the January 3, 2017 Record of Decision (ROD) for the Portland Harbor Superfund Site (ROD) (USEPA 2017b)[1]. Although not directly related to a cancer slope factor or a measurement of risk, the change in the BAP slope also has implications for the total PAH remedial action levels (RALs) used to establish the remedial footprint of the Selected Remedy presented in the ROD.

This memorandum discusses EPA's evaluation of information presented in document provided by NW Natural titled: "*USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor*" dated August 2, 2017 (NWN BaP Memo) (Anchor QEA 2017) and summarizes EPA's evaluation and conclusions regarding the effect of the cancer slope factor (CSF) change on the Selected Remedy.

The change in the cancer slope factor for BaP does not impact the Portland Harbor ROD's human health PRGs for surface water because they are based on water quality criteria promulgated by the State of Oregon and these criteria have not been changed. Similarly, risks to ecological receptors are also unaffected by this change. As a result, EPA's evaluation only considered potential changes to the risk-based cPAH CULs based on the direct contact and clam consumption exposure scenarios, the risk based cPAH highly toxic PTW threshold and potential changes in RALs resulting from these changes.

Specifically, this memorandum discusses the following:

- Potential change in direct contact beach and nearshore sediment CUL based on changes to the BaP CSF
- Potential change in fish consumption sediment CUL based on changes to the BaP CSF
- Potential change in highly toxic PTW threshold based on changes to the BaP CSF

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[1] cPAH CULs were calculated using a cancer slope factor to achieve a 1×10^{-6} cancer risk level and the principle threat waste (PTW) thresholds are set at a 1×10^{-3} risk level based on the CUL. The Toxicological Review of Benzo(a)pyrene (USEPA 2017a) also included an updated non-cancer oral reference dose of 0.0003 mg/kg-day. However, this updated value was already utilized in the human health baseline risk assessment and development of preliminary remedial goals (PRGs) for the Portland Harbor Site.

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- Potential change in nearshore and navigation channel RALs for total PAHs
- Potential application of the cPAH in-water sediment PRG as cPAH CUL for in-water sediments (exclusive of beach and navigation channel sediments).

Carcinogenic PAH Cleanup Levels and Principal Threat Waste Thresholds

Reducing the BaP CSF from 7.3 to 1 $(mg/kg\text{-}day)^{-1}$ results in an increase in the direct contact sediment CUL and highly toxic PTW thresholds specified in the PH ROD by a factor of 7.3. Target tissue thresholds for cPAHs and clam tissue are similarly adjusted. Due to the non-linear relationship between cPAHs in clam tissue and sediment, the clam consumption CUL is adjusted by a factor of approximately 25. Changes to cPAH CULs, target tissue levels and PTW thresholds are summarized in Table 1. The basis for these changes is described in greater detail below.

Table 1 – cPAH (BaP Eq) CUL and Highly Toxic PTW Thresholds

Scenario	Application Area	ROD cPAH CUL	Updated cPAH CUL [1]
Direct Contact Sediment CUL	Nearshore Sediment	12 µg/kg	85 µg/kg
Direct Contact Sediment CUL	Nearshore sediment (excluding beach areas)	Not provided	774 µg/kg
Clam Consumption Tissue Target Level	Navigation Channel Sediment	7.1 µg/kg	51.6 µg/kg
Clam Consumption Sediment CUL	Navigation Channel Sediment	3,950 µg/kg	107,600 µg/kg
Highly Toxic PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg

[1] Updated Value is based on change in BaP CSF from 7.3 to 1 $(mg/kg\text{-}day)^{-1}$

Human Health Direct Contact In-Water Sediment Cleanup Level

The Portland Harbor Human Health Risk Assessment presented in the Portland Harbor Remedial Investigation Report (USEPA 2016a) evaluated a range of direct contact exposure scenarios for beach sediment and in-water sediment. Potentially exposed populations evaluated under the beach exposure scenarios included dockside workers, transients, recreational beach users, high frequency fishers, and tribal fishers. Potentially exposed populations evaluated under the in-water sediment exposure scenarios included in-water workers, high frequency fishers, tribal fishers, diver wet suit, and diver dry suit.

The human health direct contact sediment CUL for cPAHs established in ROD of 12 µg/kg established in the Portland Harbor ROD was based on a recreational beach exposure scenario. Adjusting the human health direct contact sediment CUL by a factor of 7.3 results in a revised CUL of 85 µg/kg.

The Portland Harbor ROD did not develop cleanup levels based on the in-water exposure scenarios evaluated in the baseline human health risk assessment. In-water sediment PRGs ranged from 106 µg/kg for the tribal fisher exposure scenario to 8,572 µg/kg for the in-water worker exposure scenario. Adjusting the in-water nearshore sediment PRG of 106 µg/kg by a factor of 7.3 results in a revised PRG of 774 µg/kg.

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EPA has re-evaluated application of the nearshore sediment CUL based on the recreational beach exposure scenario and determined that two cPAH direct contact CULs should apply to nearshore sediments. The updated cPAH direct contact beach CUL of 85 µg/kg will apply to recreational beaches identified in the baseline human health risk assessment and RI Report (EPA 2016a) (EPA 2016a). EPA also developed a cPAH direct contact CUL of 774 µg/kg based on the tribal fisher exposure scenario. The cPAH direct contact tribal fisher CUL for tribal in-water sediment of 774 µg/kg will apply to the remainder of nearshore sediments (non-recreational beach areas).

Human Health Clam Consumption Cleanup Level

For the clam consumption exposure scenario, the target tissue level also increases by a factor of 7.3. However, the relationship between cPAH (BaP Eq) clam tissue levels and sediment levels is a non-linear relationship represented by the following equation presented in Appendix B of the Portland Harbor FS (USEPA 2016b):

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue})-(\ln(f_{lipid})-\ln(CF)+2.47)}{0.6} + ln(f_{oc}) \text{ (Equation 1)}$$

Where:

PRG_{sed} = Risk-Based Sediment Preliminary Remediation Goal, dry weight (µg/kg)
C_{tissue} = Risk-Based Acceptable Tissue Concentration, wet weight (µg/kg)
CF = Correction Factor of 2.31
f_{oc} = Fraction Organic Carbon, dry weight (0.0171)
f_{lipid} = Fraction of lipid in clam tissue, wet weight (0.22)

As a result of the non-linear relationship between bulk sediment BaP concentrations and clam tissue BaP concentrations, the cPAH sediment CUL bases on the clam consumption scenario increases from 3,950 to 107,600 µg/kg.

Benthic Risk Direct Contact Cleanup Level

The total PAH cleanup level for protection of the benthic community was established in the Portland Harbor ROD at 23,000 µg/kg. This concentration is above the nearshore total PAH RAL of 13,000 µg/kg established in the Portland Harbor ROD but below both the navigation channel total PAH RAL of 170,000 µg/kg and the highly toxic PTW threshold of 106,000 µg/kg. Although the benthic risk direct contact total PAH sediment CUL is unaffected by the change in BaP CSF, any changes to the remedial action levels for the Selected Remedy will have to consider the impact on benthic risk.

Principal Threat Waste Thresholds

The Portland Harbor ROD established a highly toxic principal threat waste (PTW) threshold for cPAHs of 106,000 µg/kg based on a 1×10^{-3} risk level. Because the cPAH highly toxic PTW threshold is based on cancer risk, it is also affected by the BaP CSF change. Adjusting the highly toxic PTW threshold by a factor of 7.3 results in a revised PTW threshold of 774,000 µg/kg.

Remedial Action Levels

Remedial action levels (RALs) are a range of contaminant concentrations that fall between the site-wide spatially area weighted average concentrations (SWACs) prior to initiation of remedial action and

cleanup levels for the focused COCs. The Portland Harbor FS developed RALs for six focused chemicals of concern (COCs), including total PAHs[2], by plotting site-acres remediated against the estimated post-remediation SWAC.

Thus, six sets of RALs bracketing the distribution of contamination for seven remedial alternatives (Alternatives B through H) were evaluated in the FS based on this relationship for each focused COC. The RAL curve for total PAHs is presented in Figure 1. For total PAHs, RALs ranged from 170,000 to 970 µg/kg. As noted in Figure 1, the most conservative RAL of 970 µg/kg equates to a cPAH (BaP Eq) concentration of 106 µg/kg based on a regression analysis between total PAH and total cPAH (BaP Eq) sediment concentrations at the Portland Harbor Site developed in the FS. This relationship is represented by the following equation:

$$Total\ PAHs = (BaP\ Eq)(BaP\ EQ)^m \times 10^b \text{ (Equation 2)}$$

Where: m = 0.984 and b = 0.996

The remedial footprint for the Selected Remedy established in the Portland Harbor ROD are defined by exceedances of RALs and the presence of PTW. RALs are contaminant-specific sediment concentrations of focused COCs used to identify areas where capping and/or dredging will be conducted. The Selected Remedy for the Site identified remedial footprints based on two sets of RALs—one applicable to nearshore sediments (the Alternative F RAL) and one applicable to the federally authorized navigation channel (the Alternative B RAL). The total PAH RALs for the Selected Remedy are 13,000 µg/kg for nearshore sediments and 170,000 µg/kg for the federally authorized navigation channel.

EPA evaluated whether changes to the total PAH RALs were necessary due to the BaP CSF change. The evaluation considered both the nearshore RAL and the navigation channel RAL. The evaluation assessed the effect of the RAL change on post-construction risk estimates and if the change would affect attainment of the RAOs established for the Site.

Based on its evaluation, EPA determined that the nearshore RAL should be revised from 13,000 to 30,000 µg/kg to avoid remediation of PAH-contaminated sediments that no longer pose a risk to human health based on the changes to the nearshore sediment cPAH CUL. EPA determined that this change would result in a negligible change to the protectiveness of the remedy and would not appreciably change the ability of the remedy to attain the RAOs established for the Portland Harbor Site.

Based on its evaluation, EPA determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5). This is because the selected total PAH RAL of 170,000 µg/kg is well above the total PAH CUL and the lack of natural recovery processes within the navigation channel between RM 5 and RM 7 where the total PAH RAL is exceeded. A summary of the total PAH RALs is presented in Table 2 below.

[2] It should be noted that although RALs were developed for both total PAHs, CULs were established for both total PAHs and cPAHs.

Table 2 – Total PAH RAL Summary

Application Area	ROD Total PAH RAL	Updated Total PAH RAL
Nearshore Sediment (RAL F)	13,000 µg/kg	30,000 µg/kg
Navigation Channel (RAL B)	170,000 µg/kg	No Change

Remedial Quantity and Cost Implications Quantities

EPA evaluated the changes in remedial quantities and cost associated with changing the total PAH RAL applicable to nearshore sediments outside the navigation channel. EPA determined that this change would reduce the total nearshore remedial footprint by 17 acres, reduce the capping area by 8 acres, and reduce the dredging volume by 43,800 cy. This results in a decrease in the present value cost for the Selected Remedy of approximately $35 million. This represents a 3.4% decrease in the overall present value cost of the Selected Remedy.

Summary

EPA evaluated the effect of changes to the BaP CSF will result on risk-based CULs, target tissue levels and risk-based highly toxic PTW thresholds for cPAHs selected in the Portland Harbor ROD. This evaluation considered the information and analysis included in the document provided by NW Natural titled: "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor" dated August 2, 2017 (NWN BaP Memo) (Anchor QEA 2017).

Based on its analysis, EPA determined that changes to the cPAH CULs and PTW thresholds were warranted. EPA also determined that including a human health direct contact cPAH CUL based on the tribal fisher exposure scenario was appropriate. Finally, EPA determined that a change to the total PAH nearshore sediment RAL was appropriated but that a change to the total PAH navigation channel RAL was not appropriate because it may affect the ability of the remedy to attain the RAOs established in the Portland Harbor.

References:

Anchor QEA. 2017. Memorandum: USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor. August 2.

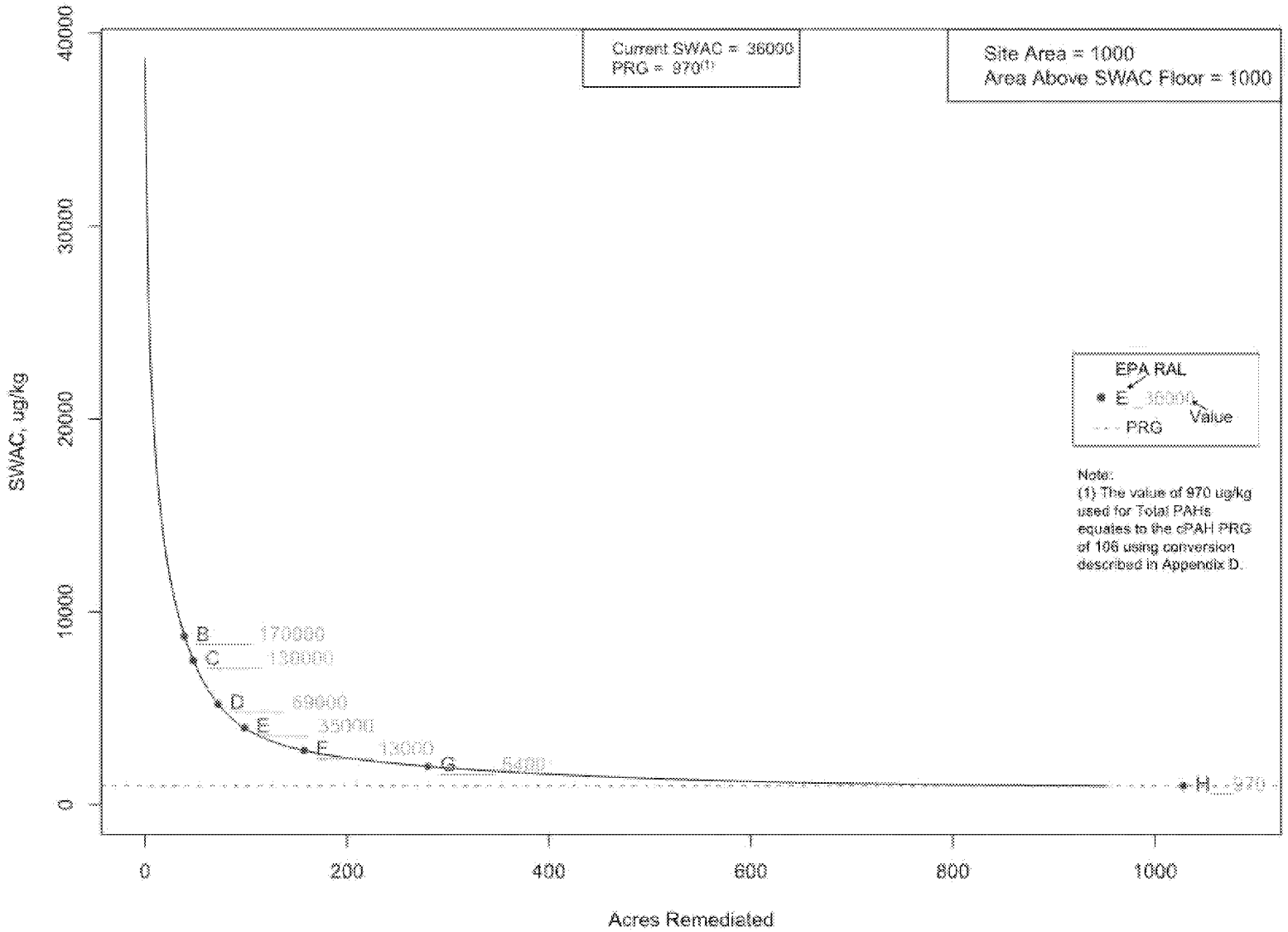
USEPA. 2016a. *Final Remedial Investigation Report, Portland Harbor Remedial Investigation/Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. February 8.

USEPA. 2016b. *Draft Final Portland Harbor Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. June.

USEPA. 2017a. Toxicological Review of Benzo(a)pyrene. EPA/635/R-17/003Fa. January.

USEPA. 2017b. Record of Decision, Portland Harbor Superfund Site. January 3.

Figure 1 – Total PAH RAL Curve



Appendix A4

Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017

DRAFT

MEMORANDUM

TO: Elliott Laws

FROM: Patty Dost

DATE: November 28, 2017

RE: Portland Harbor cPAH Cleanup Levels

When you, Tom and Margaret met with Jim Woolford and others on November 15, you requested three changes to the cleanup levels in the ROD. First, EPA's current Portland Harbor cleanup level for direct contact with underwater sediments impacted by carcinogenic polycyclic aromatic hydrocarbons (cPAHs) appears to be a mistake – instead of 12 µg/kg, it should be 106 µg/kg to be consistent with the risk assessment.

Second, EPA's cPAH cleanup level of 3,950 µg/kg for the navigation channel is based on consumption of clams, an exposure scenario EPA had determined in the risk assessment to be incomplete. Accordingly, it should be removed.

Third, all Portland Harbor cPAH cleanup levels should be updated using EPA's current toxicity values so that remedial actions can be designed using the best scientific information to efficiently and cost-effectively reduce risk.

I understand that you promised to send EPA legal and other support for making the requested changes. That support is set forth below.

I. <u>EPA's cPAH cleanup levels are inconsistent with the Baseline Risk Assessment and therefore legally indefensible</u>.

EPA completed the Portland Harbor Baseline Human Health Risk Assessment (BHHRA) in March 2013. The BHHRA identified potential risks to human health from cPAHs in sediment through several different exposure scenarios, including direct contact with soil or sediment on upland beaches, direct contact with in-water sediment during fishing or occupational activities, and consumption of clams and fish. Based upon the BHHRA, EPA developed preliminary remediation goals (PRGs) it believed would be protective of humans exposed to cPAHs in Portland Harbor sediments: 12 µg/kg for direct contact exposure to beach sediment, 106 µg/kg for direct contact with in-water sediment, and 3,950 µg/kg for consumption of clams.[1] EPA was unable to develop a technically sound cPAH sediment PRG for fish consumption.[2]

The Portland Harbor Record of Decision (ROD) adopts two of these three PRGs as cleanup levels, but applies them to areas of the site in which the BHHRA concluded that the exposure pathways for which the PRGs were developed are not complete. First, the ROD applies the 12 µg/kg beach sediment PRG to nearshore in-water sediments. Second, the ROD applies the 3,950 µg/kg clam consumption PRG to sediments in the navigation channel. In both cases, this results in the ROD requiring large areas of cleanup where the BHHRA identified no unacceptable human health risk from cPAHs in sediment.

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[1] Portland Harbor Feasibility Study (June 2016), Table 2.2-1a.

[2] EPA memorandum, *Evaluation of Analyses Used to Calculate Bioaccumulation Calculation Results Portland Harbor Superfund Site RAC Contract Number EP-W-05-049* (May 2016), attached at Tab 1.

EPA has no legal basis for requiring remediation in the absence of unacceptable risk.[3] EPA's remedial investigation must include a site-specific baseline risk assessment.[4] The baseline risk assessment provides "the basis for determining whether remedial action is necessary as well as the framework for developing risk-based remediation goals."[5] "As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority."[6]

EPA's selection of in-water cleanup levels that are inconsistent with the BHHRA would likely not survive a judicial challenge. EPA's remedy decisions must be based in reason and science, and EPA must articulate a rational connection between the facts it has found and the choices it has made.[7] EPA has a legal obligation to "explain the key assumptions that underpin its remedy"[8] and must explain decisions that run counter to evidence before it.[9] Although EPA's technical decisions are entitled to deference, courts will review EPA's analysis to "ensure that it is 'rational' and 'makes sense'" and will not absolve EPA of "obvious mistakes."[10]

A. *EPA's ROD applies an upland beach cleanup level to in-water sediments that the baseline risk assessment found posed no direct contact risk.*

EPA's BHHRA identified potential risk from direct contact with cPAHs in nearshore in-water sediment to in-water workers, fishers, and divers. Based upon the BHHRA, EPA developed a direct contact PRG of 106 µg/kg for in-water sediment to be protective of tribal fishers.[11] In the ROD, however, EPA selected a cPAH in-water sediment cleanup level of 12 µg/kg, based upon a child recreational beach exposure scenario.[12] EPA provided no explanation for its application of a beach exposure PRG to in-water sediments other than the statement that its selected cleanup levels "represent the lowest value in each medium (beach or in-river sediment) to be protective of all receptors."[13] EPA did not explain why it abandoned the finding of the BHHRA that the tribal fisher was

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[3] 42 U.S.C §9606(a).
[4] 40 CFR §300.430(d)(4).
[5] *Contaminated Sediment Remediation Guidance or Hazardous Waste* Site (EPA-540-R-05-012, December 2005) ("Sediment Guidance"), p. 2-9.
[6] *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (OSWER Directive 9355.0-30) (April 22, 1991), p. 3.
[7] *United States v. NCR Corp.*, 911 F. Supp. 2d 767, 773 (E.D. Wis. 2012) *aff'd sub nom*. United States v. P.H. Glatfelter Co., 768 F.3d 662 (7th Cir. 2014); *United States v. Newmont USA Ltd.*, 504 F. Supp. 2d 1077, 1082 (E.D. Wash. 2007).
[8] *Emhart Industries, Inc. v. New England Container Company, Inc.*, 2017 WL 3535003, *11-12 (D.R.I. 2017) (citations omitted) (finding EPA assumptions concerning use of groundwater and risks from fish consumption on which remedy selection was based arbitrary and capricious).
[9] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.,* 463 U.S. 29, 43, 103 S. Ct. 2856, 2867 (1983).
[10] *Emhart Industries* at *11.
[11] Portland Harbor Feasibility Study, Appendix B, Table B3-4.
[12] *Id.* The 12 µg/kg cPAH sediment cleanup level actually represents a background value, because the acceptable risk value for children on recreational beaches was below EPA's calculated background value for cPAHs. See Portland Harbor Feasibility Study Table 2.2-4. This cleanup level is applicable to nearshore in-water sediments. *See*, ROD, Table 17, n.7.
[13] ROD, § 9.1.1

the most sensitive receptor for in-water sediment and assumed instead that children would be playing in underwater sediments offshore of industrial facilities.

Although EPA's cPAH in-water sediment cleanup level is based upon a child recreational beach exposure assumption, virtually all of EPA's evaluations supporting its remedy selection for nearshore sediments are based upon the 106 µg/kg PRG for tribal fishers. For example, the Remedial Action Levels (RALs) for cPAHs developed in the Feasibility Study and used to define action areas in the ROD were based on the 106 µg/kg PRG for in-water sediment exposure.[14] "Highly toxic" principal threat waste concentrations in the Feasibility Study and ROD are based on the 106 µg/kg PRG.[15] Most importantly, the Feasibility Study evaluated the performance of all alternatives (including the selected alternative) for EPA's Remedial Action Objective (RAO 1) (reduce risks to people from direct contact with chemicals in sediment and beaches) against the 106 µg/kg tribal fisher PRG.[16] EPA's residual risk evaluations led it to conclude that its selected remedy would be protective of direct contact with sediments "immediately after construction."[17] However, even a cursory review of EPA's residual risk tables in the final Feasibility Study (as well as a set of EPA figures prepared for an earlier draft of the Feasibility Study) reveals that the 12 µg/kg cPAH sediment cleanup level would not be met in almost every segment of the river at the rolling half-mile scale evaluated for RAO1 immediately following construction.[18]

EPA's selection of the 12 µg/kg cPAH cleanup level for in-water sediments looks like an "obvious mistake."[19] EPA should correct the ROD to identify the nearshore in-water cPAH sediment cleanup level as 106 µg/kg.

B. *EPA's ROD applies a clam consumption cleanup level to areas of the river in which the baseline risk assessment correctly assumed that clams would not be harvested.*

The ROD applies a cPAH sediment cleanup level for clam consumption in areas of the river in which the BHHRA found no clam consumption risk: "The cleanup level applicable to sediments in the navigation channel is 3,950 µg/kg and is based on human consumption of clams."[20] This is a change from EPA's Feasibility Study and the Proposed Plan, which identified a PRG of 3,950 µg/kg cPAH as protective of humans consuming fish and shellfish.[21]

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[14] Portland Harbor Feasibility Study, Figure 3.4-2.
[15] ROD, Table 6.
[16] ROD, Appendix J – Update, Calculation of Residual Risk and Post Construction Risk Estimates, Table J2.2-2c. *See also*, ROD Responsiveness Summary at p. 2-126 ("the evaluation of direct contact human health presented in Appendix J (of the FS) only considered direct contact with sediment and did not consider beach exposures").
[17] ROD, p. 121.
[18] ROD, Appendix J, Table J2.2-1c, attached at Tab 2; EPA draft August 2015 draft Feasibility Study, Figure 4.2-7a-h, attached at Tab 3. Indeed, cPAH concentrations alone would exceed 1 x 10^{-5} levels in many segments of the river. Note also that the ROD states that "at the end of construction ... people will be protected from risks associated with playing on beaches and swimming in the river," even though the detailed comparative analysis of remedial alternatives states that, "[r]esidual risk estimates are based on direct contact exposure to shallow sediments. There is insufficient data to estimate post construction risks based on exposure to beach sediments." ROD, p. 121; ROD, Table 22 n. 1.
[19] *Emhart Industries* at *11.
[20] ROD, Table 17, note 7.
[21] EPA FS (June 2016), Table 2.2-1a.

During the RI/FS, EPA was unable to develop a technically sound cPAH sediment PRG for fish consumption, because there is no observable relationship between sediment sources and PAH concentrations in fish tissue.[22] Because it was unable to link cPAHs in sediment to fish consumption risk, and despite marginal cPAH fish consumption risk, EPA originally assigned a shellfish consumption PRG to the navigation channel as a surrogate for fish consumption.[23] After several potentially responsible parties, including NW Natural, commented on the lack of technical basis for the fish consumption PRG, EPA dropped the PRG for fish consumption from the ROD but established a 3,950 µg/kg cleanup level for the navigation channel based on clam consumption.

EPA's BHHRA found no risk to humans from clams harvested in the navigation channel.[24] EPA explicitly assumed in the BHHRA that clam harvesting occurred only in nearshore areas: "EPA acknowledges that an appropriate exposure area should be determined in consideration of water depth (i.e., nearshore areas) and the area over which a sustainable shellfish harvest consistent with the clam consumption is possible."[25] Nonetheless, EPA's responsiveness summary states that "EPA ... disagrees that the shellfish consumption pathway is not complete for the navigation channel. The commenter has not provided any information to support this statement."[26] On this basis, EPA has determined that approximately 25 acres of the navigation channel must be dredged at an estimated cost in the tens of millions of dollars.

EPA must "explain the key assumptions that underpin its remedy"[27] and must explain decisions that run counter to evidence before it and its own prior findings.[28] EPA itself determined that the clam consumption exposure pathway was complete only in nearshore areas of the site; it cannot put the burden on responsible parties or members of the public to provide "information" supporting the assumptions in EPA's own risk assessment. EPA's requirement for cleanup of large areas not shown by

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[22] *See,* Lower Willamette Group Comments on Portland Harbor Proposed Plan (September 6, 2017), attached at Tab 4, p. 26. EPA's own internal reviews indicate its inability to establish this relationship. *See supra*, note 2. Further, the science is extensive that PAHs do not readily accumulate in vertebrate fish tissue. See Meador et al. 1995, *Reviews of Environmental Contamination and Toxicology* 143:79-164; September 2014 *Toxicological Review of* Benzo(a)pyrene, ORD EPA/635/R-14/312a; Varanasi, et al. 1989, Biotransformation and Disposition of Polycyclic Aromatic Hydrocarbons (PAHs) in Fish: In Varanasi U (ed); Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment, CRC Press; and Metabolism of PAHs in Teleost Fish-Scientific Findings, Memorandum from the Northwest Fisheries Science Center of NMFS, available at http://sero.nmfs.noaa.gov/deepwater_horizon/previous_reopening/index.html, October 22, 2010.

[23] 2016 draft Final FS Appendix B, p. B-35.

[24] See Map 5-4.1 (Portland Harbor RI/FS Appendix F, March 28, 2013 – Risks from Clam Consumption, RME), attached at Tab 5.

[25] EPA Comments on Comprehensive Round 2 Site Summary and Data Gaps Analysis Report (January 15, 2008), p. 26.

[26] ROD, Responsiveness Summary, p. 2-35. The extent to which the freshwater clams found in Portland Harbor (which are an invasive species illegal to possess in Oregon) are actually consumed is unknown. BHHRA, p. 29. EPA's decision to include the clam consumption exposure scenario in the risk assessment was based on a single round of interviews of 23 transient individuals. Wagner, letter to DHS (June 6, 2004), attached at Tab 6. The interviews were conducted by an individual with "a severe problem with alcohol" while drinking and fishing with the interviewees; four interviewees reported harvesting clams. *Id*. None of the interviewees reported harvesting clams from the navigation channel.

[27] *Emhart Industries* at *11-12 (D. R.I. 2017) (citations omitted) (finding EPA assumptions concerning use of groundwater and risks from fish consumption on which remedy selection was based arbitrary and capricious).

[28] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.,* 463 U.S. 29 at 43.

the BHHRA to present unacceptable risk based on the unexplained, last minute abandonment of prior decisions is the very definition of arbitrary and capricious.[29]

II. EPA should recalculate cPAH cleanup levels based upon current IRIS toxicity values before requiring PRPs to design remedies for areas of the river that present no unacceptable risk.

On January 19, 2017, approximately two weeks after EPA issued the Portland Harbor ROD, EPA updated its Integrated Risk Information System (IRIS) toxicity values for benzo(a)pyrene. It is appropriate for EPA to update the cPAH cleanup levels (which are calculated as benzo(a)pyrene equivalent values) with the new IRIS toxicity values now, before requiring potentially responsible parties to incur the substantial expense of designing remedies for areas of the site that EPA could no longer consider to present unacceptable risk based on EPA's own current scientific information.

EPA guidance is clear that risk estimates and the cleanup levels that follow from those estimates should be based upon the most current IRIS values available. EPA "generally recommends IRIS as the principal source for toxicological data in preparing superfund risk assessments."[30]

> In general, if health assessment information is available in the Integrated Risk Information System for the contaminant under evaluation, risk assessors normally need not search further for additional sources of information. Since EPA's development and use of peer review in toxicity assessments, IRIS assessments have undergone external peer review in accordance with Agency peer review guidance at the time of the assessment. IRIS health assessments contain Agency consensus toxicity values.[31]

IRIS "represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review."[32] When selecting remedial goals, EPA site managers should "[u]se the most current toxicity values provided by the Integrated Risk Information System (IRIS) or the Health Effects Assessment Summary Tables (HEAST)."[33] Indeed, if the new IRIS values had been announced two weeks before the Portland Harbor ROD issued, rather than two weeks after, EPA would have been required to take a step back and update the FS to consider the updated cleanup levels.[34]

Even after a remedy is selected, EPA guidance directs site managers to review existing cleanup levels against updated IRIS values. "It is EPA's policy to encourage appropriate remedy changes in response to advances in remediation science and technology."[35] EPA "recognizes that some remedy decisions made at Superfund sites in the past should be modified to bring those decisions up to date

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[29] *United States v. NCR Corp.*, 911 F. Supp. 2d at 773 (agency must not rush through the process, "throw darts," "flip a coin," or make a "sudden, knee-jerk decision.").
[30] *Use of IRIS Values in Superfund Risk Assessment,* OSWER directive 9285.7-16 (December 21, 1993), p. 1
[31] *Human Health Toxicity Values in Superfund Risk Assessments*, OSWER directive 9285.7-53 (December 5, 2003), p. 2.
[32] *Id.*
[33] *Rules of Thumb for Superfund Remedy Selection*, OSWER 9355.0-69 (August 1997), p. 6.
[34] *Emhart Industries* at *13 ("Soon after its publication, EPA released a nationwide change to its non-cancer toxicity value for dioxin. Since dioxin is present at the Site, EPA was forced to issue a "Technical Memorandum" updating the BHHRA, cleanup levels, and FS for the Site.").
[35] *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents,* EPA 540-R-98-031 (July 1991) ("ROD Guidance), p. 7-1.

with the current state of the science."[36] EPA's *Comprehensive Five-Year Review Guidance* instructs site managers to check for updated toxicity values:

> Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid? In conducting your five-year review, you should evaluate the effects of significant changes in standards and assumptions that were used at the time of remedy selection. *** Similarly, you should investigate the effect of significant changes in the risk parameters that were used to support the remedy selection, such as reference doses, cancer potency factors and exposure pathways of concern.[37]

At other sites, EPA has recalculated cleanup levels based on updated IRIS values by issuing Explanation of Significant Difference (ESD) documents. Here are some examples:

- Salem Acres (Salem, MA) January 1998 ESD (revising cPAH cleanup levels based upon updated B(a)P IRIS values ("benzo(a)pyrene less potent than it was believed when the ROD was written").[38]

- Burlington Northern Somers Plant (Somers, Montana) July 1998 ESD (revising soil remediation level for cPAHs from 36 to 57 ppm B(a)Peq based upon revised B(a)P cancer slope factor).[39]

- Petrochem Recycling Corp (Salt Lake City, Utah) March 1999 ESD (updating soil performance standard for PCBs from 0.15 ppm to 2.7 ppm based upon updated IRIS slope factors).[40]

- Commencement Bay November 1997 ESD (updating PCB cleanup levels for multiple reasons, including new toxicity information and updated exposure assumptions).[41]

We hope that EPA will consider our request to update the cPAH cleanup levels to incorporate the new IRIS toxicity values now.[42] As we have demonstrated in our prior technical submittals to EPA,[43] updating the cPAH cleanup values and the RALs based on those values would, alone, resolve the question of the clam consumption cleanup level, because all areas of the site would already meet protectiveness criteria at the appropriate exposure scale.[44] Updating the RALs and cleanup levels now would provide greater assurance to the public that direct contact with sediments will be protective

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[36] *Superfund Reforms: Updating Remedy Decisions*, EPA 540-F-96-026 (September 1996), p. 2.
[37] *Comprehensive Five-Year Review Guidance*, OSWER 9355.7-03B-P (June 2001), p. 4-4. *See also, Id.* p. 4-5 ("Have toxicity factors for contaminants of concern at the site changed (e.g. Integrated Risk Information System (IRIS) evaluations)?
[38] Attached at Tab 7.
[39] Attached at Tab 8.
[40] Attached at Tab 9.
[41] https://nepis.epa.gov/Exe/ZyPDF.cgi/9100NGII.PDF?Dockey=9100NGII.PDF
[42] "The lead agency is required to consider comments submitted by interested persons after the close of the public comment period only to the extent that the comments contain significant information not contained elsewhere in the administrative record file which could not have been submitted during the public comment period and which substantially support the need to significantly alter the response action. All such comments and any responses thereto shall be placed in the administrative record file." 40 C.F.R. §300.825(c).
[43] *USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor* (AnchorQEA, August 2, 2017), Attached at Tab 10.
[44] *Id.* at p. 8.

immediately after cleanup. Because updated cleanup values would significantly reduce the amount of unnecessary cleanup, they should also reduce disputes among potentially responsible parties and accelerate remedy implementation.[45]

As we understand it, EPA has just agreed to a baseline sampling program that will require approximately 2 years to complete. The extent to which site-specific pre-remedial design investigations, let alone remedial design, will commence at sites other than Gasco remains unclear, but there is certainly no compelling policy reason based upon the status of implementation of the ROD to delay recalculation of the cleanup values to reflect the most current EPA science on cPAH risk.[46]

CONCLUSION

EPA should recalculate its Portland Harbor cPAH sediment cleanup levels and RALs to incorporate the January 19, 2017 updated IRIS toxicity values for benzo(a)pyrene. Doing so now will reduce unnecessary costs for remedial design work based upon outdated values and will promote the harbor-wide settlement process by better defining the costs associated with cPAH cleanups. Updating the cleanup values in conjunction with correcting the nearshore direct contact cleanup level to be consistent with the risk assessment would provide greater assurance to the public that the site will be protective of direct contact with sediments immediately after construction of the remedy, and the update itself could prevent disagreements between EPA and potentially responsible parties over the legality of the clam consumption PRG.

cc: Tom Imeson
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[45] *Id.*

[46] NW Natural acknowledges that the IRIS update to the benzo(a)pyrene value would not affect EPA's RAO 5 TPAH cleanup level. We understand the ROD to support additional data collection to refine areas of benthic toxicity in areas that are not driven by risk via another RAO. ROD, Responsiveness Summary, p. 2-218.

TAB 1

MEMORANDUM

To: EPA Region 10 Portland Harbor RI/FS File

From: Portland Harbor RI/FS Team

Date: May 2016

Subject: Evaluation of analyses used to calculate bioaccumulation calculation results
Portland Harbor Superfund Site
RAC Contract Number EP-W-05-049

PURPOSE

The purpose of this memo is to confirm the analyses used to calculate biota-sediment accumulation factors (BSAFs) and biota-sediment accumulation regressions (BSARs) presented in the Portland Harbor Bioaccumulation Modeling Report (Winward Environmental, 2015) and Appendix Da of the draft Portland Harbor Feasibility Study (Anchor QEA, 2012). The primary steps in this evaluation are:

- Review Section 4 of the Bioaccumulation Modeling Report and the current set of PRGs to identify chemicals for which confirmatory analysis is required.
- Use the results presented in Appendix A of the bioaccumulation Report, the Portland Harbor RI data base and supplemental information provided by the Lower Willamette Group (LWG) to confirm the relationship (or lack thereof) between OC normalized sediment and lipid normalized tissue.
- Determine the potential impact on the current sediment PRGs for the human health fish consumption exposure pathway (RAO 2) and ecological receptor biota (predator) exposure pathway (RAO 6).

IDENTIFICATION OF CHEMICALS

This analysis is limited to chemicals for which BSAFs or BSARs were used to develop PRGs that were used to evaluate remedial action alternatives in the Portland Harbor FS. Based on a review of Tables 2.2-5 (RAO 2 PRG Derivation) and 2.2-9 (RAO 6 PRG Derivation), the following PRGs were selected for evaluation:

- Arsenic
- Mercury

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- Carcinogenic PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, dibenz(a,h)anthracene and chrysene
- Bis(2-ethylhexyl) phthalate
- Hexachlorobenzene
- Total PCBs

Human health sediment PRGs for carcinogenic PAHs, were based on consumption of shellfish. As a result, the analysis focused on benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene and chrysene in field collected clams. However, the analysis also looked at the development of BSARs for benzo(a)pyrene in smallmouth bass and the development of BSAFs for benzo(a)anthracene, benzo(a)pyrene and dibenz(a,h)anthracene in large home range fish.

In addition to the above chemicals, total PCBs were included in the smallmouth bass evaluation even though PRGs were developed using the mechanistic model to determine whether a BSAR relationship could be established for total PCBs.

Because the all of the RAO 6 sediment PRGs were developed using the Arnot and Gobas mechanistic food web model, the analysis focused specifically on RAO 2 and the BSARs developed for smallmouth bass and clams and the site-wide BSAFs developed for black crappie, brown bullhead and carp. The process for identifying chemicals for evaluation is presented in Tables 1 and 2.

BSAR AND BSAF RELATIONSHIP CONFIRMATION:

BSARs were developed for those species with exposure areas smaller than the site. These species include benthic invertebrates (laboratory worms, field clams, and crayfish), sculpin, and smallmouth bass. Because PRGs were not established based on tissue-sediment relationships for benthic invertebrates and sculpin, this analysis focused on field collected clam tissue and smallmouth bass.

According to the Bioaccumulation Modeling Report, BSARs were attempted using untransformed and log-transformed sediment and tissue data as follows:

1. Untransformed tissue concentrations vs. sediment concentrations
2. Untransformed tissue concentrations vs. log-transformed sediment concentrations
3. Log-transformed tissue concentrations vs. log-transformed sediment concentrations

BSAFs were developed for large home range fish species including brown bullhead, black crappie and carp.

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For organic chemicals, sediment concentrations were normalized based on OC content, and tissue chemical concentrations were normalized based on lipid content to account for the partitioning of these chemicals. No adjustments were made to sediment and tissue chemical concentrations for metals.

Field Clam BSARs:

Selected BSARs for field clams are presented in Table 4-1 of the Bioaccumulation Modeling Report. Of the 15 chemicals evaluated, relationships were established only for benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene and chrysene. BSAR equations for these chemicals are presented in Table 3.

To confirm the field clam BSARs, collocated clam tissue and sediment sample data were extracted from the July 2011 version of the Portland Harbor RI data base (RI_BERA20110727+RA-SummedParams.mdb). Table 1 of Appendix A of the Bioaccumulation Modeling Report presents the collocated sediment and field collected clam tissue sample identification numbers. Sediment and tissue results were normalized to total organic carbon and total lipids respectively consistent with the procedures described in the Bioaccumulation Modeling Report. In addition, any co-located data pair with non-detected tissue or sediment concentrations was removed from the BSAR analysis, so that only pairs of detected sediment and detected tissue concentrations were used in BSAR development.

As noted in Table 4-1, all field clam BSARs were developed based on log-log relationships. According to the Bioaccumulation Modeling Report and supplemental information provided to EPA by the LWG on February 12, 2016, a correction factor was utilized when the BSARs were derived using log-transformed data. Correction factors were applied using the the "smearing estimator" of Duan (1983), as described in Helsel and Hirsh (2002). According to Helsel and Hirsh, transforming estimates from a log regression equation back into the original units imparts a bias into the BSAF estimate. Specifically, the arithmetic mean of log-data provides an estimate of the geometric mean or median rather than the arithmetic mean. The correction factor or "smearing estimator" for a linear model requires re-expressing the residuals (difference between predicted and measured or observed value) from the log-log equation into the original units, and computing their mean. This mean is the correction factor. Correction factors presented in the Bioaccumulation Modeling Report were calculated using the equation presented in Duan (1983) and the R software package. R is a software package that allows a wide range of statistical tests and analyses to be performed. The text of the R code is included as attachment A.

The results of the regression analysis confirmation as obtained from Excel (and without application of the correction factor) are presented in Figure 1. A comparison of the regression equations and r^2 values presented in Figure 1 shows that it was possible to confirm the slope of the line and the r-squared values but not the intercept due to application of the correction factor. This is significant because according to information presented in Burkard (2009), unlike untransformed data where the slope of the line is the

BSAF, for log-log transformations, the log of the BSAF is the intercept of the regression line and not the slope:

$$\ln(C(tissue)) = slope\ x \ln\big(C(sediment)\big) + \ln BSAF$$

Although calculation of the correction factor used to developed field clam BSARs has not been confirmed, application of the correction factor is consistent with the statistical procedures presented in Helsel and Hirsh. In addition, because the R software code has been provided by the LWG, sufficient documentation is available to justify the use of the field clam BSARs developed for benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluroanthene and chrysene.

Smallmouth Bass BSARs:

BSARs for smallmouth bass were not established for RAO 2 PRG contaminants not included in the Food Web Model. In order to confirm the lack of a relationship, BASR relationships were attempted for arsenic, mercury, benzo(a)pyrene, bis(2-ethylhexyl) phthalate, and hexachlorobenzene. A BSAR relationship was also attempted for total PCBs to determine whether a BSAR could be developed for a chemical for which a relationship would be expected based on its physiochemical and bioaccumlative properties. Sediment SWAC data corresponding to each fish tissue sample were obtained from Appendix A of the Bioaccumulation Report. Smallmouth bass fish tissue data were taken from the July 2011 version of the Portland Harbor RI data base (RI_BERA20110727+RA-SummedParams.mdb). Whole body fish tissue (or combined fillet and body w/o fillet fractions) were lipid normalized on a sample by sample basis. Unlike the collocated clam tissue results, it does not appear that the non-detected results were eliminated from the data set prior to developing the BSARs. However, evaluation of the data with the non-detected results removed, did not improve the relationships. The results of the regression analysis are presented in Figure 2. With the exception of total PCBs, the results of the analysis confirmed the lack of a relationship between tissue and sediment. Values of r^2 for arsenic, mercury benzo(a)pyrene, bis(2-ethylhexyl)phthalate and hexachlorobenzene ranged between 0.0009 to 0.2564 depending on the transformation applied. For total PCBs, the r^2 values ranged between 0.44 and 0.50 with the untransformed data providing the best relationship. This confirms that a BSAR relationship could be developed for total PCBs.

Large Home Range Fish Tissue BSAFS:

BSAFs were calculated for large home range species. The tissue concentration was the average of available composite samples for each species, and the sediment concentration was the Study Area SWAC based on a natural neighbor interpolation. However, neither the average tissue concentrations nor the sediment SWAC results are presented in the Bioaccumulation Modeling Report.

As presented in Table 4-6, BSAFs for large home range fish species were developed for antimony, lead, benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, tributyltin and hexachlorobenzene. However, the only chemical for which large home range fish

tissue BSAFs were used to develop RAO 2 sediment PRGs is hexachlorobenzene. A summary of the BSAFs developed is presented in Table 4.

An evaluation of the detection frequency for hexachlorobenzene in large home range fish species indicates that there were infrequent detections of hexachlorobenzene in large home range fish tissue (Table 5). Similarly, although BSAFs were developed for brown bullhead and carp for benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene, there were no detections in 6 brown bullhead tissue samples and only 1 or 2 detections in carp samples. Although no model was developed for bis(2-ethylhexyl) phthalate, there was only one detection of this chemical in large home range fish species (brown bullhead).

Neither the Bioaccumulation Modeling Report nor the supplemental data provided by the LWG included organic carbon normalized SWACs for the chemicals of interest. As a result it is not possible to verify the BSAFs for large home range species presented in Table 4-6. However, there are limited detection of hexachlorobenzene in black crappie and brown bullhead and black crappie. The detection frequency of hexachlorobenzene in carp (9 out of 15 samples) is sufficient that this is only species for which hexachlorobenze BSAFs can reasonably be developed. The lack of detections of benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene in large home range fish species indicates that BSAFs should not be used to develop fish consumption based PRGs for these chemicals.

SUMMARY

The results of this analysis show that a BSAR with an r^2 value of greater than 0.3 can be developed for clam tissue and the four carcinogenic PAHs evaluated, and that the slope of the line of the log-log regression can be verified. Although calculation of the correction factor has not been confirmed, the application of the correction factor is consistent with the procedures presented in Helsel and Hirsh.

The analysis also confirms the lack of a tissue sediment relationship for smallmouth bass for all chemicals that were evaluated (arsenic, benzo(a)pyrene, bis(2-ethylhexyl) phthalate, hexachlorobenzene and mercury). However, the bioaccumulation report does not present the results of the regression analysis so it is not possible to verify the BSAR equations presented in Figure 2.

The analysis also shows that with the possible exception of hexachlorobenzene in carp, there are not sufficient detections of benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene in large home range fish species and hexachlorobenzene in black crappie and brown bullhead to warrant the use of BSAFs to develop PRGs for these chemicals and species. However, neither the Bioaccumulation Modeling Report or the supplemental data provided by the LWG included organic carbon normalized SWACs for the chemicals of interest for which BSAFs were developed (benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, and hexachlorobenzene).

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Further, the underlying assumption BSAR in the analyses – that the BSAF should change in a linear or ln-linear fashion across all sediment concentrations – may be incorrect for some analytes and ranges of sediment and tissue concentrations. A BSAF may be applicable even when r^2 is zero (BSAF doesn't change with sediment concentration). One might still use a BSAF in this case to help guide monitoring during and after remediation.

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TAB 2

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
1.8	East	285.27	285.27	285.22	283.78	282.50	282.50	281.82	283.78
1.9	East	186.86	183.32	182.29	179.84	176.96	176.96	175.82	179.84
2	East	109.20	96.92	94.10	91.09	87.40	87.40	85.85	91.09
2.1	East	70.52	53.34	48.21	43.79	39.56	39.56	37.86	43.79
2.2	East	68.53	46.11	40.46	35.65	30.23	30.23	27.86	35.65
2.3	East	68.30	47.58	42.36	38.13	31.09	31.09	28.41	38.13
2.4	East	72.13	53.50	48.88	45.39	37.72	37.72	34.39	45.39
2.5	East	100.32	90.32	83.48	69.85	51.04	51.04	39.92	69.85
2.6	East	260.05	230.35	127.55	89.82	58.76	58.76	42.40	89.82
2.7	East	291.09	265.35	155.32	106.32	67.62	67.62	49.07	118.83
2.8	East	330.61	302.02	178.48	123.59	83.63	83.63	63.97	137.65
2.9	East	366.76	335.38	199.80	139.56	98.14	98.14	77.89	154.99
3	East	378.99	342.93	193.30	140.72	111.59	111.59	100.92	158.45
3.1	East	147.28	147.28	144.53	129.07	117.79	117.79	114.39	147.28
3.2	East	123.17	123.17	122.85	122.85	122.69	122.69	122.47	122.85
3.3	East	136.32	136.32	133.30	133.30	132.93	132.93	128.12	133.30
3.4	East	127.61	127.61	124.55	124.55	124.09	124.09	118.04	124.55
3.5	East	103.45	103.45	100.97	100.52	91.46	91.46	80.28	100.52
3.6	East	172.84	97.27	84.23	78.46	61.95	61.95	50.44	78.46
3.7	East	179.17	100.32	86.96	79.70	61.10	61.10	45.42	79.70
3.8	East	178.68	93.22	80.33	70.51	47.73	47.73	31.63	70.51
3.9	East	195.24	106.54	91.25	69.90	40.86	40.86	19.42	69.90
4	East	248.27	129.99	109.63	81.01	46.48	46.48	19.35	81.01
4.1	East	728.16	726.84	721.31	477.94	159.25	159.25	56.39	477.94
4.2	East	1246.57	1245.78	1198.34	929.37	181.08	181.08	43.96	929.37
4.3	East	1782.86	1773.03	1345.04	975.23	235.15	235.15	60.41	975.23
4.4	East	3074.92	2823.89	1741.18	1095.22	257.00	257.00	65.42	1095.22
4.5	East	3710.28	3478.82	1862.81	1093.30	281.79	281.79	61.57	1093.30
4.6	East	4185.69	3902.69	1927.87	1114.36	293.82	293.82	61.92	1114.36
4.7	East	4957.91	4571.35	1919.87	905.11	337.01	337.01	91.48	905.11
4.8	East	4953.33	4494.46	1855.23	841.19	324.02	324.02	100.17	841.19
4.9	East	3027.23	3027.23	1047.80	489.04	353.49	353.49	151.99	489.04
5	East	327.32	327.32	327.32	327.32	326.85	326.85	258.05	327.32
5.1	East	396.32	396.32	396.32	396.32	396.32	396.32	261.20	396.32
5.2	East	472.15	472.15	472.15	472.15	472.15	472.15	253.14	472.15
5.3	East	487.34	487.34	487.34	487.34	470.21	470.21	257.25	470.21
5.4	East	648.39	648.39	648.39	648.39	473.76	473.76	201.41	473.76
5.5	East	791.48	791.48	791.48	705.73	425.67	425.67	146.70	425.67
5.6	East	756.13	754.13	754.13	662.10	327.38	327.38	96.74	327.38
5.7	East	753.01	751.51	751.51	682.34	400.16	400.16	101.62	400.16
5.8	East	783.51	782.16	782.16	719.82	444.98	444.98	122.94	475.43

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
5.9	East	708.01	706.78	706.78	646.17	462.45	462.45	210.21	511.54
6	East	619.79	618.74	618.64	607.09	486.73	486.73	267.41	542.06
6.1	East	767.76	767.76	716.22	622.10	489.94	489.94	294.15	744.48
6.2	East	746.34	746.34	685.98	575.15	425.84	425.84	315.52	742.84
6.3	East	622.76	622.76	565.35	461.89	343.59	343.59	285.64	619.62
6.4	East	514.43	513.47	457.38	362.84	266.85	266.85	215.13	512.61
6.5	East	411.54	401.88	341.10	255.14	177.55	177.55	134.57	400.61
6.6	East	175.43	159.12	140.00	130.70	105.92	105.92	78.44	157.40
6.7	East	85.51	70.14	56.22	55.99	53.65	53.65	45.73	68.53
6.8	East	63.97	49.64	37.28	37.07	34.93	34.93	30.21	48.14
6.9	East	58.10	44.76	34.06	33.86	31.91	31.91	28.18	44.38
7	East	63.19	44.64	35.46	35.27	33.73	33.73	31.64	56.05
7.1	East	83.64	60.65	42.47	42.46	41.88	41.88	40.58	83.25
7.2	East	95.25	72.49	50.52	50.52	47.62	47.62	45.94	93.68
7.3	East	97.98	74.98	52.76	52.76	49.83	49.83	48.32	96.40
7.4	East	98.34	73.13	48.63	48.63	45.35	45.35	44.13	96.57
7.5	East	88.78	74.07	50.80	50.80	46.58	46.58	44.95	86.51
7.6	East	60.06	58.83	50.07	50.07	45.79	45.79	42.16	57.54
7.7	East	47.33	47.33	47.33	47.33	47.29	47.29	42.92	47.33
7.8	East	53.59	51.37	51.37	50.95	50.59	50.59	32.93	50.95
7.9	East	60.86	41.71	41.71	41.29	40.91	40.91	22.79	41.29
8	East	64.55	32.80	32.80	32.44	31.19	31.19	15.85	32.44
8.1	East	61.58	30.57	30.57	30.22	29.04	29.04	17.10	30.22
8.2	East	58.26	27.88	27.88	27.54	26.38	26.38	15.42	27.54
8.3	East	50.11	13.97	13.97	13.97	12.84	12.84	12.45	13.97
8.4	East	45.83	24.04	24.04	24.04	22.74	22.74	22.30	24.04
8.5	East	34.24	34.24	34.24	34.24	34.24	34.24	34.20	34.24
8.6	East	36.89	36.89	36.89	36.89	36.79	36.79	36.69	36.89
8.7	East	38.29	38.29	38.29	38.29	38.00	38.00	37.70	38.29
8.8	East	38.44	38.44	38.44	38.44	37.77	37.77	33.74	38.44
8.9	East	36.13	36.13	36.13	36.13	33.72	33.72	26.51	36.13
9	East	34.04	34.04	34.04	34.04	31.13	31.13	22.15	34.04
9.1	East	28.84	28.84	28.84	28.84	26.01	26.01	17.38	28.84
9.2	East	23.29	23.29	23.29	23.29	20.75	20.75	12.61	23.29
9.3	East	22.38	22.38	22.38	22.38	19.02	19.02	13.09	22.38
9.4	East	25.39	25.39	25.39	25.39	17.81	17.81	12.92	25.39
9.5	East	24.85	24.85	24.85	24.85	17.40	17.40	11.87	24.85
9.6	East	27.04	27.04	27.04	27.04	19.92	19.92	14.41	27.04
9.7	East	33.15	33.15	33.15	33.15	26.13	26.13	20.71	33.15
9.8	East	50.35	50.25	50.16	48.52	39.91	39.91	28.13	48.52
9.9	East	157.81	157.70	157.60	149.77	67.36	67.36	38.05	154.95

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
10	East	218.90	218.78	218.67	210.07	118.10	118.10	78.51	215.75
10.1	East	303.54	303.39	303.26	292.62	178.88	178.88	121.87	299.65
10.2	East	378.63	378.44	378.28	364.85	221.32	221.32	148.55	373.72
10.3	East	435.76	435.76	435.76	422.58	247.08	247.08	171.42	433.75
10.4	East	216.49	216.49	216.49	216.49	206.99	206.99	167.83	216.49
10.5	East	127.54	127.54	127.54	125.13	113.66	113.66	92.83	125.13
10.6	East	58.37	58.37	58.37	49.33	35.81	35.81	29.97	49.33
10.7	East	55.75	55.75	55.75	46.54	27.37	27.37	17.73	46.54
10.8	East	66.50	66.50	66.50	57.49	29.84	29.84	13.99	57.49
10.9	East	71.11	70.31	69.04	58.82	34.29	34.29	15.51	58.82
11	East	74.55	71.13	65.00	54.79	33.29	33.29	12.65	54.79
11.1	East	86.31	71.05	60.46	52.10	31.40	31.40	10.07	52.10
11.2	East	88.58	59.17	46.90	37.41	22.56	22.56	7.26	37.41
11.3	East	72.01	42.92	30.43	20.47	13.20	13.20	5.28	20.47
11.4	East	63.35	34.72	23.18	13.76	7.00	7.00	1.38	13.76
11.5	East	59.21	29.21	20.91	12.40	6.58	6.58	1.78	12.40
11.6	East	47.93	23.63	18.33	12.13	6.79	6.79	1.90	12.13
11.7	East	26.65	23.05	20.74	16.24	10.33	10.33	2.89	16.24
1.8	West	62.11	62.11	62.11	62.11	62.11	62.11	62.11	62.11
1.9	West	62.46	62.46	62.46	62.46	62.46	62.46	62.46	62.46
2	West	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
2.1	West	86.86	86.86	86.86	86.86	86.86	86.86	86.86	86.86
2.2	West	109.69	109.69	109.69	109.69	109.69	109.69	109.69	109.69
2.3	West	160.70	160.70	160.70	160.70	160.70	160.70	160.70	160.70
2.4	West	216.19	216.19	216.19	216.19	216.19	216.19	215.28	216.19
2.5	West	256.95	256.95	256.95	256.95	256.95	256.95	246.87	256.95
2.6	West	320.09	320.09	320.09	320.09	320.09	320.09	285.84	320.09
2.7	West	427.95	427.95	427.95	427.95	427.95	427.95	321.95	427.95
2.8	West	513.27	513.27	513.27	513.27	513.27	513.27	352.94	513.27
2.9	West	526.51	526.51	526.51	526.51	526.51	526.51	371.27	526.51
3	West	586.96	586.96	586.96	586.96	586.96	586.96	394.01	586.96
3.1	West	647.53	647.53	647.53	647.53	647.53	647.53	407.71	647.53
3.2	West	617.29	617.29	617.29	617.29	617.29	617.29	404.33	617.29
3.3	West	546.32	546.32	546.32	546.32	545.47	545.47	365.34	546.32
3.4	West	516.01	516.01	516.01	516.01	515.01	515.01	319.22	516.01
3.5	West	431.10	431.10	431.10	431.10	429.87	429.87	282.44	431.10
3.6	West	320.54	320.54	320.54	320.54	318.90	318.90	251.50	320.54
3.7	West	373.99	373.99	373.99	352.46	258.36	258.36	194.92	352.46
3.8	West	426.48	426.48	426.48	400.88	287.29	287.29	192.64	400.88
3.9	West	503.13	503.13	503.13	472.48	330.22	330.22	212.62	472.48
4	West	644.46	644.46	644.46	605.28	390.05	390.05	176.66	605.28

Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
4.1	West	821.69	821.69	821.69	782.88	489.17	489.17	144.37	782.88
4.2	West	682.16	682.16	682.16	677.65	533.94	533.94	145.20	677.65
4.3	West	732.10	732.10	732.10	727.05	571.97	571.97	135.33	727.05
4.4	West	840.73	840.73	840.73	835.63	557.96	557.96	94.96	835.63
4.5	West	772.50	772.50	772.50	772.50	499.14	499.14	119.79	772.50
4.6	West	593.79	593.79	593.79	592.04	376.81	376.81	136.58	592.04
4.7	West	718.99	718.99	711.00	652.47	325.64	325.64	160.79	652.47
4.8	West	696.78	696.78	688.77	630.08	296.69	296.69	182.46	630.08
4.9	West	756.67	756.67	706.02	604.99	298.34	298.34	201.23	604.99
5	West	904.84	904.84	845.85	597.11	283.58	283.58	187.08	597.11
5.1	West	1352.60	1352.60	980.81	638.54	300.18	300.18	167.35	638.54
5.2	West	2277.41	1934.17	906.25	545.19	286.52	286.52	127.53	545.19
5.3	West	3143.22	2757.01	1149.48	648.54	279.96	279.96	65.85	648.54
5.4	West	3233.89	2819.33	1154.25	673.79	396.69	396.69	59.08	673.79
5.5	West	3059.56	2650.05	1008.27	707.00	475.85	475.85	75.97	707.00
5.6	West	2640.67	2264.25	1070.46	836.59	518.55	518.55	127.89	859.25
5.7	West	1869.14	1836.29	1266.85	917.04	504.08	504.08	171.97	1158.39
5.8	West	2391.43	1841.79	1354.01	1098.30	510.74	510.74	165.33	1354.01
5.9	West	6066.89	2386.42	1320.10	1019.74	404.12	404.12	140.70	1320.10
6	West	14260.55	2215.14	1193.81	906.11	328.49	328.49	116.58	1193.81
6.1	West	21991.86	2044.06	1034.16	760.87	249.80	249.80	81.87	1034.16
6.2	West	29236.75	1824.08	779.40	627.65	183.65	183.65	41.57	779.40
6.3	West	40104.32	1213.09	285.27	177.98	22.86	22.86	0.00	285.27
6.4	West	38796.86	294.52	214.70	165.60	46.48	46.48	10.64	47.78
6.5	West	25684.49	586.63	504.02	402.75	89.43	89.43	13.56	90.77
6.6	West	11444.97	950.62	843.35	662.72	130.46	130.46	15.80	131.76
6.7	West	2747.09	819.26	678.48	511.10	100.81	100.81	12.81	101.80
6.8	West	955.57	730.89	601.93	447.69	88.31	88.31	11.43	88.31
6.9	West	573.49	476.19	403.08	296.09	51.95	51.95	4.36	51.95
7	West	431.07	288.39	222.10	150.91	26.41	26.41	2.66	26.41
7.1	West	388.34	93.24	39.15	7.75	1.09	1.09	1.19	1.09
7.2	West	337.05	32.98	18.15	6.13	1.25	1.25	0.00	1.25
7.3	West	301.70	27.00	18.52	12.86	8.11	8.11	4.10	8.11
7.4	West	242.36	38.97	36.32	33.02	28.44	28.44	18.99	28.44
7.5	West	174.70	51.50	49.49	45.92	36.50	36.50	22.23	36.50
7.6	West	72.27	65.47	64.07	61.45	49.58	49.58	27.75	49.58
7.7	West	67.72	65.88	64.55	62.32	51.23	51.23	28.44	51.23
7.8	West	65.82	65.80	65.73	64.95	53.14	53.14	28.90	54.27
7.9	West	69.93	69.92	69.83	66.98	47.04	47.04	21.18	55.04
8	West	81.38	81.38	81.38	71.75	44.11	44.11	18.32	64.36
8.1	West	154.22	154.22	152.78	127.27	13.66	13.66	2.77	126.62

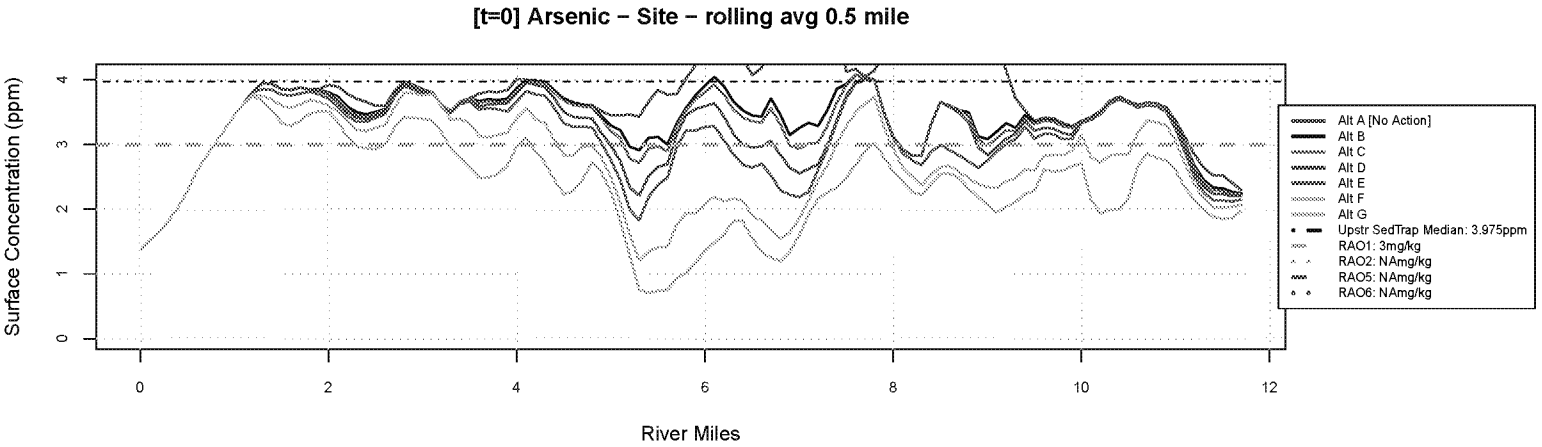
Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

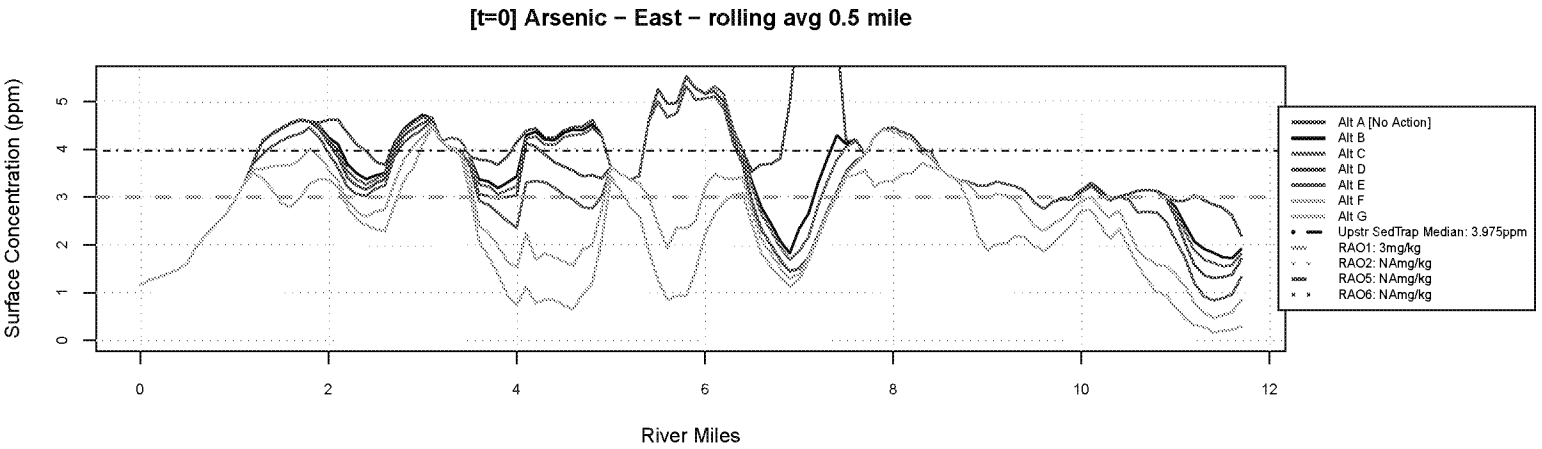
		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
8.2	West	182.11	182.11	180.96	158.76	37.60	37.60	8.66	158.76
8.3	West	166.50	165.99	165.12	142.72	43.08	43.08	20.70	142.72
8.4	West	164.84	163.87	163.05	131.35	39.75	39.75	19.52	131.35
8.5	West	157.94	156.98	156.07	122.94	38.06	38.06	19.12	122.94
8.6	West	127.83	119.42	110.27	78.72	40.20	40.20	20.23	78.72
8.7	West	126.22	90.14	77.50	40.06	21.28	21.28	17.73	40.06
8.8	West	157.77	85.13	59.05	15.14	2.29	2.29	0.58	15.14
8.9	West	199.49	73.54	34.76	5.52	0.00	0.00	0.00	5.52
9	West	244.30	88.99	22.98	3.73	0.00	0.00	0.00	3.73
9.1	West	177.20	61.01	24.76	13.06	4.58	4.58	2.95	13.06
9.2	West	117.12	60.71	33.93	24.75	10.68	10.68	6.83	24.75
9.3	West	88.48	58.85	42.66	34.62	11.69	11.69	7.59	34.62
9.4	West	102.36	77.62	61.19	36.99	12.35	12.35	8.13	36.99
9.5	West	148.22	125.81	81.07	34.07	10.73	10.73	7.05	34.07
9.6	West	173.60	145.67	90.06	34.97	10.55	10.55	7.00	34.97
9.7	West	212.97	176.37	103.49	31.20	7.10	7.10	5.20	31.20
9.8	West	277.97	226.84	125.00	23.84	8.75	8.75	7.45	23.84
9.9	West	300.06	277.99	132.37	28.88	19.25	19.25	12.56	28.88
10	West	122.87	122.87	121.18	110.42	90.67	90.67	38.14	112.11
10.1	West	156.51	156.51	155.27	144.59	87.73	87.73	31.04	145.83
10.2	West	282.49	282.49	281.38	272.30	222.85	222.85	121.80	273.41
10.3	West	354.58	354.58	353.49	344.85	297.10	297.10	199.55	345.93
10.4	West	352.57	352.57	351.48	342.73	295.04	295.04	208.29	343.81
10.5	West	186.72	186.72	186.72	185.45	167.31	167.31	106.71	185.45
10.6	West	146.85	146.85	146.85	146.85	146.85	146.85	100.48	146.85
10.7	West	92.15	92.15	92.15	92.15	92.15	92.15	70.90	92.15
10.8	West	70.85	70.85	70.85	70.85	70.85	70.85	52.63	70.85
10.9	West	66.88	66.88	66.88	66.88	66.88	66.88	50.18	66.88
11	West	65.35	65.35	65.35	65.35	65.35	65.35	65.33	65.35
11.1	West	77.48	77.48	77.48	77.48	77.48	77.48	77.48	77.48
11.2	West	91.43	91.43	91.43	91.43	91.43	91.43	90.27	91.43
11.3	West	89.88	89.88	89.88	89.88	89.88	89.88	88.54	89.88
11.4	West	79.16	79.16	79.16	79.16	79.16	79.16	77.95	79.16
11.5	West	84.56	84.56	84.56	84.56	84.56	84.56	83.18	84.56
11.6	West	77.70	77.70	77.70	77.70	77.70	77.70	75.99	77.70
11.7	West	49.64	49.64	49.64	49.64	49.64	49.64	49.64	49.64
7.8	Swan Isl	274.24	34.87	34.82	3.82	1.90	1.90	0.28	3.82
7.9	Swan Isl	180.11	14.06	13.93	7.22	1.90	1.90	0.72	7.22
8	Swan Isl	230.60	19.33	18.31	9.87	4.01	4.01	0.98	9.87
8.1	Swan Isl	270.08	21.30	19.69	11.76	5.88	5.88	1.26	11.76
8.2	Swan Isl	306.92	20.23	18.69	11.55	6.23	6.23	2.12	11.55

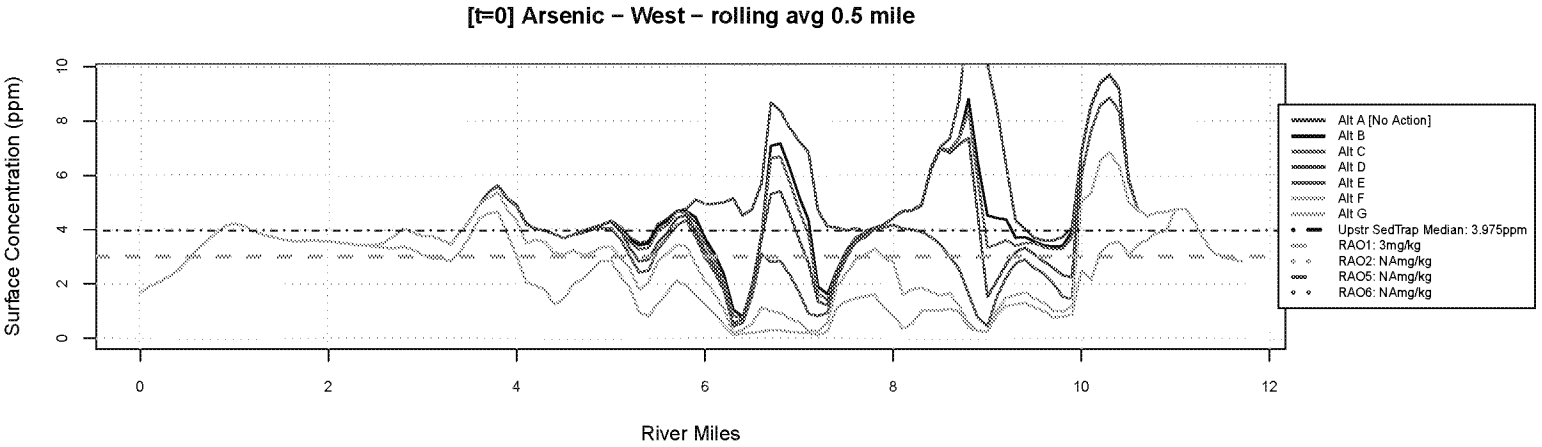
Table J2.2-1c
Rolling River Mile Average Concentrations - cPAHs (µg/kg) - 0.5 Mile Increments
Portland Harbor Superfund Site
Portland, Oregon

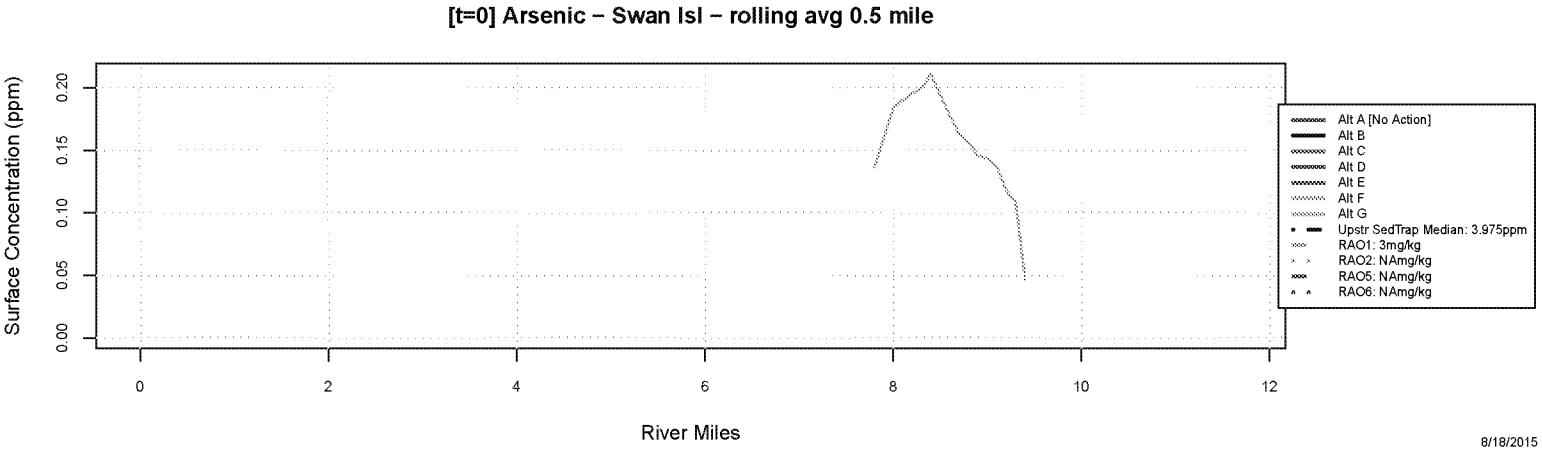
		Alternative							
River Mile	Segment	A	B	D	E	F Mod	F	G	I
8.3	Swan Isl	324.18	18.63	17.03	11.80	6.47	6.47	2.34	11.80
8.4	Swan Isl	385.51	21.35	19.09	13.03	8.70	8.70	3.54	13.03
8.5	Swan Isl	388.14	18.20	15.29	11.45	9.16	9.16	5.45	11.45
8.6	Swan Isl	359.27	21.05	10.30	7.14	6.12	6.12	5.51	7.14
8.7	Swan Isl	288.09	25.06	8.82	5.66	4.49	4.49	3.91	5.66
8.8	Swan Isl	258.99	26.91	8.34	5.28	3.96	3.96	3.54	5.28
8.9	Swan Isl	309.88	108.46	63.12	40.65	6.27	6.27	4.28	87.76
9	Swan Isl	339.31	131.60	76.02	49.89	7.15	7.15	4.69	109.02
9.1	Swan Isl	325.88	167.56	104.18	68.44	8.88	8.88	5.55	151.36
9.2	Swan Isl	379.46	258.88	169.67	111.36	13.46	13.46	8.08	249.40
9.3	Swan Isl	431.88	369.29	248.47	162.50	19.22	19.22	11.44	366.47
9.4	Swan Isl	63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59

TAB 3



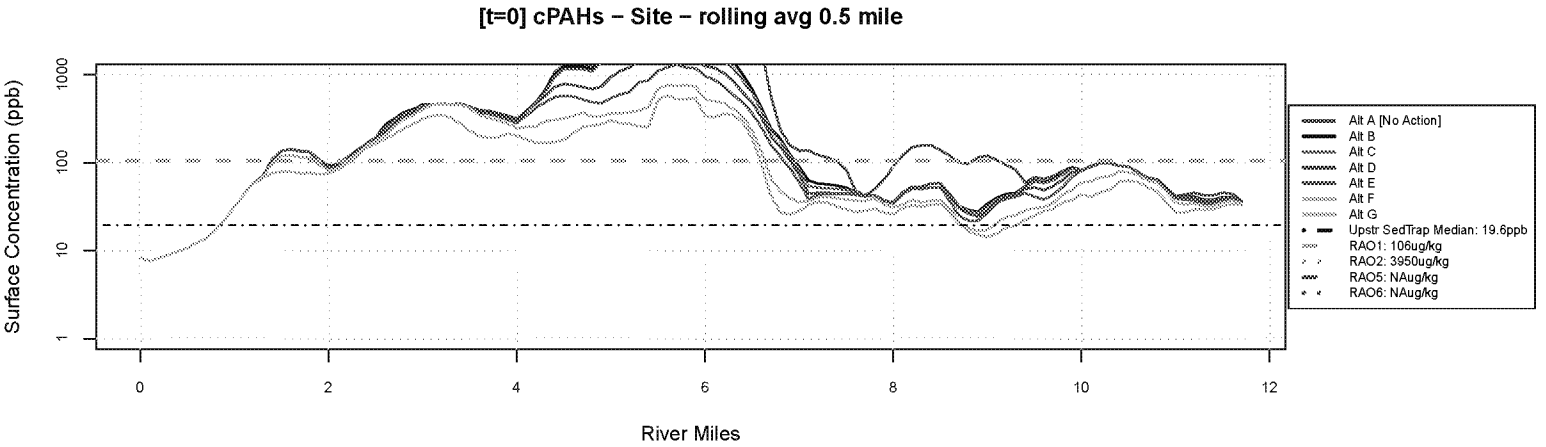


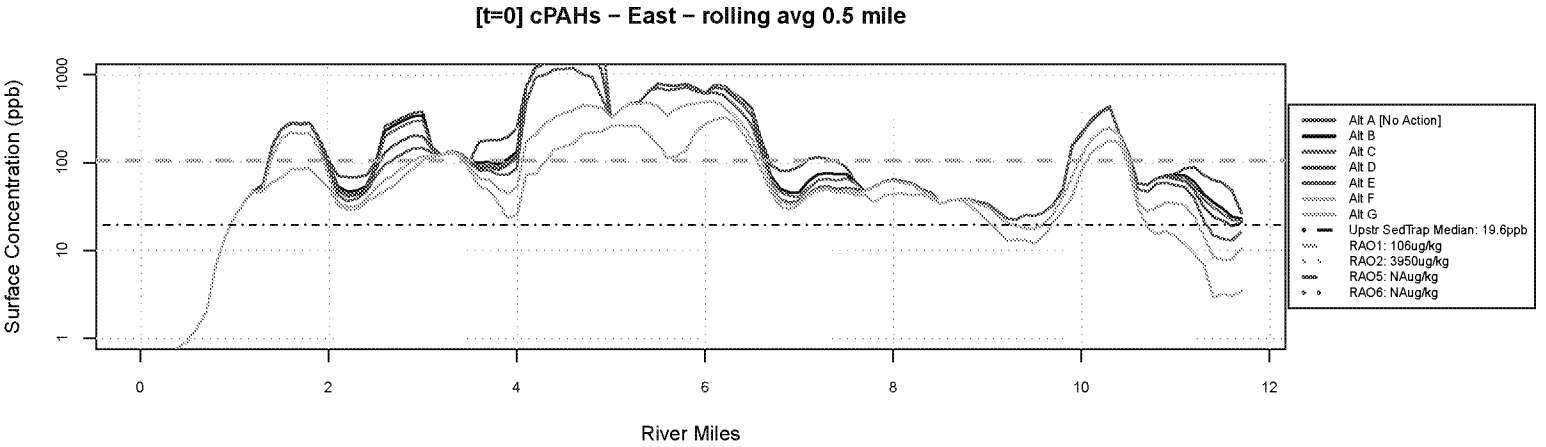


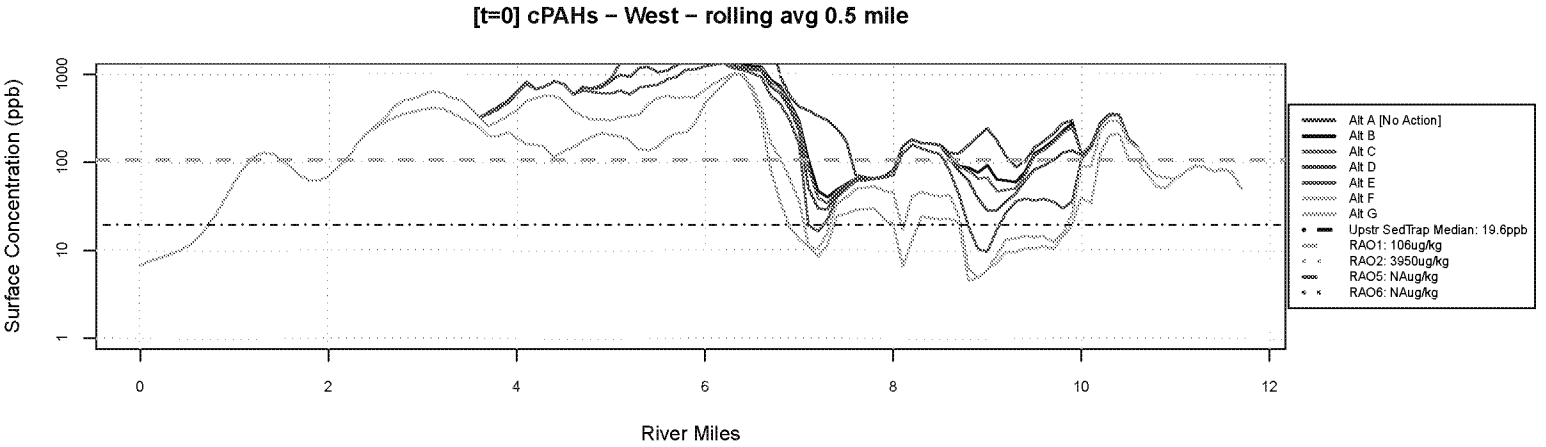


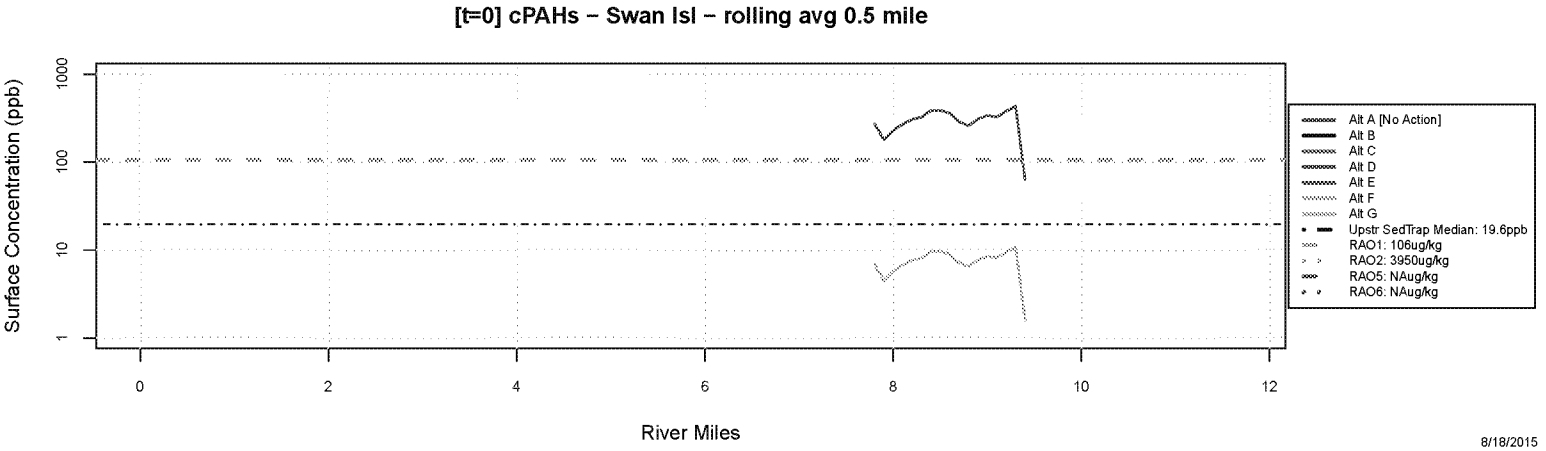
8/18/2015

Figure 4.2-7a. RAO 1 Rolling River Mile (Year 0)- Arsenic



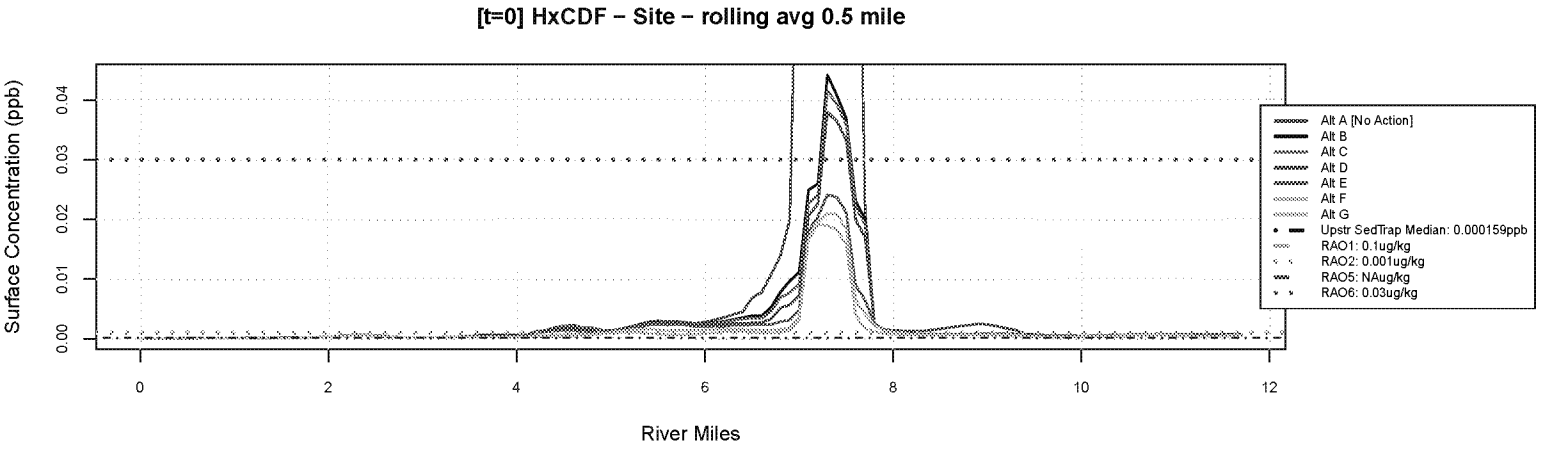


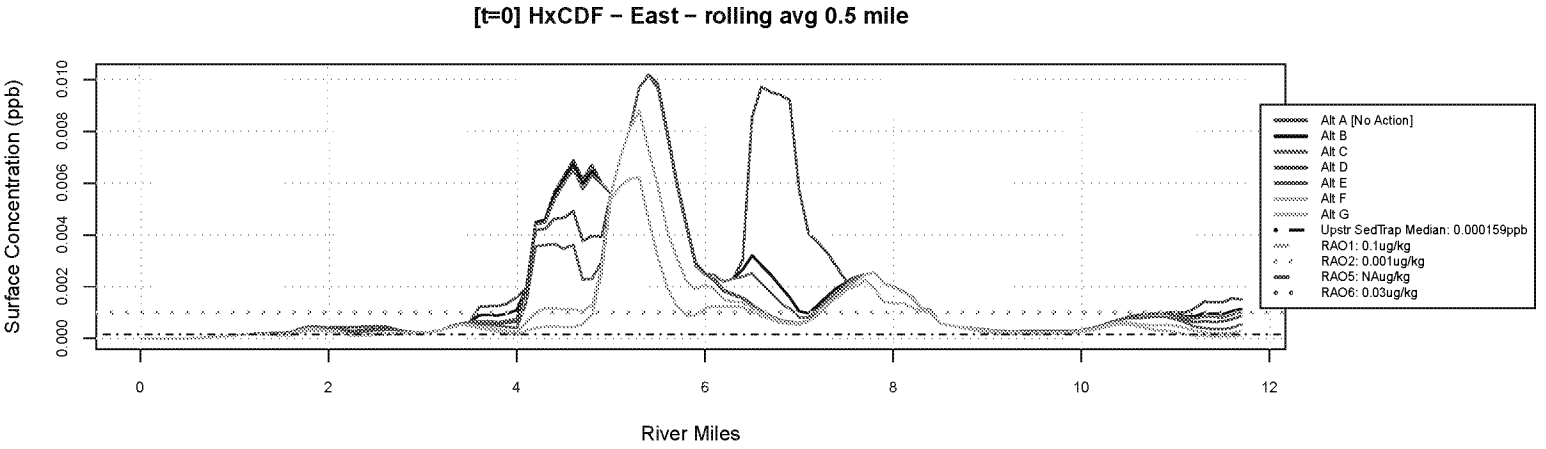


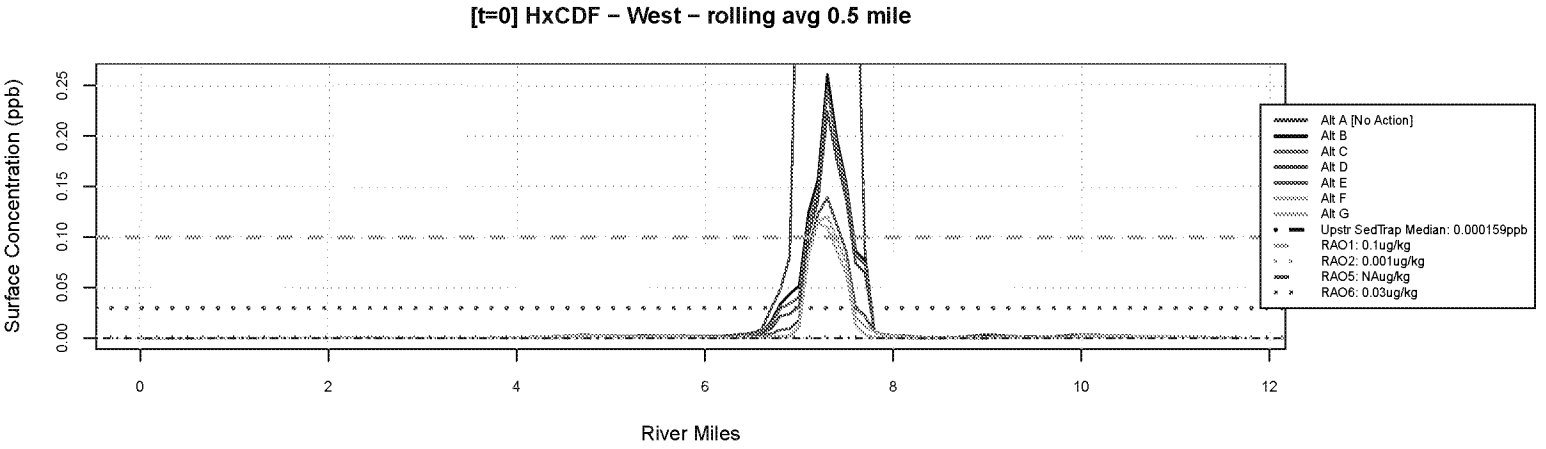


8/18/2015

Figure 4.2-7b. RAO 1 Rolling River Mile (Year 0)- cPAHs







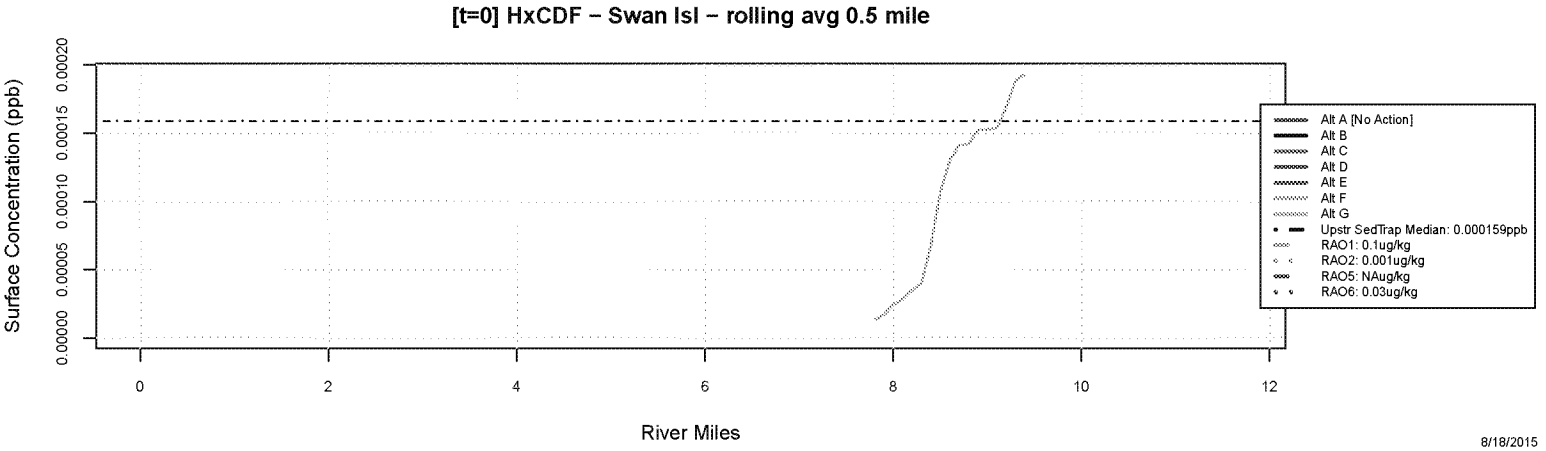
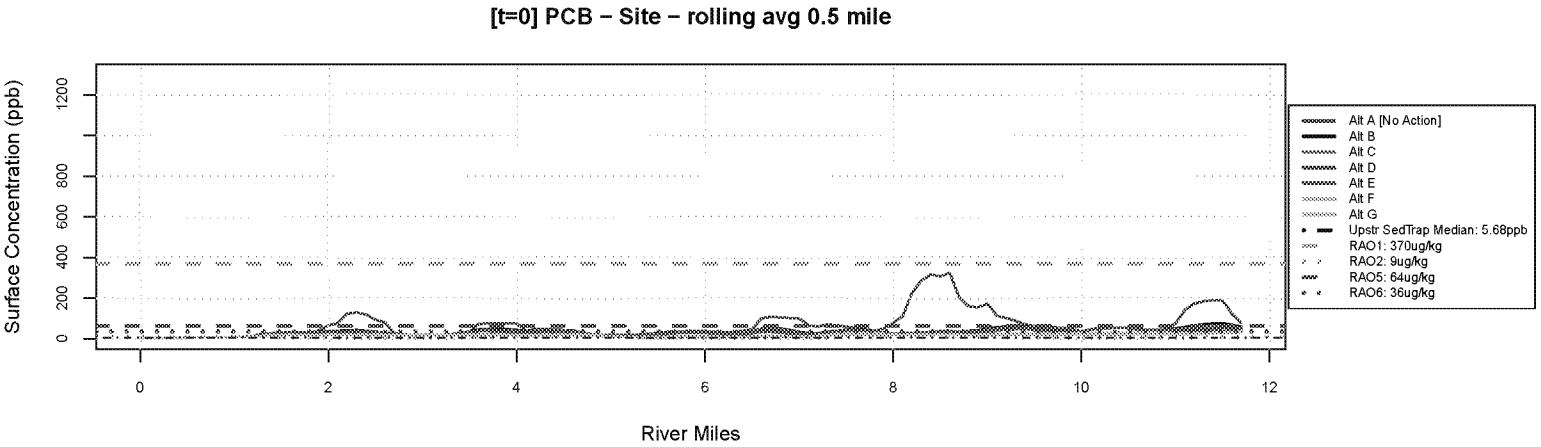
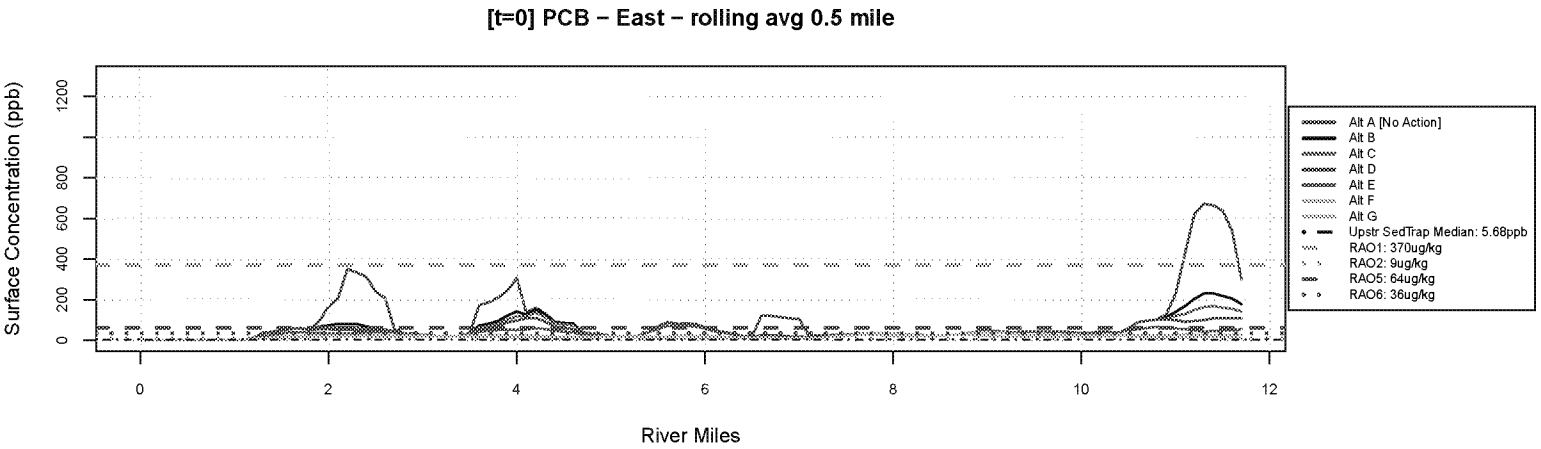
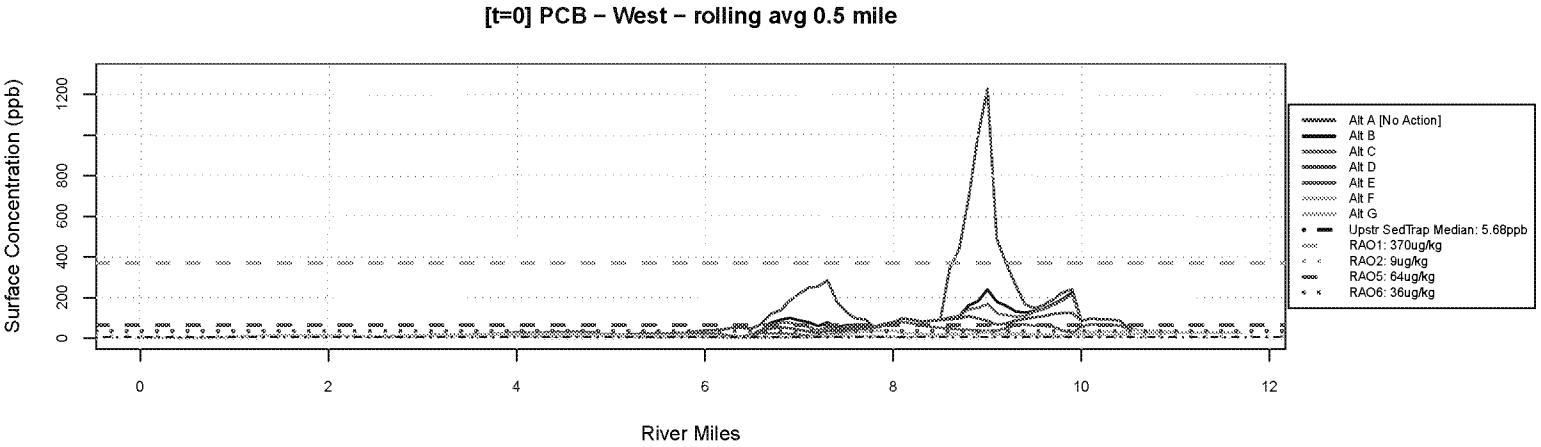


Figure 4.2-7c. RAO 1 Rolling River Mile (Year 0)- HxCDF







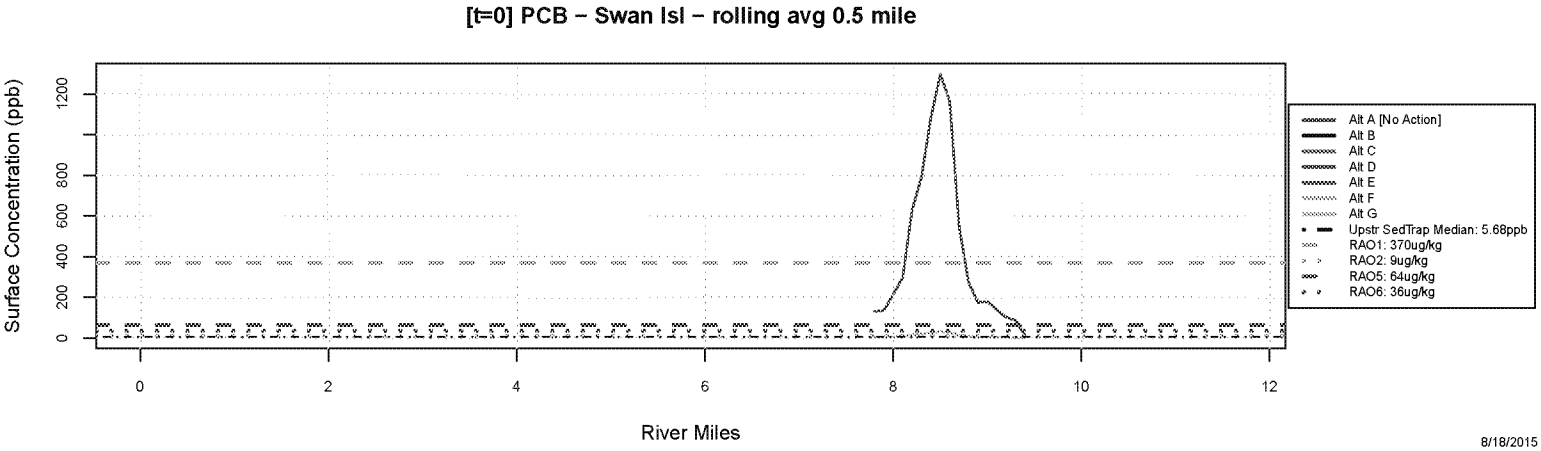
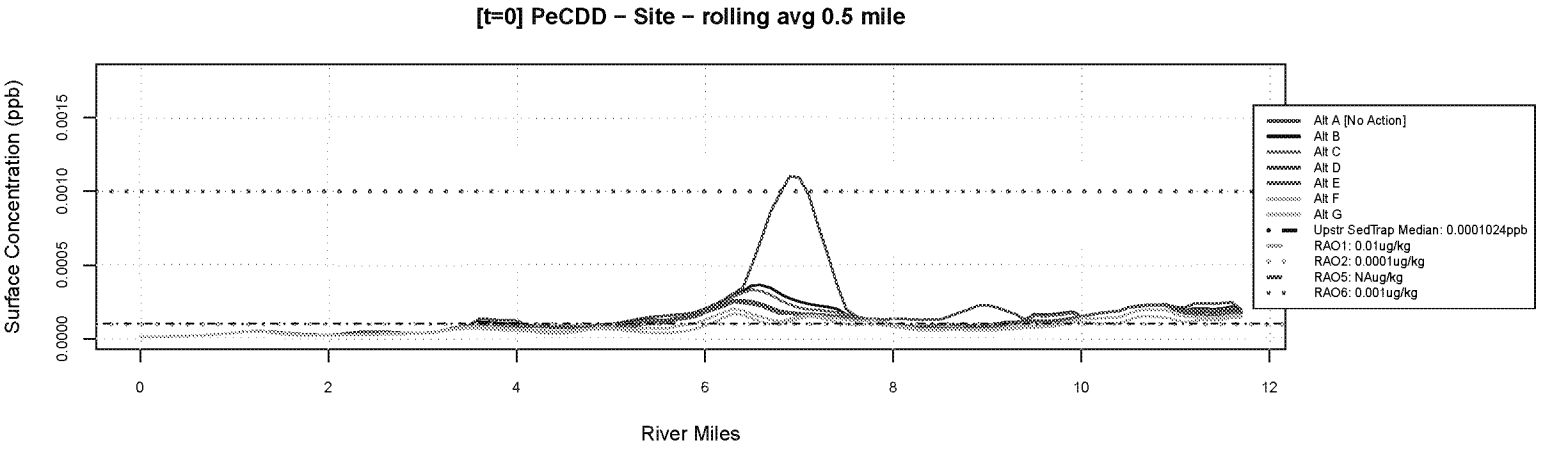
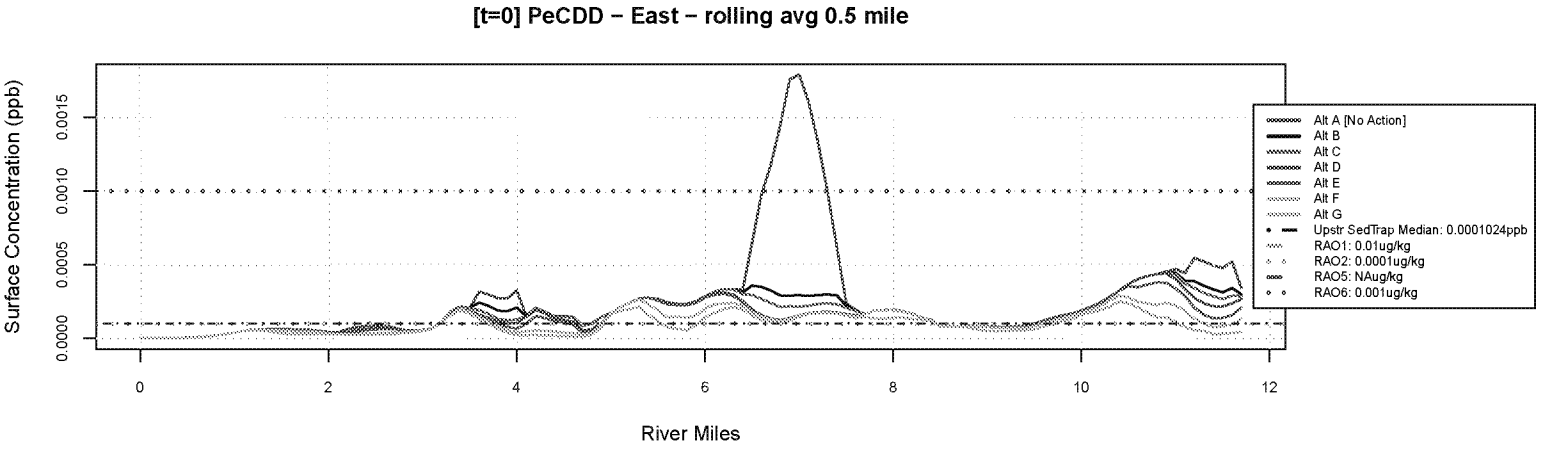
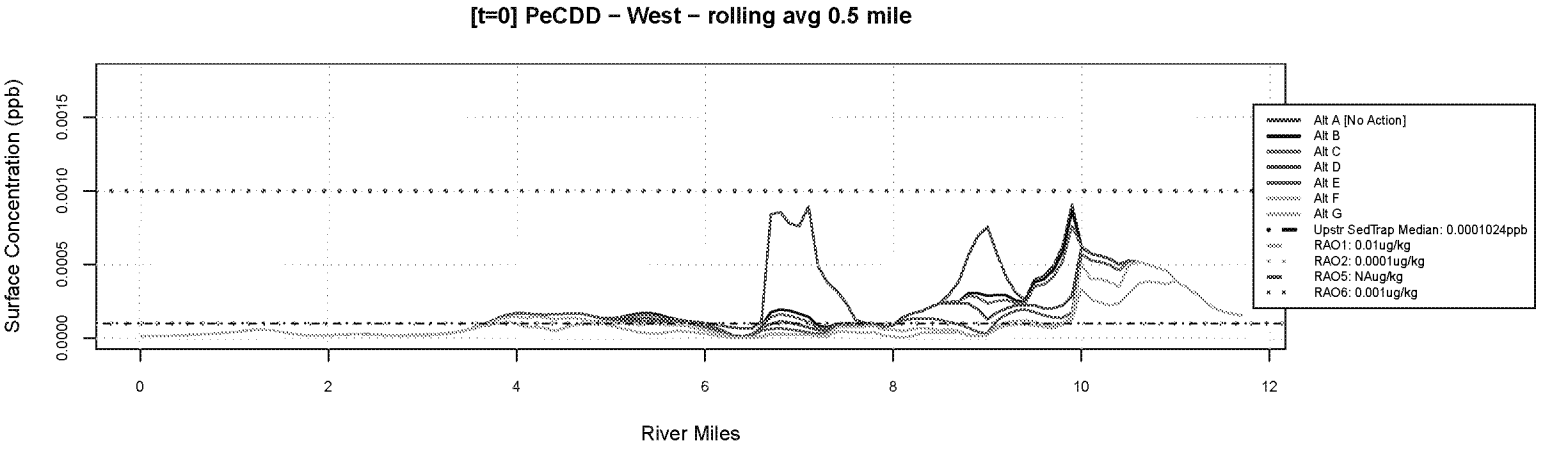


Figure 4.2-7d. RAO 1 Rolling River Mile (Year 0)- PCB







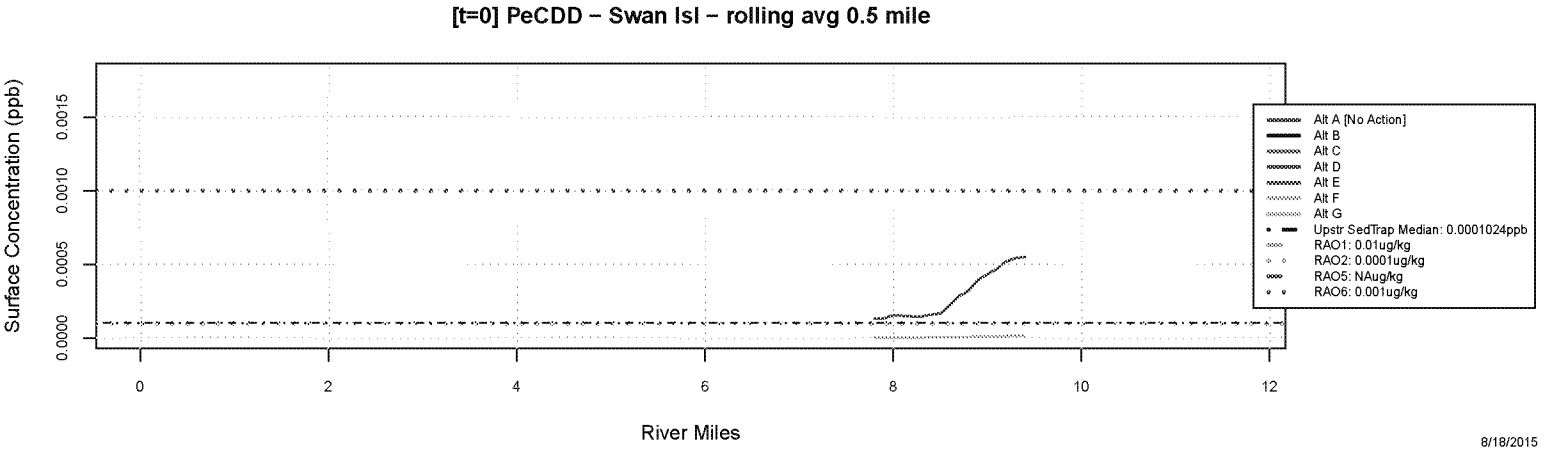
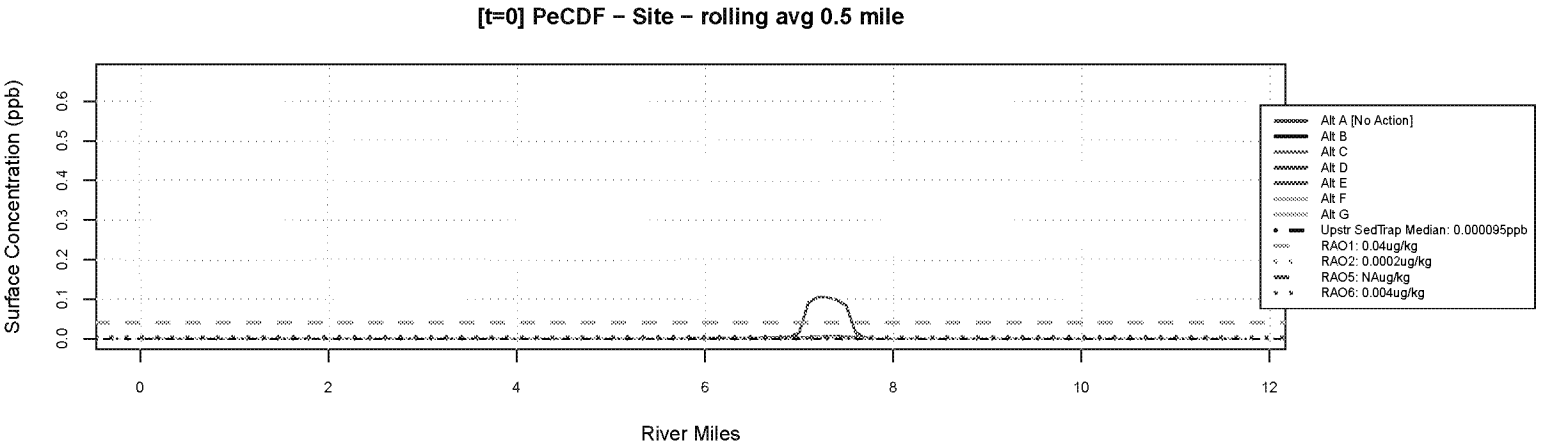
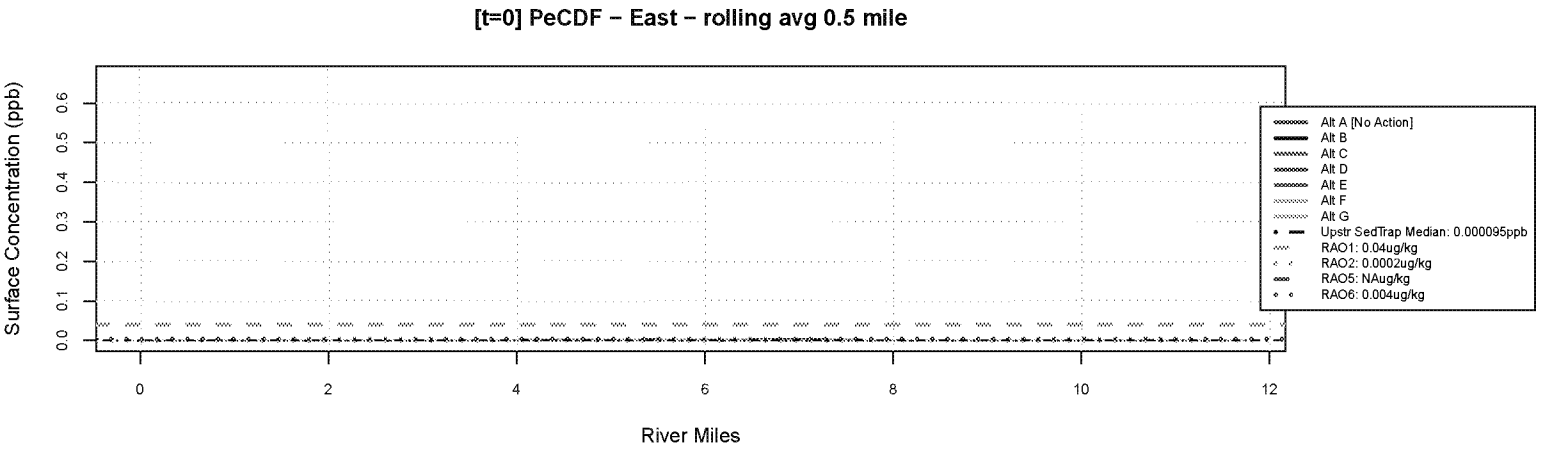
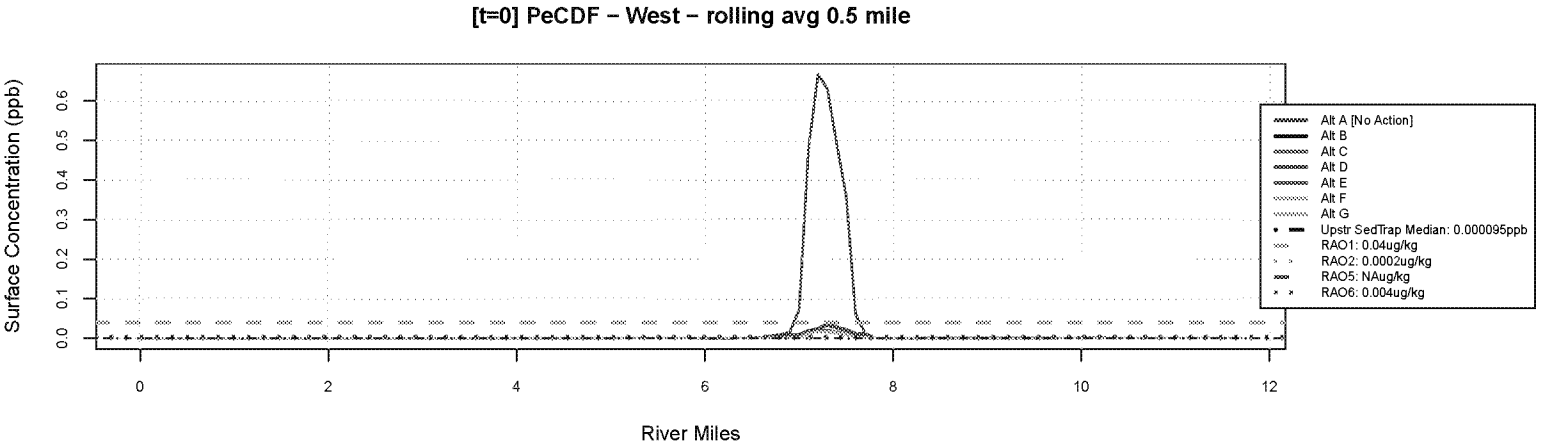


Figure 4.2-7e. RAO 1 Rolling River Mile (Year 0)- PeCDD







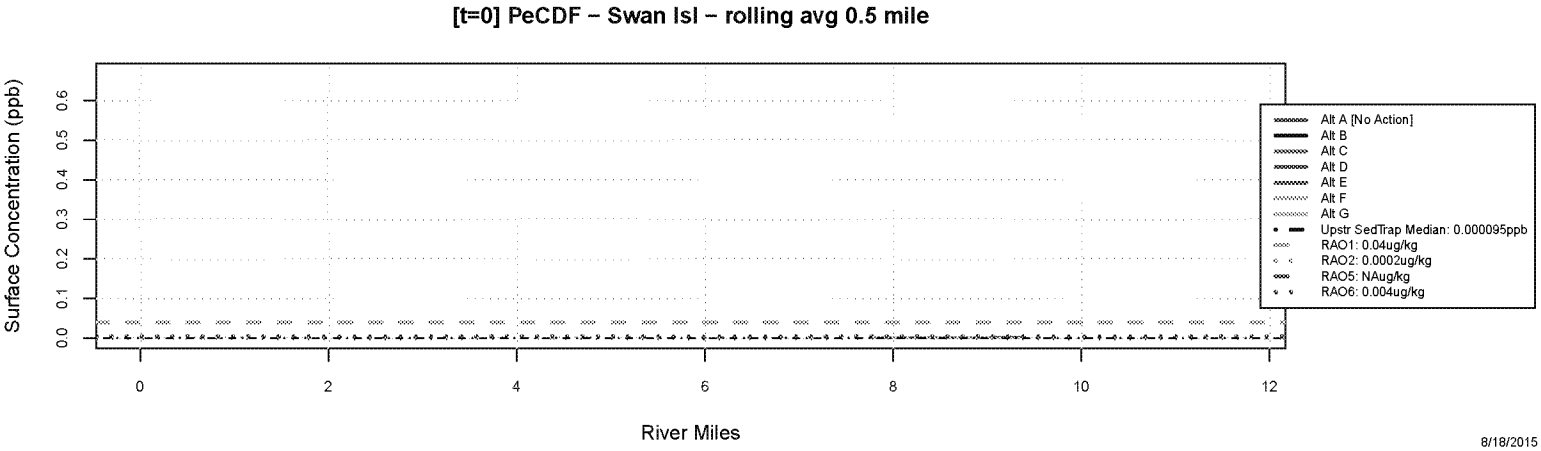
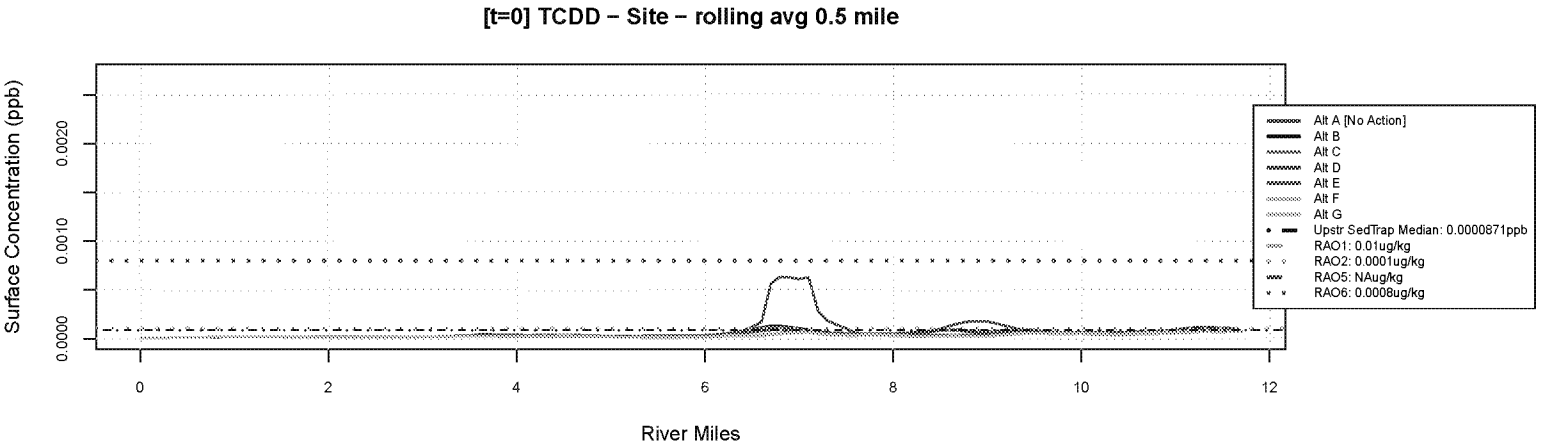
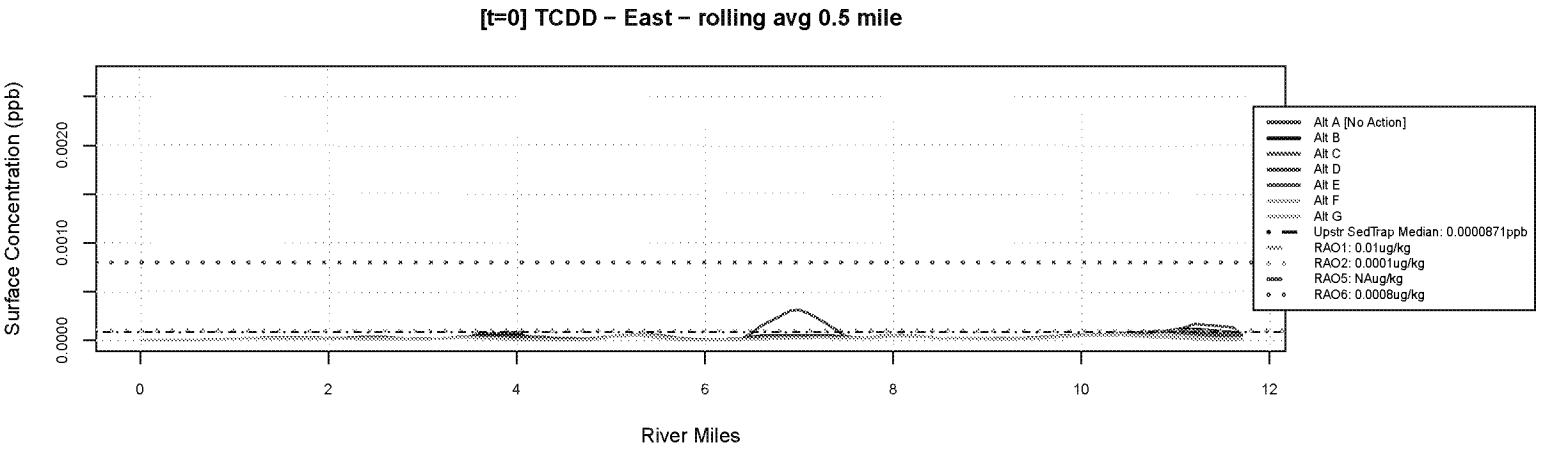
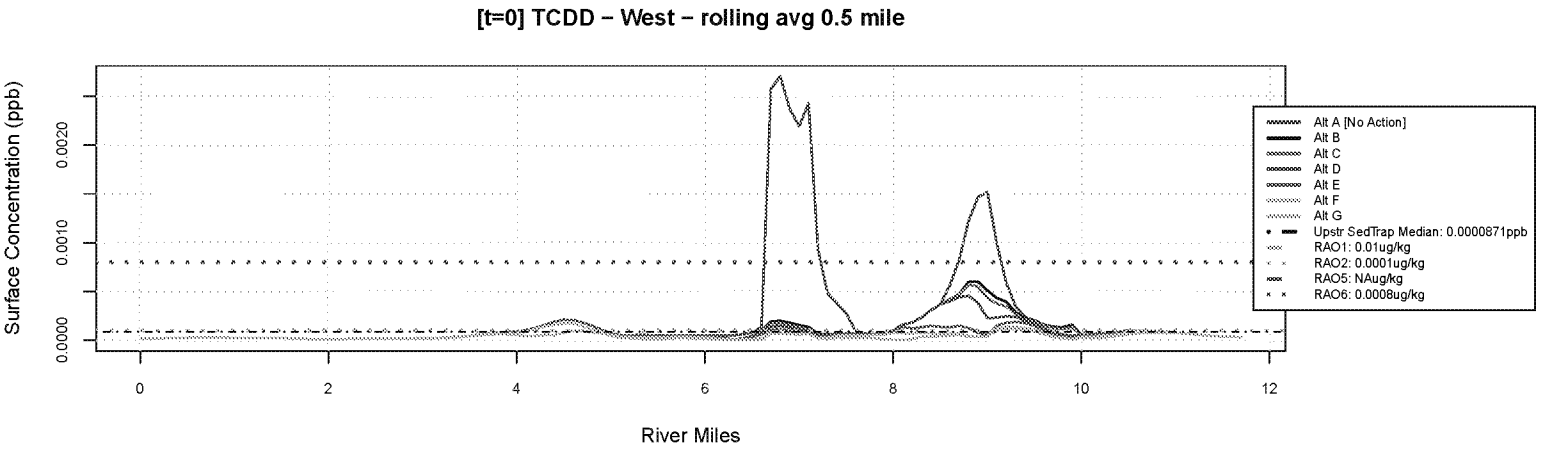


Figure 4.2-7f. RAO 1 Rolling River Mile (Year 0)- PeCDF







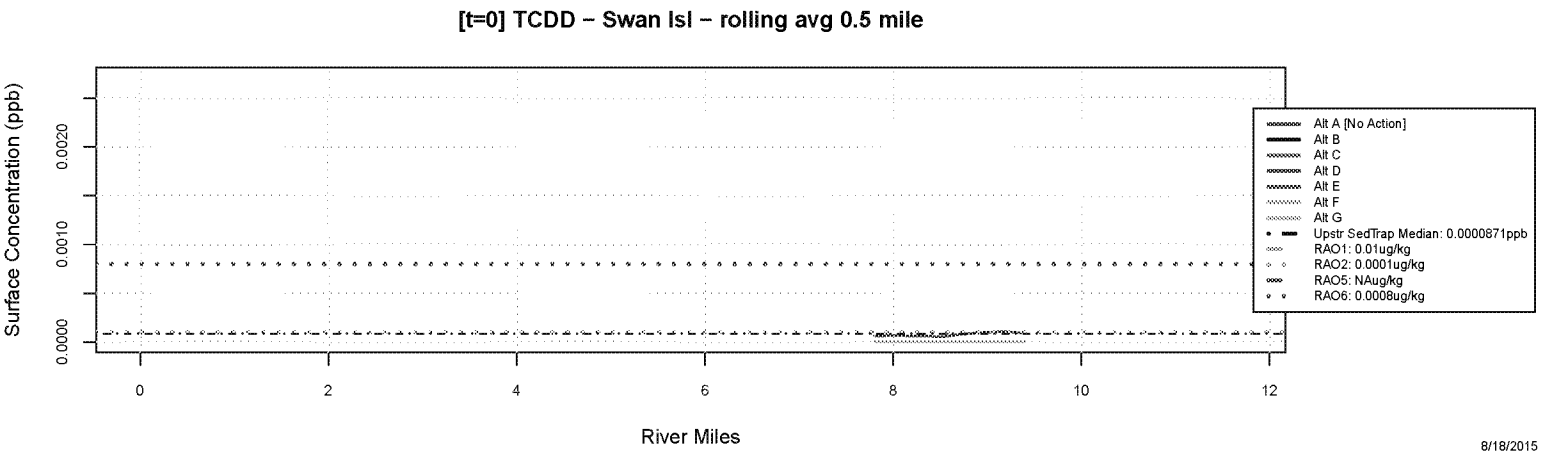
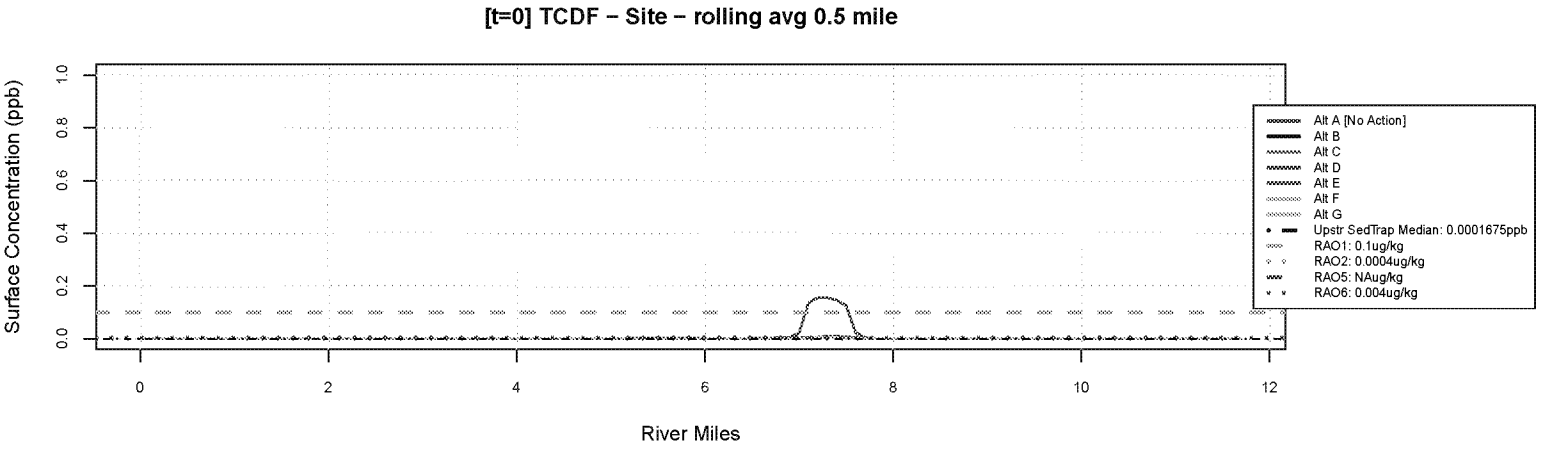
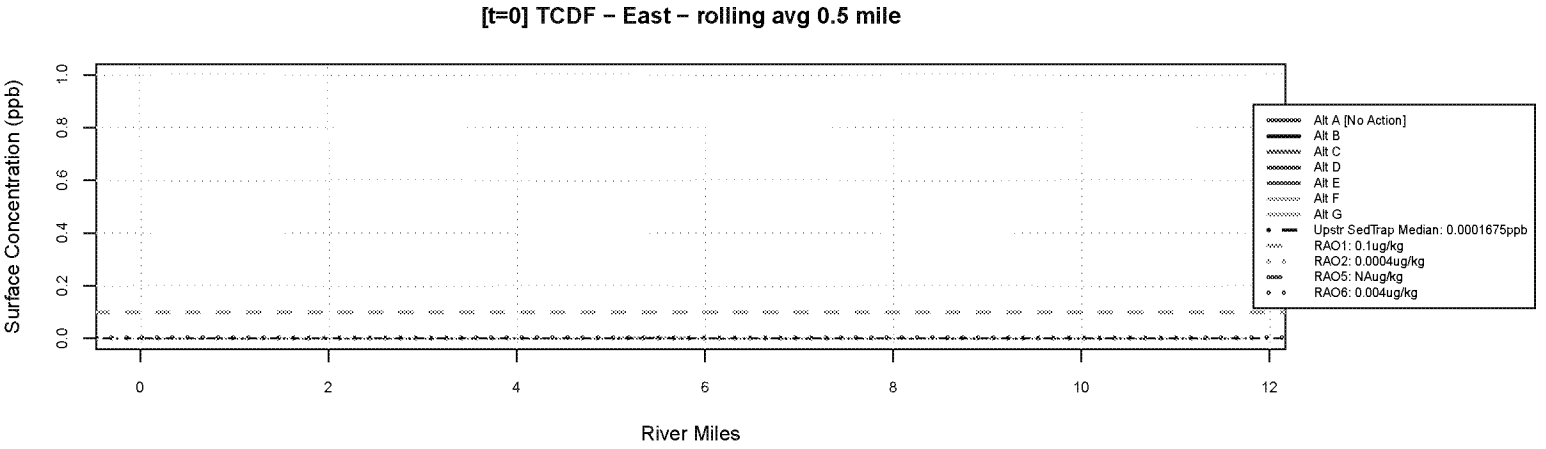
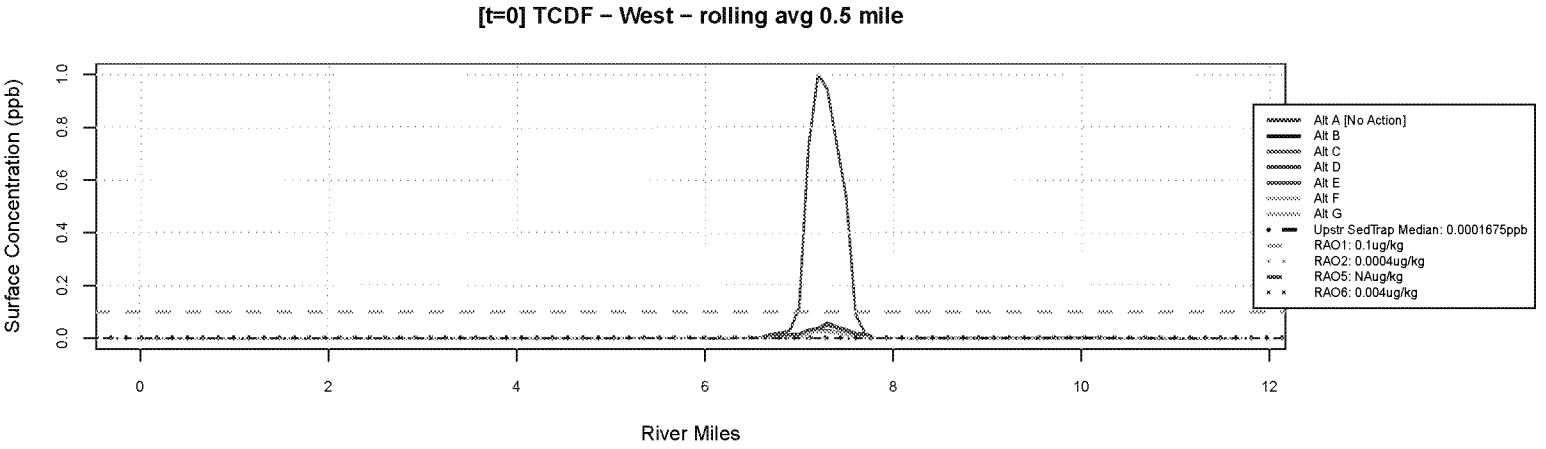


Figure 4.2-7g. RAO 1 Rolling River Mile (Year 0)- TCDD







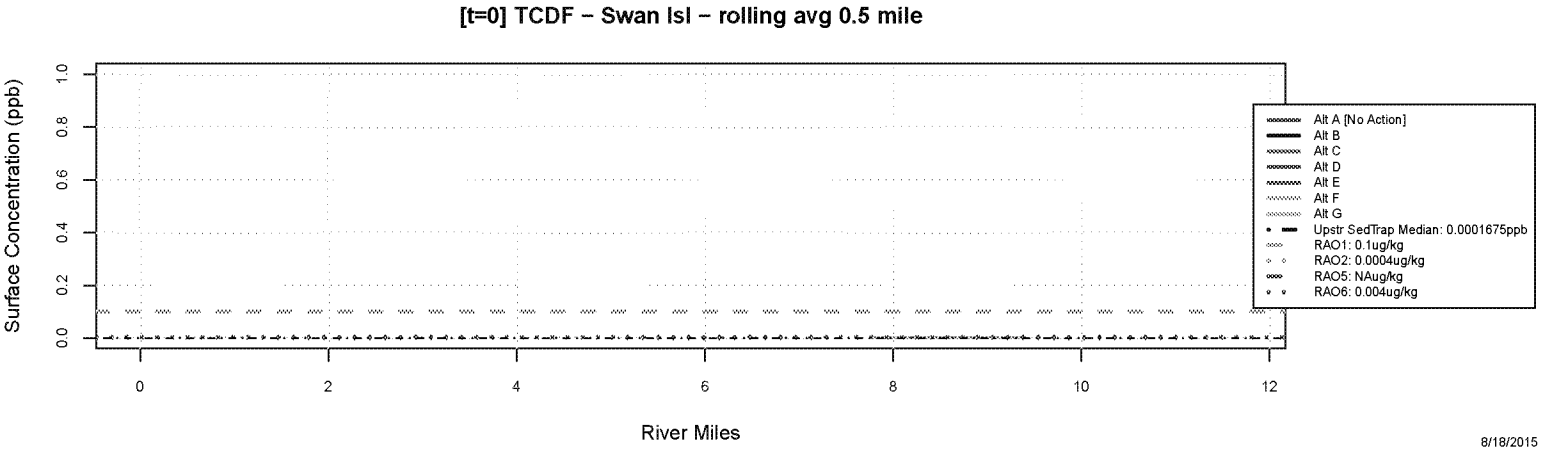


Figure 4.2-7h. RAO 1 Rolling River Mile (Year 0)- TCDF

TAB 4

LWG
LOWER WILLAMETTE GROUP

Chairperson: Bob Wyatt, NW Natural
Treasurer: Frederick Wolf, DBA, Legacy Site Services for Arkema

September 6, 2016

U.S. Environmental Protection Agency, Region 10
ATTN: Harbor Comments
U.S. Environmental Protection Agency
805 SW Broadway, Suite 500
Portland, OR 97205

Re: Lower Willamette Group Comments on Portland Harbor Proposed Plan (Lower Willamette River, Portland Harbor Superfund Site, EPA Docket No: CERCLA-10-2001-0240)

Dear EPA Region 10:

The Lower Willamette Group (LWG) appreciates the opportunity to comment on the U.S. Environmental Protection Agency's (EPA's) June 8, 2016, Proposed Plan and Feasibility Study (FS) for the Portland Harbor Superfund Site (Site).

Introduction

The LWG formed in 2001 as a group of business and government entities who stepped forward to work with EPA to study the risks posed by contamination at the Site and evaluate cleanup alternatives.[1] EPA's common practice at Superfund sites is for the Remedial Investigation (RI) and FS to be developed by potentially responsible parties (PRPs) under EPA oversight.[2] After years of data collection, analysis, and intensive engagement with EPA staff, the LWG presented EPA with a Draft FS in 2012. The LWG continues to stand behind the 2012 LWG Draft FS as a scientifically and legally supported approach to evaluating remediation alternatives for the Site. Over the years that followed, EPA took more active control of the RI/FS and, in the LWG's view, diverged further and further from a scientifically and legally supported approach to cleanup. The LWG expressed significant technical, legal, and policy concerns when EPA produced a Draft FS in 2015. Rather than engage meaningfully with those concerns, EPA formally took over the FS and produced a draft Final FS and Proposed Plan that are even further detached than EPA's 2015 Draft FS from acceptable science and responsible risk characterization and management. In-depth knowledge of the Site and of the technical and legal foundations of its own and EPA's work gives the LWG unique insight and leads the LWG to the conclusion that EPA's selection of Alternative I in the Proposed Plan is incorrect.

[1] Members of the LWG participating in these comments are Arkema Inc., Chevron U.S.A. Inc., Evraz Inc. NA, Gunderson LLC, NW Natural, Phillips 66 Company, Port of Portland, TOC Holdings Co., Union Pacific Railroad Company, Bayer CropScience Inc., BNSF Railway Company and Kinder Morgan.

[2] "The purpose of this memorandum is to reaffirm the EPA's commitment to having potentially responsible parties (PRPs) conduct the remedial investigation/feasibility study (RI/FS) at Superfund sites wherever appropriate." *Promoting Enforcement First for Remedial Investigation/Feasibility Studies at Superfund Sites* (EPA, March 20, 2012).

Executive Summary

The overarching objective of selecting a remedy under the National Contingency Plan (NCP) decision-making process is to identify the cleanup that will be effective and provide "sensible, reliable solutions for identified site problems."[3] Key factors in the decision-making process under the NCP include using a reasonable characterization of risks at the Site (including a consideration of uncertainties) and assessing how well the cleanup will protect people from unacceptable risks and how much it will cost, both in terms of adverse impacts on the community and dollars to be spent. In addition, an important consideration when selecting a remedy is how long it will take before reasonable cleanup goals are achieved.

At this Site, EPA's assessment of risks to human health is based on a series of unrealistic and unsupported assumptions regarding exposure and exposure durations and fails to consider how widely used preparation and cooking methods reduce contaminants in fish tissue. The result is cleanup goals that are not reasonably achievable, because they are based on worst case scenarios, not exposures that are reasonably expected to occur as required by the NCP.

Despite their conservative nature, EPA largely abandoned the Baseline Risk Assessments (BLRAs) in the 2016 draft Final FS by developing preliminary remediation goals (PRGs) inconsistent with the BLRAs, applying remedial action levels (RALs) in areas of the Site where relevant exposures do not occur or where the PRGs are already met, and evaluating the effectiveness of its cleanup alternatives at reducing risk using methodologies that are completely unrelated to the BLRAs. To take but one example of how divorced EPA's remedy selection is from the risk assessments, the EPA approved Baseline Ecological Risk Assessment (BERA) evaluated multiple lines of evidence and concluded that about 4 to 8% of the site presents benthic risk. In 2014 and 2015, EPA and the LWG mapped an approach for applying the BERA in the FS (the Comprehensive Benthic Risk Area [CBRA] approach) that identified approximately 61 acres for the evaluation of active remedies. In the 2016 draft Final FS, however, EPA completely abandoned the BERA and the corresponding EPA/LWG CBRA approach to conclude, without explanation, that benthic risk is present at 1,289 acres, or nearly 60% of the Site. And even with this massive expansion of asserted benthic risk, EPA's preferred remedial alternative fails to address 16% of the 61 acres of benthic risk area identified by the EPA/LWG CBRA approach.

In the face of overwhelming evidence to the contrary, EPA assumed that the complex and dynamic Willamette River is essentially unchanging over time and lacks diversity in its course, assigned prescriptive remediation technologies without accounting for site-specific details, and then incorrectly estimated the probable cost and duration required for implementation of those technologies. As a result, EPA's evaluation of the relative performance of its remedial alternatives is seriously flawed, and its attempt at considering the cost-effectiveness of the alternatives lacks any meaningful foundation.

For example, EPA's evaluation of the protectiveness and "long-term effectiveness" of cleanup alternatives and "cost-effectiveness" is not based on achievement of cleanup goals. Rather, because EPA rejected all methods that might have allowed it to quantify the expected rate of natural recovery of sediments, EPA employs an invented standard—"interim targets" for "risk reduction at construction completion"—to evaluate these criteria and exclude less expensive alternatives from the evaluation for reasons not based on data. EPA rationalizes using these interim targets by stating that protective alternatives would achieve ultimate cleanup goals within a reasonable timeframe (i.e., 30 years) through natural recovery. EPA *assumes* Alternatives E and I will achieve cleanup goals and Applicable or Relevant and Appropriate Requirements (ARARs) in 30 years and *assumes* Alternatives B and D will not. No information in the record supports EPA's assumptions. In the absence of credible information to support its assumptions, EPA has no basis for representing whether alternatives will or will not achieve cleanup goals within a certain time. This critical omission and reliance on assumptions in the long-term effectiveness and cost-effectiveness determinations is arbitrary and capricious. A less expensive alternative that is easier to implement (and therefore quicker to start and finish) may achieve cleanup goals in a comparable or even faster timeframe than a much more complex, disruptive, and expensive alternative.

[3] NCP Preamble, 55 Fed. Reg. 8666, 8700 (March 8, 1990).

The trend shown by the data is decreasing surface sediment and fish tissue concentrations. In 2013, the LWG presented an evaluation of smallmouth bass polychlorinated biphenyl (PCB) tissue measurements made in 2002, 2007, and 2012 that indicate statistically significant declines in tissue concentrations across almost all areas of the Site.[4] Further, 2014 site-wide sediment PCB data[5] show this downward trend in contaminant concentrations in surface sediments due to the effects of natural recovery at the Site. EPA's disregard of recent data in its evaluation of the effectiveness of alternatives undermines the validity of its conclusions.

In addition, EPA's evaluation of cost-effectiveness is superficial and based on inaccurate cost estimates. Cost-effectiveness is not a minor, dispensable factor in the NCP. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that EPA determine that the selected remedy be cost-effective.[6] EPA must compare the cost to effectiveness of each alternative individually and compare the cost and effectiveness of alternatives in relation to one another.[7] Effectiveness means evaluating long-term effectiveness; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness.

In analyzing an individual alternative, the decision-maker should compare, using best professional judgment, the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness in order to determine that the effectiveness afforded is proportional to the cost. EPA's inadequate analysis of this important criterion in the Proposed Plan is not sufficient.

Further, EPA substantially underestimated the cost for its Preferred Alternative (Alternative I). EPA estimated Alternative I as $1,173 million compared to LWG's estimate of $2,127 million (non-discounted capital costs and annual expenditures over a 30 year period). In addition to using overly optimistic estimates for dredging and capping production rates, EPA's estimate fails to include reasonable estimates for contingencies, oversight, project management, construction management, water quality control structures, mobilization/demobilization, design, and fees for capping on state lands, as well as several other important categories of cost. The LWG's experienced sediment remediation consultant reviewed EPA's cost estimate and believes the cost is underestimated by about $954 million (non-discounted capital costs and annual expenditures over a 30 year period). A more realistic estimate of the cost to perform EPA's Preferred Alternative is well above EPA's margin of error of +50/-30% accuracy for FS cost estimates, rendering the selection of Alternative I invalid.[8]

Portland Harbor was added to the National Priorities List (NPL) in 2000. Sixteen years later, EPA has identified a preferred cleanup alternative that will not be under construction for at least 5 to 7 years. In the opinion of experienced sediment remediation professionals who have reviewed the Proposed Plan, construction will take 14 years or more to complete, given the constraints on performing intrusive work in designated critical habitat for several endangered species of salmon and steelhead and the physical and logistical complexities presented by an active commercial harbor. Completion of the active phase of the cleanup appears to be decades in the future. This is not an acceptable outcome.

As explained in this letter, because EPA is overly conservative in describing the risks at the Site, has not prioritized which areas of the Site pose the highest risk and should be addressed first, has disregarded recent data, and has evaluated cleanup alternatives in a manner that is arbitrary and capricious, EPA's proposed cleanup will not provide meaningful protection within a reasonable timeframe. Unless EPA addresses the issues raised in these comments when it writes the Record of Decision (ROD), this project, after all of these years and well over $100 million spent to date, will not succeed.

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[4] Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis, a presentation file from Anchor QEA provided to EPA on March 18, 2013. A copy of this presentation file is Attachment 1.

[5] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015). (Attachment 2)

[6] 42 U.S.C. § 9621(b).

[7] NCP Preamble, 55 Fed. Reg. 8728.

[8] *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, page 2-10 (EPA October 1988).

EPA can and must do better. In its October 19, 2015, letter to the National Remedy Review Board (NRRB), the LWG provided several recommendations on implementing the cleanup, including focusing on the most significant and pervasive risks, reducing the uncertainty about natural recovery, and maximizing flexibility in remedial design and implementation of the cleanup. Our review of the Proposed Plan has not changed those general recommendations. The risks at the Site do not warrant a cleanup with a completion so far in the future.

Comments

In keeping with the LWG's in-depth and long-term engagement with risk assessment and remedial alternatives evaluation at the Site, the following comments are highly detailed, technical explanations of the key deficiencies in EPA's 2016 draft Final FS and Proposed Plan. The choices and decisions EPA makes in the Portland Harbor ROD must be based in reason and science, and EPA must articulate a rational connection between the facts found and the choices it has made.[9] EPA must consider all important aspects of the problem and explain decisions that run counter to evidence before it.[10] And EPA must not rush through the process, "throw darts," "flip a coin," or make a "sudden, knee-jerk decision."[11] As explained below, EPA's 2016 draft Final FS and Proposed Plan contain major technical errors and draw conclusions that are contrary to the facts and data before EPA and that are, without explanation, inconsistent with the NCP, EPA guidance and even EPA's own prior decisions about the Site.[12]

Our comments identify the incorrect assumptions, inaccurate information and flawed analyses supporting EPA's remedial alternatives evaluation and therefore EPA's Preferred Alternative (Alternative I). EPA's approach diverges from legal requirements for remedy selection, including the nine criteria set out in the NCP, and is inconsistent with EPA guidance and EPA practice at other similar sites. EPA did not consider adequately or ignored completely important information, and the conclusions drawn by EPA are unsupported by, or run counter to, the evidence before EPA. In short, the choices and decisions EPA has made in the Proposed Plan are not supported by reasoned, scientific explanation provided in the FS or elsewhere. As a result, it would be arbitrary and capricious for EPA to select the Preferred Alternative identified in the Proposed Plan as the remedy for Portland Harbor.

The LWG's comments are organized around six categories of deficiencies in EPA's approach:

- **Section I**: EPA departed from the previously approved BLRAs and selected Remedial Action Objectives (RAOs) and PRGs that are not risk-based, risk-managed, or achievable.
- **Section II**: EPA took an unprecedented, inappropriate approach to designating "principal threat waste" (PTW) at the Site, which adds significant costs but does not reduce risk.
- **Section III**: EPA oversimplified the complex, dynamic natural processes occurring within and outside of the Site (the conceptual site model), leading it to inappropriately discount relevant new scientific information and the impact of changes over time to remedy evaluation and selection.
- **Section IV**: EPA did not apply, or misapplied, quantitative analysis to the NCP-required remedy selection criteria of protectiveness, long-term effectiveness, short-term effectiveness, and cost.
- **Section V**: Accurate analysis shows that EPA's remedy is not cost-effective—i.e., it does not meaningfully reduce risks when compared to less time- and resource-intensive remedy alternatives—and that EPA has not conveyed to the public accurate information about risk or risk reduction at the Site.

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[9] *United States v. NCR Corp.*, 911 F. Supp. 2d 767, 773 (E.D. Wis. 2012) *aff'd sub nom.* United States v. P.H. Glatfelter Co., 768 F.3d 662 (7th Cir. 2014); *United States v. Newmont USA Ltd.*, 504 F. Supp. 2d 1077, 1082 (E.D. Wash. 2007).
[10] *Motor Vehicle Mfrs. Ass'n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43, 103 S. Ct. 2856, 2867 (1983).
[11] *United States v. NCR Corp.*, 911 F. Supp. 2d at 773.
[12] EPA has acknowledged that certain of its FS evaluations were "arbitrary" and that it needs to provide a rationale for its choices. Koch email to McKenna, June 17, 2014. A copy of this email is Attachment 3. As these comments discuss, in many cases, EPA has not met this standard.

- **Section VI:** EPA's remedy selection should include a plan for how cleanup will be implemented through baseline data collection and remedial design and implementation at operable units.

The LWG's comments also provide additional information for the Administrative Record. This information was exchanged between EPA and the LWG during preparation of the RI/FS, provided by the LWG to EPA in the course of the LWG's work on the RI/FS, or previously generated by EPA. The LWG previously recommended that most of these records be placed within the Administrative Record as appendices to relevant LWG deliverables; in most if not all cases, EPA required the LWG to remove the records from the deliverables. We are therefore incorporating these and similar records into our comments on the Proposed Plan for inclusion in the Administrative Record file pursuant to 40 CFR §300.815(b).

I. EPA's Proposed Remedy is Inconsistent with Approved Risk Assessments, is Not Focused on Actual Risk Reduction, and Lacks Any Meaningful Risk Management

In its August 2015 Draft FS, EPA determined that all of the remedial alternatives it evaluated, Alternatives B through G, were protective of human health and the environment and in compliance with ARARs. Yet, EPA indicated to the National Remedy Review Board (NRRB) and Contaminated Sediment Technical Advisory Group (CSTAG) that it favored an alternative that included a relatively high level of mass removal through dredging and upland disposal with an extremely high cost estimate of about $1.5 billion. The LWG commented to the NRRB and EPA that each component of the remedy should be aligned with addressing risks identified in the BLRAs included in the RI and that a remedy tailored to addressing sediment contamination that is actually causing risk would result in a remedy that is protective, effective, implementable, and cost-effective. The primary basis for the LWG's recommendation to ground the remedy in measurable and meaningful risk reduction was EPA's own guidance.

It appears that the LWG's comments caught EPA's attention by demonstrating that EPA was proposing a remedy that was far more expensive with no material increase in risk reduction. However, rather than selecting a remedy in its Proposed Plan more focused on achieving actual risk reduction in a timely and cost-effective manner, EPA without explanation recalculated baseline risk in a manner inconsistent with the EPA-approved BLRAs in order to artificially inflate risk reduction estimates for larger alternatives and claim that now the very same Alternatives B and D that were declared protective in the 2015 Draft FS are no longer protective of the environment.[13]

A. <u>EPA's Declaration that Alternatives B and D May Not Be Protective of the Environment is Arbitrary and Capricious</u>

EPA's Proposed Plan rejects Alternative B and D as not meeting the threshold criteria of protectiveness.[14] EPA has determined that an alternative is protective if it will achieve EPA's PRGs within 30 years.[15] However, because EPA decided that "a long-term model is not available to predict the time to meet the PRGs," EPA assessed protectiveness by "evaluating achievement of interim targets at the end of construction, as well as any additional benefit provided by [institutional controls]."[16] EPA then concludes, "Alternatives B and D may not be protective of the environment because of the timeframe needed to achieve PRGs through MNR and ICs would not provide protection [*sic*] ecological receptors during this time period."[17] As we understand it, EPA reaches this conclusion (which is inconsistent with its conclusion in the 2015 Draft FS that Alternatives B and D *are* protective), based upon its determination in the FS that "post-construction risks are greater than the interim targets thus MNR is unlikely to achieve PRGs within a reasonable time frame due to the uncertainty regarding the effectiveness of MNR with such high remaining contaminant concentration."[18]

EPA's evaluation of interim targets does not address the guidance recommendation that the long-term outcome of remedial alternatives should be assessed quantitatively.[19] EPA's selection of interim targets, generally at 10 times

[13] See, e.g. Proposed Plan, p. 50-51.
[14] Proposed Plan, Table 15.
[15] EPA draft Final FS p. 4-6 ("[A] reasonable time frame... was considered to be 30 years").
[16] EPA draft Final FS p. 4-6.
[17] Proposed Plan, p. 50-51.
[18] EPA draft Final FS p. 4-18. See also EPA draft Final FS p. 4-43.
[19] *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005) (hereafter, the "Sediment Guidance," p. 2-23 and 2-25; *Contaminated Sediments Remediation Guidance* (Interstate Technology and Research Council, 2014) (hereafter, "ITRC") ITRC), p. 61.

the PRGs, is arbitrary and unexplained. In the absence of a quantitative long-term assessment, EPA has no way to determine whether 10 times the PRGs are more likely to be met in 30 years as compared to any other multiplier of the PRG, or any other benchmark based upon, for example, physical properties of the river or chemical properties of a specific contaminant. Despite this arbitrary framework, EPA concludes that only Alternatives B and D "may not be protective of the environment because of the time frame needed to achieve PRGs through MNR." EPA does not explain when it expects Alternatives E and I to achieve the PRGs relative to either Alternatives B and D or its 30 year reasonable timeframe. Nothing in the 2016 draft Final FS or Proposed Plan explains why EPA considers some of the alternatives that meet some ecological risk interim targets protective and others not protective.

EPA acknowledges that concerns about potential risks to human health related to the inability of all of the alternatives to achieve interim targets immediately post-construction can be effectively managed by institutional controls while monitored natural recovery works to attain remedial goals.[20] Ecological exposures, however, cannot be managed through institutional controls. The Proposed Plan concludes that Alternative B does not achieve the RAO 5 (ecological direct toxicity) interim target[21] and that Alternatives, B, D, E, and I may not meet the RAO 6 (ecological bioaccumulation RAO) interim target.[22] The Proposed Plan does not claim that those goals will not be met by the 30-year reasonable timeframe. The actual results of EPA's own analyses indicate that all of these alternatives are in fact protective.

With respect to RAO 5, EPA's 2016 draft Final FS and Proposed Plan approach to benthic risk is entirely inconsistent with the multiple lines of evidence approach used to identify benthic risk areas in the approved BERA and should not be used to conclude that Alternative B is not protective of ecological receptors. Although the BERA concludes (as EPA notes in the Proposed Plan) that "[u]nacceptable risks to benthic invertebrates are located in approximately 4-8 percent of the Site,"[23] the draft Final FS presents benthic risk areas that cover 1,289 acres (or about 59% of the Site).[24]

EPA's large benthic risk areas mapped in the 2016 draft Final FS and Proposed Plan extend into areas shown to lack toxicity based on laboratory toxicity tests and other BERA lines of evidence. EPA and the LWG agree that empirical toxicity testing is one of the most important and direct measures of benthic toxicity available. Figure 1 shows the locations of failing and passing bioassay tests in relationship to "benthic risk" areas mapped on Figure 4.1-1 in the 2016 draft Final FS. EPA identifies broad areas of benthic risk (yellow) in locations that passed bioassay tests (blue dots). Thus, the benthic toxicity that EPA's Proposed Plan assumes exists in these areas in fact does not exist.

EPA determined these broad benthic risk areas by mapping any exceedance of individual benthic PRGs, which are derived from various toxicity models, and by ignoring empirical toxicity data from Portland Harbor. Without explanation, EPA's current approach is exactly the opposite of its own prior instructions to the LWG: "EPA and the LWG recognize that the sediment quality guidelines produced by any model (LRM, FPM or generic SQGs such as PECs or PELs) are intended to be used as a set – not individually."[25] EPA further compounds this error by making numerous errors (or at least unexplained decisions that differ from the EPA-approved BERA) regarding its compilation of the individual benthic PRGs for RAO 5 involving at least PCBs, DDx, and DDT.[26] The overall result of this haphazard approach is that EPA's alternatives require large amounts of active remediation on the basis of RAO 5 while failing to even address all of the EPA/LWG CBRAs previously agreed to as shown in Table 1.

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[20] See Proposed Plan p. 50 (All alternatives other than the no action alternative "in conjunction with MNR and institutional controls, are expected to be protective of human health.").
[21] "Alternative B is the only alternative that does not achieve the interim target of addressing 50 percent of the benthic risk area; all other alternatives achieve the interim target."
[22] "Alternatives B, D, E and I do not achieve the ecological HQ interim target of 10."
[23] BERA, p. 774, Proposed Plan, p. 20.
[24] See, e.g., Table 4.2-7. Pages 11-12 of the Proposed Plan describe the site as 2167 acres.
[25] "Resolution of EPA September 27, 2010 Comments on Benthic Risk Evaluation" in EPA-approved BERA Attachment 1.
[26] See, Windward Environmental's Technical Memorandum *Review of EPA's FS relative to the LWG/EPA agreed comprehensive benthic approach (September 6, 2016)*, Attachment 4.

Figure 1. Comparison of EPA Mapped Areas Above RAO 5 PRGs and Pooled Bioassay Results from the BERA.

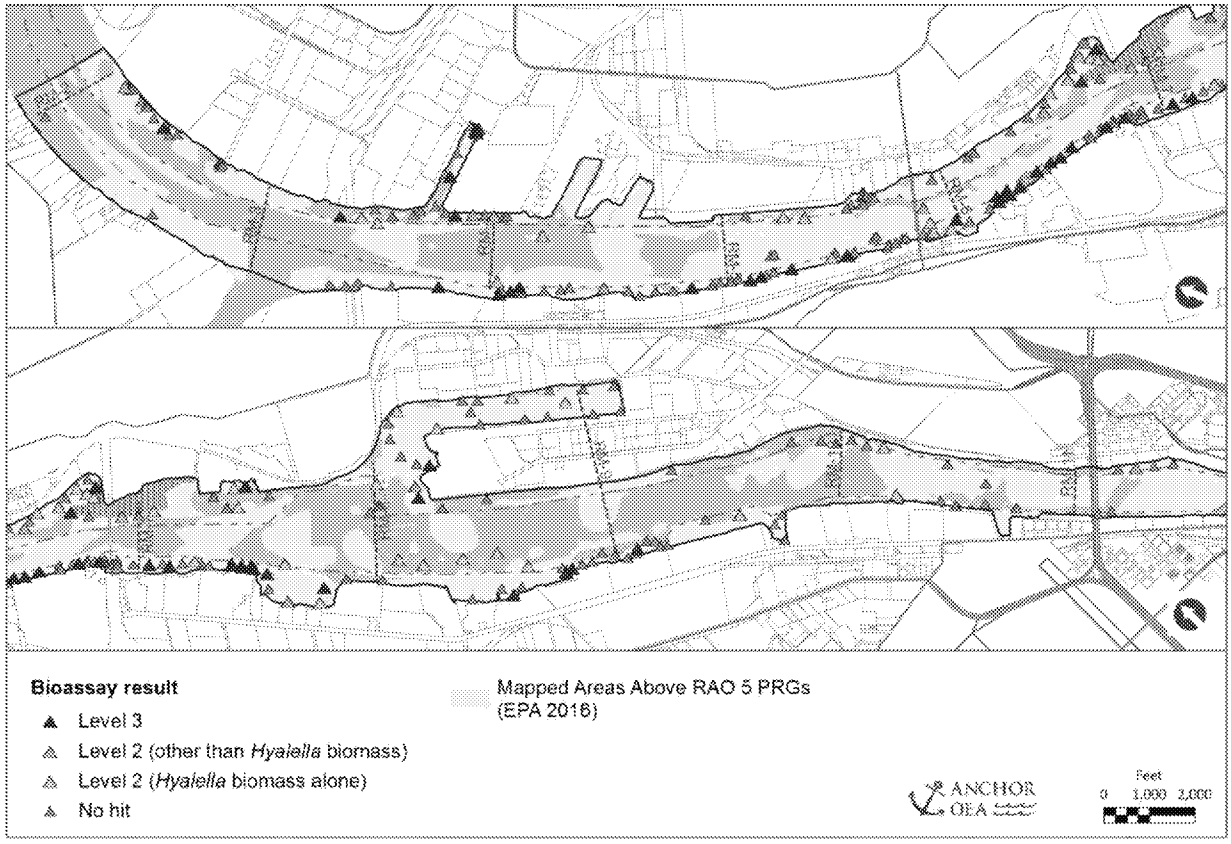

Table 1. Comparison of EPA's 2016 Draft Final FS Alternatives to the CBRAs Directed by EPA in 2014.

EPA Draft Final FS Alternative	Percent of EPA/LWG CBRAs Addressed by EPA Alternative
B	59%
C	66%
D	77%
E	83%
F	89%
G	92%
H	100%
I	84%

The EPA/LWG CBRA approach combines multiple lines of evidence, including bioassay toxicity tests. EPA supported this approach for many years before abruptly abandoning it in the final stages of preparation of the 2015 Draft FS. On April 4, 2014, EPA provided final direction to the LWG on mapping the CBRAs developed for the 2012 LWG Draft FS.[27] On February 2, 2015, EPA advised the Oregon Department of Environmental Quality (DEQ) that it was "not doing something new or different than what was done in the final BERA" and that the revised CBRA layers "are part of the Section 3 development of the alternatives, not Section 2, since they are depiction *[sic]*

[27] Burt Shepard email to John Toll, April 4, 2014, Attachment 5.

remedial action areas and not used for development of PRGs."[28] On February 27, 2015, EPA requested that the LWG submit revised text and maps incorporating its April 4, 2014, direction for the CBRAs; the LWG submitted the requested information on April 3, 2015.[29] The 2015 Draft FS, however, makes no mention of the EPA/LWG CBRAs, and the June 2016 draft Final FS maps benthic risk areas by point-by-point application of PRGs. EPA has never explained its changed approach to benthic risk and the corresponding shift from a remedial approach focused on the most certain areas of benthic risk, which (consistent with the findings of the BERA) encompasses a few percent of the Site to a very large percentage of the Site where significant evidence demonstrates limited or no benthic risk. And yet EPA's alternatives (except Alternative H, which covers the entire Site) do not address even the focused areas of elevated benthic risk.[30] Thus, EPA's distinction that Alternative I is protective of benthic risk, while Alternative B is not protective, is even more arbitrary when readily available and technically appropriate information is considered.

Further, EPA's interim target for RAO 5 is arbitrary based upon EPA's own analyses. EPA very simplistically mapped individual benthic PRG exceedances and used a 10 times exceedance factor to identify interim target benthic risk areas. EPA completed this interim target determination by assuming that an alternative would be protective if it is addressed through active remediation of 50% of the 10 times exceedance area. As discussed above, the 10 times exceedance factor is arbitrary and not supported by any long-term assessment of the alternatives. The 50% requirement is a second arbitrary step that is not tied to any quantitative assessment. EPA provides no explanation of why it picked 50% and not 33 or 67%, or any other value between 1 and 100%. EPA's own 2016 draft Final FS Table 4.2-7 illustrates the arbitrary nature of these decisions. In that table, EPA indicates that Alternative B addresses 48% of the 10 times benthic risk area, while Alternative I addresses 64%. Missing the threshold of 50% by a mere 2% implies a level of certainty to the analysis that is implausible, given the arbitrary nature of the threshold in the first place. Indeed, based on Table 4.2-7, Alternative B would actively remediate about 90 acres based on benthic risk, while the EPA-approved BERA concluded there may be as few as 87 acres of benthic risk.[31] The fact that, as discussed above, none of EPA's final alternatives actually address all benthic risk areas identified by the EPA/LWG CBRA approach just underscores the arbitrariness of EPA's approach in the 2016 draft Final FS.

With respect to RAO 6 (ecological bioaccumulation), as noted above, EPA concluded that "Alternatives B, D, E and I do not achieve the ecological HQ interim target of 10." Putting aside EPA's arbitrary decision to single out only Alternatives B and D as not protective, and ignoring the failure of its Preferred Alternative to meet the same interim target, a cursory review of EPA's own results suggests that all of these alternatives are protective. In the 2016 draft Final FS, EPA refers to Figures 4.2-9 through 4.2-17 and Table 4.2-5 to support its conclusions about RAO 6.[32] Based on this information, there are numerous problems associated with concluding any of these alternatives are not protective:

- As EPA notes on page 4-20 of the 2016 draft Final FS, these figures show that only bis-2-ethyhexyl-phthalate (BEHP) exceeds the 10 times threshold in any river mile or Sediment Decision Unit (SDU) examined and only in Swan Island Lagoon (SIL) or portions of SIL in the case of the rolling river mile analysis.

- On an SDU area basis, Table 4.2-5 shows that the BEHP exceeds the threshold by a factor 11 (slightly above the arbitrary threshold of 10) for Alternative B only.

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[28] Koch email to Jennifer Peterson, February 2, 2015, Attachment 6.
[29] Koch email to Toll, February 27, 2015Attachment 7.
[30] *Appendix P, Comprehensive Benthic Approach, Draft Feasibility Study* (Windward Environmental LLC, March 2015), Attachment 8. The LWG's 2012 draft FS addressed all CBRAs, with the exception of the 3 small additional areas resulting from EPA's April 4, 2014 direction and reflected in these revised text and maps submitted April 3, 2015.
[31] *See,* BERA p. 776. EPA concluded that benthic risk is "projected to extend over between 4 and 8% of the surface sediment area within the Study Area." According to the Proposed Plan, the Site covers approximately 2167 acres; four percent of 2167 acres is just under 87 acres. Proposed Plan, p. 11-12.
[32] See e.g., draft Final FS p. 4-20.

- The BEHP Hazard Quotient (HQ) exceedances highlighted in EPA's 2016 draft Final FS for Alternatives D and I are identical, each with an HQ of 19.[33] EPA cannot legitimately conclude with identical HQs in the same small area that Alternative D is not protective but Alternative I is protective.

- The rolling river mile analysis shows the BEHP exceedances (above threshold of 10) only occur for small fractions of a rolling river mile, around river miles 8 and 9.5 within SIL. This strongly suggests that these "exceedances" are due to one or two individual samples at either end of the SIL area. This reason appears insufficient to declare entire site-wide alternatives as not protective, particularly when any concerns (if real) could be addressed by small modifications to the alternatives in these limited areas either in the FS or in remedial design.

- EPA indicates in the 2016 draft Final FS that "…it is unlikely that ENR in SIL would sufficiently reduce the HQs in the long term due to the remaining concentrations outside the SMA." This appears to be a misstatement of EPA's own approach, because SIL is one of the few places in EPA's alternatives where Enhanced Natural Recovery (ENR) is specifically used outside the Sediment Management Area (SMA) boundaries as defined by the RALs.[34] Under EPA's approach, ENR material would be placed throughout SIL outside the SMAs, which would presumably address the one or two samples with relatively high BEHP concentrations on either end of SIL.[35] There is no quantitative analysis of the long-term outcomes for BEHP concentrations for any of these alternatives. Even a simple calculation of the concentration reduction expected from sand ENR placement in SIL would likely show substantial reductions in the specific BEHP exceedances noted by EPA.

- The HQ exceedances highlighted in EPA's 2016 draft Final FS for Alternative B, D, E, and I range from 34 to 15, with Alternatives D and I both having HQs of 19. EPA does not explain how it decided that an HQ of 34 in a very limited area is not likely to achieve protectiveness in 30 years while an HQ of 19 is protective in one case, but not in the other, over the same period.

Further, all these "exceedances" are based on a BEHP PRG that is questionable. EPA's RAO 6 PRG for BEHP is 135 micrograms per kilogram (ppb) and is based on a bioaccumulation endpoint for smallmouth bass tissue, but the PRG cannot be entirely replicated by the LWG based on the information available in the 2016 draft Final FS. As the LWG previously commented on the EPA 2015 Draft FS, taking into account the low frequency of surface water and tissue Toxicity Reference Value (TRV) exceedances, the conservatism of the fish tissue TRV, the absence of a relationship between site sediment and tissue concentrations, and the absence of evidence of BEHP biomagnification, EPA's selection criteria for contaminants of ecological significance do not support its decision to identify BEHP as a contaminant of ecological significance. It does not warrant an RAO 6 PRG.[36] It is also noteworthy that the BERA did not find widespread risks for BEHP. The BERA found smallmouth bass TRV exceedances in 4 of 31 samples in only 3 river miles.[37] The maximum BEHP exceedance occurred at river mile 3.5, which is many river miles downstream of the SIL area that caused EPA's determination that Alternatives B and D are not protective. Finally, the BERA is clear that the smallmouth bass BEHP TRV is based on one highly uncertain study.[38] Thus, determining a precise but arbitrary threshold of 10 times this highly uncertain PRG, and then rigidly applying that threshold to make a site-wide non-protectiveness determination highlights the absence of any reasonable risk management decision framework for the 2016 draft Final FS and Proposed Plan.

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[33] Draft Final FS, p. 4-42 and 4-80.
[34] Draft Final FS p. 4-20. See also Proposed Plan Figures 10a, b, and c, which indicate application of ENR sand outside SIL RAL boundaries.
[35] As noted elsewhere (in this document) it is problematic that EPA did not include ENR in SIL in the calculations of SWAC reductions. In this case, including ENR in SWAC calculations would likely have changed EPA's determinations in the 2016 FS about BEHP exceedances in SIL. EPA replied on July 20, 2016 to LWG clarification requests that, "The post-construction SWACs in the FS do not reflect the placement of ENR as they also do not include MNR." This reply attempts to equate ENR with MNR, but ENR clearly includes active placement of sand material at the time of construction, which is a form of active remediation as indicated by the word "enhanced" in the term ENR.
[36] *See,* "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240". Letter from LWG to EPA dated June 19, 2014.
[37] BERA Table 7-7.
[38] BERA Table 7-45.

B. <u>If Alternative B Fails to Meet Chemical-specific ARARs, All Alternatives Do, and EPA Should Waive Them Now</u>

EPA's Proposed Plan states that "Alternative B does not achieve chemical-specific ARARs in a reasonable time frame, but will attain the action-specific and location specific ARARs. All other alternatives will attain their respective Federal and State ARARs."[39] The 2016 draft Final FS states, "Alternative B may not comply with all ARARs.... It is unlikely that chemical-specific ARARs would be achieved in a reasonable time frame."[40] As noted above for EPA's long-term protectiveness evaluations, EPA's conclusion about Alternative B not meeting chemical-specific ARARs "in a reasonable timeframe" is entirely arbitrary, because EPA has no quantitative method to assess the long-term outcomes of the alternatives.[41] This ARAR determination for Alternative B is also arbitrary, because it is based on a flawed EPA analysis of surface water data that is inconsistent with Site technical information and any reasonable conceptual site model (CSM).

EPA supports these conclusions with the following statements on page 4-20 of the 2016 draft Final FS: "Exceedances of water quality criteria for protection of human health from contaminated sediment within the Site would continue for PCBs, cPAHs, and 2,3,7,8-TCDD eq at the completion of construction. There is insufficient surface water data to evaluate the effectiveness of this alternative in meeting the aquatic life water quality criteria for BEHP, PAHs and TBT." On page 4-6 of the 2016 draft Final FS, EPA refers to Appendix K as the source of these determinations. The LWG reviewed Appendix K and found it contains numerous flaws that preclude any accurate conclusions regarding surface water concentrations or compliance with surface water ARARs.[42] In summary, EPA's Appendix K analysis errors include the following:

- EPA used flow weights for averaging surface water data that are the opposite of the actual average annual river flow conditions. EPA assumed 240 days of the year were in a high flow condition, when the U.S. Geological Survey Portland river gauge data show that <u>low</u> flows (less than the long-term average of 33,000 cubic feet per second) occur about 250 days out of the year.

- EPA used river mile 11 West and Navigation Channel data to calculate weighted average surface water concentrations (SWACs) for the Site and for concentrations entering the Site. Using these same data to represent both locations on the river results in inaccurate determinations for both locations.

- Although perhaps a typographical error, EPA indicates it subtracted the concentration entering the Site from the average site concentration to obtain concentrations for the "Downtown Reach." As written, such a calculation would produce the contribution from the Site instead.

- EPA assumes that post-construction surface water concentrations will decrease proportional to the percent reduction in sediment surface-weighted average concentrations (SWACs). This simplistic assumption ignores other contributions to surface water, most notably the upstream concentrations entering the Site. As a result, EPA estimates much greater percent reductions for the alternatives than is possible. For example, EPA calculates 92% reduction in Site surface water concentrations for Alternative G, but correctly accounting for upstream inputs would place this estimate at only about a 50% reduction.

- EPA also ignores within-site upland sources such as National Pollutant Discharge Elimination System (NPDES)-permitted stormwater and NPDES-permitted process and cooling water discharges that are beyond the control of sediment remedies.[43] For example, the annual loading summary provided in Table 6.1-11 of the EPA-approved RI shows that nearly 30% of the PCB load to the Site comes from stormwater.

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[39] Proposed Plan, p. 52. See also Proposed Plan Table 15.
[40] EPA draft Final FS, p. 4-20.
[41] EPA rejected the fate and transport model that the LWG developed with EPA encouragement and EPA input over the course of the RI/FS which, if finalized in EPA's draft Final FS, would have provided the means to assess those outcomes.
[42] See the technical memorandum *Further Evaluation of EPA's Flawed Surface Water Analysis in 2016 draft Final FS Appendix K* (Anchor QEA August 8, 2016), Attachment 9.
[43] NPDES-permitted discharges are exempt from CERCLA remedial action requirements under the "federally permitted release" exemption. 42 USC §9607(j).

By ignoring these sources, EPA further and incorrectly inflates the erroneous percent reductions achieved by all alternatives.

These flaws cause EPA to systematically over-estimate the percent reduction in surface water concentrations provided by the alternatives. If EPA applied the same subjective judgments in the 2016 draft Final FS text for Alternative B to corrected (lower) reduction estimates for the other alternatives, EPA would conclude that most of the alternatives (likely including Alternative I) do not meet chemical-specific ARARs. Instead of attempting to correct the Appendix K results, EPA should develop a plausible CSM that recognizes the true role of upstream inputs to the Site and NPDES-permitted discharges.[44] A correct CSM for surface water would demonstrate that it is unreasonable to expect sediment remedies to drive improvements in Site surface water concentrations that are unrelated (e.g., upstream watershed sources) to Site sediment issues.

Such a CSM is fully supported by Site and upstream surface water data. The LWG previously submitted to EPA in the 2012 LWG Draft FS (p. 3-11) analyses demonstrating that "upstream background surface water 95th percentile UPL concentrations of arsenic, total PCBs [polychlorinated biphenyls], total PAHs, dieldrin, 4'4-DDT, sum DDT, and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) entering the Site exceeded the respective fish consumption values for these contaminants." The values being referred to here are various state and federal water quality criteria, which EPA has adopted as PRGs in the 2016 draft Final FS (Tables 2.1-4 and 2.2-1) and Table 11 of the Proposed Plan. EPA subsequently rejected the RI surface water upriver statistics (i.e., the upper confidence limit [UPL]).[45] However, even if EPA had examined just the arithmetic mean of upriver surface water data,[46] EPA would have found the concentrations of aldrin, arsenic, BEHP, DDD, DDE, DDT, hexachlorobenzene, PCBs, several polycyclic aromatic hydrocarbons (PAHs), and 2,3,7,8-TCDD toxic equivalent entering the Site exceed both the state and federal fish consumption water quality ceritifcation (WQC) for these contaminants. It is important to note that this list includes all of the focused RAL chemicals (i.e., PCBs, DDx, dioxin/furans, and PAHs). Therefore, a waiver will be needed for these criteria-based surface water PRGs due to upstream inputs, regardless of the exact statistics used to evaluate those upstream inputs. Consequently, no sediment remedy, even combined with source controls within the Site itself, can technically be expected to attain water concentrations lower than incoming upstream conditions for these chemicals.

Per EPA sediment remediation guidance,[47] "RAOs should reflect objectives that are achievable from the site cleanup." This leads to one of two possible EPA management decisions: 1) EPA should remove surface water RAOs from the 2016 draft Final FS, given that site sediments are not the primary cause of surface water ARAR exceedances and therefore sediment remedies alone cannot achieve all of the most important chemical-specific ARARs in surface water; or 2) EPA should waive water quality ARARs for these same chemicals in the ROD. EPA continues to maintain that, "Currently, EPA does not have a basis for waiving any ARARs. Any ARAR waivers would have to be conducted through the remedy selection process and documented in a ROD amendment."[48] If EPA had correctly estimated alternative surface water concentrations (even using the simplistic approach attempted in Appendix K), or simply compared the upstream concentrations to EPA's proposed surface water PRGs, then it would have an obvious available basis for waiving many of the water quality-related ARARs. Instead EPA maintains that site sediment remedies might somehow achieve site surface water reductions below ARARs despite multiple other sources also contributing to those same ARAR exceedances. EPA supports this ongoing bias by conducting obviously flawed analyses, such as Appendix K, and ignoring upstream data and then contending there is no basis for waiving the surface water ARARs.

Although EPA's guidance contemplates that ARAR waivers can be made either at the time of the ROD or later in a ROD amendment, CERCLA Section 121 strongly suggests that this determination should be made at the time of the ROD ("The President may select a remedial action meeting the requirements of paragraph (1) [protectiveness] that

[44] See Section III, infra.
[45] EPA's rejection of the calculation of upriver statistics was formally disputed by the LWG. See request for Dispute Resolution of EPA's Notice of Decisions on Background Regarding Section 7 of the Remedial Investigation; Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240.
[46] See 2011 draft RI, Table 7.2-5a. EPA removed reference to upstream concentrations statistics from later versions of the RI.
[47] Sediment Guidance, p. 2-15.
[48] 2016 draft Final FS p. 2-6.

does not attain a level or standard of control at least equivalent to [an ARAR] if the President finds that . . . ."). The LWG calls upon EPA to make these decisions at the time of the ROD. EPA has the information it needs now to make the waiver determinations. If EPA does not do so, tens or hundreds of millions of dollars may be wasted striving to meet unachievable surface water ARARs that no sediment remedy can meet.

Similarly, Safe Drinking Water Maximum Contaminant Levels (MCLs) that EPA uses as surface water and groundwater PRGs[49] are likely not achievable throughout the spatial extent of some groundwater plumes along the shoreline or out under the river, and achievement of such criteria is not necessary to design and implement groundwater and sediment remedies that are protective of all reasonable and likely future uses of groundwater. EPA should either determine that MCLs are not applicable, relevant or appropriate because MCLs do not apply to the groundwater in this context, or it should waive these water quality criteria ARARs now. MCLs are not applicable, relevant, or appropriately applied to groundwater here because the Oregon statute designates the Lower Willamette River as a potential public and private water supply only following adequate pretreatment[50] and because the federal Safe Drinking Water Act under which MCLs are developed designate that drinking water is appropriately sampled at the point of distribution.[51]

C. EPA's Risk Evaluations in the 2016 Draft Final FS and Proposed Plan, Individually and Collectively, Present an Inaccurate and Biased Picture of Risk Reduction Attainable through Sediment Cleanup at Portland Harbor

1. EPA's development and application of PRGs for the 2016 draft Final FS and Proposed Plan are inconsistent with the BLRAs

EPA's methods and results throughout the 2016 draft Final FS and the Proposed Plan are often inconsistent with the BLRAs, culminating in both a baseline (i.e., no action) and a post-construction risk assessment that departs significantly from the methods and findings of the BLRAs. EPA should address only those potential risks for contaminants, media, and pathways that were clearly found to pose unacceptable risks in the BLRAs, and EPA should further focus on the subset of unacceptable risks that are required for selecting an effective and protective remedy using all of the FS criteria (i.e., EPA should conduct reasonable risk management). Instead, EPA has departed from the BLRAs and applied virtually none of EPA's 11 Risk Management Principles for "making scientifically sound and nationally consistent risk management decisions at contaminated sediment sites."[52] In short, EPA should use a "risk-based framework" to "select site-specific, project-specific, and sediment specific risk management approaches that will achieve risk-based goals" and "ensure that sediment cleanup levels are clearly tied to risk management goals."[53]

The LWG has previously commented that EPA's PRG development procedures were substantially flawed and should be corrected prior to finalization of the FS.[54] The vast majority of errors previously identified persist in the 2016 draft Final FS and are carried through to the PRGs summarized in Table 11 of the Proposed Plan. EPA continues to propose chemicals of concern (COCs) and PRGs under circumstances that are technically inappropriate, scientifically invalid, and inconsistent with guidance. As noted in prior comments, EPA should instead include in the FS only those COCs and PRGs:

- For contaminant/exposure scenario pairs (ecological or human health) for which the EPA-approved BLRAs identified potentially unacceptable risk from in-river media.

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[49] 2016 FS Tables 2.1-4 and 2.2-1.
[50] OAR 340-041-0340, Table 340A.
[51] 40 CFR Part 141, § 141.23(a).
[52] *Principles for Managing Contaminated Sediment Risk at Hazardous Waste Sites*; February 12 2002. OSWER Directive 9285.6-08. See also Sediment Guidance, Appendix A-1. The relevance of this guidance to risk management steps in the FS is reviewed in detail in Sections 10.1 and 10.2 of the LWG's 2012 draft FS.
[53] Sediment Guidance, page 1-5.
[54] "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)". Letter from LWG to EPA dated June 19, 2014; "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

- That are calculated consistent with EPA-approved BLRA methods.
- Where there is sufficient scientifically valid information to calculate those PRGs.
- That are technically practicable to achieve or, alternatively, for which acceptable risk levels can be reached through sediment remedial action alternatives evaluated in the FS.
- That reflect a reasonable risk management framework including that: 1) the BLRAs indicate a contaminant is significantly contributing to risk' and 2) evaluation of remedial alternatives with respect to a potential COC or PRG is necessary to select a protective remedy.
- That can be attained through sediment remediation, which would exclude any surface water PRGs based on water quality ARARs with substantial contributions from upstream sources or CERCLA-exempt NPDES-permitted discharges. Instead, EPA should waive these ARAR criteria in the ROD, as they are clearly impracticable to meet due to upstream and likely continued upland sources.
- For matrices that can be directly addressed through sediment remediation, which would exclude PRGs for the fish tissue matrix, given that upstream and upland water sources contribute to unacceptable levels in fish tissue. As noted in the past, the LWG agrees with the concept of using fish tissue levels as monitoring tools for a limited number of COCs but not as performance goals or PRGs for sediment remedies.

EPA's designation of large areas in the navigational channel for cleanup based on petroleum contamination is a clear example of the magnitude of errors resulting from EPA's inexplicable severance of the results of the BLRAs from the 2016 draft Final FS and Proposed Plan. The Baseline Human Health Risk Assessment (BHHRA) is clear that fish consumption risks from cPAHs are likely less than 1% of the total cumulative risks for this pathway, with the remainder coming mostly from PCBs and dioxin/furans.[55] EPA has been unable to develop a technically sound cPAH sediment PRG for fish consumption because there is no observable relationship between sediment sources and PAH concentrations in fish tissue.[56] Because it was unable to link cPAHs in sediment to fish consumption risk, and despite the marginal cPAH fish consumption risk, EPA assigned a shellfish consumption PRG to the navigation channel as a surrogate for fish consumption,[57] even though no shellfish harvesting can occur within the navigation channel. EPA cannot simply assume that a PRG based on bioaccumulation in shellfish is representative or appropriate for protection of humans consuming fish.[58] A "rich and comprehensive" body of scientific literature establishes that vertebrate fish and shellfish metabolize PAHs very differently and that there is "very low risk of exposure to PAHs that are a health concern for humans consuming finfish."[59] In the Lower Duwamish Waterway ROD, in fact, EPA concluded that development of a sediment cPAH PRG for the human health seafood

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[55] See Figure 7-3 of the EPA-approved BHHRA.

[56] EPA's own internal reviews indicate this. See EPA memorandum, May 2016 "Evaluation of analyses used to calculate bioaccumulation calculation results Portland Harbor Superfund Site RAC Contract Number EP-W-05-049" to EPA Region 10 Portland harbor RI/FS File from Portland Harbor RI/FS Team (May 2016), Attachment 10. Further, the science is extensive that PAHs do not readily accumulate in vertebrate fish tissue. See Meador et al. 1995, *Reviews of Environmental Contamination and Toxicology* 143:79-164; September 2014 *Toxicological Review of* Benzo(a)pyrene, ORD EPA/635/R-14/312a; Varanasi, et al. 1989, Biotransformation and Disposition of Polycyclic Aromatic Hydrocarbons (PAHs) in Fish: In Varanasi U (ed); Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment, CRC Press; and Metabolism of PAHs in Teleost Fish-Scientific Findings, Memorandum from the Northwest Fisheries Science Center of NMFS, available at http://sero.nmfs.noaa.gov/deepwater_horizon/previous_reopening/index.html, October 22, 2010.

[57] 2016 draft Final FS Appendix B, p. B-35.

[58] In response to LWG comments noting this fact, EPA's explanation for such an assumption was, "EPA calculated a PRG for cPAHs to address unacceptable risks associated with consumption of shellfish, and we anticipate that this PRG will also address the unacceptable risks identified in the BHHRA associated with consumption of fish." How or why EPA believed this to be a scientifically appropriate decision was never explained. Koch email to McKenna and Wyatt (April 10, 2015).

[59] *Metabolism of PAHs in Teleost Fish-Scientific Findings*, Memorandum from the Northwest Fisheries Science Center of NMFS (vertebrate fish enjoy "highly efficient metabolism of PAHs" whereas bivalves such as oysters and clams have a "low capacity to metabolize PAHs"). See also, *Metabolism of Polycyclic Aromatic Hydrocarbons (PAHs) in the Aquatic Environment*, CRC Press.

consumption pathway was inappropriate, because no observable relationship exists between cPAH sediment and tissue concentrations.[60]

Even if such a PRG were valid, EPA's further decisions to abandon the site use factor used in the BHHRA for the direct contact cPAH PRG,[61] convert that cPAH PRG to a TPAH PRG based upon an irrelevant correlation calculation,[62] and then use this number as a basis for development of TPAH RALs for application in areas of the Site where no direct contact can occur results in a meaningless alternatives analysis. EPA's own immediate post-construction SWAC estimates[63] indicate that Alternative B SWACs in the navigation channel would be below the cPAH shellfish consumption PRG of 3,950 parts per billion (ppb) for every rolling river mile examined (the maximum SWAC at river mile 5.5 was 3,305 ppb within SDU 6Nav). Because Alternative B meets the cPAH shellfish PRG in the navigation channel immediately after construction, even if the shellfish PRG were a valid surrogate for a fish consumption PRG there would be no additional cPAH risk reduction from any of the other larger alternatives (D through I). Alternative RALs much higher than the Alternative B TPAH RAL (170,000 ppb) might provide a more cost-effective balance of active remediation and natural recovery for cPAHs in the navigation channel, but EPA considers no such alternatives. EPA's alternatives evaluation effectively compares only Alternative B against the "no action" Alternative A before selecting an extensive dredging remedy for the navigation channel. The LWG's estimated cost (based upon review of EPA's dredge volumes) of this unnecessary remediation in SDU 6Nav exceeds $62 million, which would classify this SDU, standing alone, as a mega-site. This outcome is manifestly inconsistent with any reasonable risk management approach, especially where fish consumption risks associated with PAHs account for less than 1% of the fish consumption risk identified in the BHHRA, and therefore, no meaningful or measurable human health risk reduction would be attained.[64]

The LWG's prior comments provide many other examples and detail how EPA's deviation from the BLRAs and failure to apply risk management are clearly inconsistent with EPA guidance.[65] Numerous examples of each of these issues are provided in the LWG's prior comments on 2015 Draft FS Section 2. Table 2 provides a summary of COCs and PRGs that EPA should use. Attachment 11 provides additional comments on EPA's COCs and PRGs contained in the 2016 draft Final FS and corrects the numerous issues and EPA errors identified by the LWG in EPA's most recent PRG tables (Proposed Plan Table 11 and 2016 draft Final FS Table 2.2-1).

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[60] Lower Duwamish Waterway Superfund Site Record of Decision, November 2014, p.75.
[61] This issue is detailed in "LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)". June 19, 2014. See also, "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.
[62] The LWG previously commented on this issue on page 11 of "List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)" September 8, 2015.
[63] 2016 FS Appendix J Table J2.3-2i.
[64] TPAHs may be a source of benthic risk, but (for the reasons described above) benthic risk is targeted more precisely through application of the multiple lines of evidence used to evaluate benthic risk in the BERA and as applied in the EPA/LWG CBRA approach.
[65] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240", letter from LWG to EPA dated June 19, 2014. "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

Table 2. LWG Proposed Remediation Goals

Contaminant	Sediment - In-Water		Sediment-Beach Human Health Direct Exposure Areas	
	Units	Conc.	Units	Conc.
Arsenic	ppm	4	ppm	3 (or site-specific background)
Cadmium	ppm	Rely on EPA/LWG CBRA instead		
Chlordanes	ppb	Need to derive RAO 2 RG using upstream water values		
DDx	ppb	7.5		
DDD	ppb	Rely on EPA/LWG CBRA instead		
DDE	ppb	Rely on EPA/LWG CBRA instead		
DDT	ppb	Rely on EPA/LWG CBRA instead		
Dieldrin	ppb	Need to derive RAO 2 RG using upstream water values		
Lead	ppm	Rely on EPA/LWG CBRA instead		
Mercury	ppm	Rely on EPA/LWG CBRA instead		
PCBs	ppb	(20 or as determined by additional equilibrium evaluations)		
PAHs	ppb	Rely on EPA/LWG CBRA instead		
cPAHs (BaPEq) - human health direct contact unacceptable risk exposure areas	ppb	424	ppb	12
cPAHs (BaPEq) - areas contributing to clam unacceptable risk consumption exposure based on bioaccumulation	ppb	OC-normalized		
Dioxins/Furans (2,3,7,8-TCDD eq)	ppb	0.04		
1,2,3,4,7,8-HxCDF	ppb	Recalculate based on equilibrium		
1,2,3,7,8-PeCDD	ppb	Recalculate based on equilibrium		
2,3,4,7,8-PeCDF	ppb	Recalculate based on equilibrium		
2,3,7,8-TCDF	ppb	Recalculate based on equilibrium		
2,3,7,8-TCDD	ppb	Recalculate based on equilibrium		
TPH-Diesel	ppb	Rely on EPA/LWG CBRA instead		

As discussed above, the LWG disagrees that there should be any surface water PRGs, because it is not possible to achieve them through sediment remedies (any ARARs related to these PRGs should be waived by EPA in the ROD), and there should be no groundwater and riverbank PRGs. To the extent that EPA chooses to proceed with these types of PRGs, specific ongoing concerns associated with EPA's most recent COCs and PRGs include:

- To the extent that any surface water PRGs are noted as "A" for "ARARs" on Proposed Plan Table 11, these should all be the Oregon water quality standard (WQS) rather than the National Recommended Ambient Water Quality Criteria (NRWQC) (e.g., aldrin, arsenic, copper, DDE, pentachlorophenol, BaP, dibenz(a,h)anthracene).

  > "If a State has promulgated a numerical [water quality standard, or "WQS"] that applies to the contaminant and the designated use of the surface water at a site, the WQS will generally be applicable or relevant and appropriate for determining cleanup levels, rather than [the National Recommended Water Quality Criterion or "NRWQC"]. A WQS represents a determination by the State, based on the [NRWQC], of the level of contaminant which is protective in that surface water body, a determination subject to EPA approval." (Emphasis added.) 53 F.R. 51394, 51442 (Dec. 21, 1988, explanation of revisions to the National Contingency Plan). [66]

  The proposed arsenic surface water PRG is a good example of this. Oregon revised its human health water quality criteria for arsenic to 2.1 micrograms per liter (µg/L) on April 21, 2011. In doing so, Oregon evaluated the NRWQC but set its standard higher than the NRWQC based on state-specific reasons, including its development of state-specific bio-concentration factors. EPA approved these criteria on October 17, 2011, making these revised criteria effective under the Clean Water Act. Thus, any discharge to the Willamette River meets the state water quality standard as long as it does not create a concentration in the river in excess of 2.1 µg/L. However, EPA ignored this Oregon standard in its Proposed Plan and has instead proposed a surface water PRG for arsenic of 0.018 µg/L, based on the NRWQC. This means that EPA will require any discharge to the Portland Harbor (e.g., groundwater or discharges from remedial actions) to be cleaned up as if it had to meet a 0.018 µg/L concentration in the river, even though the State of Oregon has said that a concentration of 2.1 µg/L is fully protective. EPA should not so arbitrarily ignore Oregon's protectiveness determination on this issue—that is, set the stage to require very substantial expenditures so that water discharging to the river is more than 100 times cleaner than the surface water standard itself, a standard that Oregon has determined through its EPA-approved water quality standard process is fully protective.

- To the extent that EPA has set surface water PRGs for a class of chemicals on an ARAR basis where Oregon has chosen not to have a WQS for that class, but instead has WQSs for the individual chemicals in the class, it should be removed. For example, Oregon opted to adopt WQSs for individual PAHs rather than cPAHs as a class. EPA should not set a surface water or groundwater PRGs on an ARAR-basis for cPAHs, because it has already set PRGs for the individual chemicals included in that class consistent with Oregon's WQSs.

- In no case should a groundwater PRG be set on an ARAR-basis using a surface WQS or NRWQC. Instead, EPA should rely on the surface water PRG and indicate that groundwater treatment is required if the groundwater would cause the exceedance of that surface water PRG in the surface water.

- To the extent the WQS or NRWQC that are adopted as PRGs have associated limitations, those need to be carried forward into the final PRGs (e.g., some apply only to a dissolved fraction or to a particular valance state). Similarly, to the extent a PRG is based on a particular exposure scenario (e.g., beach direct contact), it should not be applied to different exposure areas. See Table 2 and Attachment 11.

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[66] *See also* Lori Cora letter of February 2, 2010: "If the State's water quality criteria is promulgated after the most recent NRWQC for that contaminant is published, but adopted a criteria less stringent than the NRWQC due to water body-specific reasons, per Subsection 2(B) (i), EPA may determine that the NRWQC is not relevant and appropriate as long as the remedy will be protective using the State promulgated standard."

- As discussed above, MCLs should not be surface water PRGs or groundwater PRGs; if they are, they should be applied at the theoretical point of distribution after treatment, consistent with Oregon and federal law. [67]

- Tapwater Regional Screening Levels (RSLs) should not be groundwater PRGs, and manganese in particular should not be a PRG for the following reasons:

  - Table 11 of the Proposed Plan proposes a groundwater PRG for manganese of 430 µg/L. The origin of this criterion appears to be an EPA RSL for *tapwater*, based on risk to human health. [68]

  - Table 2.2-2 of the EPA draft Final FS indicates that manganese was not found to pose a risk to human health, so it should not have a PRG set based on a human health criterion.

  - The value is an RSL, not an ARAR.[69]

  - The surface water itself already meets this identified PRG; thus, there is no basis for setting a PRG in groundwater for the purpose of protecting the surface water pursuant to RAO 4.[70] This is because manganese is one of the chemicals subject to changes in concentration based on the geochemistry; specifically, the manganese becomes oxidized as it moves into the surface water, and it precipitates out of solution. Thus, groundwater concentrations are not predictive of surface water concentrations.

  - For RAO 4, which appears to be the basis for the proposed groundwater PRG, human use of surface water from the Willamette River requires pre-treatment as discussed above. Manganese is one of the substances that is most clearly controlled by conventional water pretreatment, which includes hardness adjustment/water softening, filtration, and chlorination. Therefore, manganese levels in groundwater/porewater in no way reflect the manganese concentrations that would be present in water used for potable purposes.

  - The current manganese RSL, which is the basis of the Portland Harbor manganese PRG, is derived from an incorrect and unsubstantiated, un-peer-reviewed evaluation of the manganese EPA IRIS assessment and is not appropriate as a PRG.

- Table 11 of the Proposed Plan lists some substances where there is no PRG (e.g., phenanthrene and pyrene). These should be removed.

The Proposed Plan does not explain how water PRGs will be applied. If EPA chooses not to delete them for reasons discussed above, risk-based surface water PRGs should be applied consistent with the exposure scenario that determined the unacceptable risk. If the PRGs are ARAR-based, they should be applied consistent with state procedures to determine water quality standard exceedances. [71] Further, if EPA keeps groundwater PRGs that are

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[67] OAR 340-041-0340, Table 340A; 40 CFR Part 141, Section 141.23(a).
[68] Note that Table 2.1-1 of EPA draft Final FS incorrectly identifies the source of this PRG as an "EPA Regional Screening Level (RSL) for Groundwater." In fact, the current version of the document that EPA references in that table is called the "Regional Screening Level (RSL) Resident *Tapwater* Table" (May 2016 version). The prior November 2015 version to which EPA cites in FS Table 2.1-1 was called the "Regional Screening Level (RSL) Summary Table," but it clearly indicated that the manganese RSL to which EPA refers of 430 µg/L was for "Tapwater."
[69] Table 2.1-1 of EPA draft Final FS specifically identifies the RSL table from which this was taken as a "To Be Considered" criteria, not an ARAR.
[70] See Attachment 12.
[71] ODEQ rules establish that all aquatic protection water quality standards are applied as a 96-hour average concentration, which may not be exceeded more than once every three years. OAR 340-041-8033, Table 30. Oregon guidance establishes that its human health criteria should be evaluated based on the geometric mean of 24-hour composite samples of high and low flow conditions of the waterbody. ODEQ, *Reasonable Potential Analysis Process for Toxic Pollutants*, Feb 13, 2012, at 34 and 80.

based on surface water ARARs, these need to be as measured in the surface water at the point of groundwater discharge,[72] because that is the beneficial use those ARARs are meant to protect.

Finally, we note that Proposed Plan Table 11 attempts to "summarize" the more detailed PRG tables from the 2016 draft Final FS. Proposed Plan Table 11 combines human health and ecological PRGs by media so that the origin and appropriate application of each PRG is lost. For example, Proposed Plan Table 11 cPAH notes a "riverbank soil/sediment" PRG of 12 ppb; which is an incorrect and misleading summary of that PRG. In fact, this particular PRG only applies to very limited beach areas as more accurately described in 2016 FS Table 2.2-1, and does not apply to the vast majority of the Site. EPA appears to have simply picked the lowest available PRG value from the 2016 draft Final FS PRG tables for each matrix "summarized" in Proposed Plan Table 11 without reference to how or where each particular PRG might be applicable or inapplicable to certain evaluations and decisions in remedy design and implementation. This leaves the reader with the false impression that each of these PRGs applies in all situations, which is clearly not the case and would be inconsistent with both the 2016 draft Final FS and the BLRAs.

In summary, EPA should apply the risk management called for by guidance and, in the ROD, select a refined and narrowed subset of PRGs as Remediation Goals (RGs). As explained above, the LWG believes RGs should be established only for sediments and only for COCs for which the EPA-approved BLRAs found significant unacceptable site-related risk and which can be addressed through a sediment remedy. Those proposed RGs are set forth in Table 2 above. Attachment 11 (specifically Table 11a of that attachment) shows in detailed, red-lined form how and why EPA should narrow its list of sediment PRGs contained in Proposed Plan Table 11 to get to the Table 2 list of proposed RGs. Because concentrations of COCs in fish tissue are highly influenced by upstream and NPDES sources that are not subject to the Portland Harbor remedial action, EPA should not set fish tissue PRGs. The LWG does believe it would be useful, however, to set fish tissue monitoring levels and shows in Attachment 11 (specifically Table 11b to that attachment) how EPA should narrow its list of fish tissue PRGs contained in Proposed Plan Table 11 to a meaningful list of fish tissue monitoring concentrations. For the reasons described above, the LWG does not believe EPA should set either surface water or groundwater RGs in the ROD. If EPA should proceed to use any of these values as RGs or as targets, please note that the LWG has also found errors and inconsistencies with the risk assessments in the PRG values that EPA has proposed. These comments are also provided in Attachment 11. Finally, the LWG reiterates its previous comments on EPA's PRG development.[73] Attachment 11 provides a summary of the LWG's position with respect to each PRG, by matrix and by RAO, narrowed to the list of PRGs set forth in EPA's 2016 draft Final FS.

2. EPA's post-construction risk evaluation is not consistent with the BLRAs

EPA conducts a post-construction risk evaluation in the 2016 draft Final FS for each alternative and uses the resulting post-construction risk estimates to evaluate the effectiveness of the various alternatives immediately after construction. EPA's post-construction risk estimates are inconsistent with the BLRAs in numerous respects. These inconsistencies cause EPA to err regarding the relative effectiveness of the alternatives, which in turn, results in EPA selecting an unnecessarily large and expensive preferred alternative (Alternative I).

a. The post-construction risk evaluation assumes different exposure scenarios and spatial scales than the BLRAs

Just as EPA's PRG selection in the 2016 draft Final and Proposed Plan deviates from the BLRAs in multiple respects to drive potentially unnecessary cleanup, EPA's post-construction risk estimates alter exposure scenarios and spatial scales and use inappropriate PRGs to inflate the perceived benefit of more aggressive actions. We have

[72] Except for 303(d) listed chemicals, this would have to include provision for assumed mixing in the water column, consistent with Oregon's rules for allowed mixing zones.

[73] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240", letter from LWG to EPA dated June 19, 2014; "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text", March 25, 2015.

identified the following discrepancies (which are not comprehensive) between the BLRAs and the 2016 draft Final FS post-construction risk evaluation:

- For RAO 1, continued exclusion of the site use factor from the BHHRA for the benzo(a)pyrene equivalent (BaPEq) FS PRG (106 ppb) results in concluding that not even Alternative G will meet this PRG for many half river miles examined (2016 draft Final FS Table J2.2-1c). However, if the BHHRA site use factor is accurately applied (resulting in a PRG of 424 ppb), Alternative B appears to achieve RAO 1 immediately following construction in all but a few half river miles (e.g., around river miles 4, 5, and 6 East and 3, 4, 5, and 6 West).

- For RAO 2 human health fish consumption risks, EPA generated post-construction SWACs on: 1) a 1-river mile basis longitudinally split into the two shoreline areas and the navigation channel for the recreational fisher scenario; 2) a site-wide basis for the subsistence fisher scenario: and 3) an SDU basis (which represents subareas of various inconsistent sizes and shapes) for the recreational fisher scenario.[74] However, in the EPA-approved BHHRA, risks were evaluated by whole river miles with no longitudinal splitting for recreational fish consumption and without reference to SDUs, which did not exist when the BHHRA was completed.

- For RAO 2, the human health post-construction risks for Alternative A (which should be identical to the BHHRA baseline condition) differ from the risks calculated in the BHHRA, which indicates there are inconsistencies. The baseline highest non-cancer risk for a breastfeeding infant in the BHHRA was a Hazard Index (HI) of 10,000 site-wide (for nursing infants of subsistence fishers). The highest 2016 draft Final FS post-construction risk estimates for the same scenario for Alternative A were 3,333 for site-wide, which is substantially less than the BHHRA result. The highest FS HI estimates for Alternative A (254,000 on a river mile scale and 22,589 on an SDU scale) should be equivalent to the BHHRA recreational fisher infant scenario, because EPA calculated them using an ingestion rate of 49 grams per day. However, the maximum recreational fisher infant river mile HI from the BHHRA is 1,000, which is one to two orders of magnitude less that EPA's Alternative A estimates. The reasons for these differences are unclear.

  In addition to questionable assumptions regarding exposure to resident fish, EPA does not take into consideration several key uncertainties in assessing risk, including food preparation and cooking methods (which can reduce PCB concentrations by up to 87%).[75] EPA's assumptions are not merely conservative but are wholly unrealistic, contrary to the "conservative but within a realistic range of exposure scenarios" recommended by the NCP.[76]

- For RAO 2, there is a significant disconnect between the BHHRA and post-construction risks for dioxins/furans (and other inconsistencies with the BHHRA results also likely exist).

  - For a breastfeeding infant, the highest HQs for dioxin/furan TEQ calculated in the BHHRA are 10 on a site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational reasonable maximum exposure [RME] consumption, river mile 7). Table J2.3-1a in the 2016 draft Final indicates that the site-wide HQ for the same infant scenario from HxCDF alone (not the entire TEQ) is 785 for Alternative A, almost two orders of magnitude higher.

  - For a child, the highest HQs for dioxin/furan TEQ calculated in the BHHRA are also 10 on a site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational RME consumption, river mile 7). Table J2.3-1a in the 2016 draft Final FS shows a site-wide HQ of 23 for just HxCDF.

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[74] 2016 FS, p. 4-10.
[75] BHHRA, p. 89. EPA states that on page 49 of the same document that no adjustments were made to contaminant concentrations in raw fish tissue because of the uncertainties associated with preparation and cooking practices.
[76] NCP Preamble, 55 Fed. Reg. 8710.

- The dioxin/furan Reference Dose has changed since the BHHRA was completed but that appears unlikely to account for the difference between the BHHRA and Alternative A post-construction risks.

- In August 2015, EPA acknowledged the inadequacy of HxCDF data in terms of quality and spatial coverage in written correspondence with the DEQ. At that time, EPA was in charge of finalizing its FS and had the authority to require supplemental scientific investigations to address and resolve these concerns. Instead, it chose to develop PRGs and RALs based on data EPA characterized as inadequate. In doing so, EPA abrogated its duty to produce scientifically sound and supportable risk estimates as well as cleanup criteria in the form of supportable PRGs and RALs.[77]

- Additional issues with EPA's dioxin/furan PRGs and post-construction risk approach are detailed in Attachment 11.[78]

- For RAO 5, ecological direct contact risks, multiple issues with EPA's benthic post-construction risk estimates are discussed above.

- For RAO 6, ecological bioaccumulation risks, 2016 draft Final FS SWACs were generated on a rolling 1-river mile basis with longitudinal splitting and on an SDU scale (p. 4-8). Like other post-construction risk estimates, EPA divides the post-construction SWAC by the PRG for each chemical. Importantly, the PRGs for the various RAO 6 chemicals are based on different ecological receptors evaluated in the BERA. These include smallmouth bass tissue for BEHP, sculpin tissue for DDx, sandpiper dietary assessment for DDE, mink for PCBs, and osprey egg assessment for dioxin/furans. These receptors all have widely divergent exposure parameters (including spatial scales) in the BERA and post-construction risks cannot be estimated by applying a "one size fits all" spatial scale to every PRG. Further, none of the BERA-appropriate spatial scales are consistent with longitudinally split river miles or SDUs. EPA does not recognize in the 2016 draft Final FS that this is even an issue and presents no discussion of why blanket application of split river miles and SDU spatial scales are possibly consistent with the various receptor exposures being evaluated.

  - For example, the DDE PRG is based on the BERA spotted sandpiper dietary assessment that was evaluated on a 2-river mile scale of beach sediment. The BERA evaluation spatial scale differs substantially from EPA's longitudinally split river miles or SDUs. EPA's Dioxin/furan PRG is based on the BERA osprey egg assessment, which was evaluated on a much larger scale than 1 river mile, much less longitudinally split river miles, or SDUs.

  - Also, the LWG has previously commented[79] that almost all of the RAO 6 PRGs, and as a result the post-construction risks calculated, are based on inappropriate or inconsistent determinations as compared to the BERA methods. Attachment 11 contains a summary of the most up-to-date comments from LWG on each of the RAO 6 PRGs.

  - As a result, all of the RAO 6 post-construction risk estimates appear to be unsupported and do not present any accurate accounting of the relative ecological risks or risk reductions achieved by any of the alternatives.

- For RAO 9, EPA considers the number of lineal feet of riverbank soils that are addressed by each alternative as a qualitative measure of human health and ecological risk reductions (EPA draft Final FS p. 4-9). Given that the RI and BLRAs include no riverbank soils (as defined in the RI) data and contain no

[77] See email message E. Allen USEPA to DEQ dated August 20, 2015.
[78] See Technical Memorandum, *Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan*" (S), Section 3 (detailing a comparison of EPA's fish consumption risk estimates to BHHRA and 2012 smallmouth bass estimates). A copy of this memorandum is Attachment 14.
[79] LWG Comments on Revised FS Section 2 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240," letter from LWG to EPA dated June 19, 2014. "LWG comments on EPA's Feasibility Study Revised Draft Section 2 Text," March 25, 2015.

> risk assessment of riverbank soils, EPA should not have evaluated these post-construction risks at all. Any "qualitative" assessment is mere conjecture in the absence of actual evaluation of riverbank soils data or baseline risks earlier in the RI/FS process.[80]

Appendix J of the 2016 draft Final FS glosses over many method details; thus, it is not possible to fully comment on EPA's post-construction risk methodology. However, given that it is clear that all of the above aspects are inconsistent with the BLRAs, it is highly likely that other details of the methods, if they were known, would also be inconsistent with the BLRA methods.

b. Inflated SWAC recalculation skews the apparent performance of EPA's alternatives

As noted above, all of EPA's post-construction risk estimates are based on calculating a ratio of the immediate post-construction exposure concentrations in the numerator (SWACs or related tissue concentrations) to the toxicity level (PRGs) in the denominator. EPA presents these ratio results as HQ (non-cancer) or cancer-risk levels for each alternative.[81] As noted above, there are numerous inconsistencies with the BLRAs in EPA's determination and application of the risk-based PRGs in the denominator. This subsection focuses mainly on the numerator (exposure concentration) errors. EPA's FS conclusions rely mainly on post-construction risk estimates for human health fish consumption (RAO 2) and ecological bioaccumulation risks (RAO 6), so discussions here are confined to those scenarios (human health) and receptors (ecological). (In addition, EPA evaluated benthic risk reduction for ecological (RAO 5), and errors associated with this analysis are discussed previously.)

Regarding human health fish consumption (RAO 2), EPA relies on PCB post-construction non-cancer risk estimates for the child[82] (e.g., 2016 draft Final FS Figures 4.2-2 and 4.2-6) and infant scenarios (e.g., 2016 draft Final FS Figure 4.2-4). To simplify the discussion, we focus here on the child scenario errors, but similar errors exist for the infant scenario. EPA presents two types of results: 1) non-cancer HQs and cancer-risk levels;[83] and 2) allowable fish meals, which are calculated through an algebraic rearrangement of the risk equation to solve for the number of meals producing an acceptable risk level under any given post-construction exposure concentration. EPA uses the same flawed exposure concentrations to support both results.

Specifically, EPA graphics (such as 2016 draft Final FS Figures 4.2-2, 4.2-4, and 4.2-6) present baseline (Alternative A) and immediate post-construction risk levels and allowable fish meals for each alternative that depict a sharp decrease in the risk levels between the baseline condition (Alternative A) and the progressively more aggressive alternatives. This steep decrease is caused by EPA's flawed calculation of baseline PCB SWACs for the Site, which EPA newly assumed to be about 208 ppb site-wide.[84] As recently as EPA's 2015 Draft FS and November 2015 NRRB presentation,[85] EPA had been presenting the site-wide SWAC as about 85 to 87 ppb, which is similar to the site-wide SWAC presented in the 2012 LWG Draft FS, the EPA-approved BHHRA and BERA, and essentially all EPA and LWG prior discussions and documents. The 2016 draft Final FS indicates the same FS database was used as the 2015 Draft FS; however, the new SWAC does not involve any new data and is exclusively a reinterpretation of the same data available for many years. In addition, EPA presents a site-wide SWAC of 92 ppb on Figure 3.4-1 (depicting PCB RAL curves) in the 2016 draft Final FS, which is only slightly higher than the

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[80] EPA acknowledges the RI/FS data are insufficient to make an assessment (p. 4-9), but proceeds nonetheless, "A qualitative assessment of protectiveness for river banks is conducted for each alternative as there are no current means to quantitatively assess the effectiveness of the alternative in achieving PRGs in river banks due to uncertainty in contaminant concentrations and locations."

[81] Note that this is a "short cut" method for a residual risk assessment. Typically, such assessments are conducted by calculating post remediation sediment (and other matrices as appropriate) concentrations and then applying those concentrations to forward risk assessment calculations.

[82] EPA's FS and Proposed Plan fail to mention that these risk estimates are for the child scenario, which is more conservative (higher risks) than the adult scenario (e.g., FS Table 4.2-2, Figure 4.2-2, and similar figure titles do not mention whether the risks presented are for adult or child scenarios). EPA typically mentions that "people would be advised to eat no more than 6 fish meals every 10 years" (Proposed Plan p. 58); this makes it unclear which "people" are being evaluated. EPA's widespread use of the child scenario was only discovered through laborious cross checking between EPA's FS main text and appendices and by conducting independent calculations.

[83] EPA focuses on the adult scenario for discussion of cancer risks in the 2016 FS.

[84] This critical information is buried in Draft Final FS, Appendix J, Table J2.3-1a.

[85] "Portland Harbor Remedial Investigation". Presentation to the CSTAG/NRRB, November 18, 2015. Kristine Koch, U.S. EPA, Region 10. Part 2, p. 27.

historical estimates. This SWAC level implies that EPA developed the RAL curves using a different baseline SWAC than the post-construction risk estimates, which is another unexplained inconsistency in EPA's methods.

EPA's new assumed baseline PCB SWAC of about 208 ppb is not mentioned once in the 2016 draft Final FS and Proposed Plan main text, figures, or tables.[86] EPA also does not explain why an upward shift that more than doubles the previously estimated baseline PCB site-wide SWACs is warranted or why this huge inconsistency with the EPA-approved BLRAs is acceptable. EPA generally cites in the FS main text both Appendix I and Appendix J for further information regarding SWAC uncertainties and methods for the post-construction risk assessment. Appendix I of the 2016 draft Final FS presents site-wide PCB SWAC uncertainty analysis results that range from 79 to 205 ppb (p. I-5), and the five methods used produced an average result of 120 ppb (Table I-1). Thus, the 208 ppb SWAC is even above the extreme maximum value from the analyses in Appendix I. Appendix J indicates (p. J-3) that "[s]ite-wide sediment concentrations were calculated for RAO 2 using the post remedial SWACs developed for each SDU and other areas of the river as described in Appendix I. A site-wide average concentration for each COC – represented by the 95 percent upper confidence limit on the mean – was then calculated for each RAO 2 COC using ProUCL." In response to the LWG's questions, this method was later clarified by EPA in an email response: "The figure below was used to develop site-wide SWACs. A SWAC of each area was computed and then put into Pro-UCL to determine the 95th percent UCL on the mean of those SWACs. The SWACs that are used in the FS are provided in Appendix J and K."[87] Despite the confusing and conflicting scattered statements, our current understanding is that the EPA value of 208 ppb derived in Appendix J may be completely separate from the value of 205 ppb described in Appendix I, and they are only coincidentally similar. This remains unclear.

Assuming that this interpretation is correct, the Appendix J method of calculating site-wide SWACs appears fundamentally flawed. EPA is indicating that the Site was cut into 31 subareas, and a SWAC was "computed" (the SWAC method here is unclear) for each subarea. EPA then made the assumption that the SWAC for each subarea was somehow a potentially representative "sample" of the entire Site SWAC, which is clearly an inaccurate and scientifically unsupportable assumption. Empirical data collected over 15 years irrefutably demonstrate that the Site has areas with relatively high and low PCB (and other chemical) concentrations, and the SWAC in any given subarea may have little relationship to the overall surface-weighted average across the entire Site. By selecting the concentration from one subarea to represent all post-construction risk estimates for the entire Site, EPA is deciding that all human health and ecological exposures represented by any particular RAO or scenario occur in that one subarea. In other words, while a given BHHRA scenario may assume a person is catching fish from the entire Site, EPA's FS method reduces this assumption to a person catching fish from just one select subarea for the entire exposure period. And because EPA is using an UPL, this person is assumed to consume only fish from an area with comparatively high concentrations.

A second unstated assumption is that the 31 subareas defined by EPA are a statistically valid way of dividing the Site. EPA clarified that the subareas are based on SDUs, which EPA states were devised to specifically identify the areas of highest COC concentrations on a rolling river mile basis. Obviously, many other methods could be used to define subareas of the Site, each of which would yield different statistics than the one EPA selected. Further, EPA has created an explicitly bimodal distribution of subareas, with some subareas focused on the highest observed concentrations (the SDUs) and remaining subareas focused on the lowest observed concentrations. This method is biased and inherently inaccurate for subsampling Site SWACs, and consequently it is likely that other less biased and more scientifically supportable subsampling methods would produce a lower overall SWAC estimate.

Regardless, it is inappropriate to use any of these new subsampling methods, because they will all create Site SWACs that are inaccurate and inconsistent with those used in the EPA-approved BLRAs, which in turn causes the remedy selection process to diverge from an appropriate focus on reducing risks actually identified in the BLRAs.

EPA's unscientific and artificially inflated new SWACs apply to other COCs as well, as shown in Table 3. An evaluation of EPA's new site-wide SWAC for 2,3,4,7,8-PeCDF clearly illustrates the problems with EPA's new

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[86] Indeed, the 208 ppb PCB SWAC would effectively designate the entire Site as Principal Threat Waste (PTW). *See* 2016 draft Final FS Table 3.2-1 (highly toxic PTW threshold is 200 ppb). Yet 2016 draft Final FS Table 4.2-9 identifies just 172 (out of 2167) acres of the Site as PTW.
[87] Email response number 8 from Kristine Koch on July 20, 2016 regarding LWG's "Request for Clarification."

SWACs. EPA's new site-wide SWAC for 2,3,4,7,8-PeCDF is 0.04 ppb. Out of 374 surface sediment samples analyzed for 2,3,4,7,8-PeCDF, only 10 samples in the entire Site are equal to or greater than 0.04 ppb, and these samples were all collected between river mile 6.7 and 7.3. The LWG calculated SWAC using EPA's 2015 natural neighbor contour surfaces is 0.00588 ppb, which is an order of magnitude less than EPA's new SWAC for this compound. As an additional example, EPA calculates that risk from a single dioxin/furan congener, 1,2,3,4,7,8-Hx CDF, is higher than the total TEQ. This is physically and logically impossible. It was also known to EPA to have been calculated using a flawed characterization and poor data quality.[88] When EPA's own contractor summarized percent contributions to risk from dioxin/furan congeners from actual fish tissue date, the TEQ risk from 1,2,3,4,7,8-Hx CDF was approximately 3 percent.[89]

Table 3. Comparison of EPA's New Site SWACs to Values Estimated by LWG Using EPA's Natural Neighbor Surfaces.

Chemical	Site-Wide SWAC (ppb)	
	Table J2.3-1a (EPA 2016 Draft Final FS)	SWACs Estimated by LWG Using Natural Neighbor Surfaces Provided by EPA
PCBs	208	86
DDx	138	30
1,2,3,7,8-PeCDD	0.0003	0.0002
2,3,4,7,8-PeCDF	0.04	0.006
2,3,7,8-TCDD	0.0003	0.0001

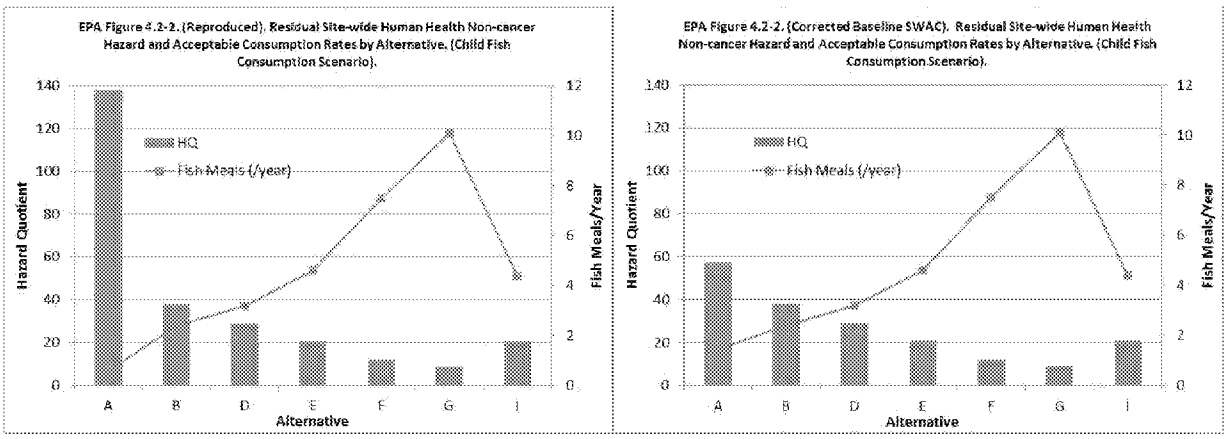
Another issue with EPA's post-construction SWACs is that EPA assumes a "zero" replacement value for areas where active dredging and capping is assumed to take place.[90] That is, the remediated area is assumed to attain a concentration of zero for any evaluated COC immediately after construction is complete. Although this assumption is convenient and simple, it is clearly incorrect for dredge areas, where dredge residuals are known to occur. These residuals can be managed, but it is nearly impossible to reduce post-dredge residual concentrations to zero.[91] The use of zero as a replacement values for dredge areas makes the larger alternatives with more mass removal appear to have greater immediate risk reduction than will actually occur. For example, EPA presents several post-construction SWACs for PCBs that are below EPA's background value of 9 ppb (and the LWG's calculated equilibrium value of 20 ppb). Even if such immediate post-construction concentrations were temporarily achievable, inputs and deposition of sediments from upstream would be expected to quickly return these areas to an equilibrium concentration. Thus, EPA compounds the appearance of steep SWAC declines by simultaneously artificially inflating the baseline SWAC and then over-estimating the SWAC reductions that will occur due to dredging.

The consequences of substantially diverging from the BLRA SWACs at this late date are not considered or discussed anywhere in the 2016 draft Final FS or Proposed Plan. The consequences, combined with other issues like the zero replacement value, are widespread, impacting every post-construction risk estimate presented by EPA and skewing the overall evaluation of the alternatives' effectiveness. Because EPA increases the baseline Alternative A SWACs by a factor of about 2.4, all of EPA's baseline risk estimates are higher than the BHHRA by a

[88] See email message E. Allen USEPA to DEQ dated August 20, 2015.
[89] CDM Smith, "Evaluation of Dioxin/Furan Congeners Against Total Dioxin/Furans, Portland Harbor Superfund Site," December 23, 2014, Table 1 (presenting results by river mile, with the contribution to risk attributed to 1,2,3,4,7,8-Hx CDF by river mile segments ranging from 0 to 20 percent and, once corrected for the fact that the wrong TEF was applied (TEF for 1,2,3,4,7,8-Hx CDF is 0.1, not 0.3, according to https://rais.ornl.gov/documents/dioxin_tef.pdf), averaging approximately 3%).
[90] 2016 draft Final FS p. ES-14.
[91] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; ITRC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA. (Attachment 13)

similar factor.[92] Figure 2 provides an example of how EPA's post-construction risk figures would change if baseline SWACs consistent with BLRAs were used instead. The risk reduction (HQs) from the baseline condition in Alternative A provided by all the alternatives becomes substantially less, and the graph becomes much less compelling visually. Similarly, the number of allowable fish meals provided by Alternative I (for example) goes from 7 times greater than baseline to only 3 times greater than baseline.

Figure 2. Comparison of EPA's FS Risk Estimates to Corrected Values Using a Baseline SWAC Consistent with the BLRAs.

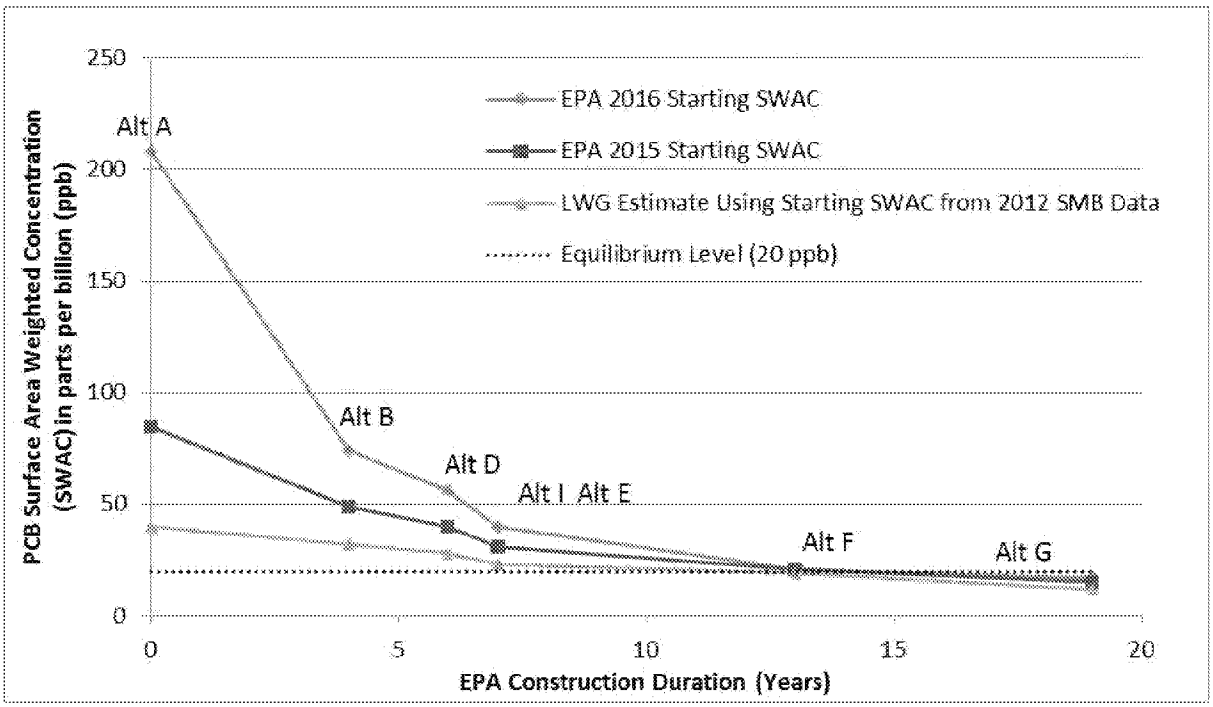


As another example, EPA calculated, using the Food Web Model and the new sediment SWAC of 208 ppb, an average PCB site-wide fish tissue concentration of 521 ppb. The comparable average site-wide fish tissue concentration in the BHHRA, based on actual tissue data collected in 2007 and earlier, is 227 ppb, which equates to a site-wide modeled sediment SWAC of 85 ppb.[93] Using EPA's modeled tissue concentration of 521 ppb, the acceptable consumption rate based on the non-cancer endpoint would be 1.9 fish meals/year for the child scenario; whereas the actual BHHRA tissue concentration of 227 ppb results in an acceptable consumption rate of 4.2 meals/year. The above calculation of 1.9 meals/year for Alternative A (baseline) using EPA's fish tissue concentration is higher than the meals per year shown for Alternative A in EPA's Figure 4.2-2 (reproduced in Figure 2 above), which presents 0.6 fish meal/year for the presumably same scenario. This difference illustrates another error in EPA's calculations that was only discernable through independent calculations. It appears that EPA is using the child scenario but altering the fish meal size from 3.5 ounces to the adult meal size of 8 ounces, which is clearly inconsistent with the BHHRA methods. Putting aside the reasonableness of a child consuming adult meal portions for long periods while still remaining a child, the net result of EPA's poorly explained additional change to the exposure assumptions is to drive allowable fish meals even further down for the baseline condition. Combined with the artificially inflated new SWAC, this meal size change compounds the portrayal of the baseline condition as much worse than the actual BHHRA findings. Again, this further increases the perceived benefit of any SWAC and tissue concentration reductions assumed for the more aggressive alternatives. It should also be noted that even with the change to adult meal size for the child scenario, the LWG could not exactly reproduce EPA's allowable fish meals, which likely indicates other undescribed procedures were employed that create further inconsistencies with the EPA-approved BHHRA.

[92] There may be other differences between some calculations because EPA used additional methods that are also inconsistent with the BLRAs. A factor of 2.4 is accurate to assess the impact of this one variable (i.e., the new SWAC for PCBs).
[93] See Attachment 14. memorandum "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan" detailing a comparison of EPA's fish consumption risk estimates to BHHRA and 2012 smallmouth bass estimates. See also, "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013." (Attachment 1)

Figure 3 illustrates the effect of the choice of the baseline site-wide SWAC on the utility of various alternatives, as represented by construction durations,[94] using a "knee of the curve" analysis. Figure 3 presents the knee of the curve when the baseline PCB SWAC is assumed to be 208, 85, and 40 ppb. These are EPA's artificially inflated 2016 draft Final FS SWAC estimate, the SWAC consistent with the EPA-approved BLRAs that EPA used in the 2015 Draft FS, and the SWAC estimated from the 2012 smallmouth fish tissue sampling, respectively.[95] As the initial SWAC decreases, the incremental benefit in terms of SWAC reduction for each successively longer alternative also decreases. The utility of the alternatives as determined by the knee of the curve shifts away from Alternatives F and G and toward Alternatives B and D. In the case of the lowest initial SWAC (gray line), there is virtually no added benefit in moving from Alternative B to I, while the short-term and other duration associated impacts increase substantially. When a higher value is used for the initial conditions, the most aggressive and resource consuming alternatives erroneously appear to provide more benefit. Also note that due to EPA's zero replacement value assumption, the SWACs for the largest alternatives erroneously appear to achieve levels below equilibrium level (black dotted line in Figure 3).

Figure 3. Immediate Post-construction SWACs and EPA Durations.



While EPA has increased the perceived benefit of the larger alternatives (such as Alternative I) by artificially increasing the baseline condition by a factor of 2.4 above the approved BLRAs, the 2012 smallmouth bass data strongly suggest the Site has continued to recover below the BLRA SWACs (i.e., the RI and BLRAs use data that were collected mostly between 2002 and 2008). As noted in the LWG's presentations of the 2012 smallmouth bass data to EPA, that data strongly suggest that some parts of the Site that EPA identifies for active remediation are already approaching equilibrium conditions.[96]

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[94] As EPA's draft Final FS points out, as the durations of the alternatives rise the short-term impacts to the environment and community, the number of feasibility issues, and costs also rise.

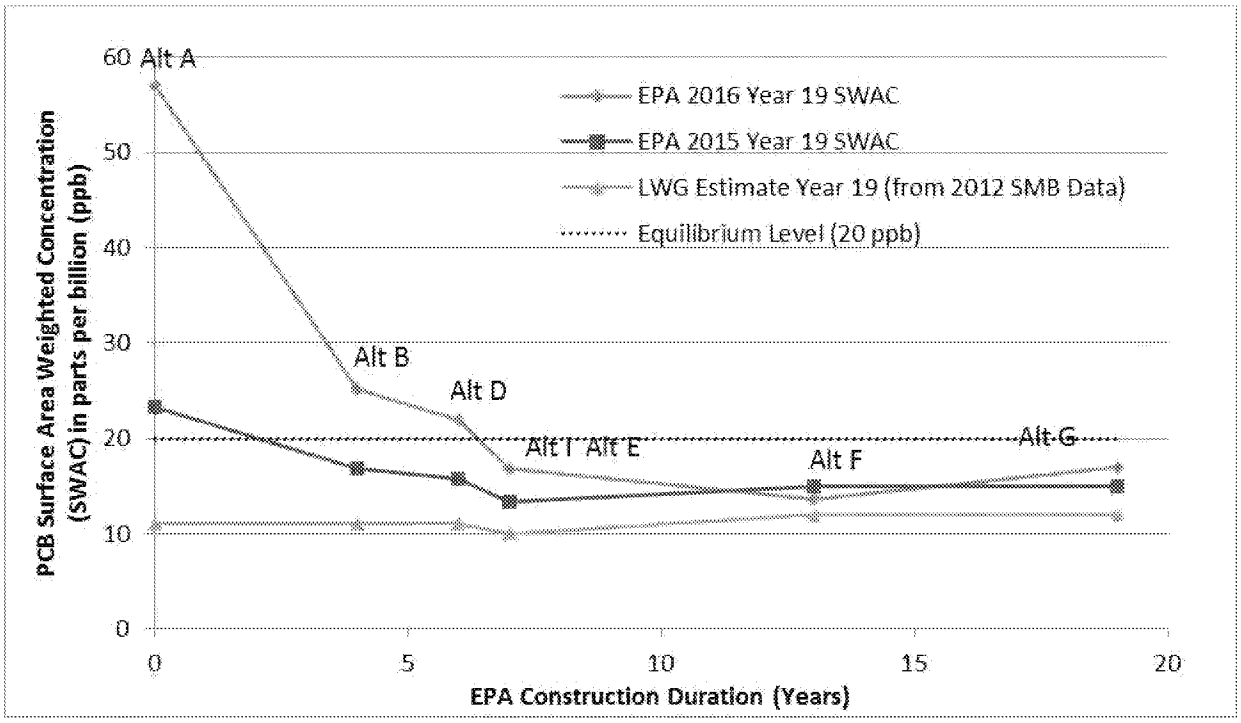
[95] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)

[96] See also Kennedy/Jenks Consultants Memo dated March 6, 2013, that summarizes the data that shows a decline in concentrations. Kennedy Jenks' March 6 memo acknowledges it is comparing 2012 discrete samples to earlier composite samples and bases its comparison on means, maximum, and minimum detected concentrations. (Attachment 15)

c. EPA ignores upstream and other external contributions that limit the risk reduction available through sediment cleanup to system equilibrium values

EPA has previously acknowledged that equilibrium is a useful concept for the Site.[97] The LWG has provided EPA with detailed evaluations demonstrating that, due to upstream sources, the Site is unlikely to ever achieve site-wide PCB SWACs less than 20 ppb.[98] Figure 3 shows immediate post-construction SWACs using EPA's incorrect zero replacement value assumption, but as the Site continues to recover over time, presumed additional decreases in Site SWACs provided by longer and larger alternatives will not actually occur. Figure 4 presents estimated SWACs for all alternatives at 19 years after construction starts,[99] which is EPA's assumed construction duration for Alternative G. Figure 4 shows that any perceived benefits of longer and larger alternatives are unlikely, because EPA's analysis does not consider that concentrations cannot decrease below Site equilibrium conditions. For example, using EPA's 2016 SWAC values, the additional 14 years of estimated construction from Alternative G, or 3 years of construction from EPA's Preferred Alternative. would result in a difference in PCB SWAC of only about 5 ppb from Alternative B.[100]

Figure 4. Estimated SWACs 19 Years after Construction Starts.



The equilibrium concept is a critical consideration in evaluating the long-term effectiveness of remedial alternatives in the FS. EPA guidance provides that sediment remedies "should reflect objectives that are achievable from the site

[97] As recently as April 2015, EPA endorsed the concept of equilibrium as a measure of the most a sediment remedy can accomplish and committed to perform an equilibrium evaluation in Section 4 of the FS. "EPA will conduct an equilibrium evaluation in Section 4 of the FS. The most appropriate means to evaluate whether RAOs or PRGs are achievable by any of the alternatives being developed in Section 3 of the FS is to conduct the detailed evaluation in Section 4 of the FS using the first seven NCP criteria. This information will be considered in developing the final remediation goals/cleanup levels." EPA Response to LWG's March 25, 2015 Comments on the Portland Harbor FS Section 2 (April 10, 2015), p. 2. A copy of EPA's response is Attachment 16.

[98] *Sediment Equilibrium Estimates for the Revised Feasibility Study*, (LWG, August 7, 2014). This Technical Memorandum is Attachment 17. The discussion herein focuses on the expected Site equilibrium for PCBs. As addressed in the LWG's memorandum, equilibrium concentrations for a number of COCs (including background sensitive risk-drivers DDX and dioxins/furans) can be predicted, and the LWG specifically provided that analysis to EPA for PCBs and DDX.

[99] See Section V.C. for a description of methods to estimate long-term SWACs. These methods avoid using computer models that EPA has expressed uncertainty about.

[100] See Table 6, infra.

cleanup."[101] Concentrations below equilibrium cannot be achieved by any alternatives, and any comparisons assuming otherwise are fundamentally flawed. Unlike Portland Harbor, equilibrium has been fully integrated into Proposed Plan decisions at other sites. In the Lower Duwamish Waterway (LDW) Proposed Plan, several datasets representing COC concentrations in suspended sediments entering that site from the upstream Green/Duwamish River system were evaluated because they represent "future COC concentrations in the LDW after implementation of cleanup alternatives."[102] This included the use of deposited sediments in an upper turning basin, because "these data provide an indicator of suspended sediments settling within the upper reach of the LDW."[103] The Grasse River ROD indicates, "The selected remedy will comply with all of the listed ARARs in Tables 13-1 through 13-3 except two chemical-specific ARARs which are not expected to be met due to Site background PCB loading conditions. Therefore, because of technical impracticability, those two ARARs are being waived."[104]

D. EPA's Selection of Its Preferred Alternative is Not Based Upon Meaningful Risk Reduction and Fails to Apply Appropriate Risk Management Principles

According to the EPA-approved BHHRA, consumption of resident fish, such as carp and smallmouth bass, represents the majority of potential human health risk at the Site. Calculated site-wide subsistence fisher risks are orders of magnitude higher than other scenarios,[105] and 93% of this risk comes from PCBs.[106]

EPA's BHHRA evaluated the risks to a subsistence fisher eating 228 resident fish meals/year.[107] EPA calculated such high potential risk to subsistence fishers that EPA has determined that, under current conditions, children and other vulnerable populations should eat only 0.6 resident fish meal/year.[108] According to EPA, healthy adults can currently eat 4.3 meals/year.[109] The most aggressive cleanup alternatives evaluated by EPA would allow vulnerable populations to eat 7.5 to 10 meals/year after construction is complete.[110] Healthy adults could eat 38 meals/year after construction of Alternative F, but because the estimated post-construction PCB SWAC of 21 ppb is approximately the equilibrium value, Alternative G would be unlikely to push additional fish consumption using EPA's risk assumptions much, if at all, above the 38 meals/year estimated for Alternative F. EPA's Preferred Alternative would allow 4.4 meals/year for children and 22 meals/year for adults after construction.

Extensive evidence from other sites suggest that fish tissue PCB concentrations will temporarily increase for a period of 3 to 5 years after dredging of contaminated sediments takes place.[111] The dynamic Food Web Modeling of alternatives in the 2012 LWG Draft FS (Appendix Hb) also projects this reaction in fish tissue concentrations during and after dredging. This evidence all indicates that fish consumption risks will increase significantly during construction and will persist for several years after construction is completed to allow time for the fish tissue to respond to the new sediment conditions. Therefore, and as discussed more fully in Section V.C. below, because the fish consumption risk reduction achievable through a sediment cleanup is limited by sediment equilibrium, cleanup alternatives involving longer and more aggressive construction activities are likely to significantly increase fish consumption risks in the short term while resulting in no greater long-term increase in fish meals. In other words, as

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[101] Sediment Guidance, p. 2-15.
[102] *Proposed Plan Lower Duwamish Waterway Superfund Site*, EPA, Region 10. Seattle Washington. February 28, 2013, pp. 26-27.
[103] *Id.*
[104] *Record of Decision Grasse River Superfund Site (a.k.a. Alcoa Aggregation Site) Massena, St. Lawrence County*, New York. EPA, Region II. New York, New York. April 2013, p. 54.
[105] BHHRA page 101; Figure 7-1.
[106] BHHRA p. 4; Figure 7-3; Table 5-74.
[107] Proposed Plan p. 18.
[108] Proposed Plan p.32.
[109] EPA focused on the child fisher non-cancer scenario in the 2016 FS. Consequently, to compare to OHA adult advisories, the LWG estimated adult allowable fish meals using EPA's methods. See "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan," Attachment 14.
[110] Proposed Plan p. 58. As noted previously, EPA does not state these values are based on the child recreational scenario, but independent calculations suggest that this is the scenario that EPA is presenting in the Proposed Plan.
[111] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; IRTC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.

shown in Table 8 below, Alternative B, which EPA projects would take 4 years to complete, would allow 4.1 meals/year for children 12 years after construction starts, right about the same time that fish tissue levels for Alternative I, which EPA projects would take 7 years to complete, would likely be settling down to EPA's projected post-construction 4.4 meals/year.[112]

The Oregon Health Agency's current fish consumption health advisories are summarized in Table 4. Table 4 compares these advisories to the results of EPA's 2016 draft Final FS allowable fish meal calculations for each alternative. For the adult scenario, Table 4 shows that EPA's Alternative A, representing the existing condition, provides an allowable number of fish meals (4.3 meals/year) that is substantially less than both of the current Oregon Health Agency (OHA) adult advisories. For the vulnerable population or child scenario, Table 4 shows that EPA would allow children to currently eat a little more fish than the OHA advisory, but only because that advisory is already set at zero.

Table 4. Comparison of EPA 2016 Draft Final FS and Oregon Health Agency Allowable Fish Meals (meals/year).

Estimate Source	Healthy Adults[1]	Vulnerable Populations (including children)[2]
OHA Advisories		
PCBs, Portland Harbor	12	0
Mercury, Willamette River[3]	48	12
EPA 2016 Draft Final FS – EPA assumed immediate post-construction consumption per Appendix J		
Alternative A (no action, assumed current condition)	4.3	0.6
EPA recommendation during construction	[4]	0.6
Alternative B	12	2.4
Alternative D	16	3.2
Alternative E	23	4.6
Alternative F	38	7.5
Alternative G	52	10.1
Alternative I	22	4.4

Notes
1 Because the 2016 draft Final FS focuses on child scenario, EPA adult values are estimated by LWG calculations (see attached memorandum "Review of Human Health Risk Analyses in the Portland Harbor Feasibility Study and Proposed Plan.")
2 OHA "vulnerable" populations include children, women of child bearing age, and people with some types of diseases. EPA child values from Figure 4.2-4 in the 2016 draft Final FS.
3 For mainstem Willamette, which includes Portland Harbor.
4 Page 58 of EPA's Proposed Plan states that "people" would be advised no more than 0.6 meals per year during construction. Based upon the calculations in Appendix J, we interpret "people" to mean children and are therefore unable to determine what EPA recommends for adults.

EPA's 2016 draft Final FS concludes that "the existing [OHA] advisories might not be sufficiently effective in protecting human health since the current recommended rate of one meal per month [12 meals/year] for the general population may not be sufficiently protective of consumers."[113] We are not aware that EPA has previously stated that the OHA fish advisory was not protective for adults, even though EPA approved the BHHRA more than 3 years ago. EPA should consider that the conflict between the OHA advisory and EPA's BHHRA indicates EPA's risk estimates may be incorrect. At a minimum, EPA should coordinate with OHA to provide clear, credible, and consistent public health information. EPA should also explain its advisory in light of the U.S. Food and Drug

[112] See Section V.C, *infra*.
[113] 2016 draft Final FS, p. 4-15.

Administration's threshold for PCBs in fish sold in supermarkets of 2 parts per million (ppm), which is more than 1,000 times higher than EPA's cleanup goal of 0.3 ppb in resident fish tissue.[114]

EPA must also recognize that consumption of resident fish in the Willamette River will continue to be limited by mercury fish tissue concentrations that are unrelated to Portland Harbor (e.g., upstream watershed soils, upstream historic gold mining activities, and regional and global combustion sources) and therefore beyond the scope of the Superfund cleanup to address. Mercury, like PCBs, is also a persistent pollutant that will remain in the river after the cleanup is completed. Accordingly, we assume OHA's fish advisory with respect to mercury will remain in place. To a person eating fish from the Site, there is no real world difference between fishing limitations based on PCBs versus mercury. Both chemicals potentially reduce the amount of fish people can consume. The continuing mercury fish advisory is guidance from a credible health agency that provides important context for sediment remediation risk management decisions and determining the most cost-effective sediment remedy.

E. EPA's Establishment of RAO 9 for Source Control Is Arbitrary and Capricious Because There is No Information in the RI or Risk Assessment to Support It

EPA's Proposed Plan includes an RAO 9 for riverbanks. EPA's reason for including this RAO is that, according to vaguely described information it received from DEQ, some contamination remains in some identified riverbank soils at levels that, if erosion were to occur, might result in recontamination of sediments.[115] EPA states in the Proposed Plan that remediation of contaminated river banks is included "if it is determined that it should be conducted in conjunction with the in-river actions." EPA's Proposed Plan provides Figure 6 and Table 5 as the full extent of its evaluation of why and where such remedial action is required. It adds that "[o]ther river banks may be included in the remedial action, if contamination contiguous with the river sediment is found during remedial design sampling."[116]

In February 2001, a Memorandum of Understanding (MOU) related to the Site was executed among EPA, Oregon DEQ, and several state, federal, and Tribal natural resource trustees. That MOU provided that EPA would be the lead agency for investigating and cleaning up contamination in the river sediment and DEQ, using state cleanup authority, was designated as the lead agency for identifying and controlling upland sources adjacent to or near the river. Pursuant to that MOU, the Portland Harbor Joint Source Control Strategy was finalized by EPA and DEQ in December 2005. Since that time, many owners and operators of facilities along the river, including several LWG members, have been actively involved with DEQ, planning and implementing source control measures. DEQ has provided EPA regular updates on its source control efforts. As of March 2016, DEQ reported it is on track to complete its determinations of the need for source control measures at all upland sites within the Portland Harbor and to have needed measures in place prior to implementation of CERCLA in-water remedies, in order to prevent likely future adverse effects on water or sediment quality.[117]

In the 2016 draft Final FS and Proposed Plan, EPA has ignored many of those fully or partially completed actions and identified groundwater and riverbank concerns. Although the FS states that information received from DEQ was the basis of these concerns, that information must not be current or complete. In some instances, the groundwater and riverbank contamination has already been addressed, and in others property owners have agreed with DEQ to implement remedies at or before the time of the adjacent in-water remedy.[118] There is no reason for EPA to now insert RAO 9 into the FS and Proposed Plan, given the ongoing, successful efforts to control upland sources.

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[114] 21 CFR §109.30.
[115] 2016 draft Final FS, page 1-17.
[116] Proposed Plan at 13.
[117] Portland Harbor Upland Source Control Summary Report (DEQ, March 25, 2016 update), at 119.
[118] For example, as of March 2016, DEQ reported that river bank remedial action at the Evraz Rivergate site had been fully implemented and that the pathway was considered controlled. *Id.* at 101. Figure 6 of the Proposed Plan, however, shows this as a river bank requiring remediation.

At no time during the LWG's development of the RI and risk assessments did EPA suggest that riverbank data should be collected sufficient to support the development and evaluation of riverbank remedial alternatives.[119] EPA's last-minute incorporation of riverbanks in the FS, when no upland media were evaluated in the approved RI or risk assessments, is counter to EPA policy and guidance. "The purpose of the remedial investigation (RI) is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating remedial alternatives."[120] Here, EPA provides no data or analysis related to what riverbank-related remedial actions are to be implemented or what specific areas present unacceptable risks. EPA refers to Appendix A as the data source for its riverbank analysis. Appendix A appears to be a random compilation of various data, some of which has nothing to do with riverbanks. A review of the "matrix code" column finds most entries are blank, and many entries are data that are not from riverbank soils. The entries include tissue, water, porewater, groundwater, outfall, stormwater, and surface water. In summary, no care was used to put this database together, and much of the information appears to have little to do with delineating contaminated riverbanks. Appendix A also contains a disclaimer noting that it is taken exactly as-is from third-party sources with no quality assurance or quality control performed by EPA. Section 2.2.2 of the EPA-approved RI states that EPA Order 5360.1 and Office of Solid Waste and Emergency Response (OSWER) Directive 9355.9-01[121] requires that environmental measurements be of known quality, verifiable, and defensible. The Office of the Inspector General concluded in an audit of Region 9 Superfund sites[122] that data used for cleanup decision-making should be validated using EPA functional guidelines.[123]

Despite all of these inadequacies in the data, EPA relies on the data to identify riverbank areas for remediation and then to assess the relative effectiveness of remedial alternatives. This assessment is not grounded in adequate site specific information and therefore is arbitrary and capricious.

EPA should delete RAO 9 and all evaluations of alternatives based on riverbank contamination and rely upon DEQ to adequately address source control as it is required to do under the 2001 MOU and as it is successfully doing.

F. <u>To the Extent the Plan Intends to Prescribe In-river Actions to Address Groundwater Contamination, it is Arbitrary and Capricious Because There is No Information in the RI or Risk Assessment to Support It</u>

EPA's discussion of groundwater in the Proposed Plan is confusing. On the one hand, it appears that the Plan does not prescribe remedies for groundwater and that it is EPA's intent that the ROD will not address it either:

> "It is EPA's expectation that DEQ's upland source control actions will adequately address groundwater contamination. EPA's RAOs above are focused on containing and reducing migration of COCs from groundwater to surface water and biologically active areas of sediment. Should groundwater not be addressed adequately under DEQ's actions, EPA may, at a future time, determine if action is warranted under CERCLA to further address groundwater contamination."[124]

On the other hand, the Proposed Plan states that reactive caps "may" be required when it is predicted that " flow of groundwater or pore water will release contamination through the cap,"[125] and that

> "[i]t is EPA's expectation that the majority of the current identified groundwater plumes will be addressed by DEQ's actions and the alternatives will only need to address the portion of the plumes that extend into the river. Since the extent of these plumes impacting pore water is not currently known, these areas will

[119] For the same reason, EPA has no basis for drawing conclusions about any potential risks to the Columbia River associated with potential transport of chemicals from the Portland Harbor Site. The Columbia River was not investigated or evaluated in any part of the RI, BLRAs, or FS.
[120] 40 CFR §300.430.
[121] *Data quality process for Superfund, Interim final.* EPA-540-G93-071. USEPA, 1993.
[122] Environmental data quality at DOD Superfund sites in Region 9.
http://www.epa.gov/oig/reports/1995/ffqar9rp.htm . Office of Inspector General, USEPA, 1995.
[123] U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA 540/R-99/00801. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, October 1999. And USEPA contract laboratory program national functional guidelines for inorganic data review. EPA 540-R-01-008. Office of Emergency and Remedial Response, USEPA, 2002.
[124] Proposed Plan at 22.
[125] Proposed Plan at 27.

> need to be refined during remedial design and at that point it will be determined which residual groundwater plumes will need to be addressed in the river."[126]

EPA goes so far in the Proposed Plan to identify a single commercial product, "AquaGate+10%PAC," to use in reactive caps where groundwater contamination is present.[127]

If EPA's intent was the former, to leave groundwater remedial actions to DEQ under its source control authority or, at the most, to address groundwater in subsequent ROD amendments, then EPA need not address the remainder of comments in this subsection. For purposes of estimating costs, it may have been reasonable for EPA to include some screening level scoping of groundwater measures to account for the cost of some groundwater-focused actions identified during remedial design as having a potential to recontaminate sediments. However, if this is all EPA intended, in the ROD EPA should: 1) remove the groundwater RAOs; and 2) remove the comparative analysis of alternatives criteria related to groundwater RAOs. Groundwater and the potential for any stranded wedges to affect caps should be considered as part of sediment remedial designs and sediment caps should be appropriately designed to address recontamination or groundwater migration issues.

However, if it is EPA's intent to issue a ROD that prescribes groundwater-focused remedial action as actually described in the Proposed Plan, that would be completely unsupported by the RI and Risk Assessments or by any analysis included in EPA's 2016 draft Final FS and Proposed Plan, and would therefore be arbitrary, capricious, and not in accordance with law, for the following reasons:

- The entire extent of the Proposed Plan's discussion of groundwater remediation consists of three isolated paragraphs, one figure, and one table.[128] As quoted above, EPA admits that it does not know the extent of any groundwater plume, because its RI and risk assessments were not intended to investigate or assess any such plumes. Proposed Plan Table 3 is a summary of contaminants of concern in "porewater and transition zone water" with no explanation of where in the site these samples are or where they present risk.

- Proposed Plan Figure 5 is described only as "multiple areas" that "DEQ has identified...with groundwater contamination," with no data or quantitative assessment. There is nothing in the Proposed Plan that provides data or analysis to support the figure, and it is inconsistent with DEQ documentation, ignoring extensive and successful groundwater source control evaluation and remedial action work by DEQ at many of these sites, including the Arkema, Evraz, Gunderson, NW Natural and Time Oil sites.[129]

- EPA does not have any basis in the Administrative Record before it to conclude as it does in Section 3.4.7.3 of the 2016 draft Final FS and page 27 and Figure 10 of the Proposed Plan (and in its discussions of the various alternatives) with respect to groundwater that reactive caps are necessary at any particular site, or type of site, or to specify a particular type of reactive cap:

  - EPA has not evaluated the risks associated with any particular site or in any way (beyond drawing Proposed Plan Figure 5) defined the technical basis for its assumed extent of groundwater "plumes";

  - Without any analysis of appropriate technologies to treat the COCs driving risk, EPA has no basis to prescribe any particular type of reactive cap;

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[126] Proposed Plan at 60.
[127] Proposed Plan at 65.
[128] Proposed Plan at 13, 27 and 60, Table 3 and Figure 5.
[129] As with the vague references to communications with DEQ regarding riverbanks, this information does not appear to be current or accurate. For example, as of March 2016, DEQ has concluded that no source control measures are needed in groundwater for the Evraz Rivergate site and that the potential for recontamination from groundwater at that site is low. *Portland Harbor Upland Source Control Summary Report* (DEQ, March 25, 2016 update), at 101. Nonetheless, Figure 5 of the Proposed Plan shows a groundwater plume encompassing the entire shoreline of the Evraz site. Similarly, with respect to the Time Oil site, the March 2016 DEQ report states that "a pump and treat system is operating to prevent [the pentachlorophenol plume's] migration to the river." *Id.* at 83. Yet EPA's FS identifies the Time Oil pentachlorophenol plume as one of the "known contaminated groundwater plumes currently or potentially discharging to the river." 2016 draft Final FS pages 1-13 – 1-14.

- EPA has, nonetheless, gone so far as to prescribe one particular commercial product for a reactive cap, AquaGate+10%PAC, apparently based on one presentation that this for-profit commercial business provided to EPA in April 2015, without any performance assessment to determine whether this reactive cap product or any other alternative reactive cap products would address particular COCs driving risk at any particular location;

- EPA has failed to address the implementability of its prescribed reactive caps. Rather than prescribe the use of AquaGate+10%PAC, EPA's ROD should simply state that the need for reactive caps will be evaluated at the design stage for any areas with "stranded" groundwater plumes and that any particular cap material and deployment mechanism will be chosen based on that assessment.

In summary, groundwater should be addressed in the ROD by stating that EPA continues to rely upon DEQ to adequately address source control, as it is required to do under the 2001 MOU and as it is successfully doing. If EPA selects any groundwater-focused "in-river actions," they should be only in those areas where the BLRAs identified known in-water risks from the residual impacts of contaminated groundwater discharge and the extent of the action should be determined in the sediment remedial design. EPA should not prescribe sediment remedies that ignore completed or committed upland source control measures.

II. EPA's Principal Threat Waste Approach Leads to Arbitrary and Capricious Remedial Technology Selections, Inconsistent with both EPA Guidance and Practice as to the Appropriate Consideration of Principal Threat Waste

EPA's Proposed Plan addresses three categories of principal threat waste (PTW), which it describes as "PTW source material," "PTW that cannot be reliably contained," and "highly toxic PTW."[130]

EPA's Proposed Plan incorporates an unprecedented approach in its consideration of PTW that leads to prescriptive remedial technology assignments that are inconsistent with EPA guidance and practice. Perhaps more importantly, EPA's PTW approach is unnecessary to making Portland Harbor remedial technology assignments, because it duplicates other proper risk-based alternatives evaluation considerations already taken into account. In particular, EPA's designation of PTW leads to two aspects of its proposed remedial alternative that should be eliminated as unnecessary:

1. Designation of a set of RALs based on PTW (Table 13 of the Proposed Plan)

2. Prescriptive technology assignments based on the PTW designation (Figures 10a, 10b, and 10c of the Proposed Plan)

Between these two results, EPA adds very material costs to its remedy. For example, EPA requires activated carbon or aquablock/organoclay amendment in caps and residual covers in all areas where PTW (as defined by EPA) exists, even if the PTW is removed by dredging. This assumption adds approximately $52 million to the remedy cost. Additionally, EPA has specific ex situ treatment and disposal requirements for certain PTW that would increase disposal costs by as much as $43 million. Both of these are required by EPA without any evaluation of implementability or effectiveness, let alone cost-effectiveness.

A. EPA's Application of PTW Concepts is Inconsistent with Guidance and Practice

EPA has designated large geographic areas as PTW based on its evaluation of the "high toxicity" criterion as compared to the human health fish consumption PRGs.[131] Its designations are inconsistent with its risk assessment and inconsistent with EPA guidance.

[130] Proposed Plan, p. 14.
[131] Proposed Plan, p. 14.

First, EPA does not accurately assess the presence of greater than 10^{-3} cancer risk at the Site consistent with risk assessments or the intent of EPA guidance.[132] For total PCBs, dioxin/furan TEQ and total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), EPA simply multiplied certain 10^{-6} cancer risk PRGs by 1,000 based on human health fish consumption (high consumption rate, mixed diet, fillet only) to determine concentrations associated with 10^{-3} cancer risk. For BaPEq, EPA followed the same procedure using a sediment direct contact PRG for high frequency fisher.

However, before applying such concentrations for PTW identification, even assuming this is an appropriate pathway to evaluate in this context, the presence of actual risks greater than 10^{-3} needs to be determined. In fact, greater than 10^{-3} risk was not found in the BHHRA for dioxin/furan TEQ, total DDx, or BaPEq for any scenario evaluated. Therefore, the definition of highly toxic as described in EPA PTW guidance[133] is only potentially applicable to total PCBs.

That leads to the question of what pathways are relevant for purposes of defining principal threats. For total PCBs, greater than 10^{-3} cancer risk was found in the BHHRA for three fish consumption scenarios: subsistence (mixed diet, fillet), recreational (mixed diet, fillet), and tribal (whole body and fillet). The PTW guidance states:

> "'Source material" is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or acts as a source for direct exposure." [emphasis added].

The fish consumption risks do not represent direct exposures from source materials, but rather integrate contaminant contributions from sediment, surface water, and diet. As a consequence, the sediments by themselves do not directly pose risks greater than 10^{-3}. In addition, contaminants in fish do not represent a reservoir for migration of contamination to other media in any reasonable sense.

Applying the PTW guidance, only contaminants that were actually found to pose greater than 10^{-3} cancer risk in media that potentially represent a source to other media or of direct exposure should be evaluated for the highly toxic aspect of the PTW definition, and only in those areas where that level of risk was found to occur in the BLRAs. No contaminants meet these conditions at the Site. EPA's definition of PTW in this case is particularly inappropriate given 2012 fish tissue data[134] that show PCB concentrations in fish tissue have declined significantly. If these 2012 concentrations are applied to risk estimates using methods consistent with the BHHRA (using the 95% UCL for the site-wide subsistence consumption scenario, fillet tissue), the resulting human health cancer risk for consumption of smallmouth bass is 4×10^{-4}, substantially lower than 10^{-3}. And the end result of EPA defining PTW by these methods is that EPA has designated material containing PCBs at 200 ppb as PTW; a concentration which is 100 ppb below the sediment cleanup objective of 300 ppb applied in the Hylebos Waterway of Commencement Bay. Thus, EPA is adding nearly $100 million to remedial action costs based on its consideration of a risk level that likely no longer exists and concentrations that are below final cleanup levels established at other Region 10 sites.

Regardless of concentration, EPA should not identify materials that can be reliably contained as principal threat waste. EPA's 2016 draft Final FS states, "'[r]eliably contained' was not used in identifying PTW but rather was used to determine what concentrations of PTW could be reliably contained."[135] This clearly contradicts the guidance, which discusses reliably contained as part of PTW identification.[136]

> "Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. *** No 'threshold level' of toxicity/risk has been established to

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[132] *A Guide to Principal Threat and Low Level Wastes*. Office of Solid Waste and Emergency Response. Superfund Publication 9380.03-06FS. November 1991.
[133] *Id.*
[134] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)
[135] 2016 draft Final FS, page 3-3.
[136] NCP Preamble, 55 Fed. Reg. 8666 at 8703 (March 8, 1990); A Guide to Principal Threat and Low Level Wastes, OSWER Superfund Publication 9380.03-06FS (November 1991).

> equate to 'principal threat.' However, where toxicity and mobility of source material combine to pose a potential risk of 10-3 or greater, generally treatment alternatives should be evaluated. *** Determinations as to whether a source material is a principal or low level threat waste should be based on inherent toxicity as well as consideration of *** the potential mobility of the wastes in the particular environmental setting ***."[137]

The guidance is clear that PTW only exists where the factors of highly toxic or highly mobile *combine* with a condition of not reliably containable. EPA acknowledges (in 2016 draft Final FS Table 3.2-2) that all COCs at the concentrations present in the Site, with just two exceptions (chlorobenzene and naphthalene), *can* be reliably contained.[138] Thus, none of the areas where these contaminants are absent should be designated as PTW. Accordingly, if all PCB, PAH (except naphthalene), and DDx concentrations present at the Site can be reliably contained, then EPA is not required to address them as a PTW. And naphthalene concentrations detected in the RI were not found in the BHHRA to pose a greater than 10^{-3} risk for any media or scenario evaluated and therefore do not constitute PTW.

Similarly, the 2016 draft Final FS and the Proposed Plan provide no discussion or explanation of how material with sediment concentrations above the EPA-identified highly toxic thresholds or the presence of "globules or blebs"[139] of non-aqueous phase liquid (NAPL) pose a risk of migration without any knowledge as to what the globules or blebs consisted of or whether such substances are naturally occurring.[140] EPA's interpretation of any trace evidence of NAPL as PTW is devoid of scientific justification and is inconsistent with situations described in the guidance, such as "pools of NAPLs submerged beneath ground water or in fractured bedrock, NAPLs floating on ground water" or where physical processes are likely to mobilize "source materials" as defined in the guidance.[141] EPA had the responsibility and opportunity to require scientific investigation of globules and blebs as part of the RI or as a supplemental RI. Except at the Gasco Sediment Site (where extensive investigations have defined areas of "substantial product" consistent with the consent order for that site), EPA chose not to do so and to rely entirely on unsupported speculation for its decision making instead. The 2016 draft Final FS interpretation is also inconsistent with the final remedy selected by EPA at the McCormick and Baxter site within Portland Harbor, where sediments containing NAPL were reliably contained using conventional and active capping technologies.[142]

Finally, the 2016 draft Final FS and Proposed Plan state that "All PTW treated ex-situ is assumed to be disposed at a RCRA Subtitle C facility." This assumption is inconsistent with the detailed waste disposal decision and treatment framework identified in the Gasco Sediment Site Statement of Work and FS dataset.[143] A total of 22 toxicity characteristic leaching procedure (TCLP) samples were collected as part of the FS and Gasco Sediments Site investigations to support waste disposal determinations (i.e., Subtitle C versus Subtitle D) and only three samples exhibited concentrations exceeding the TCLP Allowable Limits, all for benzene. Bench-scale testing showed that addition of a minimum 5% Portland cement reduced the benzene concentrations below the TCLP Allowable Limits. Both the 2016 draft Final FS and Proposed Plan assume all PTW is treated ex situ (e.g., with Portland cement);

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[137] Id. at 2.
[138] The LWG disagrees this determination is correct. The LWG 2012 draft FS conducted the same analysis (Appendix Hc) using more appropriate technical procedures and determine that all materials and chemicals at the Site are reliably containable through readily available sediment capping technologies. Importantly, these exceptions were based on preliminary cap modeling that used "representative site conditions" for model input parameters. These "representative" model input parameters do not exist at all sites. For example, they have been demonstrated not to exist at the Gasco site based on site-specific data collection performed under oversight by DEQ and in coordination with EPA. Consistent with the Proposed Plan text, it will be important to perform site-specific cap modeling evaluations during remedial design to determine cap protectiveness. Proposed Plan p. 15.
[139] Draft Final FS, page 3-3.
[140] We also note that EPA's PTW-NRC footprint is mapped inconsistently between the FS and Proposed Plan. EPA provided a later clarification (July 20, 2016 email from Kristine Koch) that one map represents "subsurface NRC" and the other "surface NRC," but the FS and Proposed Plan do not ever use these terms, and it is entirely unclear how these different types of NRC are relevant to EPA's PTW evaluations, if at all.
[141] *A Guide to Principal Threat and Low Level Wastes*, OSWER Superfund Publication 9380.03-06FS (November 1991)
[142] *Third Five-Year Review Report for McCormick & Baxter Creosoting Company Superfund Site*. (Oregon Department of Environmental Quality and U.S. Environmental Protection Agency. September 26, 2011).
[143] Administrative Settlement Agreement and Order on Consent for Removal Action for the Gasco Sediment Site, U.S. EPA Region 10 CERCLA Docket Number 10-2009-0255 (September 9, 2009).

therefore, the Proposed Plan should assume that all ex situ treated PTW material may be disposed of at a Subtitle D facility. Otherwise, the need for treatment of sediments destined for an upland landfill should be based on acceptance criteria of that facility.

B. EPA's Designation of PTW is Unnecessary and Legally Inappropriate Given the Balanced Evaluation of the NCP Evaluation Criteria that is Required

Moreover, even if EPA concludes that any areas of the Site contain PTW, which we believe would be inconsistent with guidance, that does not justify EPA's creation of a distinct PTW RAL set or prescriptive technology assignments based on the presumed presence of PTW. According to EPA's PTW guidance, "the principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement."[144] The NCP itself notes that even duly designated PTW is appropriately contained, rather than removed or treated, when it "poses a relatively low long-term threat or where treatment is impracticable."[145] EPA's Sediment Guidance confirms that this is most often the appropriate, practicable approach at sediment sites: "Based on available technology, treatment is not considered practicable at most sediment sites," and "[i]t should be recognized that in-site containment can also be effective for principal threat wastes, where that approach represents the best balance of the NCP nine remedy selection criteria."[146]

EPA's alternatives evaluation for Portland Harbor demonstrates that virtually all material at the Site can be reliably contained, and where EPA's analysis indicates it may not be contained, the material does not represent a direct 10^{-3} or greater cancer risk. Accordingly, EPA should eliminate the designation of any PTW areas. This outcome would be consistent with EPA's treatment of the same issue at the Lower Duwamish Waterway Superfund site and other similar sediment cleanup sites.[147]

III. EPA's Conceptual Site Model is Inadequate

The purpose of a CSM in environmental remediation is to aid site managers in understanding and directly accounting for contaminant sources, environmental fate and transport processes, and exposure pathways and receptors. "For sediment sites, perhaps even more so than for other types of sites, the CSM can be an important element for evaluating risk and risk reduction approaches…A good CSM can be a valuable tool in evaluating the potential effectiveness of remedial alternatives... [t]he CSM should capture in one place the pathways remedial actions are designed to interdict to reduce exposure of human and ecological receptors to contaminants."[148] "Because of the inherent complexity of these projects, site characteristics (such as source areas, transport mechanisms, background and upstream areas, and key site features) should be clearly identified in a CSM before evaluating and selecting remedial alternatives."[149] Therefore, to be an effective tool in decision-making, a CSM must provide the framework for establishing testable hypotheses related to the behavior of the system and how it will react to any given alternative.

The CSM should be developed iteratively, as more data and site information become available (for example, during the course of the RI).[150] The CSM should reflect the best and most recent understanding of site conditions and dynamics. A more dynamic site will require a more elaborate and detailed CSM. The Lower Willamette River is a highly complex and dynamic system, and the CSM must account for this complexity.

Given the complex and dynamic nature of the Site and the clear need for a robust CSM as recommended by EPA's Sediment Guidance, EPA's reduction of 15 years of data collection and evaluation to two sentences and a one-page

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[144] *Id.* at 2.
[145] 40 CFR §300.430(a) (1) (iii) (B).
[146] Sediment Guidance at p 7-4.
[147] See, *LWG Response to EPA's Principal Threat Waste Approach* (August 7, 2014).
[148] Sediment Guidance, p. 2-7.
[149] ITRC, p. 6.
[150] "As a site CSM is refined, professional judgment must be used to determine the additional data needed for remedy selection." ITRC, p. 4.

sketch[151] is inexplicable by any scientific or technical measure. EPA's sketch compares poorly to the description in guidance of a CSM. "Project managers may find it useful to develop several CSMs that highlight different aspects of the site. At complex sediment sites, often three CSMs are developed: 1) sources, release and media, 2) human health, and 3) ecological receptors. For sites with more than one contaminant that are driving the risks, especially if they behave differently in the environment (e.g., PCBs vs. metals), it is often useful to develop a separate CSM for different contaminants or groups of contaminants."[152] "The first step in the remedial evaluation framework is to review the CSM to understand the relationship between sources, migration pathways, and receptors and to understand the physical conditions and contaminant properties governing exposure and risk at the site. Information presented in the CSM should support identification of the site-specific characteristics needed in the evaluation of remedial technologies."[153]

EPA's CSM sketches some of the site receptors and processes as though the Site exists in a permanent condition of uniformity and steady state, despite the Willamette River being a very dynamic system. EPA errs by considering site processes through the lens of a closed system in which outside sources and forces are largely irrelevant, thereby defeating the very purpose of a CSM.[154] At best, EPA's Portland Harbor CSM is a static snap shot of the Site that offers no explanation of the complex behaviors of the Site. Site-specific hypotheses cannot be deduced from a sketch. The sketch does not allow its users to coherently understand the effects of changes in surface chemistry of the sediments, surface water quality, or tissue concentrations over time. It also cannot adequately address the effects of source control over time, the effects of human activity, or the relative benefits associated with different remedial alternatives.

To formulate and implement effective remedial alternatives at Superfund sites, site-specific conditions must be well characterized and incorporated into a CSM demonstrating that observed conditions can be accurately extrapolated to the system as it may vary physically, biologically, and temporally. NRC guidance appropriately states the importance of conducting risk management decisions "on a site-specific basis…incorporat[ing] all available scientific information" because "[w]ithout a valid conceptual model of the site, it is not possible to define how a management option can successfully meet the risk-reduction goals and objectives."[155] At contaminated sediment sites in particular, "the development of an accurate conceptual site model, which identifies contaminant sources, transport mechanisms, exposure pathways, and receptors at various levels of the food chain" is "especially important...because the interrelationship of soil, surface and groundwater, sediment, and ecological and human receptors is often complex."[156] EPA's Technical *Resource Document on Monitored Natural Recovery* explains that an evaluation of the feasibility of monitored natural recovery (MNR) (and presumably other proposed remedial alternatives) "is best achieved through the development of a CSM that adequately captures the physical, chemical, and biological processes that control contaminant fate, transport, and bioavailability."[157]

Neither the RI nor EPA's FS contains a coherent, complete and accurate CSM that identifies and addresses site-specific context and conditions in sufficient detail to adequately describe the dynamic complexity present at the Site. The result is an inability to rationally develop and evaluate resource intensive and technically challenging remediation alternatives at the Site.

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[151] 2016 draft Final FS p. 1-21, "The CSM integrates the information gathered to date and provides a coherent hypothesis of the contaminant fate and transport at the Site. Figure 1.2-26 provides a simplified visual summary of this hypothesis, including the complete human and ecological exposure pathways."
[152] Sediment Guidance, p. 2-7.
[153] ITRC, p. 19.
[154] "The CSM and site geomorphology help determine the degree of site characterization required to properly evaluate remedial technologies. Understanding the relationship between contaminant sources, transport mechanisms, exposure media, and factors that control contaminant distribution and potential exposure is critical to developing a focused site characterization approach. For example, sediment transport is often controlled by infrequent, high energy events. " ITRC, p. 21.
[155] *A Risk-Management Strategy for PCB-Contaminated Sediments*. (Committee on Remediation of PCB-Contaminated Sediments, Board on Environmental Studies and Toxicology, Division on Life and Earth Studies, National Research Council, May 2001).
[156] Sediment Guidance, p. ii.
[157] *Resource Document on Monitored Natural Recovery* (EPA 2014), Section 1.3.2, p. 6.

A. Errors that Result from the Use of EPA's CSM

There are numerous examples of important dynamic processes that have been overlooked or poorly evaluated in the development of EPA's CSM. Appropriate evaluation of these processes is critical to understanding source dynamics; rate and extent of physical, chemical, and biological transformations; exposure; and how the system will react to any given remedial alternative.

1. Non-steady State Conditions and Aggregation of Data

Due to EPA's nearly non-existent CSM, for many analyses EPA inappropriately aggregates extensive data collected over the course of a decade, which erroneously portrays a highly dynamic system as unchanging and uniform.

There were multiple rounds of data collected at the Site during sampling events over an approximately 10-year period of time, and some data included in the RI/FS database predate this period by another 5 years (back to 1997). It is potentially appropriate for some RI/FS purposes to aggregate these data and plot them on maps and figures, such as portraying the general nature and extent of contamination in relative terms (i.e., to discern relatively high and low concentration areas). However, such simple aggregation is fatally flawed for any evaluations where an appropriately developed CSM would indicate dynamic changes over time (e.g., evaluating potential natural recovery or long-term outcomes of remedial alternatives).

An appropriate CSM would emphasize that Site river sediments have dynamic characteristics and parameters including chemical concentrations that likely increase or decrease over time. By continually aggregating synoptic data without regard to sampling year, any sense of time dependent variation present in these data was lost in EPA's evaluations. There are numerous examples of 2016 draft Final FS statements and conclusions that are incorrect or misleading due to the insufficient CSM that fails to recognize dynamic and changing site conditions. A few examples include:

- Groundwater and riverbank source descriptions (e.g., FS pp. 1-13 through 1-19) and plume maps do not consider source controls implemented at many upland sites in the last five years or so.

- For unexplained reasons, EPA uses only the 2007 and 2012 fish tissue data (and ignores the 2002 tissue data) in its very limited evaluation of tissue contaminant trends (FS pp. 3-34), which essentially halves the available time period that can be evaluated. EPA's discussion is heavily focused on finding any potential evidence of a "zero" trend, which is a bias caused by EPA's simplistic and static CSM.[158]

- EPA's effectiveness evaluations focus almost exclusively on SWACs immediately post-construction (p.3-65, 4-6, 4-10 and elsewhere), and no quantitative estimates of long-term alternative outcomes are included. As described elsewhere in this document,[159] EPA could have easily devised empirically based estimates of long-term outcomes of the alternatives without resorting to complex computer models.

- EPA states that "Sediment trend data do not exist for this Site; insufficient biota and water trend data exist…" (p. 4-4).[160] If EPA had adopted the CSM formulated early in the RI/FS process, any trend data deficiencies now perceived by EPA would have been addressed. In fact, the LWG provided such

[158] EPA provides no details in the 2016 FS of its fish tissue statistical analysis, but a memorandum titled "MNR Evaluation – Fish Contaminant Concentrations," May 2016 is within EPA's Administrative Record for the Site. The LWG found EPA's statistical analysis to be flawed in several respects including that EPA's statistical model lacks power for detecting declines in fish tissue concentrations, is overly simplistic for the task, confounds the analysis by normalizing by non-correlated lipid contents, and ignores 2002 data for poorly explained reasons. See LWG memorandum, *Comments on EPA MNR Evaluation Using Fish Contaminant Concentrations*, (September 6, 2016) (Attachment 18) EPA's results disagree with the LWG's findings as previously provided to EPA in "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis," a presentation file from Anchor QEA provided to EPA on March 18, 2013 (Attachment 1).
[159] See Section V.C.
[160] Note that the LWG disagrees with this statement, and the LWG 2012 draft FS Section 6.2 provides a good example of using the available data to understand Site trends to the maximum extent practicable. The LWG's conclusion, which was later verified by the 2012 smallmouth bass tissue data, was that Site concentrations are declining measurably in just the last 10 years.

> supporting information as far back as the Programmatic Work Plan stage, and when the LWG requested collecting time series surface sediment data to fill part of this data gap, EPA rejected that request.[161]

Probably the least defensible use of the static Site bias portrayed by EPA's insufficient CSM appears a little later on page 4-4 of the 2016 draft Final FS.

> "EPA has concluded that the HST model predictions are inconsistent with the CSM for this Site, as it shows significant concentration reductions occurring within the first 10 years for the No-Action alternative. However, given that the majority of the contamination was released into the river 30-80 years ago and similar reductions have not been observed, the model results appear inconsistent with the empirical data collected during the RI."

We are unaware of chemistry data from 30 to 80 years ago that EPA has compared to data collected during the RI/FS to reach this "empirical" conclusion, and no such data appears in the Administrative Record for the Proposed Plan. However, a significant amount of information collected during the RI demonstrates that river conditions have changed over time. For example, EPA's RI found that, "Concentrations of total PCBs, DDx, total PAHs, hexachlorobenzene, total chlordanes, aldrin and dieldrin, gamma-HCH, lead, and TBT are higher in subsurface than in surface sediments, indicating that historical inputs were likely greater than current inputs."[162]

The dynamics of sediment surface chemistry also have a direct effect on the calculation of RALs and evaluations of natural recovery. When sediment surface chemistry is dynamic over time, the RAL will also vary depending on the time and rate of natural recovery estimated, because RALs define the dividing line between areas that will be actively remediated versus areas that will undergo natural recovery. In turn, these time-dependent RALs and their linkage to natural recovery estimates are one of the key characteristics of the selected remedy (i.e., they define where active remediation will take place).

Yet, EPA devotes about three pages of its FS (starting at p. 3-32) to a discussion of the processes affecting RAL selection and natural recovery. As described in guidance, "Using MNR as a remedy at a contaminated sediment site requires a thorough understanding of the sources, exposure pathways, and receptors in the CSM. Site managers must be able to predict, with some degree of certainty, that contaminant concentrations will decline or be effectively addressed within a specific time frame." Guidance also states that natural recovery evaluations at contaminated sediment sites should be based on multiple lines of evidence.[163] Many of these lines of evidence were collected as part of the Portland Harbor RI/FS process and provide a strong empirical basis for the occurrence of natural recovery in Portland Harbor. Section 6.2.2 of the LWG 2012 Draft FS provides a detailed evaluation of each of these lines of evidence, which were summarized in past LWG FS comments.[164] These important lines of evidence include:

- Sources are being progressively controlled. DEQ's latest source control report indicates DEQ has completed source control evaluations and implemented (or will implement) controls on one or more potential pathways at approximately 149 of 171 sites examined in detail to date.[165]

- The aggregate information from five multi-beam surveys indicates widespread deposition of sediments across many areas of the Site. Although EPA's FS emphasizes the uncertainties of these data, for reasons

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[161] Letter from EPA to LWG dated January 2, 2008, regarding "Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. Round 3B Comprehensive Sediment and Bioassay Field Sampling Plan – Addendum 1: Fate and Transport Modeling – Estimation of Temporal Chemistry Changes in Surface Sediments."
[162] RI, page 10-4.
[163] Sediment Guidance; Magar et al. 2009 (Magar, V., D. Chadwick, T. Bridges, P. Fuchsman, J. Conder, T. Dekker, J. Stevens, K. Gustavson, and M. Mills. 2009. Technical Guide: Monitored Natural Recovery at Contaminated Sediment Sites. Environmental Security Technology Certification Program (ESTCP), Project ER-0622.); ITRC 2014.
[164] Letter to EPA, September 8, 2015, Re: List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240).
[165] Portland Harbor Upland Source Control Summary Report (DEQ, March 25, 2016 update), at 108.

detailed in past comments, the LWG disagrees that these data present substantial uncertainties about deposition.

- Sediment trap and suspended sediment data clearly show that incoming settling sediment has substantially lower contaminant concentrations than most of the site bedded sediment, which will drive bedded sediment concentrations lower over time.

- Radio-isotope coring data, although limited, indicates deposition rates consistent with other measures such as the bathymetry time series.

- Site surface sediment grain sizes are fine-grained across the majority of the Site, strongly indicating a long-term depositional environment exists in these areas.

- Surface to subsurface sediment concentration ratios in most areas of the Site indicate newer surface strata contain lower concentrations than older subsurface strata, which illustrates that surface sediment concentrations are decreasing over time.

- Surface sediment concentrations measured over time (i.e., time series) indicate surface sediments have decreasing contaminant concentrations. The 2012 Draft FS data are somewhat limited, but new PCB data collected in 2014 by other parties provide additional useful information and suggest that PCB sediment concentrations are continuing to decline.[166]

- Smallmouth bass PCB tissue measurements made in 2002, 2007, and 2012 indicate statistically significant declines in tissue concentrations across almost all areas of the Site.[167] Despite uncertainties expressed in EPA's FS, differences in sampling and compositing schemes across the years can be controlled to determine statistically valid results.

- Comparisons of sediment profile images collected in 2001 (by the LWG) and 2013 (by other parties)[168] indicate that much of the Site now has well established Stage 3 benthic communities indicating stable and recovering substrates.

- Simple modeling (such as EPA's SEDCAM modeling, which was never included in EPA's FS) and complex modeling (such as the 2012 Draft FS QEA FATE model and coupled dynamic Food Web Model) all generally indicate recovery of surface sediments over a reasonable timeframe toward a relatively consistent range of potential equilibrium levels.

One of the most important rules of environmental data analysis is the evaluation of time series data to establish the dynamics of site processes (e.g., the rate and extent of changes in physical, chemical, and biological systems). EPA failed to conduct this evaluation, and the assumption of a steady state and uniform Site was mistakenly accepted as valid for the vast majority of the EPA's FS analyses.

2. Role of Surface Water Chemistry and Variation

EPA's CSM fails to consider the non-steady state dynamics of PCBs and DDx in surface water. This causes EPA to ignore the likely effects of water quality on fish tissue concentrations for hydrophobic COCs. Using DDx as an example, the RI demonstrates that variation in Site sediment concentrations explains about 33% of the variation of DDx in resident fish tissue.[169] Obviously, there are other factors that control the remaining 67% of the observed

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[166] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015) (Attachment 2).

[167] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)

[168] *Characterization of the Lower Willamette River with sediment profile imaging: Changes in space & time,* prepared for de maximis, Inc. (Germano & Associates, Inc. June 2014.). (Attachment 19)

[169] Integral 2016 *Review of EPA's Food Web Model* C167-1504. Prepared for Legacy Site Services LLC, Exton, PA. Integral Consulting Inc., Portland, OR. August 30, 2016. (Attachment 20)

variation, which are not addressed by EPA's sketch CSM. This error leads to the unsupportable premise that sediment remediation alone can result in acceptable levels of DDx in tissue, a premise that ignores eight rounds of surface water data that demonstrate significantly higher concentrations of DDx are entering the Site during times of high winter flow than are present during the summer or fall. A similar relationship exists for PCBs. Further, none of the surface water samples for DDx or PCBs taken during either high or low flow conditions entering the Site from upstream obtained during the RI were below EPA's New/Updated CWA 304(a) Human Health Criteria and Oregon's water quality standards. These errors could have been avoided had EPA followed standard practice that "… all sediment sites should include the development of a CSM that identifies watershed inputs and characterizes background conditions."[170]

The CSM also fails to account for the endogenous risk (or risk arising from factors outside the domain of the CSM), including the contribution of upstream chemical inputs to surface water PRG exceedances and ongoing human health fish consumption risks. For example, as discussed in Section I.D and Table 4, the current OHA mercury fish consumption advisory for vulnerable populations on the Lower Willamette River allows only 12 resident fish meals/year. Because this advisory is due to mercury sources upstream of the Site, the advisory is expected to continue after any Portland Harbor sediment remediation is implemented. EPA's FS focuses on (flawed) post-construction risk estimates for the child fish consumption scenario (a vulnerable population). EPA estimates that under the most aggressive alternative (Alternative G), a child will be able to consume 10 fish meals/year, while Alternative B allows 2.4 meals/year. Thus, none of EPA's alternatives result in actual increase in the amount of fish people can consume above the current OHA fish consumption advisory. Similarly, the difference between the smallest and largest alternatives is just a few fish meals per year. Consequently, any perceived benefit to allowable fish consumption from the more aggressive alternatives does not actually exist.

In fact, even if every grain of sediment was removed from the Site and replaced with the cleanest sand available, resident fish tissue would still be adversely impacted by mercury, PCBs, and other contaminants from upstream sources. Contrary to guidance, the CSM sketch fails to address this key relationship between upstream water quality and marginal risk reductions and, as a consequence, the utility of the alternatives.

3. Importance of Non-steady State Chemical Processes

Some of the COCs associated with site sediments are chlorinated organic compounds (e.g., PCBs, DDx, and dioxin/furans). Current scientific literature demonstrates chlorinated compounds can undergo biotic and abiotic changes when present in sediments, surface water, and groundwater. Such processes include aerobic and anaerobic reactions (i.e., in the presence and absence of oxygen). Potentially important biogeochemical recovery pathways observed at other sites are not identified or operationalized in the CSM sketch or discussed elsewhere in EPA's FS. "At a minimum, the CSM should address the following: source(s), nature and extent of contamination, sediment transport pathways and mechanisms, sediment deposition rate; exposure pathways associated with chemical contamination, and the potential for in situ degradation...."[171] Section 2.6 of the LWG 2012 FS provides a good example of such a CSM.

a. Role of Spatial Complexity

Data obtained during the RI demonstrate the Site is complex and varies substantially over space for many parameters relevant to sediment remediation (sediment concentrations, grain size, organic carbon content, deposition rates, erosive forces, varying sources, water movements and currents, etc.). Given there is no CSM that discusses this complexity, particularly with regards to spatial variations in sediment grain size and organic carbon content, EPA erred when it calculated background concentrations for the Site. This error was the subject of a formal dispute by the LWG,[172] where LWG requested retaining the previously calculated RI background values for multiple

[170] ITRC, p. 59.
[171] ITRC, p. 69. [emphasis added]
[172] Request for Dispute Resolution of EPA's Notice of Decisions on Background Regarding Section 7 of the Remedial Investigation; Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240. The LWG requested that, "the full data set with consideration of organic carbon correction be retained as the selected set of background values and applied in the FS. These values are shown in the "all data" columns of Table 7.3-1b (and the related Appendix H Table H-2b) of the RI Section 7 revision agreed to by EPA and the LWG on December 12, 2013."

chemicals including a value of 16 ppb for PCBs. In addition, the LWG submitted a technical memorandum regarding equilibrium conditions,[173] which represent the lowest likely achievable sediment concentrations at the Site due to ongoing upstream inputs of COCs. This memorandum concludes that the appropriate site-wide equilibrium value for PCBs is 20 ppb. Both these documents address issues of sediment spatial variations, particularly for organic carbon content.

EPA rejected the LWG's position that EPA used background data outlier identification methods that are only appropriate for parameters whose latent distribution is normal. Because river sediment grain size and organic carbon content are highly varied over space due to natural processes and concentrations of organic compounds in sediments co-vary with grain size and carbon content, the concentration of compounds (including PCBs and DDx) cannot be normally distributed at the sampling spatial scales associated with the upstream (reference area) data. Thus, EPA's application of outlier methods associated with assumed normal distributions combined with inappropriate data censoring led EPA to artificially low background values (e.g., 9 ppb for PCBs) that are not likely achievable by any sediment remedy. Both an appropriate background analysis and incorporation of equilibrium concepts indicate that EPA should be using a background value more in the 20 ppb range for PCBs. EPA's error could have been avoided had the CSM properly addressed spatial complexity of sediment and other parameters both at the Site and upstream of the Site.

4. Effect of Inadequate CSM on Alternatives Selection

The absence of a coherent and complete CSM results in the selection of the wrong alternative. EPA assumes that time zero (immediate post-construction) SWACs are a good measure of risk reduction for all alternatives measured against arbitrary interim targets, which ignores any reasonable CSM conclusions regarding the dynamic nature (and overall declining concentrations of chemicals) of the system. Thus, EPA assumes that the Preferred Alternative will achieve faster and more cost-effective risk reduction, when in fact smaller, less resource-intensive alternatives will achieve similar risk reduction in a similar time period (and at much lower cost), if the dynamic nature of MNR (both during remedy construction and after) is properly taken into account. See Section V.C of this document for a more detailed discussion on the appropriate alternative selection taking into account expected system changes over the long term.

IV. EPA's Alternatives Evaluation is Incomplete, Misleading, and Almost Entirely Qualitative

An appropriate alternatives evaluation must fairly and carefully weigh the costs[174] against the benefits[175] of the alternatives both individually and relative to one another. "The evaluation should consider both positive effects, such as long-term effectiveness as measured through risk reduction, and negative effects, such as the adverse effects associated with implementation."[176] This evaluation should also demonstrate how the alternatives' dollar costs are proportional to their effectiveness (benefit) in reducing risk. The NCP states, "Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in § 300.430(f)(1)(ii)(A) and (B)…A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." The evaluation should also fully and transparently assess each of the FS criterion contained in the NCP (40 CFR Section 300.430(e)(9)). Unfortunately, EPA's alternatives evaluation has almost no comparison of the overall costs and benefits of the alternatives and fails to fully evaluate many of the FS criterion. Further, where costs (including impacts) or benefits (effectiveness) are discussed independent of each other, EPA:

- Develops alternatives that prescribe technology assignments, which precludes any meaningful comparison of the effectiveness of different technologies.

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[173] *Sediment Equilibrium Estimates for the Revised Feasibility Study*, an LWG Technical Memorandum submitted to EPA on August 7, 2014.
[174] Including the wider sense of the term "costs" such as environmental and community negative impacts due to remedy implementation.
[175] Per the NCP, benefits are measured through effectiveness criteria: "Cost-effectiveness is determined by evaluating the following three of the five balancing criteria noted in § 300.430(f) (1)(i)(B) to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness.
[176] ITRC p. 52.

- Fails to evaluate alternatives consistent with any coherent CSM (as already discussed in Section III).
- Presents flawed post-construction risk estimates to support effectiveness and protectiveness determinations.
- Presents no quantitative or detailed short-term effectiveness evaluation.
- Presents no quantitative or detailed long-term effectiveness evaluation.
- Ignores valuable recent data that would aid in long-term effectiveness evaluations.
- Systematically underestimates the costs and durations of the alternatives.
- Fails to fully consider many implementability challenges.

The result is a defective alternatives evaluation that leads to the ultimate error: selecting the wrong remedial alternative.[177]

A. EPA's Prescriptive Technology Assignments Preclude Meaningful Comparison of the Effectiveness of Different Technologies

EPA's 2016 draft Final FS and Proposed Plan continue to prescriptively assign technologies on the basis of a generic scoring matrix and decision trees without consideration of site-specific factors. EPA's approach prevents meaningful comparison of the performance of various technologies in the FS, because all alternatives employ the same technologies in the same geographic areas.[178] And because the technology assignment is based on FS-level information and screening evaluations, the prescriptive set of evaluation criteria will not appropriately or accurately predict the most appropriate technology assignments or configurations for remedial design based on design-level engineering evaluations and data available at the time of design, including data collected post-ROD. For example, the FS assignments are based on overall general assumptions regarding slopes, presumed erosion and deposition zones, and required depths of removal to reach protective levels. However, real designs implemented throughout the country at other sites (and within Portland Harbor to date) have varied, often substantially, from the FS-assumed criteria and are known to be effective. With respect to riverbank contamination and presumed groundwater contamination, the FS technology assignments are based solely on those general broad designations, without consideration of which COCs are present and conditions of exposure.[179]

EPA's selected remedy should build in the flexibility needed to evaluate the likely performance of technologies against RAOs in the context of the complexities of each particular SDU and within SDUs. EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, and requirements for rigid containment) might be considered or allowed based upon site-specific engineering evaluations and newly developed information.[180]

Attachment 21 provides a decision framework EPA could include in the ROD to specify how technology assignments would be finalized or refined on a site-specific basis. Subject to some general rules (i.e. dredging will typically be required for active remediation in the navigation channel or future maintenance dredge areas and capping will typically be required around permanent structures), dredging or capping at a specific location would be

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[177] Table 15 of the Proposed Plan summarizes EPA's comparison evaluation of alternatives.
[178] 2016 draft Final FS, p. ES-17: "Alternative A is a No Action Alternative, Alternatives B through I that apply the same suite of remedial technologies and process options to varying degrees based on Site-specific characteristics: containment, sediment/soil treatment (in-situ and ex-situ), sediment/soil removal, sediment/soil disposal, MNR/ENR, and institutional controls" (emphasis added).
[179] By contrast, the Corps of Engineers capping guidance document provides design level guidance of modeling and assessment methods to determine the concentration of contaminants of concern that can be safely isolated by capping.
[180] The Lower Duwamish Proposed Plan had an entire subsection that described some of the issues with design implementation and what factors and remedy components would have to be worked out in more detail in design. Proposed Plan, Lower Duwamish Water Superfund Site, https://www3.epa.gov/region10/pdf/sites/ldw/pp/ldw_pp_022513.pdf, §10.1, page 89.

determined by application of demonstration criteria through engineering evaluations during remedial design.[181] Such an approach is consistent with guidance, which clearly indicates both dredging and capping are feasible under a wide range of highly overlapping conditions, and many design options and components exist so that either capping or dredging can be tailored to be highly effective and protective under the same conditions.[182]

B. EPA's FS Presents Flawed Post-construction Risk Estimates

As discussed in Section I.A., EPA fails to maintain consistency with the BERA regarding benthic risk areas, and as a result, all FS estimates of the alternatives' ability to reduce benthic risks are incorrect. As demonstrated in Section I.C.1. EPA uses many PRGs that are inconsistent with the BLRAs and factors in virtually no risk management decisions, resulting in risk estimates that are misaligned with the findings of the BLRAs. As discussed in Section 1.C.2, EPA's incorrect PRGs combined with artificially inflated baseline SWACs create much higher estimates of baseline risks for Alternative A in the FS as compared to the baseline risks in the BLRAs. This approach also creates the appearance of greater risk reductions for the other alternatives than are possible, including unrealistic numbers of increased allowable fish meals as discussed in Section I.D. The overall result of these problems is that EPA repeatedly identifies large areas that are designated for active sediment cleanup where risks are either not present or cannot be meaningfully reduced through a sediment cleanup. A prime example of this is the application of PAH RALs in the navigation channel with no clear benefit as described in Section I.C.1.

Because of EPA's continual and compounding disregard for the methods and findings of the BLRA, all of the risk estimates presented in the 2016 draft Final FS are incorrect and generally portray inflated baseline risks and greater risk reductions than are possible or achievable. EPA cannot use the incorrect risk estimates to determine the relative effectiveness or risk reduction of any of the alternatives. And EPA has no foundation to reasonably decide whether any of its alternatives meet the threshold criteria of protectiveness or compliance with ARARs.

C. No Quantitative or Detailed Short-term Effectiveness Evaluation

As the LWG has previously commented,[183] guidance strongly recommends a comprehensive and quantitative evaluation of dredge release impacts:

- "Generally, the project manager should assess all causes of resuspension and realistically predict likely contaminant releases during a dredging operation."
- "To the extent possible, the project manager should estimate total dredging losses on a site-specific basis and consider them in the comparison of alternatives during the feasibility study."
- "Dredging residuals have been underestimated at some sites, even when obvious complicating factors are not present."
- "Project managers should be aware that most engineering measures implemented to reduce resuspension also reduce dredging efficiency. Estimates of production rates, cost, and project time frame should take these measures into account."

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[181] Attachment 21 builds on a capping demonstration decision tree developed by EPA in late 2015 for the FS but ultimately not included in the final FS.

[182] For example, EPA's Sediment Guidance, page iii states: "When evaluating alternatives with respect to effectiveness and permanence, it is important to remember that each of the three potential remedy approaches may be capable of reaching acceptable levels of effectiveness and permanence…" See also p. 3-2, "However, due to the limited number of approaches that may be available for contaminated sediment, generally project managers should evaluate each approach carefully, including the three major approaches (MNR, in-situ capping, and removal through dredging or excavation) at every sediment site at which they might be appropriate." See also p. 7-5, "Project managers should note that these characteristics are not requirements. It is important to remain flexible when evaluating sediment alternatives and when considering approaches that at first may not appear the most appropriate for a given environment. When an approach is selected for a site that has one or more site characteristics or conditions appearing problematic, additional engineering or ICs may be available to enhance the remedy."

[183] Letter to EPA, September 8, 2015, Re: List of significant comments on EPA Feasibility Study Section 3 and 4 (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)

- "The strategy for the project manager should be to minimize the resuspension levels generated by any specific dredge type, while also ensuring that the project can be implemented in a reasonable time frame."

EPA provides some discussion of dredge residuals and releases, but no new quantitative evaluations were added since the LWG's comments were submitted on the 2015 Draft FS. The general discussion provided in FS Appendix O and page 3-23 continues to rely on the findings of one project (Hudson River Phase 2) as the basis for its assumption that contaminant releases during dredging in Portland Harbor will be only 1% of the total contaminant mass dredged. This is three times lower than the 3% release rate recommended by the LWG in the 2012 Draft FS based on a review of numerous other recent contaminated sediment dredge projects. EPA further uses this one project to assume that most releases greater than 1% can be eliminated by quickly covering dredge residuals by applying daily clean cover. This assumption will require additional equipment to be available to place these materials or the dredge production rates need to be reduced, which is inconsistent with the 2016 draft Final FS-assumed 24 hours a day, 6 days a week dredging production rate (see Section IV.F). Thus, EPA is establishing a 1% release rate for Portland Harbor based on one project (Hudson River Phase 2) that appears to be one of the lowest release rates documented to date. Further, EPA is applying this optimistic release rate from a site that is entirely different both chemically and physically from Portland Harbor, which includes 10 river miles of highly varying physical and chemical conditions. Regardless of these general discussions, EPA never applies the assumed 1% release rate in any type of quantitative evaluation of dredging releases or the associated increases in fish tissue concentrations as documented on many other projects.[184] These projects document that fish tissue PCB levels typically increase dramatically during contaminated sediment dredging events and stay elevated for 3 to 5 years afterward. None of these likely impacts are quantified or factored into EPA's assumptions about allowable fish meals during and shortly after the construction period.

EPA also states on page 3-24 of the 2016 draft Final FS that residual covers should be applied on a daily basis, a requirement without precedent for a project of this scale. EPA also discusses many other water quality best management practices (BMPs), silt curtains, sheetpile walls, and other dredging water quality controls that are assumed to be employed either all the time or under various conditions. However, contrary to guidance (cited above) the effect of daily covers and this wide array of dredging controls on alternative costs and durations are not quantified or even discussed. The effects of all these controls on alternative cost, duration, and implementability are substantial and are not demonstrated in the 2012 LWG Draft FS to provide additional risk reduction.

For example, EPA assumes sheetpile barrier walls will be used anywhere that trace or greater levels of NAPL is present in water depths up to 50 feet (see 2016 draft Final FS Appendix O). Yet, the 2016 draft Final FS FS fails to incorporate into each alternative's duration the time to install and remove sheetpile walls or factor in the lower dredging production rates that occur in and around the confined space created. The costs of sheetpiles that EPA uses ($2,750 per linear foot) would not be sufficient for water depths approaching 40 to 50 feet; these depths would require a much more expensive cofferdam-type system and require site-specific engineering analyses to determine if they are even feasible. EPA also continues to depict (2016 draft Final FS FS Figure 3.4-33) sheetpiles in greater than 50 feet of actual water depth, which is technically infeasible. Figure 3.4-33 also implies that sheetpiles will be installed in the navigation channel, which would not be permitted by the U.S. Army Corps of Engineers (USACE) or U.S. Coast Guard, because it presents a hazard to navigation in an active vessel traffic lane. Sheetpiles would also impact or prevent ongoing shoreline water dependent operations and nearshore fish migration. EPA also fails to discuss that driving sheetpile walls can transport sediment contamination deeper into clean subsurface sediments or that removal of the sheetpile walls after construction will cause contaminated sediment releases as well. Finally, EPA never quantifies whether the additional cost of sheetpiles (including the impact of slower construction times on costs) is justified by their assumed additional effectiveness.

Other types of construction and short-term impacts could occur with all the alternatives, such as:

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[184] See discussion in the LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; ITRC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.

- Potential risks to both construction workers and the general public from sediment removal, transload, transportation, and treatment
- Community impacts from multi-year dredging, capping, and transload operations on the river (e.g., recreational uses, light, and noise)
- Increased greenhouse gas and air pollution discharges
- Impacts to the community and commerce from increased river vessel traffic, community road truck traffic, and potential increased train traffic

EPA only briefly discusses these issues, and when they are discussed, EPA quickly transitions to biased explanations of how these impacts can be avoided or minimized (e.g., FS pages 4-34 through 4-38). Although EPA mentions that short-term impacts will be greater for larger alternatives, the pervasive explanations of minimization measures misleadingly makes these impacts all appear relatively inconsequential.

EPA does not perform any type of quantitative evaluation of dredge releases or other short-term impacts. Almost all of EPA's alternative comparison conclusions rest on simple comparisons of construction durations and the amount of materials handled. We note that EPA made numerous comments on the 2012 LWG Draft FS indicating that document spent too much time discussing durations of the alternatives,[185] even though that document included quantitative estimates of dredge releases, worker risks, community impacts, and air emissions, all of which are important to remedial alternatives evaluation and selection.

In comparison to the 2012 LWG Draft FS, EPA's short-term impact conclusions rely on little more than conjecture about construction durations. For example, EPA notes that "since Alternative I also involves less construction than Alternative E, Alternative I would have less short-term impact on the community, workers, and the environment." However, EPA's Proposed Plan Table 15 shows that Alternatives E and I receive the same overall short-term effectiveness score of "better," as does Alternative D. Alternative B, which has shorter durations and less material transport, recieves a score of "moderate" for unclear reasons. (No alternative receives the "best" score here, which is inconsistent with the other criteria scoring.) Regardless of the approach to evaluating short-term effectiveness, sound policy demands that risk be evaluated holistically and not in baseline and post-construction silos. If the objective is to prevent environmental morbidity and mortality, then the possible tradeoff related to occupational and implementation related injuries, disease, and deaths caused by the cleanup activities themselves must be explicitly taken into consideration in the cost-benefit analysis of the remedial alternatives.

D. <u>No Quantitative or Detailed Long-term Effectiveness Evaluation</u>

As discussed previously, EPA made the determination that no quantitative long-term modeling of the alternatives or natural recovery was possible for the Site. EPA's Sediment Guidance addresses the role of quantitative estimates in making these critical decisions:

> "The time needed until protection is achieved can be difficult to assess at sediment sites, especially where bioaccumulative contaminants are present. Generally, for sites where risk is due to contaminants in the food chain, time to achieve protection can be estimated using models. These models may have significant uncertainty, but may be useful for predicting whether or not there are significant differences between times to achieve protection using different alternatives. When comparing time to achieve protection from MNR to that for active remedies such as capping and dredging, it is generally important to include the time for design and implementation of the active remedies in the analysis."

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[185] "For example, the comparative evaluation of alternatives overemphasizes duration of cleanup in the evaluation of short-term impacts…" and "The FS bases a significant portion of the overall effectiveness evaluation on the duration of the cleanup." Letter from EPA to LWG December 18, 2012 regarding, Portland Harbor Superfund Site, Administrative Order on Consent for Remedial Investigation and Feasibility Study: Docket No. CERCLA-10-2001-0240 EPA Comments on the Portland Harbor RI/FS Draft Feasibility Study (March 30, 2012).

This guidance is particularly relevant for large and complex sites like Portland Harbor where uncertainties are often greater and quantitative estimates help to understand those site uncertainties and better support appropriate remedy decision-making. For example, EPA Region 10 recently completed decision-making using such quantitative approaches for the similarly complex Lower Duwamish Waterway Superfund site.[186]

The absence of quantitative evaluations is the result of rejecting empirical data collection and modeling studies that the LWG conducted in coordination with EPA and under its interim approvals and for the express purpose of informing the RI/FS.[187] EPA's ultimate rejection of LWG's proposed QEAFATE model only came after years of discussion and refinements to that model based on EPA's detailed comments. EPA made little earnest attempt to replace that model with another form of quantitative long-term estimate. For example, EPA rejected its own SEDCAM modeling results and USACE particle tracking models and then failed to consider simple quantification techniques like the half-life estimates discussed in Section V.C.

As a result, and despite the fact that EPA acknowledges that natural recovery is occurring at the Site,[188] EPA is reduced to assuming that:

- Immediate post-construction sediment SWACs are the only available means to quantify the long-term effectiveness of the alternatives, which EPA acknowledges is not an actual long-term measure of the alternatives.

- These immediate post-construction SWACs will remain constant for all alternatives until construction commences, despite EPA identifying the need for multiple years of post-ROD assessment and pre-design data collection and the fact that alternatives that involve more construction will likely take longer to design than alternatives that require less construction.

- SWACs will remain constant during the time of construction even though some areas will not be actively remediated and will obviously undergo natural recovery to the extent that is expected for any given area.

- Immediate post-construction SWACs are static relative to each other even over long periods of time. For example, EPA assumes the estimated post-construction SWACs for Alternative B, with an estimated 4-year construction period, can somehow be compared directly to Alternative I, with an estimated 7-year construction period, or Alternative H, with an estimated 62-year construction period.

These assumptions greatly simplify the alternatives analyses, but they have no basis in reality and are directly contrary to guidance.

The assumption that SWACs remain constant until construction commences is particularly problematic. EPA describes the construction timeframes for all alternatives to be preceded by a "Year 0" condition.[189] This Year 0 is described as including the following work:

- Establishment of initial conditions: "Monitoring (sampling) of sediment, water, biota, and pore water will need to be the first phase, and it will encompass the entire Site to establish a baseline and delineate the SMAs for construction. It is expected that <u>this phase will take 3 to 5 years</u>."

- Construction of an on-site material handling/treatment facility

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[186] Record of Decision. Lower Duwamish Waterway Superfund Site. EPA, Region 10. November 2014.
[187] During this same period, EPA was only able to express ever increasing uncertainty about every empirical data collection effort it approved and oversaw, including one of the most detailed time series bathymetry data sets (showing widespread deposition) ever collected for a sediment Superfund site, high resolution grain size sampling, sediment trap and suspended sediment data, subsurface sediment concentration profiles, radio-isotope cores, disaggregated surface sediment data, time series fish tissue data (including the 2012 smallmouth data collection EPA itself conceived and attempted to execute), and other data.
[188] 2016 draft Final FS p. 3-33.
[189] 2016 draft Final FS p. 3-41 (emphasis added).

- Start-up activities and mobilization, including pre-design investigations
- And the first year of construction: "Year 0 is the first year of construction."

This conceptual timeline does not include any explicit time for completion of the ROD and Consent Decrees. It also does not include time for remedial design, which usually proceeds in at least three EPA review steps (e.g. 30, 70, 100% design). At the most optimistic, the assumptions lead to construction starting no sooner than 5 to 7 years from the ROD. Given EPA assumes that the PRGs will be achieved in 30 years (and as discussed in Section V.C, this equates to a natural recovery half-life of about 10 years), the Site sediment concentrations will have decreased by at least an additional 25% before construction starts. Thus, once initial conditions are set, it will be time to conduct another round of initial condition sampling. More importantly, EPA does not appear to have given any meaningful consideration to pre- or post-construction time periods when evaluating the relative performance of its alternatives. EPA should provide a realistic vision and timeframe for implementation of its alternatives, including the time prior to construction. EPA should clearly identify in its alternatives development and decision trees that sediment management areas and technology assignments and process options will be refined and adjusted through site-specific remedial design and implementation, because the Site is sure to have changed substantially in the time between the ROD and construction.

EPA converted immediate post-construction SWACs to risk estimates by comparing PRGs, many of which are inconsistent with the risk assessments, using spatial scales that are also inconsistent with the risk assessments. EPA also made analogous estimates for fish tissue and surface water that rely on the same immediate post-construction SWACs, and as a result, these estimates are equally useless to assess long-term effectiveness of the alternatives. Some of the problems associated with the tissue estimates are discussed in Section I.C.2.b, and the additional errors involved in EPA's surface water estimates from Appendix K are discussed in Section I.B and are not repeated here.

Rather than actually quantitatively evaluating long-term effectiveness, EPA's new approach for the 2016 draft Final FS uses interim targets, which are basically 10 times its PRGs. EPA then compared immediate post-construction risks to these interim targets for evaluating the "overall protection of human health and the environment" for each alternative. EPA states that if alternatives meet these interim targets, it is reasonable to assume the PRGs will be met through subsequent natural recovery in 30 years.[190] This assumption is justified only by saying that it is "commensurate with the site-specific contaminants and conditions." Particularly in the absence of a coherent CSM, EPA cannot simultaneously claim that it cannot quantitatively estimate MNR and then decide that MNR will work in 30 years. This global assumption also hides a second and equally important and unsupported assumption that EPA's PRGs can eventually be achieved through a sediment remedy. As the equilibrium analyses discussed above demonstrate, many of EPA's PRGs are not achievable even over the very long term. EPA never explains why these assumptions and flawed associated analyses are technically superior to either the LWG's effectiveness evaluations or its own prior evaluations in the 2015 EPA Draft FS.

Even within EPA's interim targets approach to evaluating effectiveness, there are internal inconsistencies. For example, the Preferred Alternative does not meet the interim targets for RAOs 1, 2, and 6 (Proposed Plan pp. 51-52). Likewise, Figure 4.2-4 of the 2016 draft Final FS shows none of the alternatives meet the interim targets (except Alternative G) ,and Figure 4.2-2 shows a similar result (no alternatives except Alternatives F and G meet the interim target). And for most of the other RAOs, there is either "insufficient information" to determine whether Alternative I meets EPA's interim targets, or only qualitative comparisons between alternatives, such as "[p]ost-construction, the estimated contaminated groundwater area addressed by each alternative increases as the footprint of the SMAs increases."

[190] Draft Final FS p. 4-6: "As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions. These interim targets are higher than residual risks once PRGs are achieved, and assume that further reductions will be achieved through MNR."

Ultimately, EPA simply abandons any effort to consider long-term effectiveness beyond its assumed construction durations. EPA notes in the Proposed Plan that Alternatives D, E, and I have roughly the same MNR footprint.[191] However, Alternative D is ranked *low* and Alternatives E and I are ranked *moderate* in Proposed Plan Table 15. To the extent this conclusion is based on EPA's stated goal in the Proposed Plan (page 63) to "maximize permanence through removal of highly contaminated sediment" this conclusion is directly contradictory to guidance, which is clear that mass removal is not an appropriate way to evaluate sediment remediation alternatives; rather the evaluation must address reduction in risk.[192]

Finally, EPA's FS does not quantify or otherwise estimate the performance of enhanced natural recovery (ENR) in SIL SDU either in terms of sediment SWACs or post-construction risks. EPA identified ENR as an applicable technology for SIL in all alternatives considered in the FS, with ENR covering more than 60% of the SDU for Alternative I. ENR is a commonly employed remedial alternative for contaminated sediment sites. It refers to accelerating the natural recovery process by engineering means and includes adding a thin layer of clean sediment and/or additives to enhance contaminant degradation. The 2016 draft Final FS concludes that ENR is expected to meet RAOs in SIL. It provides that the thickness and composition of the ENR layer will be determined during remedial design but that a 12-inch layer is expected to be sufficient.

Despite EPA's conclusions regarding the applicability and effectiveness of ENR in the SIL environment, EPA has arbitrarily ignored the impact of ENR on reducing PCB SWACs and corresponding risks. That is, SWAC and risk calculations reported for the SIL area by EPA in the FS simply do not reflect any benefit expected to be achieved by ENR. EPA's failure to evaluate the impact of ENR on risk results in an incomplete analysis of effectiveness for all alternatives and therefore prevents a meaningful comparison among the alternatives in accordance with the NCP. It is also contrary to EPA's 2015 Draft FS, which explicitly considered the effect of ENR on the SWAC. EPA has failed to provide any reason for its change in position from the 2015 Draft FS. Furthermore, ENR (including the potential for an additive to enhance contaminant degradation or sequestration) contributes significantly to the overall costs of a remedy. Therefore, its effect on risk reduction must be considered when evaluating the cost-effectiveness of remedial alternatives.

E. EPA Ignores Recent Data that Aid in Long-term Effectiveness Evaluations

There is substantial evidence that important chemical characteristics of the Lower Willamette River have changed significantly since the RI.[193] Analyses of the 2012 smallmouth bass data (submitted to EPA) strongly suggest the Site is already approaching equilibrium levels in some areas of the Site. Because that analysis also suggests that the half-life of the process is about 10 years, which is consistent with the recovery rate that EPA must have used as the basis for its assumption that a PCB PRG of 9 ppb can be reached in 30 years,[194] it appears likely that a large proportion of the surface sediments at the Site will be at or near equilibrium levels by the time of remedy implementation, thus eliminating the need for an aggressive cleanup approach such as Alternative I. As noted above, based on a realistic assessment of EPA's timeframe until construction start, Site concentrations are likely to be around 25% lower than the already much lower 2012 estimate. The 2014 PCB sediment data yield similar conclusions.

Because of the relationship between RALs and natural recovery (RALs delineate active construction areas from natural recovery areas), RALs are sensitive to SWAC changes caused by natural recovery. As the Site recovers before construction, the same RALs will delineate ever smaller areas of active construction until equilibrium is reached. Failure to recognize these ongoing processes will cause errors in the selection of the most cost-effective alternative as well as in the assignment of remedial technologies in the absence of flexibility during remedial design to adjust to changing river conditions. Yet, EPA's 2016 draft Final FS and Proposed Plan provide no clear

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[191] Proposed Plan, p. 61.
[192] Sediment Guidance, p.7-1 and p. 7-16.
[193] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis," a presentation file from Anchor QEA provided to EPA on March 18, 2013.
[194] Using Alternative I (the preferred alternative), EPA estimates a post-construction SWAC of 40 ppb at construction completion, which is 7 years after construction started. In order to reach a level of 9 ppb in the 23 years remaining within EPA's 30-year assumption, the site-wide concentration would need to halve every 10 years. This equates to 20 ppb at 17 years after construction started and 10 ppb at 27 years after construction started. Consequently, 9 ppb would be achieved at about 28 years after construction started.

description of how any future design adjustments might impact alternative selection now, what site-specific remedy adjustments will be allowed in the remedial design phase, how those adjustments would be determined, and what procedural steps would be needed (e.g., part of design decisions, Explanation of Significant Difference, or ROD amendments). Instead, the Proposed Plan describes technology assignments based on FS-level screening criteria that apparently will be entirely prescriptive during remedial design regardless of how the Site might evolve over time.

F. EPA Systematically Underestimates Costs and Durations

EPA's estimated costs for performing each of the alternatives continue to omit significant cost elements, including EPA's anticipated "initial conditions" sampling, sufficient pre-remedial engineering design investigations, Oregon Department of State Lands access, lease and easement fees, and agency oversight and participation costs (which alone have amounted to more than 27% of the LWG'S RI/FS costs to date). EPA also dramatically underestimates other cost elements on the basis of unrealistic and, in some cases, impossible assumptions about dredge and cap production rates and volumes, remediation waste processing, engineering design, construction management, BMPs EPA intends to require, and the present value of money (including the cost of financial assurance).

As EPA itself notes, "[c]ost is a central factor in all Superfund remedy selection decisions." Cost estimates are developed at different stages of the Superfund process and are dependent on and have a direct relationship with project definition and design. The cost estimate of the Preferred Alternative is usually transferred from the FS to the Proposed Plan and further included in the ROD, subject to any modifications resulting from the public comment process or the availability of new information.

During the FS phase, cost estimates are developed for the purpose of "comparing remedial alternatives during the remedy selection process...." Cost estimates are prepared during the "development and screening of alternatives" stage, as well as during the "detailed analysis of alternatives" stage. "Screening-level cost estimates are used to screen out disproportionately expensive alternatives in determining what alternatives should be retained for detailed analysis," while estimates generated during the "detailed analysis" stage are "used to compare alternatives and support remedy selection." EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* describes data sources that should be used to generate cost estimates, which include "cost curves, generic unit costs, vendor information, standard cost estimating guides, historical cost data, and estimates for similar projects, as modified for the specific site."

Overall, properly evaluating the cost and cost-effectiveness of each remedial alternative is crucial to ensuring compliance with CERCLA and NCP directives. Regardless of the relevant FS stage, cost estimates "should clearly present" the "expected accuracy range of the cost estimate." The expected accuracy range of cost estimates generated during the "screening of alternatives" phase is -50 to +100%, while the expected accuracy range of cost estimates generated during the "detailed analysis of alternatives" phase is -30 to +50%.

1. Correcting Significant Errors in EPA's Cost Estimates Results in Cost and Duration Projections more than Double EPA's Estimates

An accurate estimate demonstrates that EPA's proposed remedy is more likely to cost close to $1.8 billion (net present value)—more than double EPA's estimate of $811 million (net present value). Attachment 22 presents a side-by-side comparison of EPA's approach to major cost items with LWG's approach.[195] This comparison is summarized in Table 5. The areas of difference most significant to the overall discrepancy between EPA's and the LWG's cost estimates include production rates, volume estimates for capping, use of sheetpile walls, mobilization and demobilization, and design and contingency cost percentages.

EPA's June 2016 cost estimate reduced the publicly announced cost of the remedy without actually changing many significant elements of the remedy. When EPA presented its Preferred Alternative to the NRRB in November 2015, it estimated a cost of $1.5 billion. When EPA proposed virtually the same alternative on June 8, 2016, the cost was

[195] The LWG follows EPA's approach of using a certain cost for each line item. In fact, of course, there is variability and uncertainty in each cost projection. Attachment 23, LWG memorandum on EPA Cost Sensitivity Evaluation (September 6, 2016) evaluates the impacts of these uncertainties.

$811 million—nearly a 50% decrease from what EPA had estimated in November. A couple of material, but isolated, changes to the remedy approach contributed to the decrease (such as the assumed method of PTW ex situ treatment). But without any other significant changes to the key drivers of remedy cost—like significant changes in the volume of material to be dredged and disposed of—it was not clear how the remedy cost estimate decreased by hundreds of millions of dollars.

EPA did choose estimates at the low end of EPA-recommended ranges for many cost assumptions. For contingency assumptions, EPA modified contingency percentages to the low end of the recommended range on the grounds of the remedy's high cost and the detailed technology assignment modeling in the FS. In reality, the size, uncertainty and complexity of Portland Harbor warrants contingency percentages at least in the middle of the range. For remedial design, EPA guidance recommends 6% of capital cost, yet EPA selected 2%. Reasonable estimates for these two factors alone contribute an additional $375 million to the remedy cost estimate.

Table 5. Comparison of EPA and LWG Cost Approach.

Capital Costs			
Item	**EPA**	**LWG**	**Difference**
Direct Costs			
Mobilization/Demobilization	$9,045,000	$42,784,000	$33,700,000
Debris Removal and Disposal	$3,827,000	$3,779,000	$0
Obstruction Removal and Relocation	$15,146,000	$14,955,000	-$200,000
Erosion/Residual Control Measures (Dredge Water Quality Controls)	$25,228,000	$136,546,000	$111,300,000
Dredging of Contaminated Sediments (Open Water)	$38,183,000	$28,889,000	-$9,300,000
Dredging of Contaminated Sediments (Confined)	$2,897,000	$63,343,000	$60,400,000
Excavation of Riverbanks	$533,000	$3,337,000	$2,800,000
Dewatering and Water Treatment for Dredging Operations	$7,261,000	$31,465,000	$24,200,000
Subtitle C/TSCA Disposal	$68,536,000	$81,961,000	$13,400,000
Subtitle D Disposal	$280,706,000	$302,648,000	$21,900,000
Mitigation	$36,408,000	$62,900,000	$26,500,000
DSL Costs	-	$8,616,000	$8,616,000
Sand Placement for Technology Assignments	$20,353,000	$38,678,000	$18,300,000
Beach Mix Placement for Technology Assignments	$3,635,000	$11,425,000	$7,800,000
Armor Placement for Technology Assignments	$5,803,000	$16,473,000	$10,700,000
Reactive/GAC Placement for Technology Assignments	$44,759,000	$94,945,000	$50,200,000
Geofabric for Riverbanks	$303,000	$304,000	$0
Organoclay Mat Placement for Technology Assignments	$1,173,000	$1,159,000	$0
Transload Facility Development	$10,529,000	$37,660,000	$27,100,000
Subtotal	**$574,325,000**	**$981,867,000**	**$407,500,000**
Contingency	$114,865,000	$392,747,000	$277,900,000
Direct Cost Subtotal	**$689,190,000**	**$1,374,614,000**	**$685,400,000**
Indirect Costs			
Remedial Design	$13,784,000	$100,000,000	$86,200,000
Project Management	$13,784,000	-	$36,399,000
Responsible Party Oversight and Project Management	-	$29,432,000	
Agency Oversight and Project Management	-	$16,848,000	
Engineering Support During Construction	-	$9,204,000	
Contractor Project Management	-	$15,375,000	
Construction Management	$20,676,000	-	
Special Insurance and Bonding	-	$68,731,000	$68,731,000

Capital Costs			
Item	**EPA**	**LWG**	**Difference**
Indirect Cost Subtotal	**$48,244,000**	**$239,590,000**	**$191,300,000**
TOTAL CAPITAL COST	**$737,434,000**	**$1,614,204,000**	**$876,800,000**
NPV Cost	**$811,299,000**	**$1,772,629,000**	**$961,300,000**

Estimated Removal Volume (cy)	1,752,000	2,080,000	328,000
Estimated Total Cap Volume (cy)	814,000	1,230,000	416,000
Estimated Duration (Seasons)	7	15	8

Other Capital Costs			
Item	**EPA**	**LWG**	**Notes**
Establish Institutional Controls	$3,726,000	$11,020,000	EPA over construction duration; LWG Year 0
Initial MNR Monitoring	$10,197,000	$10,795,000	EPA/LWG Year 0
Periodic Costs			
Item	**EPA**	**LWG**	**Notes**
Long-term Monitoring and MNR	$38,426,000	$45,137,000	EPA/LWG Years 2, 4, 6, 8, 10, 14, 18, 22, 26, 30
Long-term O&M (Caps) and Institutional Controls	$5,972,000	-	EPA every 5 years
Long-term O&M (Caps)	-	$13,303,000	LWG years 5 and 10 only
Long-term Institutional Controls	-	$650,000	LWG every year after 5 years of construction
Long-term Institutional Controls	-	$50,000	LWG every 5 years
5-year Site Review	$308,000	$341,000	EPA/LWG every 5 years

Notes:
CY - cubic yard
DMM - dredge material management
DSL - Oregon Department of State Lands
EPA - U.S. Environmental Protection Agency
GAC - granular activated carbon
LWG - Lower Willamette Group
MNR - monitored natural recovery
NPV - net present value
O&M - Operations and Maintenance
TSCA - Toxic Substances Control Act

EPA's cost estimates also do not include any specific estimate of the costs for oversight of remedy implementation by EPA, DEQ, and the PRPs performing the remedy. EPA assumed rough total percentages for project management and construction management costs, totaling approximately $34.3 million for Alternative I. Based on historical agency oversight costs charged to the LWG during the RI/FS process, plus costs based on similar projects for responsible party oversight and contractor/construction management, the LWG's estimate for this cost category is double what EPA assumed.

The present value cost of a remedy that takes close to a decade, or more, to construct is heavily influenced by the discount rate. For Portland Harbor, EPA used a 7% discount rate, as suggested by 2000 guidance.[196] In its recent

[196] *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. USEPA 540-R-00-002 OSE 9355.0-75. July 2000.

Lower Duwamish Waterway FS, EPA used the discount rate of 2.3%, taken from the Office of Management and Budget Circular A-94, per EPA guidance.[197] The equivalent treasury rate for 2016 is 1.5%, which is a much more appropriate discount rate at a site where the PRPs include the United States, the State of Oregon, municipalities, public utilities, and many parties whose principal or only source of funding for cleanup are insurance funds outside their investment control. It is also the rate that EPA would presumably use in calculating required financial assurance: "The Agency believes that [financial assurance] based on a 7% discount rate could be insufficient to perform the work because funds called in from FA mechanisms are typically deposited into 'special accounts' or standby trusts, which are unlikely to grow at this annualized real rate."[198] The cost of EPA's typically required financial assurance mechanisms, such as trust funds, letters of credit, and surety bonds, far more accurately reflects actual remediation costs than hypothetical available returns on investment in the financial market. The consequence is to skew present value cost estimates low, particularly for alternatives of long duration, and make highly dredging-intensive remedies appear more cost-effective relative to other alternatives with shorter construction durations. Many other contributing factors are explained in detail in Attachments 22 and 23.

Construction durations are also significantly underestimated in EPA's analysis. Anchor QEA, LLC's review demonstrates that EPA's dredge production volumes, based on assumptions of 24 hours a day, 6 days a week dredging using incorrect dredging technology and less constrained offloading capacity, are significantly higher than what is feasible in Portland Harbor. The LWG assumed 1,600 cubic yards per day of dredging and 104 construction days per season, while EPA assumed 5,100 cubic yards per day of dredging and 122 construction days per season. As a result of these and other assumptions, the LWG assumes that construction durations for each alternative are roughly double what EPA assumed—meaning that Alternative I would take 14 years, not 7 years, to construct.

G. EPA Fails to Fully Consider Many Implementability Challenges

Just as EPA fails to accurately describe short-term impacts and realistic durations associated with the alternatives, it also fails to thoroughly describe and consider parameters associated with the implementability of the remedial alternatives. This includes, but is not limited to:

- Identifying and staging realistic sediment transload and water and sediment treatment facilities
- Evaluating whether dredge production rates included in the EPA 2016 draft Final FS can be maintained over the entire project schedule (e.g., contingencies for weather and equipment maintenance or breakdown and repair)
- Obtaining community acceptance, particularly of short-term impacts such as noise, light, and vehicle traffic
- Placing obstructions to the navigation channel and the requirements to move the dredge and its support vessels and structures to allow for the passage of ship traffic on an ongoing and continuous basis. (An illustration of the impact of passing vessels on dredging can be found at http://dofnw.com/animation/)
- Potentially treating large quantities of sediment

V. EPA Has Failed to Perform Even a Perfunctory Cost-effectiveness Analysis

CERCLA requires that remedies be cost-effective. In the Proposed Plan, EPA failed to perform even a perfunctory cost-effectiveness analysis and only purported to compare Alternatives E and I. A factually supported, quantitative analysis of cost-effectiveness, based on measures of effectiveness that are consistent with the NCP, reveals that the increased cost of dredging-intensive remedies, including Alternatives E and I, is not proportional to increased effectiveness when compared with less costly alternatives. EPA's has failed to demonstrate that Alternative I is cost-effective.

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[197] Final Feasibility Study, Lower Duwamish Waterway Group (October 31, 2012), Appendix I, page I-5.
[198] *Guidance on Financial Assurance in Superfund Settlement Agreements and Unilateral Administrative Orders* (EPA, April 6, 2015).

A. CERCLA, the NCP, and EPA Guidance Require that Remedies Be Cost-effective

Cost plays an integral role in the Superfund remedy selection process, as demonstrated by CERCLA, the NCP, and EPA's own guidance.[199] CERCLA requires EPA to choose a remedy "that is protective of human health and the environment, *that is cost-effective*, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable."[200]

To that end, the NCP places emphasis on cost-effectiveness at various stages throughout the remediation process. The NCP preamble explains, "[i]n analyzing an individual alternative, the decision-maker should compare...the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness."[201] Furthermore, "if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist," and "[t]he more expensive remedy may not be cost-effective."[202]

With respect to the development and screening of remedial alternatives during the FS, the NCP allows for the elimination of alternatives that are not cost-effective. Specifically, the NCP provides: "[t]he costs of construction and any long-term costs to operate and maintain the alternatives shall be considered. Costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated."[203]

Cost-effectiveness is also emphasized during the detailed analysis of alternatives stage of the FS, with cost being listed as one of the nine criteria required to be evaluated for each alternative.[204] With respect to the selection of a remedy, the NCP requires that "[e]ach remedial action selected *shall* be cost-effective," so long as the threshold criteria of protectiveness and compliance with ARARs are met.[205] "Cost-effectiveness is determined by evaluating the following three of the five balancing criteria… to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective."[206] "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness."[207]

EPA guidance reinforces the need to weigh remedial alternative cost against incremental risk reduction, stating that "[t]he evaluation of an alternative's cost-effectiveness is usually concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs when compared to other available options."[208] A "[c]areful evaluation of site risks…help[s] to prevent implementation of costly remediation programs that may not be warranted."[209]

B. EPA Failed to Perform Even a Perfunctory Cost-effectiveness Analysis in the Proposed Plan

The Proposed Plan presents a "Rationale for Selecting the Preferred Alternative," which would be the appropriate section to compare and contrast the cost-effectiveness of the remedial alternatives. However, EPA fails to perform

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[199] EPA, *The Role of Cost in the Superfund Remedy Selection Process*, Publication 9200.3-23FS, 1 (Sept. 1996).
[200] 42 U.S.C. § 9621(b)(1) (emphasis added).
[201] 55 Fed. Reg. 8728.
[202] *Id.*
[203] 40 CFR § 300.430(e)(7)(iii). As the LWG previously commented, EPA's screening out of Alternative C in 2015 Draft FS Section 3 is inconsistent with guidance. Alternative C provides moderately better risk reduction than Alternative B at moderately additional cost. See Section 3 and 4 comments submitted by LWG to EPA on October 9, 2015.
[204] 40 CFR § 300.430(e)(9)(ii).
[205] 40 CFR 300.430(f)(1)(ii)(D) (emphasis added); *see also U.S. v. Am. Cyanamid Co.*, 786 F.Supp. 152 (D.R.I. 1992) ("The NCP directs EPA to prospectively choose a remedial action that EPA believes will clean-up the site for the least cost.").
[206] 40 CFR Section 300.430(f)(1)(ii)(D).
[207] *Id.*
[208] EPA, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, OSWER 9355.0-85, 7-3 (Dec. 2005).
[209] EPA, *The Role of Cost in the Superfund Remedy Selection Process*, Publication 9200.3-23FS, 2 (Sept. 1996).

this required exercise. EPA Region 10 has previously stated that the correct place for cost-effectiveness evaluations, per the NCP, is after the FS (e.g., in the Proposed Plan).[210]

The Proposed Plan only compares Alternatives E and I. It does not measure, graph, evaluate, or compare the cost-effectiveness between or among any of the other alternatives. Alternatives B, D, F, and G are dismissed in two cursory sentences. Alternatives B and D because they "may not be [sic] meet the first threshold criteria,"[211] and Alternatives F and G because they "involve a significantly greater amount of construction area, time, impact to the environment and the community and cost more." [212] EPA's Proposed Plan ignores the NCP and guidance requirements that EPA compare all alternatives' "incremental cost differences in relation to incremental differences in effectiveness,"[213] and thereby fails to satisfy CERCLA's requirement that the selected remedy be cost-effective.

Even as to the very similar Alternatives E and I, EPA's limited reference to cost-effectiveness is insufficient to comply with CERCLA and the NCP's requirements that the selected remedy be cost-effective. The Proposed Plan devotes less than a page to the comparison between Alternatives E and I, summarily concluding that "Alternative I… is a more cost-effective alternative because it involves approximately 40 fewer acres of dredging in the navigation channel… and is approximately $58M less than Alternative E while achieving the same risk reduction."[214]

As demonstrated below, if EPA had performed a cost-effectiveness analysis among the alternatives, it would be apparent that Alternative I is not cost-effective relative to lower cost alternatives that achieve the same levels of effectiveness.

C. Major Deficiencies in EPA's Effectiveness Analysis Must Be Corrected to Rationally Evaluate Cost-effectiveness

To perform the NCP-required analysis of incremental cost differences in relation to incremental differences in effectiveness, EPA must have a valid analysis of short- and long-term effectiveness, which are two of the three balancing criteria used to determine overall effectiveness. Overall effectiveness is compared to cost to ensure that the remedy is cost-effective.[215]

EPA scarcely addresses these required elements of overall effectiveness, as discussed in Section IV. Instead, EPA's effectiveness analysis is limited to comparing SWACs (and resulting expected fish tissue concentrations) immediately after construction. The Proposed Plan provides that "[t]he effectiveness of each remedial alternative is evaluated in part by comparing each alternative's post-construction [SWAC] to the PRGs for each RAO in the SDUs."[216] This comparison is intended to "provide [] an assessment of how the different alternatives reduce sediment contaminant concentrations, which can then be used to calculate reductions in contaminant concentrations in fish tissue."[217]

It is inappropriate for EPA to evaluate overall effectiveness based only on SWACs immediately after construction, because EPA fails to consider the post-construction natural recovery and ENR that EPA suggests will meet PRGs in the long term. As discussed in Section IV.D, to analyze relative long-term effectiveness, EPA abandons quantitative estimates based on a calibrated and validated long-term model, and then replaces those estimates with the assumption that the Site will recover in 30 years, which is an assumption for which EPA does not provide a rationale.

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[210] Kristine Koch of EPA provided this answer in response to questions during EPA and LWG FS rollout meetings on August 3, 2015 about the absence of cost-effectiveness discussions in the 2016 FS.
[211] We disagree. See Section I.A, supra.
[212] Proposed Plan at 66.
[213] 55 Fed. Reg. 8728.
[214] Proposed Plan at 67.
[215] 40 CFR § 300.430(f)(1)(ii)(D).
[216] Proposed Plan at 49.
[217] Proposed Plan at 49.

Setting aside questions about the validity of predictive long-term models, the analysis below provides long-term SWAC estimates that are consistent with EPA's assumption that Alternative I would meet PRGs in 30 years. This analysis was accomplished by calculating the PCB half-life in Site sediments that would achieve EPA's PCB PRG of 9 ppb[218] in 30 years for Alternative I, which works out to a half-life of about 10 years.[219] This half-life was then applied to each alternative for comparative purposes. In addition to being derived from EPA's conclusion, this estimated rate of natural recovery is supported by empirical data from smallmouth bass fish tissue collected in 2002, 2007, and 2012.[220] Recent 2014 PCB sediment data appear to confirm the validity of this half-life estimate.[221] So, although EPA does not provide any explicit rationale for the 30-year recovery assumption in the Proposed Plan, that assumption appears consistent with valid estimates of the Site recovery rate based on empirical data that do not rely on predictive models.

Table 6 depicts SWAC estimates using this method, from the completion of construction of each alternative (according to EPA's estimates) to Year 30. Table 6 uses EPA's very optimistic construction durations (based on continuous dredging) and conservative initial condition SWAC of 208 ppb for PCBs (EPA 2016 SWAC), which is much higher than the SWAC of 85 ppb used in the EPA 2015 Draft FS (EPA 2015 SWAC). As discussed in Section I.C.2.b, the EPA 2016 SWAC results in risks that are inconsistent with the BLRAs and actual initial conditions are likely much lower. Table 6 also factors in the LWG's estimated Site PCB equilibrium of 20 ppb, which is the lowest likely achievable Site concentration based on the LWG's analysis of upstream PCB inputs to the Site.[222]

Table 6 demonstrates that Alternatives B and D reach a SWAC within 20% of EPA's post-construction SWAC estimate for Alternatives E and I (40 ppb) by Years 11-13—just 4 to 6 years after EPA estimates construction of Alternatives E and I would be complete. (EPA's accepted analytical accuracy for most organic compounds is at least 20%, and it is higher for most PCB measurements.[223]) Further, as noted by the green highlighted cells in Table 6, Alternatives E and I would be within the Site equilibrium range (20 to 24 ppb) as little as 1 year sooner than Alternative D and as little as 3 years sooner than Alternative B.

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[218] Note that the LWG disagrees that a long-term concentration of 9 ppb PCBs is actually achievable. The analysis below also considers that the long-term PCB equilibrium for the Site is likely to be no lower than 20 ppb (as supported by the analysis in "Sediment Equilibrium Estimates for the Revised Feasibility Study" (LWG, August 7, 2014.)

[219] Using Alternative 1 (the preferred alternative), EPA estimates a post-construction SWAC of 40 ppb at construction completion, which is 7 years after construction started. In order to reach a level of 9 ppb in the 23 years remaining within EPA's 30-year assumption, the site-wide concentration would need to halve every 10 years. This equates to 20 ppb at 17 years after construction started and 10 ppb at 27 years after construction started. Consequently, 9 ppb would be achieved at about 28 years after construction started.

[220] "Lower Willamette River Smallmouth Bass Data Monitored Natural Recovery Analysis." A presentation file from Anchor QEA provided to EPA on March 18, 2013. (Attachment 1)

[221] *Sediment sampling data report, Portland Harbor, Portland, Oregon*, prepared for de maximis Inc., (Kleinfelder, May 11, 2015). (Attachment 2)

[222] *Sediment Equilibrium Estimates for the Revised Feasibility Study* (LWG, August 7, 2014).

[223] Kennedy/Jenks and Integral, 2005. Portland Harbor RI/FS Round 2 Surface Sediment PCB Congeners Sample Selection Memo. Prepared for the Lower Willamette Group, Portland, OR. June 10, 2005; USEPA 2008. USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. OSWER 9240.1-48; USEPA-540-R-08-01.]

Table 6. PCB SWACs (ppb) Comparison Using EPA's 24 hour/day Assumption for Alternative Durations (using EPA's 2016 initial SWAC of 208 ppb).

EPA Alternatives	Years																													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A (no action)	208	194	180	168	156	145	135	126	117	109	101	94	88	82	76	71	66	61	57	53	49	46	43	40	37	35	32	30	28	26
B				74	69	64	60	56	52	48	45	42	39	36	34	31	29	27	25	23	22	20	20	20	20	20	20	20	20	20
D						56	52	49	45	42	39	36	34	32	29	27	25	24	22	20	20	20	20	20	20	20	20	20	20	20
E/I							40	37	35	32	30	28	26	24	23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20
F													23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
G																			20	20	20	20	20	20	20	20	20	20	20	20

Notes

	Duration of alternative construction
XX	Year construction is completed and EPA estimated SWAC at that time.
XX	Using an estimated natural recovery rate, the years that the alternative achieves a concentration approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds). This equates to a concentration range of 20 to 24 ppb (i.e., 24 ppb is plus 20% of the equilibrium value of 20 ppb).

Measures of effectiveness over time depend significantly on the accuracy of construction duration estimates. As discussed in Section V.F, the LWG concludes that construction of EPA's alternatives is likely to take twice as long as EPA estimates. Table 7 uses the same methodology described above but assumes construction durations twice as long as EPA's, such that Alternatives E and I would be complete in Year 14. In addition, Table 7 initial SWACs are based on the EPA 2015 FS initial SWAC of 85 ppb, which is consistent with the BLRAs.

Table 7 demonstrates that Alternatives B and D reach a SWAC within 20% of EPA's post-construction SWAC estimate (from EPA's 2015 Draft FS) for Alternatives E and I (31 ppb) by approximately the same time that Alternatives E and I complete construction. Further, Alternatives B, D, E, and I all enter the equilibrium range (green range from 20 to 24 ppb) at about the same time (as does the no action Alternative A). This indicates that, when uncertainties associated with construction duration are accounted for, Alternatives B and D are equally effective as Alternative I, while including far less active remediation and construction.

Taking into account EPA's own 30-year recovery assumption and acknowledging the uncertainties associated with construction duration, Alternative I is highly unlikely to achieve measurably lower SWACs meaningfully sooner than other, less costly alternatives.

Further, the real world consequences of these differences in SWACs are minimal. Table 8 depicts the fish meals per month that children could safely consume (non-cancer risk) at various years after the start of remedy construction.[224] Table 8 uses EPA's starting SWAC of 208 ppb and assumed construction durations based on work proceeding 24 hours per day. Similar to the SWAC analyses above, Alternatives E and I would attain 4.3 fish meals per year immediately after construction by Year 7, and Alternative B and D would achieve the same level of fish consumption in just a few years later (by Years 11 to 13).[225]

However, Alternatives E and I would require much lower fish consumption levels[226] during an additional 3 years of construction as compared to Alternative B. Factoring in fish meals during construction, the <u>average</u> fish meals per year allowed under each alternative over the entire 30-year period shown in Table 8 would be:

- Alternative A – 2.7 fish meals/year
- Alternative B – 5.6 fish meals/year
- Alternative D – 5.9 fish meals/year
- Alternatives E and I – 6.6 fish meals/year
- Alternative F – 5.7 fish meals/year
- Alternative G – 4.1 fish meals/year

[224] As noted previously, EPA focuses many of the 2016 draft Final FS and Proposed Plan discussions on allowable fish meals for "people" based on a non-cancer endpoint, but in fact, these estimates are based on the child scenario, not the adult scenario.
[225] And, as noted in Section IV.C above, fish tissue concentrations are likely to remain elevated for 3-5 years following construction, minimizing the window of differential allowable fish consumption between the alternatives even further.
[226] EPA Proposed Plan page 58 indicates EPA assumed only 0.6 fish meals per year could be consumed during construction.

Table 7. PCB SWACs (ppb) Comparison Using LWG's 12 hour/day Assumption for Alternative Durations (using EPA's 2015 Initial SWAC of 85 ppb).

EPA Alternatives	Years																																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**
A (no action)	85	79	74	69	64	59	55	51	48	45	41	39	36	33	31	29	27	25	23	22	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
B								49	46	42	40	37	34	32	30	28	26	24	22	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
D												40	37	35	32	30	28	26	24	23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
E/I														31	29	27	25	23	22	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
F																										21	20	20	20	20	20	20	20	20	20	20	20
G																																				15	20

Notes

Duration of alternative construction

XX Year construction is completed and EPA estimated SWAC at that time.

XX Using an estimated natural recovery rate, the years that the alternative achieves a concentration approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds). This equates to a concentration range of 20 to 24 ppb (i.e., 24 ppb is plus 20% of the equilibrium value of 20 ppb).

* Half-life set to rate that would achieve background PCB PRG of 9 ppb in 30 years (without applying the equilibrium asymptote at 20 ppb, which is consistent with EPA's approach). Based on EPA's text on page 4-6: "As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions." This assumption is similar to the estimated natural recovery rate based on average smallmouth bass fish tissue half-lives using 2002, 2007, and 2012 data. Also, recent 2014 PCB sediment data appear to be approximately equivalent to this half-life.

Table 8. Fish Meals per Year (Non-cancer Child) Comparison Using EPA's 24 hour/day Assumption for Alternative Durations (using EPA's 2016 initial SWAC of 208 ppb).

EPA Alternatives	Years																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A (no action)	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.4	3.7	4.0	4.3	4.7	5.1	5.5	5.9	6.4	7.0
Alt B	0.6	0.6	0.6	2.2	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.1	4.4	4.8	5.2	5.6	6.1	6.6	7.2	7.8	8.4	9.1	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt D	0.6	0.6	0.6	0.6	0.6	2.9	3.2	3.5	3.7	4.1	4.4	4.8	5.2	5.6	6.1	6.6	7.1	7.7	8.3	9.0	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alts E/I	0.6	0.6	0.6	0.6	0.6	0.6	4.3	4.6	5.0	5.5	5.9	6.4	6.9	7.5	8.1	8.8	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt F	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	8.0	8.6	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Alt G	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3

Notes

Duration of alternative construction (EPA Proposed Plan p. 58 indicates EPA will allow 0.6 fish meals per year during construction phase).

XX Year construction is completed and EPA estimated allowable fish meals per year at that time.

XX Using an estimated natural recovery rate, the years that the alternative achieves a number of fish meals approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds).

Following EPA's assumptions, EPA's Alternative I would only allow an average of one additional fish meal per year over the entire 30-year period as compared to Alternative B, but with substantially greater and longer environmental and community impacts from construction. Further, this analysis does not account for the fact that fish consumption would likely need to be lower during construction than EPA assumes, because EPA did not quantify that dredging releases typically cause elevated fish tissue concentrations during and a few years after construction.[227] Thus, the real difference between Alternatives B and I's average fish meals per year over 30 years would be less than one additional fish meal per year.

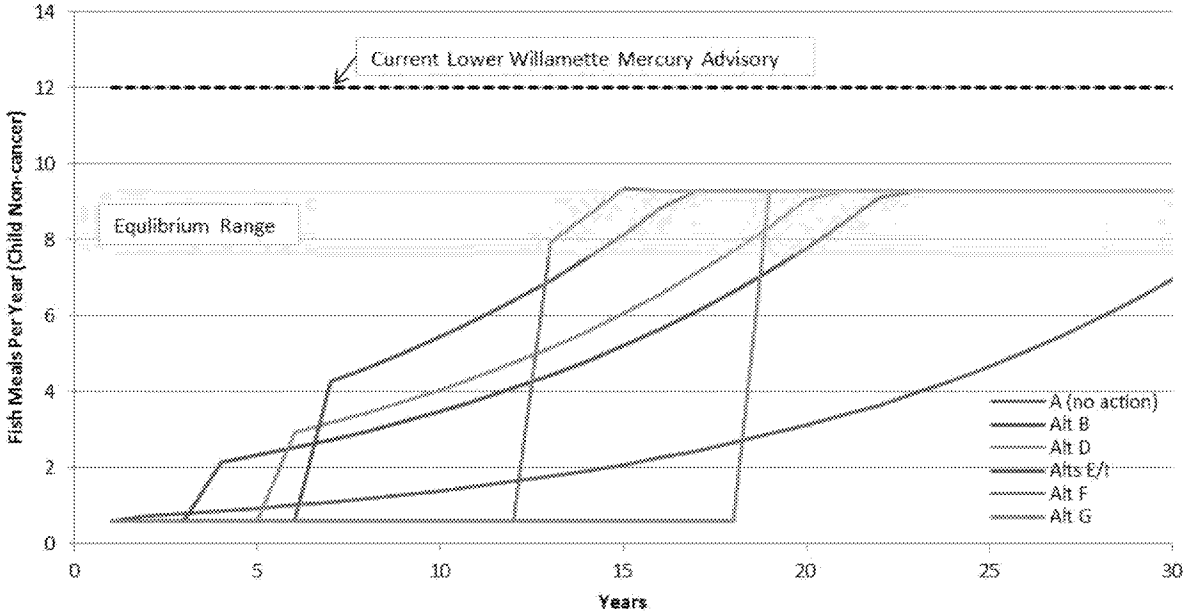
Finally, EPA acknowledges but fails to quantify or evaluate that "Estimating the number of acceptable fish meals at the end of construction is not a precise calculation, but rather is a prediction that has some degree of uncertainty."[228] Thus, the uncertainty around the calculated SWACs and related numbers of fish meals provided by various alternatives means that the results are likely to be highly overlapping. Just accounting for the different estimates in construction durations results in no difference in the SWACs achieved over time by the alternatives as demonstrated in Tables 6 and 7. For example, in Table 6 (24 hour/day construction) Alternative B reaches the equilibrium range of 20 to 24 ppb by Year 20, while Alternative I reaches the same range by Year 14, but in Table 7 (12 hour/day construction) Alternative B and Alternative I both reach the same concentration range by Year 18. Calculating fish meals is an additional highly uncertain step beyond the SWAC uncertainty, and as a result, there is no real or measurable difference between any of the alternatives in terms of the number of fish people will be able to consume over the 30-year evaluation period proposed by EPA. EPA should compare real world outcomes of different alternatives (e.g., average additional fish meals per year), quantify the uncertainties in those outcomes, and provide some estimate of the time it takes different alternatives to achieve them.

Figure 6 shows fish meals per year that can be consumed by adults for each remedy, over time, in the context of the current Portland Harbor mercury fish advisory and the estimated equilibrium range.

[227] See discussion in Sections I.C. and IV.C; LWG 2012 draft FS in Sections 6.2.7.3 and 8.2.2.4; Bridges, et al. 2010: Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging. Todd S. Bridges, Karl E. Gustavson, Paul Schroeder, Stephen J. Ells, Donald Hayes, Steven C. Nadeau, Michael R. Palermo, and Clay Patmont. Integrated Environmental Assessment and Management. February 10, 2010. 2010 SETAC; IRTC p. 181; and "Sediment Monitored Natural Recovery Case Studies." Presentation at the Battelle Eighth International Conference on Remediation and Management of Contaminated Sediments. January 12-15, 2015. Carl Stivers and Clay Patmont of Anchor QEA.

[228] Proposed Plan p. 58.

Figure 6. Fish Meals/Year (child non-cancer scenario) for 2016 Draft Final FS Alternatives using EPA's Initial SWACs and Construction Durations. ("Years" represent years from construction start.)



As Figure 6 shows, all alternatives are likely to attain the equilibrium range (gray zone) supported number of fish meals within about the same 6-year period, which will still be less than the current mercury advisory for the same population (i.e., child/vulnerable). Given the uncertainties in this calculation, the actual real world outcomes in terms of fish meals per year for these alternatives is likely to be highly overlapping.

The cost-effectiveness analysis that follows uses these rational and accurate analyses, primarily of long-term effectiveness, to display what the cost-effectiveness analysis missing from EPA's Proposed Plan would show.

D. Alternatives E and I are Not Cost-effective

The following figures demonstrate that if EPA had performed an appropriate cost-effectiveness analysis, it would be apparent that Alternatives E and I are not cost-effective relative to other alternatives.

Figure 7 shows the relative additional effectiveness (as represented by SWACs) of each successively larger alternative, as compared to incremental increases in the costs of those alternatives. (Cost estimates are based on EPA's FS, which as noted in Section IV.F, significantly underestimate the true costs of the alternatives.) The red line is based solely on SWACs immediately after construction, the right most part of the line begins with EPA's unrealistically high initial condition SWAC of 208 ppb for Alternative A.

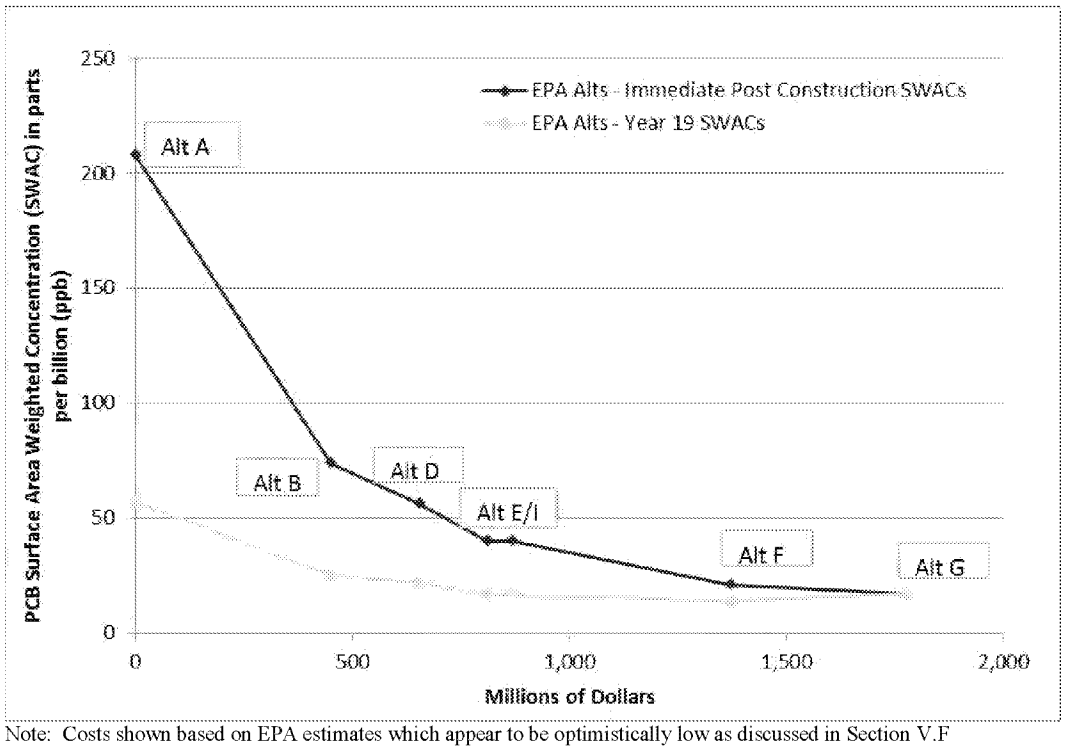
EPA focuses solely on the red line that implies relatively steep reductions in SWACs across the range of alternatives' costs. With this focus, EPA ignores the criterion of long-term effectiveness in evaluating overall effectiveness of the alternatives. A more appropriate way to evaluate cost-effectiveness among alternatives is to also evaluate the SWACs several years after construction.

The yellow line on Figure 7 shows the same alternatives evaluated 19 years after the construction of any alternative is started, given that Alternative G is estimated by EPA to be complete by Year 19 based on an optimistic 24 hour per day construction assumption. (The SWACs shown on the yellow line are the same as those presented in Table 6 above for Year 19 using the methods described there.) Clearly, the yellow (Year 19) line is much less steep than the red (immediate post construction) line, indicating that relatively little additional long-term SWAC reduction is achieved with each successively more costly alternative. Examining Year 19 SWACs, EPA's alternatives are at or near an asymptote of virtually no additional SWAC reduction by about the end of construction of Alternative D, if

not Alternative B. It is worth comparing the weaker cost-effectiveness performance of EPA's alternatives as compared with the integrated alternatives from the 2012 LWG Draft FS. The integrated alternatives were designed to reduce risk faster, at lower cost. Figure 8 adds the LWG alternatives to compare with EPA's alternatives.[229] Examining Year 19 (yellow and blue lines), both EPA and the LWG's alternatives are at or near an asymptote of virtually no additional SWAC reduction by about Alternative D, if not Alternative B. The 2012 LWG Draft FS integrated alternatives perform better than EPA's alternatives by using both immediate post-construction SWACs (green line) and Year 19 SWACs (blue line), because lower SWACs are achieved at substantially lower costs. Figure 9 depicts the same information using the cost estimates developed by the LWG and summarized in Table 5.

Figure 10 shows the same relationship between SWAC reductions and costs, as measured by dividing the alternative's total cost by the PCB SWAC reduction achieved (i.e., cost in millions of dollars to achieve each incremental ppb reduction in the SWAC). Because this measure is very sensitive to the amount of SWAC reduction, Figure 10 uses an initial SWAC (Alternative A) of 85 ppb (instead of EPA's inflated 208 ppb) to compare EPA and the LWG's alternatives. (As noted elsewhere, EPA's 2015 Draft FS used 85 ppb and up to that time EPA and the LWG were in agreement for many years that the baseline SWAC for the Site was about 85 ppb.) As expected, EPA's Preferred Alternative (red and yellow bars) achieves each increment of SWAC reduction for a higher unit cost than EPA's Alternative B (red and yellow bars) either on an immediate post-construction or Year 19 basis. Similarly, all of EPA's alternatives are equally or less cost-effective (all red and yellow bars) as compared to similar LWG integrated alternatives (all blue and green bars). Unit cost measures are consistent with the NCP and show that EPA's larger alternatives (all alternatives from Alternative E upward) have substantially higher costs per unit of effectiveness as measured by SWAC reductions.[230] As noted above, EPA's costs appear to be optimistically low. Consequently, EPA's alternatives would all be even less cost-effective if more realistic (higher) alternative costs were used in any of these figures.

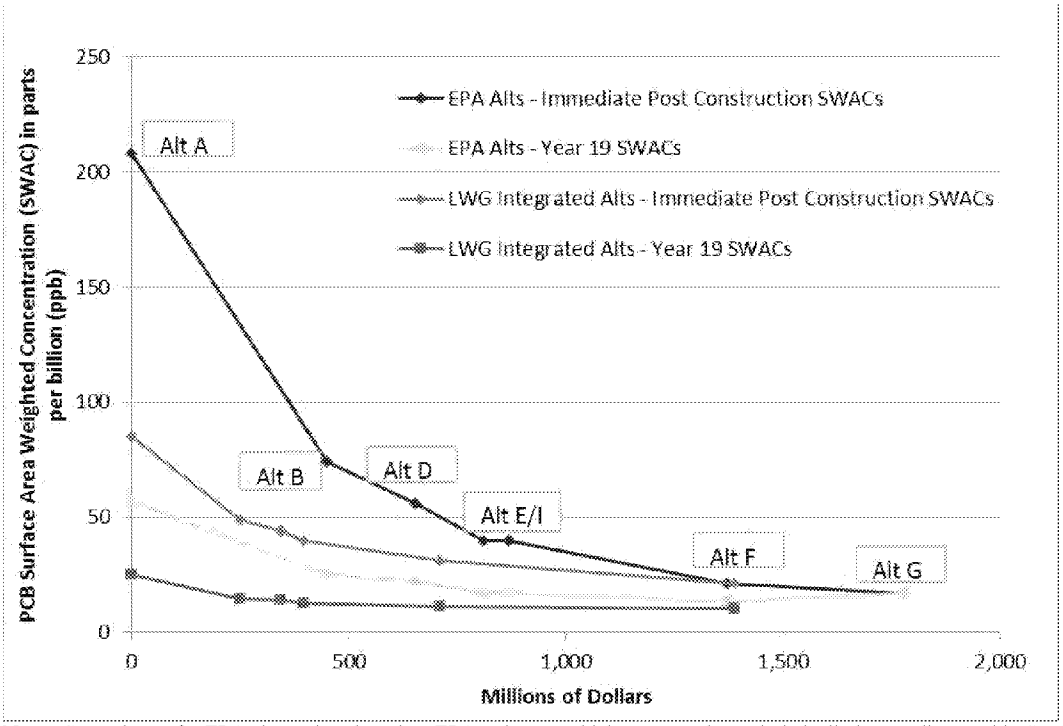
Figure 7. Comparison of EPA Alternative SWACs and Costs, Immediate Post Construction and 19 Years After Construction Start.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

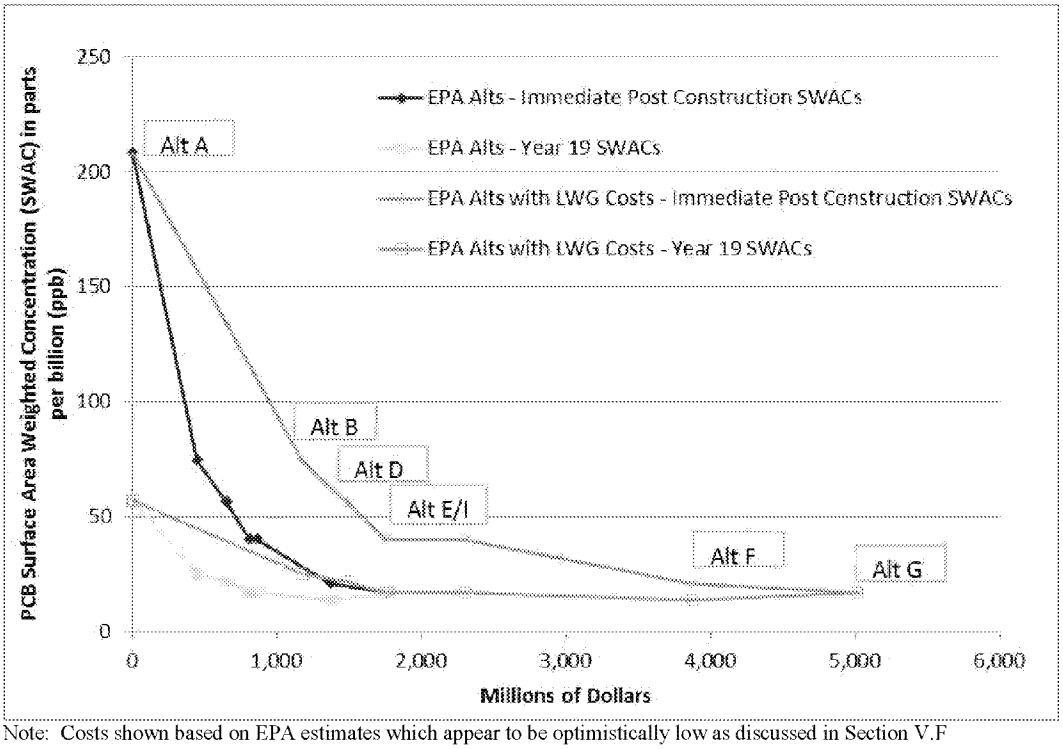
[229] The SWAC for LWG Alternative A is 85 ppb consistent with the LWG 2012 Draft FS and EPA 2015 FS as noted elsewhere.
[230] 55 Fed. Reg. 8728 ("if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist," and "[t]he more expensive remedy may not be cost-effective").

Figure 8. Comparison of EPA and LWG Integrated Alternative SWACs and Costs, Immediate Post Construction and 19 Years after Construction Start.



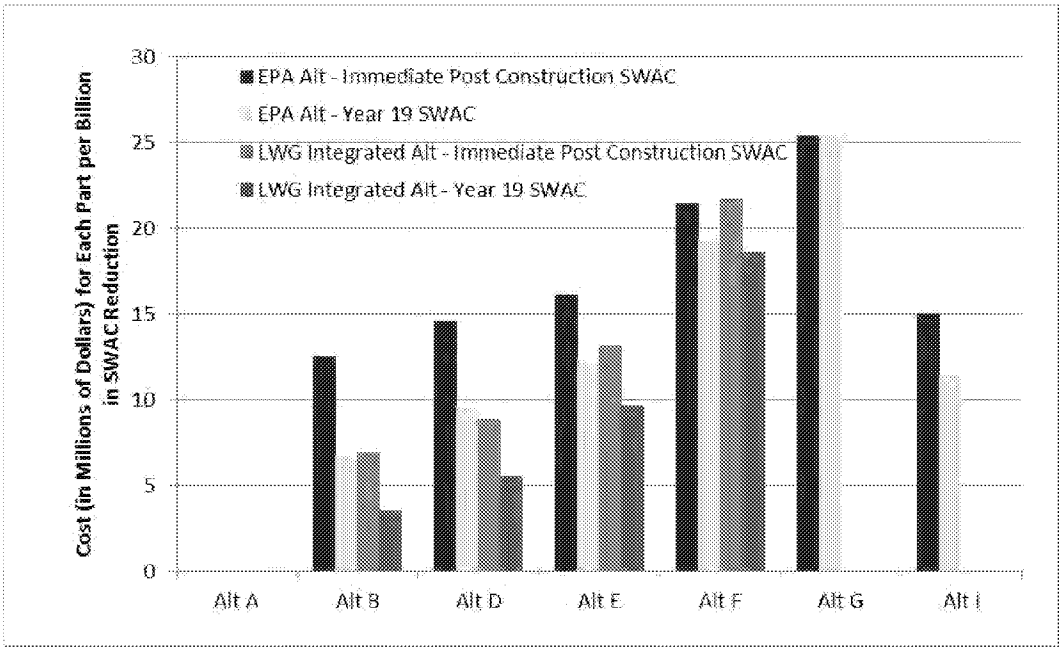
Note: Costs shown for EPA alternatives based on EPA estimates which appear to be optimistically low as discussed in Section V.F

Figure 9. Comparison of EPA and LWG Integrated Alternative SWACs and Costs, Immediate Post Construction and 19 Years after Construction Start. LWG Estimated Costs for EPA's Alternatives Shown.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

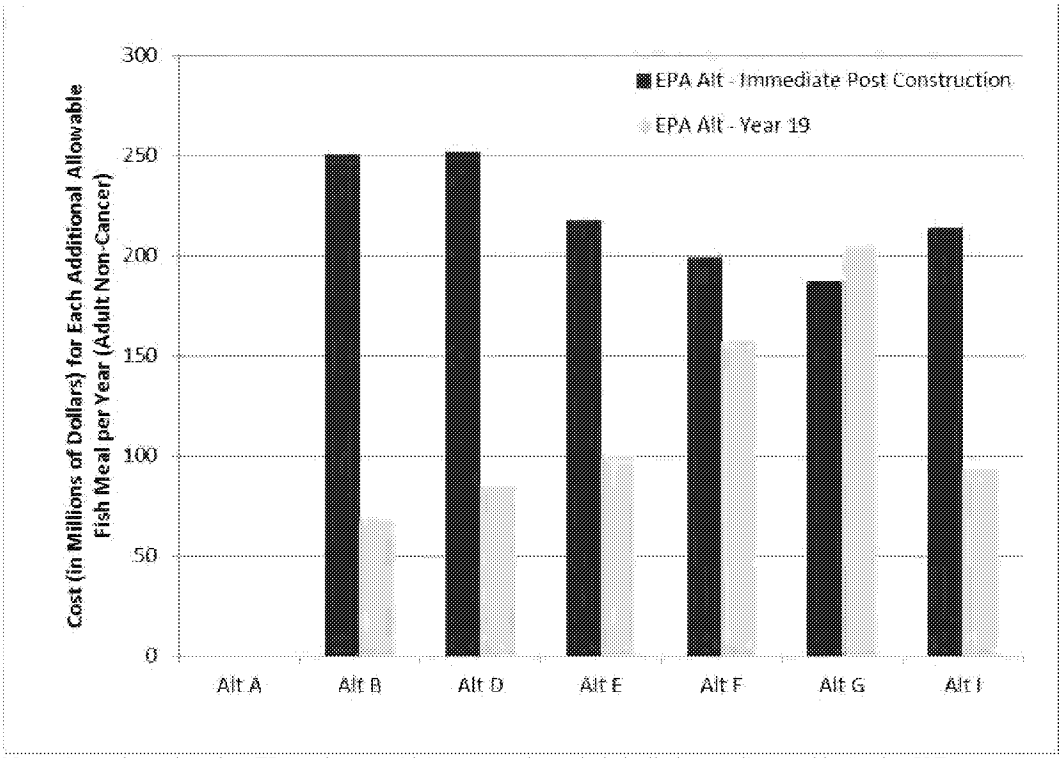
Figure 10. Cost for Each Part per Billion in PCB SWAC Reduction for EPA and LWG Alternatives.



Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

By way of further analysis in terms of cost versus risk reduction, Figure 11 reflects the unit costs of the alternatives for each additional allowable fish meal per year (beyond that provided by baseline conditions) for adult non-cancer risks consistent with the fish meal calculation assumptions in Table 8. Based on Year 19 allowable consumption rates (yellow bars), Figure 11 demonstrates that the larger alternatives have relatively higher unit costs for each additional fish meal allowed per year, and EPA's Preferred Alternative has a higher unit cost than Alternative B. Figure 11 also illustrates the dangers of EPA's sole focus on immediate post-construction conditions (red bars). The red bars imply lower unit costs for additional allowable fish meals with the larger alternatives, but this is only true if ongoing natural recovery after the construction period is ignored. Similar to effectiveness measured by SWAC reduction, effectiveness measured by additional allowable fish meals over the long term shows that Alternative I is equally or less effective than the much less costly Alternatives B and D. Also, as noted above, if EPA's entire 30-year period is examined (the period EPA assumes it will take until attainment of the PRGs), the average allowable annual fish meals for Alternative I (average of 31 fish meals/year) is only three more meals than for Alternative B (average of 28 fish meals/year).

Figure 11. Cost for Each Additional Allowable Fish Meal per Year for EPA Alternatives, Immediate Post Construction and at Year 19 after Construction Start.

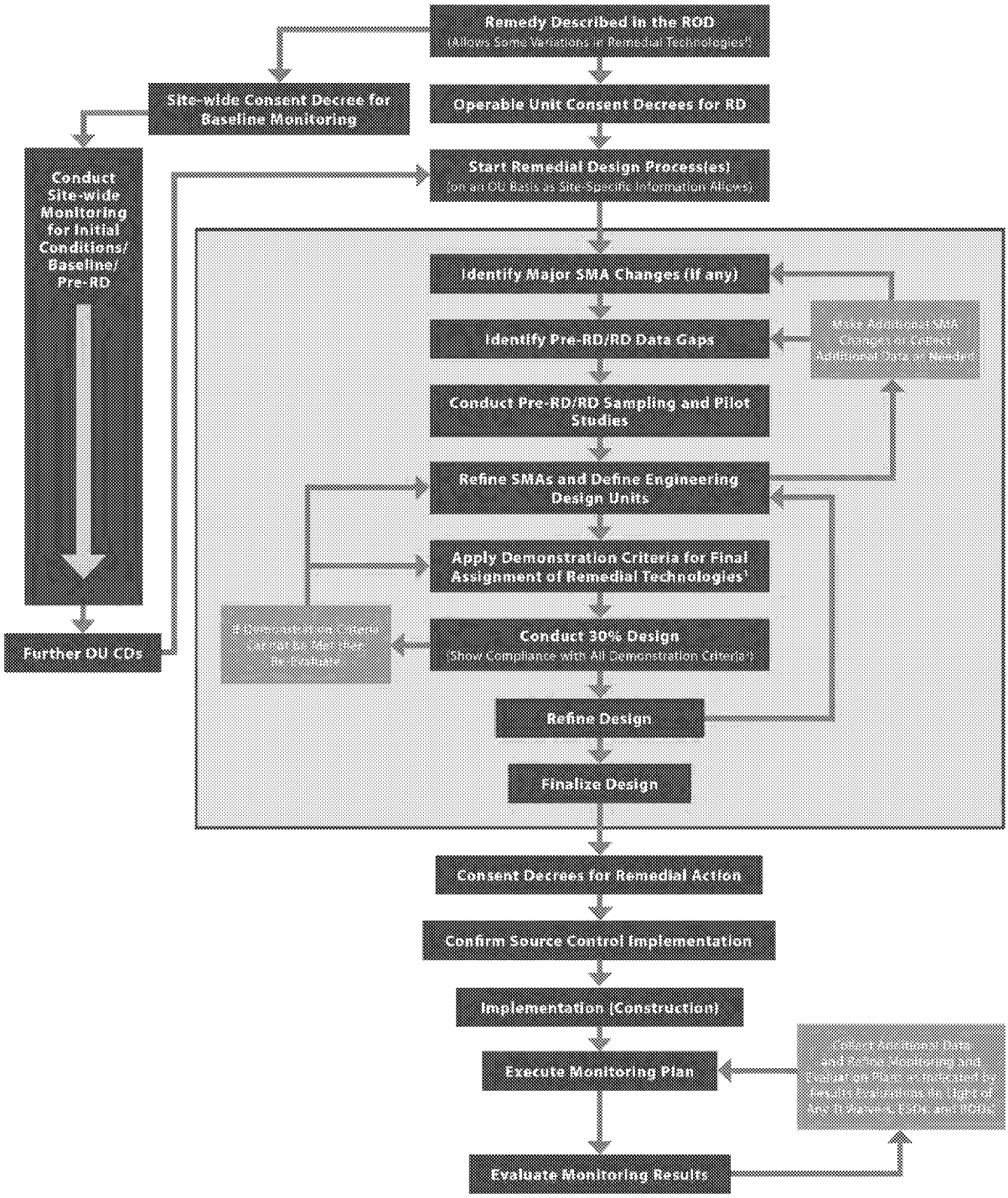


Note: Costs shown based on EPA estimates which appear to be optimistically low as discussed in Section V.F

VI. EPA's Remedy Selection Should include a Plan for How Cleanup will be Implemented Through Baseline Data Collection and Remedial Design and Implementation at Operable Units

Notably missing from EPA's Proposed Plan is a procedural and technical implementation roadmap of how cleanup of Portland Harbor will be accomplished. Having a clear understanding of that roadmap is critical to timely and successful cleanup. The LWG recommends that the ROD define a procedural process similar to Figure 12.

Figure 12. LWG Recommended Iterative Remedial Design/Remedial Action Approach



EPA should manage implementation of cleanup through the identification of operable units. After appropriate data needs are filled and pre-remedial engineering design studies are completed, some operable units may be ready to move into remedial design sooner than others. Remediation in operable units is a key CERCLA program management principle supporting EPA's "bias for action."

The National Contingency Plan provides:

> (ii) *Program management principles.* EPA generally shall consider the following general principles of program management during the remedial process:
>
> (A) Sites should generally be remediated in operable units when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup.[231]

Contemporaneous initiation of cleanup at some operable units while others undergo additional assessment is entirely consistent with the NCP:

> While the bias for action promotes multiple actions of limited scale, the program's ultimate goal continues to be to implement final remedies at sites. The scoping section of today's rule has been amended to make clear that the lead agency shall conduct strategic planning to identify the optimal set and sequence of actions necessary to address the site problems. Such actions may include, as appropriate, removal actions, interim actions and other types of operable units. Site management planning is a dynamic, ongoing, and informal strategic planning effort that generally starts as soon as sites are proposed for inclusion on the NPL and continues through the RI/FS and remedy selection process and the remedial design and remedial action phases, to deletion from the NPL.[232]

EPA's Sediment Guidance recommends exactly this approach: "Project managers may also consider separating the management of source areas from other, less concentrated areas by establishing separate operable units (OUs) for the site."[233]

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[231] 40 CFR §300.430(a)(1)(ii). The preamble to the 1990 revisions to the NCP explains,

> A bias for action is consistent with EPA's long-standing policy of responding by distinct operable units at sites as appropriate, rather than waiting to take one consolidated response action. The 1985 NCP originally codified this policy that remedial actions may be staged through the use of operable units.
>
> ***
>
> Consistent with the bias for action principle in today's rule, EPA will implement remedial actions in phases as appropriate using operable units to effectively manage site problems or expedite the reduction of risk posed by the site.
>
> ***
>
> EPA supports the operable unit concept as an efficient method of achieving safer and cleaner sites more quickly while striving to implement total site cleanups. Although the selection of each operable unit must be supported with sufficient site data and alternatives analyses, EPA allows the ROD for the operable unit to use data and analyses collected from any RI/FS performed for the site.

55 Fed. Reg. 8666, 8704-05.

[232] 55 Fed. Reg. at 8706. See also, 53 Fed. Reg. at 51423: "Where problems are reasonably severable, phased responses implemented through a sequence of operable units may promote more rapid risk reduction."

[233] EPA, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, p. 2-22. EPA's decision to approach other large and diverse Superfund sites as a monolithic whole has been criticized by the scientific community. A 2005 report by the National Academies of Science reviewing EPA's work in the Coeur d'Alene River Basin concluded that EPA's decision to treat a large and diverse area as a single operable unit resulted in a slower, less effective and more uncertain cleanup:

> By combining these different problems into one OU and subjecting them to the process established in the NCP, EPA must attempt to answer all the questions for all the problems before it can attempt to remedy any of them. As a result, the agency must delay action on addressing the more tractable problems until it has all the information it needs to decide what to do about those that are less easily addressed, or, alternatively, it must propose remedies for some of the problems with inadequate information.
>
> ***
>
> As an area increases in complexity, the certainty of cost, volume, and remedial efficacy estimates decreases as does the certainty that selected decisions will be conducted. In reality, these large geographically complex sites like the Coeur d'Alene River basin cannot be

Breaking up the site into operable units would allow EPA to get cleanup started in areas where more information exists while less well-defined areas or areas of lower risk proceed on a parallel path through collection of baseline or "initial conditions" assessment. Figure 12 depicts our recommended programmatic approach to remedial design and implementation at Portland Harbor, which could allow different areas of the Site to move at different rates based upon site-specific information and information to be developed after the ROD.

VII. The Administrative Record, As Supplemented by These Comments, Demonstrates that EPA's Selection of its Preferred Alternative Would Be Arbitrary and Capricious

Appendix A provides additional information for the Administrative Record. This information was exchanged between EPA and the LWG during preparation of the RI/FS, provided by the LWG to EPA in the course of the LWG's work on the RI/FS or previously generated by EPA. The LWG previously recommended that most of these records be placed within the Administrative Record as appendices to relevant LWG deliverables; in most, if not all, cases, EPA required the LWG to remove the records from the deliverables. We are therefore incorporating these and similar records into our comments on the Proposed Plan for inclusion in the Administrative Record file pursuant to 40 CFR §300.815(b). The LWG and its members submitted Freedom of Information Act requests to EPA on March 9, 2016 (as clarified April 4, 2016) and August 11, 2016. EPA has not completed its responses to these requests. The LWG and its members may request that the Administrative Record be supplemented by information EPA provides after the public comment period closes.

Conclusion

EPA has departed so significantly from the baseline risk assessments that it cannot accurately describe the risk reduction attained by each of its alternatives. The unrealistic assumptions EPA has made about the practical and engineering details of its alternatives, together with the simplifying assumptions it has made about the physical, chemical, and temporal properties of the Site, limit EPA to subjective and conclusory evaluations of the performance of those alternatives at attaining its inaccurate risk reduction estimates, and they prevent a meaningful assessment of the impacts of those alternatives on the community and the environment. These errors, compounded with EPA's incomplete and imprecise cost estimating, make it impossible for EPA to shine any real light on why it is making the decision it proposes to make, or how that decision is more than throwing darts at the wall, flipping a coin, or making a sudden knee-jerk decision. A thoughtful review of the evidence before EPA leads instead to the conclusion that less aggressive, shorter duration alternatives, based on site-specific information and current data, are protective, would be as effective at reducing risks identified in the baseline risk assessments, would result in less short-term risk to people and the environment, and would attain the amount of risk reduction achievable through sediment remedies in about the same amount of time and at far less cost than EPA's Preferred Alternative.

In its October 19, 2015, letter to the NRRB, the LWG provided several recommendations on implementing the cleanup, including focusing on the most significant and pervasive risks, selecting cleanup goals that are aligned with the risk assessments and are achievable, treating principal threat waste only where it is more cost-effective than other disposal options, reducing the uncertainty about natural recovery, and maximizing flexibility in remedial design and implementation of the cleanup. Our review of the Proposed Plan has not changed those general recommendations:

- Reasonable PRGs based on appropriate risk management.
- RALs that are appropriately applied to surface sediments consistent with the methods and results of the BLRAs and that focus on active remediation of the highest contaminant concentrations:
  - PCB RAL of 1,000 ppb

---

remediated in a short time frame, and efforts to describe the entirety of the problem and chart a path to completion (as attempted in the Superfund process) become less realistic with increasing complexity of the site.

National Academy of Science, *Superfund and Mining Megasites: Lessons Learned from the C'oeur d'Alene River Basin* (2005), pp. 420-21.

  - DDE RAL of 1,000 ppb
  - cPAH (as BaPEq) RAL of 20,000 ppb
  - Designated CBRAs consistent with the multiple lines of evidence evaluation of benthic toxicity in the BERA

- Flexible technology assignments assigned to SMAs or operable units, with an appropriate balance of removal and in-place technologies at the harbor-wide scale (e.g., capping, in situ treatment, and EMNR). We anticipate this will equate to approximately 50% dredging and 50% in-place technologies (by site-wide acreage). Technology assignment must take into account that the longer it takes to implement the remedy, the longer the impact to the river and the fish, and the longer it takes the system to recover.

- No identified PTW. Substantial product at the Gasco Sediment Site will be managed consistent with the 2009 Gasco Consent Order.

- Appropriate application of in situ and ex situ treatment of a significant volume of materials at the Site through application of the above appropriate RALs and technology assignments.

- Use of operable units to manage the Site based on localized chemical and physical characteristics.

- Exclude riverbank soils remedies (leaving those to be designed and implemented through either DEQ upland source control program or future sediment remedial designs).

- Refinement of technology assignment and process options in remedial design (e.g., types of dredging and dredge BMPs types of treatment, and habitat and flood mitigation methods).

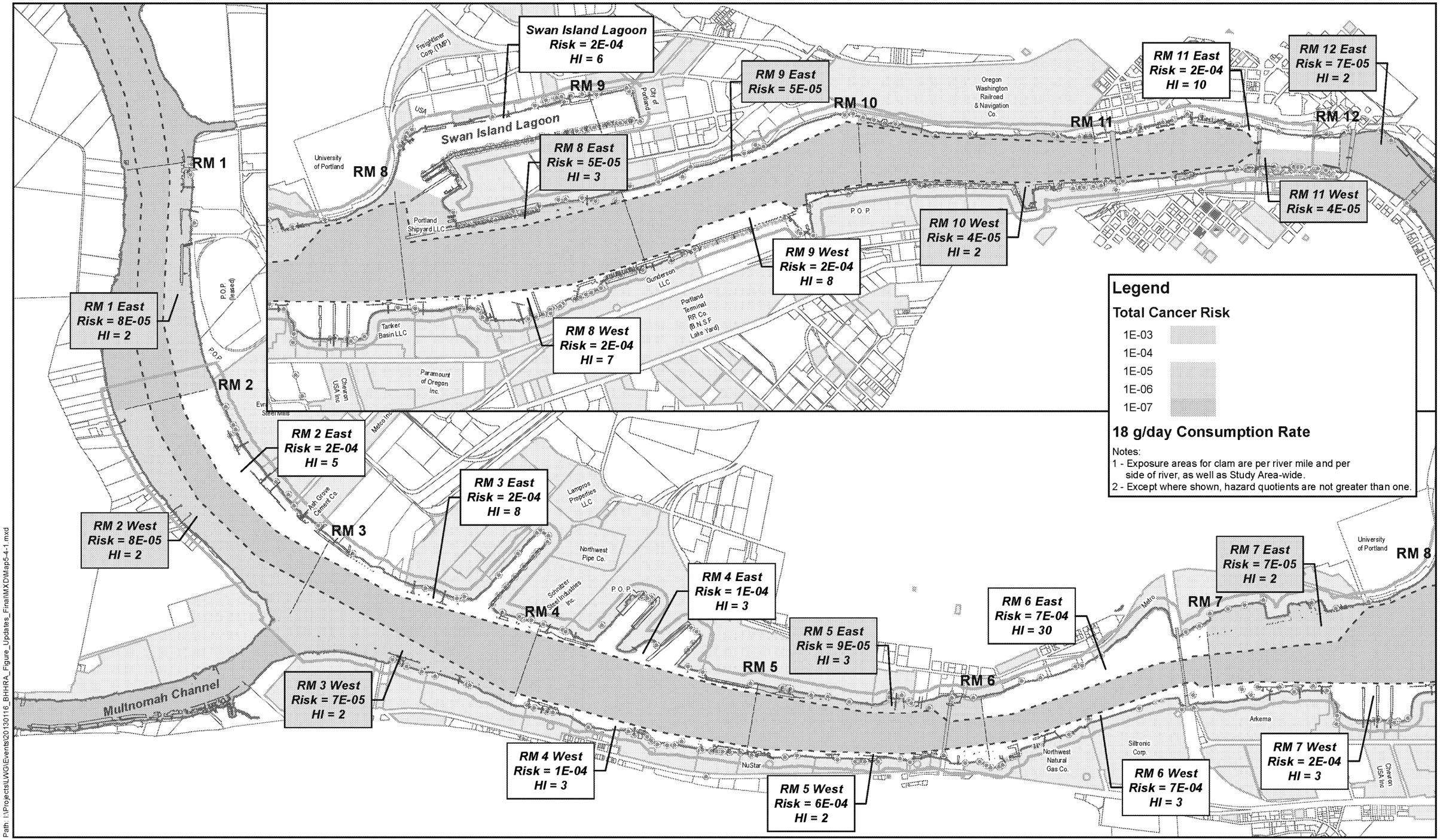
As discussed in these comments, such an alternative would be protective and compliant with ARARs and would be a cost-effective, implementable remedy. The areal extent of SMAs developed under this alternative would be defined based upon evaluation of data collected through additional baseline sampling and during remedial design, and the general balance of technology assignments would be refined or modified during remedial design as appropriate based upon site-specific engineering evaluations and design data. The LWG believes this remedy could be implemented through settlement within a reasonable timeframe following the ROD.

Sincerely,

The Lower Willamette Group

cc: Kristine Koch, US. Environmental Protection Agency, Region 10
Sean Sheldrake, U.S. Environmental Protection Agency, Region 10
Confederated Tribes and Bands of the Yakama Nation
Confederated Tribes of the Grand Ronde Community of Oregon
Confederated Tribes of Siletz Indians of Oregon
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Warm Springs Reservation of Oregon
Nez Perce Tribe
Oregon Department of Fish & Wildlife
United States Fish & Wildlife
Oregon Department of Environmental Quality

TAB 5



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Kennedy/Jenks Consultants
Engineers & Scientists

LWG
Lower Willamette Group

FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS.
Channel & River Miles: US Army Corps of Engineers.
Bathymetric Information: David Evans and Associates, Inc.

0 1,000 2,000 Feet

Map Features

- River Miles
- Navigation Channel
- River Edge +13 ft NAVD
- Study Area

Outfalls

- Outfall
- Dock Drain
- Roof Drain

- Bridges
- Docks and Structures
- Waterfront Taxlots
- Upland ECSI Sites (2008)

Map 5-4-1
Portland Harbor RI/FS
Final Remedial Investigation Report
Appendix F: BHHRA
March 28, 2013

Risks from Clam Consumption, RME

TAB 6

DHS
Oregon Department of Human Services

FAX COVER SHEET

Oregon State Public Health
Environmental & Occupational Epidemiology
503-731-4025
Fax: 503-872-5398

Date: 6/13/07	**Sender:** Julie Early
To: Cindy	**Office Name:**
Office Name:	**Address:** 800 NE Oregon St., #827
Address:	**City:** Portland
State: **Zip:**	**State:** OR **Zip:** 97232
Phone No.:	**Phone No.:** 503-731-4025
Fax No.: 503-295-4901	**Fax No.:** 503-872-5398
	Total Pages:

Re: Linntn Comm. Center Report – Portland Harbor

☐ **Urgent** ☐ **For review** ☐ **Please comment** ☐ **Please reply** ☐ **Please recycle**

Let me know if you have any ?'s.

Confidentiality Notice: The information contained in this facsimile may be confidential and legally privileged. It is intended **only** for use of the individual named. If you are not the intended recipient, you are hereby notified that the disclosure, copying, distribution, or taking of any action in regards to the contents of this fax – except its direct delivery to the intended recipient – is strictly prohibited. If you have received this fax in error, please notify the sender immediately and destroy this cover sheet along with its contents, and delete from your system, if applicable.

1 [redacted] : Living in camp trailer and an old car. Came from Texas a few months ago. Move around every few days. Park on vacant industrial land and old roads and parks located between Willbridge and St. Helens. Fish in superfund area in Multnomah Channel and in the Willamette . Their estimated age is about forty or fifty. Found parked on road off Marina Way. Don't know how long they will stay in area. They had been catching crawdads and sturgeon wanted to know the best fishing places. Mostly cook in frying pan on cook stove or boil. Make "fish head soup". (soup made with the boiled heads of any kind of fish. They catch the fishermen before they discard the fishheads and ask for the heads. The heads are boiled and seasoned in a milky broth , eyeballs and all.) They say it's really good.

2 [redacted]e: Live in a car. Move around up and down the river. Early teens late twenties. Fish for trout, sturgeon, steelhead bass squawfish. Catch squawfish for money. Bathe with river water. Do not drink river water. Park in abandoned industrial lots, sides of old roads. Move around every night. If park in same place every night police come. Don't know how long will stay in area but probably for summer. The "state" buys the squawfish for money. They pull in with a van at Diddlers Beach by the airport that has ice chests. If the squawfish are over 9" long they pay $6.00. If you have over 100 they pay $10. Cook fish over campfires on a grill or in a frying pan.

3 [redacted]. fishes off the shore for sturgeon, steelhead, salmon, bass crawdads whatever he can catch. Lives "up there" (off Skyline in Forest Park?). Would not disclose exact location where he camps. Fishing at beach in Linnton. "Lives in woods." " Don't always live in woods". Bathes and swims in river. Drinks creek water sometimes and buys water. Eats whatever he catches. Cooks the fish however he can. Sometimes buys bricquets and lighter fuel when its raining and too hard to start a fire. Puts net out for crawdads, pulls net up to the top of the water for a couple of days to let the clean water run through them for a couple of days before he eats them. "Otherwise they taste like mud" He boils them "like lobster".

4 [redacted] on trail off Newberry Rd. Catches catfish to sell to Vietnamese. Eats bass salmon and sturgeon. Fishes in Linnton area. bathes in creek. Just moved camp. Temporarily staying in Forest Park. Bathes in river when camped by river.

5 [redacted] stays in his boat at Freds Marina. Takes people fishing for money. Eats all fish, crawfish. Bathes in river, buys water. Eats "whatevers running". Cooks on a stove in his boat. Mostly fries his catch. Does not eat "junk fish".

6 [redacted] approximately fifty years old Lives in camp off Marina Way. Blue tarps are visible from road. Digs in trash at 7-11 for bottles for money. Friends give him fish or he eats fish with friends at their camps. Does not fish himself. Very uncommunicative. Very reclusive. Lives under tarps at side of Marina Way for years. Rides bike. Took 5 pamphlets to give to his friends"vietnam vets that live in the woods" " wont tell nothing else about them."

7 [redacted] stays in forest Park above Newberry. Fishes with John on Willamette and Multnomah Channel. Squawfish to sell. Eats sturgeon, bass catfish, "whatever is biting". Bathes in river. Gets $6 to $7 apiece for squawfish, Shad.

8 [redacted] lives in Forest Park when he is homeless or can't find friends to live with. Probably spends winters in houses when he can. Uses drugs. Fishes for bass whatever he can catch. Lives in tent on river bank when no one will let him stay at their house.

9 [redacted] would not disclose exact location of camp but live up trail on west side of the St. Johns Bridge in big canyon in Forest Park. There is a set of stairs and then a trail Each has own shelter behind the police impound lot. Fish for whatever they can catch. Wont eat squawfish, carp or suckers. Suckers are too bony. Drinks from creeks. Wont eat shad.

10 [redacted], just passing through. Stays in trees north of power poles Catches anything he can. Eats anything edible. Clams, carp, shad, suckers bathes in river. Throws out three of four lines pulls in with hands.

11 [redacted]. lives off river and in Forest Park. Catches whatever he can. Throws back carp suckers. Uses crawdads and clams for bait. Does not drink river water. Drinks from little creeks running into the Willamette.

12 [redacted] " a little nuts" fishes camps out on river bathes in river. Lives by power poles in camp most of the time. " Does not handle society well." Eats clams crawdads bass anything he can beg or catch. Drinks from creeks.

13 [redacted] lives in tree house "fort" above Linnton. Bathes in creek. "Fishes every once in awhile" Mostly catfish. Drinks from creeks bathes in creeks. Occassionally catches bass. Sometimes eats clams because easy to find and hungry.

14 [redacted]: Fishes in Linnton. Camps in St. Johns. Uncommunicative. Met on railroad tracks.

15 [redacted]: Lived in school bus, ambulance and several cars across from steel yard on Front Ave. in Linnton. Have lived in the area of the steel yard off Front Avenue in Linnton for years off and on.. Kept several cars running and would move them around to keep police at bay. . Have ten children aged two to 22 that lived with them in the vehicles. The state has towed their vehicles several times. Somehow they get them or others back. The state have taken the children away and put them in foster care. For some reason the teenage boys are back. The older girl is still with them and never left. One boy is about 18 and the other is 15. The 15 year old says he lives in a foster home but is always in Linnton. The community center pays the 15 year old for several hours on Sunday evenings to mop the gym floor and clean the bathrooms. . The state towed the bus and most of the vehicles away again about in February. The Galeys then began living in the back of a small white pickup with tarps and a makeshift camper. They still

park down on Front by the steel yard. The parents do not work. They do not fish. They eat fish when it is given to them by fishermen.. The steel yard is by a beach on the Willamette that is frequently used by fishermen. They cooked it and all their food in pans on a stove they had set up by the school bus. I do not know how they cook now, but probably set their stove up by the pickup.

16 [redacted] stays in his boat. He moves it up and down the river and channel. He bathes in the river. He usually cooks on a small camp stove.

17 [redacted] stays in a friends garage. He fishes on the east side of the river by the power poles. He uses a camp stove and frying pan. He eats whatever he catches. Does not eat suckers.

18 Two women met on railroad tracks by Linnton. Temporarily camped near Willbridge. Came to Portland to get married. Asked about good fishing spots.

19 Fat Man and girlfriend. Fish for everything. Whatever is biting. Currently camping at power poles. Always leave a big mess when they move camp. Have been around for years. Eat anything. Don't eat "junk fish" carp, squawfish or suckers. Haul water in plastic containers from gas station. Bathe in river. Usually fry fish. Sometimes barbecue depending on weather. Sometimes use wood, sometimes briquets. Fatman is approximately 50. His girlfriend is about 30.

20 [redacted] stays in van behind Texaco station. Fishes at power poles. Can't drive van due to DUI. Fishes for bass, catfish, squawfish for money. Uses a little fishing pole. Cooks on little campstove.

21 [redacted] move camps up and down river all the way from St. Helens to Willbridge. Fish for sturgeon, catfish, bass, croppie, squawfish for money.

22 [redacted] lives on beach below steel yard. He has a camp made of tarps. He cooks on fires. Bathes in river. Fishes for edible fish only. No suckers or carp. Sometimes drinks from river but heats the water good. .

23 [redacted] a black man about 50 years old has lived by the power poles in tarp and cardboard camp for 6 or 7 years. The "cops" tore his camp down last winter. Lived with girlfriend. When they tore his camp down he moved his camp to a cove by the railroad bridge. He uses a rope to get to his camp. Sometimes works as a pipefitter. Has money. He "just loves camping by river". "Doesn't like to be part of society." Relies on river for food. Does not eat "junk fish". Uses crawdads for bait.

Amanda Guay
Dept. of Human Services
800 NE Oregon Street
Portland, Oregon 97232-2162

Pat Wagner
Linnton Community Center
10614 NW St. Helens Rd.
Portland, Oregon 97231

JUN 1 8 2004

June 6, 2004

Dear Amanda Guay,

This project was done in the winter and spring months. In the beginning I attempted to carry the project out myself with the help of Ben Tate, a man that has lived and been homeless off and on in the Linnton area for years. Ben has a severe problem with alcohol. Ben lived in a camp on the river last summer and is as well acquainted with the transient population and their habits as a person can be. This approach did not work very well. People avoided me and would not talk. I sometimes felt afraid because the few I was involved with were not friendly or interested in talking with me.

After we realized this was not working Ben and I evaluated and changed our approach to the camp visits.. Ben made the visits by himself because the people would not communicate with me around. Ben enjoys their company. Ben had to spend time visiting them, drinking with them and fishing with them to get some of them to talk. Sometimes he spent the night with them around their campfires. . Even with this approach many did not want to answer many questions. Ben spent countless hours hiking the back trails and abandoned roads and railroad tracks where he had seen homeless people fishing and camping. Ben would just head out with his pockets full of beer and his fishing pole and would run into some that he has known for quite some time or strike up conversations with new people. He could not take notes during the conversations. Ben wrote notes in a notebook he kept in his pocket after he parted ways with the people. This project occurred between February and June.

Ben carried pamphlets in his pockets and would convey the information in the pamphlets about safe fish consumption when the time was appropriate and when he was most likely to get a positive reception. He tried to question them on their habits as best he could without pushing too hard and having them pull away and becoming uncommunicative. He gave each of these people pamphlets and sometimes extras for their friends. Ben said most seemed receptive to the information.

This population is mostly very transient. This project would have best been carried out during the summer months as that is when the population of homeless increases

In response to the questions provided by David Stone Ph.D

Most homeless people spoke to reported not seeing homeless children.

The following businesses have reported to me about homeless children.
Frank Berg, Plant Leader from OWENS CORNING 11910 NW St. Helens Rd. Portland, Oregon Phone: 273-1465, an industry with lots of riverfront property in the Superfund area reports having to tear down a camp with parents and a little girl about three or four years of age a couple of times. He eventually fenced his property to keep them off because it "broke his heart" when the little girl said" Do we have to move again Daddy."

RK Storage, a steel industry on NW Front Avenue, employees, Eric and others have reported the Galey family for garbage and not taking care of their children to the police multiple times. At one point all ten of their children lived with them in vehicles parked by the steel yard. . The men in the steel yard were always afraid they were going to run over one of the children with their lift machines and trucks.

Enclosed is a newspaper article about one homeless family. Kuney Construction workers observed this man and his child hiking back up into the woods many times. As with most homeless families they were very secretive and elusive.

The police from North Precinct that covers the Linnton area will tell you that there are a very few homeless children living along the river or in Forest Park on occasion. They say that the parents hide their children during the day and only let them out at night. Speak to Sgt. Karl McDade of North precinct about this.

Crawfish, Crayfish and Crawdads are just different names for the same thing.

2000 copies of printed brochures were divided among the ARCO store, Seven Eleven, Freds Marina store, Linnton Feed Store and the Texaco in the Linnton area. . These are the places people buy bait and snacks for fishing trips. Brochures were posted in the windows and on some doors of these businesses. Store employees agreed to give the brochures to people purchasing bait.

Pat Wagner

Pat Wagner

ADDENDUM

As this project progressed in the spring we remembered from past summers groups of Hispanic men that migrate to work on Sauvie Island in the farmers fields during the spring and summer months. One large group of these men reside communally in a large house near the Sauvie Island Bridge every summer. When we went to Krugers Farm we observed about five or six Mexican men in the back of a pickup truck just returning from a fishing trip. They did not speak English well enough to communicate effectively with us but indicated they had been fishing in the river nearby.

We did our best to have our brochure translated to the Spanish language and are currently making 1000 copies to be distributed to the farmers, markets and stores on Sauvie Island. There are more brochures than currently needed, however, this population is transient and the brochures should last throughout the summer.

TAB 7

PB97-963148
EPA/541/R-97/165
January 1998

EPA Superfund Explanation of Significant Difference for the Record of Decision:

Salem Acres
Salem, MA
4/11/1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

EXPLANATION OF SIGNIFICANT DIFFERENCE
SALEM ACRES SUPERFUND SITE
SALEM, MASSACHUSETTS

Site Name: Salem Acres Superfund Site

Location: Salem, Massachusetts

Lead Agency: U.S. Environmental Protection Agency

Support Agency: Massachusetts Department of Environmental Protection

Under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and promulgated in 40 C.F.R. Sections 300.435(c)(2)(I) and 300.825(a)(2), if the United States Environmental Protection Agency (EPA) determines that the remedial action at the Site differs significantly in scope, performance or cost from the Record of Decision (ROD) for the Site, EPA shall publish an explanation of significant difference between the remedial action being undertaken and the remedial action set forth in the ROD and the reasons such changes are being made.

This Explanation of Significant Difference (ESD) contains a brief history of the Salem Acres Site, a description of the remedy selected in the ROD signed on March 25, 1993, and a description of and rationale for the change to the ROD.

This ESD and other supporting documents can be found in the Administrative Record located at EPA's Region I office at 90 Canal Street, Boston, Massachusetts, open Monday - Friday 8 a.m. - 1 p.m. and 2 p.m. - 5 p.m., and at the Salem Public Library, 370 Essex Street, Salem, Massachusetts, 01970.

I. Site History

Salem Acres Superfund Site (the Site) is a 234 acre parcel of land located in the cities of Salem and Peabody, MA. The contaminated portion of the Site comprises an area of approximately thirteen (13) acres located in the southerly portion of the parcel, and is entirely in Salem. The contamination on the thirteen acres consists of an old landfill, three debris piles, a fly ash pile and a series of sludge lagoons. There are three potentially responsible parties (PRPs) associated with the Site, the owner, DiBiase Salem Realty Trust, and two generators, the Massachusetts Electric Company and the South Essex Sewerage District. Each of the PRPs settled with EPA and DEP and each signed consent decrees to remediate a portion of the Site.

The landfill, debris piles and the fly ash pile were substantially remediated in 1995 and 1996 by DiBiase Salem Realty Trust and Massachusetts Electric Company, respectively. The South Essex Sewerage

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that contains at least 75% recycled fiber

District is currently remediating the sludge lagoons which is scheduled to be complete in late spring of 1997.

II. Summary of Remedy

The selected remedy consists of treatment of certain contaminants in-place and excavation and disposal of all contaminated materials off-site at permitted off-site landfills. On-site wastes and soils are to be remediated to the cleanup levels specified in the ROD.

The soil cleanup levels established in the ROD for specified contaminants were based on calculations performed as part of the 1992 Health Risk Assessment (HRA) which utilized toxicity data in effect at that time. This risk assessment was performed as part of the Remedial Investigation for the Site. The cleanup criteria established in the ROD has allowed for unrestricted future use of the property once the cleanup is complete.

III. Explanation of Significant Difference

As mentioned above; the cleanup levels established in the ROD for on-site wastes and soils were calculated as part of the 1992 Health Risk Assessment, conducted as part of the Remedial Investigation for the Site. The calculated levels were based on toxicity criteria in effect at that time or on background concentrations available for the site. This ESD will establish soil cleanup levels for six carcinogenic polyaromatic hydrocarbons (cPAHs), revise the cleanup level for one cPAH and revise the background concentration and thus the soil cleanup level for beryllium.

A. With regard to the cPAHs, the risk evaluation was based on toxicity data which was available for only one of the cPAHS - benzo(a)pyrene, which had an oral potency slope factor value of 12 $(mg/kg/day)^{-1}$ when the ROD was signed. The oral slope factor is EPA's terminology for describing how potent a compound may be in causing cancer, based on studies conducted in animals and human studies when available. The risk evaluation and the cleanup value specified in the ROD for all cPAHs [1.2 parts per million (ppm)] were based on the assumption that all cPAHs were of equal potency as benzo(a)pyrene.

Since that time, EPA has revised the oral potency factor for benzo(a)pyrene to its current value of 7.3 $(mg/kg/day)^{-1}$ (EPA 1997) rendering benzo(a)pyrene less potent than it was believed when the ROD was written. EPA has also published (EPA 1993) an interim recommendation for addressing the carcinogenic potential of the other six cPAHs. This is known as the relative potency factor approach. Using the relative potency factor approach, the oral slope factor for benzo(a)pyrene can be multiplied by a relative potency factor for each of the six cPAHs to derive relative oral slope factors for each cPAH. Five of the six cPAHs identified have resulting oral cancer slope factors one to three orders of magnitude less than the oral slope factor for benzo(a)pyrene. Through this ESD, EPA will be establishing cleanup levels for each of the seven cPAHs based on the availability of a new oral slope factor for benzo(a)pyrene and the adoption of the relative potency factor approach for cPAHs.

ED_002671B_00015753-00203

Please note, however, that the original acceptable risk level of 6.7×10^{-6} which was used to determine a cleanup level in the ROD for the combined effects of cPAHs *remains unchanged* (as do all assumptions regarding the nature and intensity of exposure). The incremental cancer risk level assigned to each of the seven cPAHs in this ESD is 9.5×10^{-7} or one-seventh of 6.7×10^{-6}. The resulting soil cleanup levels are presented in the following table.

COMPOUND	SOIL CLEANUP LEVEL, ppm		CANCER RISK
Benzo(a)anthracene	2.7		9.5×10^{-7}
Chrysene	266.7		9.5×10^{-7}
Benzo(b)fluoranthene	2.7		9.5×10^{-7}
Benzo(k)fluoranthene	26.7		9.5×10^{-7}
Benzo(a)pyrene	0.3		9.5×10^{-7}
Indeno(1,2,3-cd)pyrene	2.7		9.5×10^{-7}
Dibenz(a,h)anthracene	0.3		9.5×10^{-7}
		Total cPAH risk =	6.7×10^{-6}

In summary, the only thing that has changed is the associated cleanup concentrations of the cPAHS. The risk-based protectiveness of 6.7×10^{-6} established in the ROD remains the same. The result of cleaning up cPAHS to these new concentrations will allow for the same protectiveness that was sought as a remedial action goal under the ROD. The Site, once cleaned, will allow for unrestricted future use.

In addition to the ESD, EPA is taking this opportunity to articulate how compliance with all cleanup levels identified for soils at the Salem Acres Superfund Site will be determined. Consistent with Risk Assessment Guidance for Superfund (RAGS), Part A (EPA 1989) which calls for assessment of the reasonable maximum exposure, and Supplemental Guidance to RAGS: Calculating the Concentration Term (EPA 1992) which articulates that a 95% upper confidence limit on the arithmetic mean of contaminant concentrations is to be used when computing exposure, EPA Region I will use the 95% upper confidence limit on the arithmetic mean concentration of each compound of concern in soils at the Site and compare it to the appropriate cleanup level specified in the ROD as amended today by this ESD.

EPA recognizes that data obtained from sampling and analysis are never fully representative of actual human exposure. To account for the uncertainty in the data, EPA Region I has opted to use the 95 percent upper confidence limit for Superfund Sites (RAGS, EPA 1989) as embodied in the Supplemental Guidance to RAGS (EPA 1992). The 95% UCL provides reasonable confidence that the true site average of concentrations of compounds remaining in the soils are less than the cleanup levels established for the Site.

If the 95% upper confidence limit on the arithmetic mean concentration for any compound exceeds the cleanup limit, the Site is still considered above the cleanup level for the compound. On the other hand, if the 95% upper confidence limit on the arithmetic mean concentration for any compound is below the cleanup level, the Site is considered below the cleanup level for that particular compound (i.e., no further

excavation will be necessary based on that compound of concern).

B. With regard to beryllium, the soil cleanup level established in the ROD was based on a very limited (two samples) characterization of site background. The lower of the two background concentrations (0.42 ppm of beryllium) was used as the cleanup level.

In an effort to better characterize naturally occurring levels of beryllium, twelve representative background samples were taken at various depths from undisturbed areas in close proximity to the site. The results show that beryllium is naturally present in the soils in concentrations that range from 0.50 ppm to 1.50 ppm, with an average concentration of 0.83 ppm (Memorandum dated April 4, 1997). The 95% upper confidence limit calculated for the arithmetic mean of 0.83 ppm is 1 ppm.

Given the variability in the data set, it is consistent with EPA practices to use the 95% upper confidence limit on the arithmetic mean (1 ppm) as representative of naturally occurring (background) beryllium concentrations. Thus through this ESD, EPA is redefining the background concentration of beryllium in soils as 1 ppm. EPA is replacing the former cleanup level for beryllium of 0.42 ppm with 1 ppm for compliance purposes. The excess lifetime cancer risk resulting from exposure to 1 ppm beryllium in soils given the exposure scenario and assumptions specified in the HRA is 2×10^{-6} which is consistent with EPA's goal for remedial actions (clean up to within the acceptable risk range of 1×10^{-4} to 1×10^{-6}).

As a consequence of this change, there may be a potential estimated cost savings of approximately $680,000 in remedial costs.

IV. Support Agency Comments

The Massachusetts Department of Environmental Protection has reviewed this ESD and has concurred with EPA in its issuance.

V. Affirmation of Statutory Determinations

Considering the new toxicity information for cPAHs that has been developed and the continued use of the original risk based cleanup goal of 6.7×10^{-6} for cPAHs, and the revision to the background value for beryllium based on more extensive data than was previously available, EPA believes the remedy as amended by this ESD remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, this remedy reflects EPA's commitment to utilize the most up-to-date scientific information and methodology available.

VI. Public Participation Activities

This ESD and supporting information are available for public review at the locations and times identified in the Introduction to this document. In addition, a notice of availability and brief description of the ESD will be provided to a local newspaper of general circulation, the Salem Evening News.

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VII. Declaration

For the foregoing reasons, by my signature, EPA is issuing this Explanation of Significant Difference for the Salem Acres Superfund Site in Salem, Massachusetts.

April 11, 1997
Date

Frank Cianciulli
for
Linda M. Murphy, Director
Office of Remediation and Restoration

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TAB 8

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

EXPLANATION OF SIGNIFICANT DIFFERENCES

Burlington Northern (Somers Plant) Site
Somers, Flathead County, Montana

United States Environmental Protection Agency
July 1998

I. INTRODUCTION

This Explanation of Significant Differences (ESD) is being issued by the U.S. Environmental Protection Agency (EPA) to modify certain remediation criteria established in the Record of Decision (ROD) issued by EPA on September 27, 1989 and modified by the previous ESD issued on June 26, 1992 for the Burlington Northern (Somers Plant) Site (hereby referred to as "Somers Plant" or the "Site") and identifies the documents that serve as the basis for the determination.

EPA, in consultation with the Montana Department of Environmental Quality (MDEQ), and after consideration of documents prepared pursuant to the first Five-Year Review of the Somers Plant and other documents in the Administrative Record, has determined that modifications to the remediation levels established in the 1989 ROD are required to incorporate criteria developed since the ROD was issued.

The modifications to the remedy described in this ESD do not fundamentally alter the overall approach of the remedy selected in the ROD. However, the modifications to the remediation goals at the site significantly change the scope and performance of the selected remedy. Therefore this ESD is required by the NCP and EPA guidance.

In accordance with Sections 117(c) and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund), as amended, 42 U.S.C. Section 9601, et seq. ("CERCLA"), and the regulations at 40 C.F.R. Section 300.435(c)(2)(i), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), this ESD has been prepared for the following reasons:

- to provide the public with an explanation of the nature of the changes to the remedy;
- to summarize the circumstances that led to the changes to the remedy; and
- to affirm that the revised remedy complies with all statutory requirements.

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MDEQ (formerly the Montana Department of Health and Environmental Sciences, MDHES) concurred on the ROD issued on September 27, 1989, and has participated in the review of information leading to this ESD, including the Five-Year Review Report which includes the Protectiveness Evaluation and the Five-Year Review Site Visit (Roy F. Weston, Inc., 1995a and 1995b). MDEQ has reviewed and concurred on this final ESD.

This document presents a summary of the changes to the selected remedy and a synopsis of information on the Site. The Administrative Record, which contains this ESD and the complete documentation supporting the revisions selected herein, is available for public review at the locations indicated at the end of this report.

II. SITE HISTORY AND BACKGROUND

The Burlington Northern (Somers Plant) Site is located in northwestern Montana in the unincorporated town of Somers, Flathead County. The Somers Plant was operated by Burlington Northern Railroad (BNRR) between 1901 and 1986, and covers approximately 80 acres. The plant treated railroad ties and other miscellaneous lumber products to protect the materials from weathering and insects. Treatment fluids used by BNRR included zinc chloride, chromated zinc chloride and creosote/petroleum preservative mixtures. The treatment process generated wastewater primarily consisting of steam condensate containing zinc chloride or creosote. Floor and shop washing, drippage from treated ties pulled from the retort onto the drip track and storage of treated ties on the property were other sources of process-generated wastewater. Prior to 1971, BNRR discharged wastewater into a lagoon (the "CERCLA Lagoon") located immediately south of the retort building. Overflow from this lagoon flowed in an open ditch from the facility into a swamp on the shore of Flathead Lake. Sometime prior to 1946, a pond formed in the swamp area (the "swamp pond") adjacent to Flathead Lake and waste material discharged through the open ditch accumulated there.

BNRR abandoned the CERCLA Lagoon and ditch in 1971 when the company constructed two new wastewater holding impoundments [the Resource Conservation and Recovery Act (RCRA) impoundments]. In 1984 BN implemented a recycling system and stopped all wastewater discharges.

In February 1984, the Montana Department of Health and Environmental Sciences (MDHES) sampled the soils at the Somers Plant. Based on the results of this investigation, the Site was proposed for inclusion on the Superfund National Priorities List (NPL) in 49 CFR 40320, October 15, 1984. The proposed listing cited potential adverse effects on Flathead Lake and the water supply for the town of Somers, which drew water from the lake.

In May 1985, EPA, BNRR and Sliters Corporation (a corporation which owns a portion of the site) signed an Administrative Order on Consent (AOC) (Docket No. CERCLA-VIII-85-02) providing for an Emergency Removal Action in the area of the swamp pond adjacent to Flathead Lake. The area was determined to pose an imminent and substantial hazard to Flathead Lake because of the presence of creosote contamination in water and soil located within two (2) feet of the shoreline. Pursuant to the 1985 AOC, BNRR removed

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contaminated soil and surface water from the swamp pond area and the drainage ditch. The soils were temporarily placed in the lined RCRA impoundments and eventually hauled to the BN RCRA-regulated facility in Paradise, Montana for treatment. The water was processed at the plant. The excavated areas were backfilled with clean soil and riprap was placed along the lakeshore.

In October 1985, EPA, BNRR, and Sliters Corporation signed another AOC (Docket No. CERCLA-VIII-85-07) for a Remedial Investigation and Feasibility Study (RI/FS). The purpose of the RI/FS was to determine the nature and extent of contamination at the Site, to evaluate the impacts of contamination on public health and the environment, and to formulate alternatives for remedial action. The field work to support the RI was performed from the Fall of 1985 to Fall 1988. An RI/FS Report (Remediation Technologies, Inc., 1989) was submitted to EPA in the spring of 1989.

The RCRA impoundments were closed in 1988 under the MDEQ Hazardous Waste Permitting Program. Subsequent to the closure, a groundwater monitoring well located adjacent to the impoundment indicated that groundwater was contaminated; therefore, groundwater corrective action was required.

After completion of the RI/FS, a ROD was signed on September 27, 1989 (EPA 1989a). The ROD selected a remedy and a contingency remedy for remediation of soil, groundwater and sediments, which were determined to pose a potential threat to human health and the environment. The selected remedy addressed the principal threats by removing the potential for direct contact with soils, by reducing the impact of the soils and sediments on groundwater and surface water and by treating the groundwater. The contingency remedy was to be implemented if the selected remedy was not determined to be effective. On December 20, 1991, the EPA entered into a Consent Decree (Civil Action No. CV-91-32-M-CCL) with BNRR and Burlington Northern, Inc. for Remedial Design/Remedial Action (RD/RA) of the selected remedy at the Site. The Consent Decree required performance of a Pilot Study to demonstrate the "practicability" of the innovative bioremediation component of the selected groundwater remedy. The Consent Decree required that the Pilot Study be conducted prior to any soil application on the Land Treatment Unit (LTU).

EPA issued an ESD in June 1992 (EPA, 1992) that modified the elements of the selected remedy, based on the "practicability" determination required in the ROD. The results of the Pilot Study were presented in the Remedial Design Investigation Report for the Former Somers Tie Plant (Remediation Technologies, Inc., 1991). The study was conducted to more accurately define and quantify the conditions under which the groundwater could be successfully remediated.

Operation of the 14.4 acre LTU commenced in 1994 following removal of soil from the CERCLA Lagoon to a 15 foot depth (22,300 cubic yards), Swamp Pond Area to a 12 foot depth (19,030 cubic yards), and the Drip Track/Retort Building (10,000 cubic yards). After the first year of LTU operation, the ROD remediation levels for soils were achieved. The second year of operation of the LTU produced a 19% reduction in carcinogenic Polycyclic Aromatic Hydrocarbons (cPAH) concentrations (RETEC 1995a). The cPAH reduction

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allowed BN to apply a second lift of soil to the LTU in the fall of 1995 in accordance with the 1989 ROD requirements.

The groundwater remedy consisting of five (5) extraction and ten (10) injection wells and a granular activated carbon (GAC) water treatment plant was put into operation at the end of April 1994 to capture and treat contaminants at the CERCLA Lagoon and downgradient of the CERCLA Lagoon. The system is designed to hydraulically contain Polycyclic Aromatic Hydrocarbons (PAH) contaminated groundwater within the boundary of the influence of the well fields. Extracted water is chemically and mechanically treated for free product, dissolved organics and iron at the site Water Treatment Plant prior to reinjection. Groundwater contamination at the site consists of Dense Non Aqueous Phase Liquids (DNAPL) within and adjacent to the CERCLA Lagoon and dissolved components downgradient from the lagoon.

Excavation activity in the swamp pond and slough areas resulted in the determination of the need for mitigation of damage to wetland environments. The Fish and Wildlife Service delineated and determined functional values of the wetland area in July 1993 (USFWS, 1994), which are described in the Wetlands Compensation Determination (EPA, 1994c). BNRR reconstructed the swamp pond in accordance with the plan and conducts semi-annual water quality sampling and assessment of vegetation recovery for the area.

A Five-Year Review of the Remedial Action at the Somers Plant was performed in April 1996. The objectives of the Five-Year Review were: (1) to verify that the remedy is operating and functioning as designed and, (2) to evaluate whether the remedial action selected for the site remains protective of human health and the environment. The Five-Year Review conducted for the Somers site was performed in accordance with the Office of Solid Waste and Emergency Response (OSWER) Directives 9355.7-02 entitled "Structure and Components of Five-Year Reviews", (EPA 1991) and 9355.7-02A, entitled "Supplemental Five-Year Review Guidance", (EPA 1994a).

The Five-Year Review of the Somers site was triggered by the initiation of a portion of the remedy by the responsible party, Burlington Northern Railroad, in 1991. The Five-Year Review includes recommendations for the evaluation of remediation levels for the site to ensure that the remedy is protective of human health and the environment and that the remediation levels are current and consistent with CERCLA Section 121, and EPA and State policy and guidance.

III. SUMMARY OF THE 1989 RECORD OF DECISION

The objectives of the remedy selected in the 1989 ROD are to reduce human exposure to soil, sediment and groundwater contaminants of concern. The components of the remedy are excavation and biological treatment of soils within an onsite LTU, and *in situ* biological treatment of contaminated groundwater within the water table aquifer, supplemented by extraction and treatment of contaminated water through a mechanical and chemical treatment process to remove free product, metals and particulates, and dissolved organics

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through oil/water separation, equalization, oxidation, particulate settling and granulated activated carbon filtration.

A list of the components of the original remedy selected for the site can be found on pages 40 through 46 of the 1989 ROD (EPA, 1989a). The remedy was modified by the 1992 ESD (EPA, 1992) based on the Pilot Study for ground water contaminants of concern. A brief summary of the original and modified remedy is provided below. The ROD remediation levels for contaminated soil and ground water are presented in Table 1.

- The soil remedy involved excavation of creosote and zinc contaminated soils in the CERCLA lagoon, drip track, drainage ditch, beneath the retort building and in the slough and beach areas. Some soil left below the water table in the CERCLA lagoon and swamp would be treated as part of the groundwater component of the remedy. The ROD included provisions for groundwater monitoring and post-closure care for up to 30 years or deed restrictions placed if hazardous constituents remained. Due to RCRA land disposal restrictions, a demonstration of no-migration of hazardous constituents was conducted to satisfy requirements.

- The original feasibility study alternative was modified for the selected remedy to exclude the excavation of the beach sediments. The sediments were not excavated due to a determination that the ecological risks to Flathead Lake from beach excavation outweighed the benefits of removing the contaminated sediments.

- Excavated areas were required to be backfilled with clean borrow soils and revegetated. The remedy also included replacement or restoration of wetlands lost during the remedial action.

- The ROD identified groundwater remedy involved the evaluation of the applicability of innovative technology, either hot water flushing of contaminated groundwater, ozone/UV or peroxide/UV treatment at the surface and *in situ* biological treatment of residual contamination.

  The 1991 Consent Decree required that a pilot test of the hot water flushing and *in situ* biological treatment technologies be conducted to evaluate their "practicability" in the low permeability hydrogeologic conditions at the Site. Implementation of the soil remedy was restricted until after the pilot test was conducted, as the contingency remedy involved deep excavation and incineration of soils. The remedy involved the installation of injection and recovery wells in the CERCLA Lagoon and the swamp pond area. Recovered groundwater would be treated in a chemical reactor in order to reduce contaminant levels.

- Identification and implementation of institutional controls to restrict use of groundwater downgradient of the contaminated areas was required.

- Monitoring activities required to assess the performance of the components of the remedy would be conducted throughout the life of the remedial activities. Activities

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involve monitoring of groundwater wells and semi-annual monitoring of the Somers municipal supply well until cleanup concentrations are achieved.

- The Site conditions will be reviewed no less than every five years after initiation of the remedial action to ensure that the remedy remains protective of human health and the environment.

In 1992, EPA modified the remedy selected for the site through an ESD. The ESD presented the "practicability" determination for the innovative bioremediation technology for the groundwater component. The significant differences between the remedy described in the 1989 ROD and the 1992 ESD are listed below:

1. Excavation of additional soils in the CERCLA Lagoon and the Swamp Pond Areas increasing the total excavated materials from 11,700 cubic yards to 41,000 cubic yards. Additional excavation was conducted to aid the remediation process.

2. Increase the size of the Land Treatment Facility from 10 acres to 14 acres to decrease the time required to meet remedial objectives and cleanup remediation levels. Procedure for completion of land treatment described in the ROD (p. 42) was not modified.

3. Elimination of the hot water flushing option of the groundwater remedy due to the low permeability of the aquifer materials. Excavation of additional soil in the CERCLA Lagoon would remove more source material and aid the remediation process.

4. Change in soil and groundwater cleanup times. Decrease the time to achieve soil remediation levels to 4 to 6 years rather than 10 years. Increase the estimate to achieve groundwater remediation levels from 10 to 15 years to 50 years.

IV. SUMMARY OF SIGNIFICANT DIFFERENCES TO THE REMEDY

The significant differences between the remedy selected in the 1989 ROD and the 1992 ESD and in this ESD are:

1. The soil remediation level for carcinogenic polycyclic aromatic hydrocarbon (cPAH) is revised from 36 to 57 milligrams per kilogram (mg/kg) calculated as benzo(a)pyrene (B(a)P) equivalents using the revised B(a)P cancer slope factor.

2. The limitations established in the 1989 ROD for pyrene, naphthalene and phenanthrene in soils are removed. EPA cites in part the rationale provided by field data, toxicological assessment and the language within the No-

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Migration Petition as reasons for removing these requirements. Further discussion is provided below.

3. The soil remediation level for total non-carcinogenic PAH is revised from 1875 mg/kg to 1500 mg/kg based on the revisions to the Reference Dose (RfD) for naphthalene equivalents which has been revised from 0.005 to 0.004 mg/kg-day.

4. The groundwater remediation level for total non-carcinogenic PAH is revised from 0.3 μg/L to 40 μg/L based on the current procedure of not considering co-carcinogenicity and the change in the Reference Dose (RfD) equivalent to naphthalene noted in item 3. above.

5. The groundwater remediation level for total phenolics is revised from 15,000 μg/L to 6000 μg/L calculated, based on revisions in the RfD for Phenol and RfD values for other phenolic compounds.

Only those changes in Section IV paragraphs 1 through 5 above are being made to the remedy selected in the 1989 ROD and 1992 ESD. All other aspects of the selected remedy documented in 1989 ROD and 1992 ESD remain the same. A detailed rationale and background for the changes in this ESD follows.

Risk-Based Remedial Goals

Risk-based cleanup remediation levels established in the ROD for contaminated soils and groundwater were reviewed to determine the impact of changes in the toxicological assessment of contaminants of concern (COCs) including total PAHs, cPAHs and phenolic compounds using current EPA toxicological information and updated relative potency factor (RPF) and Toxicity Equivalency Factor (TEF) guidance (EPA, 1989b, EPA 1994b, EPA 1993). This review effort was performed to assess the degree of protectiveness afforded by the current risk-based remediation levels documented in the 1989 ROD for Somers.

The residential exposure scenarios were used as the basis for 1989 cleanup levels presented in the ROD for groundwater and soil. The site-specific exposure parameters established in the human health evaluation for these scenarios were used in the calculation of chemical concentrations for specific target risk levels. In the absence of site-specific information, standard default exposure parameters were used in the calculations. Risk-based remediation levels were also prepared for contaminants with MCLs for comparison purposes only (EPA, 1994e).

A summary of the results of the risk-based cleanup goal review effort is presented in Table 1.0. Details regarding the methods and input parameters used to develop the 1998 risk-based remediation levels presented in these tables are provided in the Supplemental Remedy Protectiveness Evaluation (Roy F. Weston, 1995b).

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Soils Remediation Levels

The 1989 risk-based remediation levels for total carcinogenic and non-carcinogenic PAHs in soils differ from the 1998 risk-based remediation levels. The differences are based on revisions in the slope factor for B(a)P and the establishment of new RfD's for non-carcinogenic PAHs. Table 3 provides a summary of the slope factor and RfD revisions.

Total cPAH

The 1989 risk-based remedial remediation levels for total carcinogenic PAHs for soils, established using residential exposure scenarios differ from the 1998 risk-based remediation levels. The difference is due to revisions in the slope factor for B(a)P from 11.5 to 7.3 $(mg/kg\text{-}d)^{-1}$. Also, the 1989 remediation levels were applied to the sum of all cPAHs with the assumption that each cPAH was equal in carcinogenic potency to B(a)P. However, since promulgation of the ROD, cPAHs have been assigned RPFs which are used to convert individual cPAHs to B(a)P equivalent concentrations, thus resulting in less potent classification and having an effect of decreasing the estimated risk from cPAHs. The determination of compliance to the revised remediation levels for soils can be accomplished using EPA Region VIII Superfund Technical Guidance, Development of Toxicity Values for PAHs (EPA, 1994b).

Using the updated slope factor for B(a)P results in a change of the soil treatment cPAH limitation from 36 mg/kg to 57 mg/kg.

Total non-carcinogenic PAH

In 1989 non-carcinogenic effects of total PAHs were based upon the assumption that all PAHs were as toxic as naphthalene with an RfD of 0.005 mg/kg-d. Since promulgation of the ROD, the RfD for naphthalene has been revised from 0.005 to 0.004 mg/kg-d. Additionally, RfDs for other PAHs have been derived. As with the groundwater, those PAHs that have no RfD are conservatively evaluated as equal to most potent known RfD (naphthalene).

Application of the revised RfD produces a soil cleanup level for non-carcinogenic PAHs of 1500 mg/kg to replace the 1875 mg/kg level found in the 1989 ROD.

Naphthalene, Pyrene and Phenanthrene

EPA and MDHES established soil cleanup levels in the 1989 ROD that were based on both risk assessment results and proposed (Best Demonstrated Available Treatment) BDAT requirements for land disposal of the wastes found at the Site. These remediation levels include.

Contaminant(s)	Cleanup Goal	Source
Total cPAH	36.0 mg/kg	Risk Assessment

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Total PAH	1,875 mg/kg	Risk Assessment
Naphthalene	8.0 mg/kg	BDAT Requirements
Phenanthrene	8.0 mg/kg	BDAT Requirements
Pyrene	7.3 mg/kg	BDAT Requirements

The remediation levels listed above that are based on BDAT requirements were incorporated within the 1988 ROD due to the land disposal restrictions (LDRs) that applied to the remedy (a land treatment unit) proposed for the wastes found in soils at the Site. The BDAT limitations were included in the ROD due to the lack of other numerical standards that applied to the contaminated soils. The BDAT limitations were derived from a demonstration using an incineration technology not a bioremediation technology as was selected for implementation at the Somers site.

It was recognized by both Burlington Northern and EPA at the time of the ROD that achievement of the pyrene level by land treatment would likely prove most difficult because the BDAT limitations were based on incineration as the applicable treatment technology. The No-Migration Petition for the Somers site was submitted by ReTec, Inc., as Appendix D of the Remedial Design investigation Report (December 1991). The petition evaluated migration potential for all contaminants of concern at the Site, including pyrene, naphthalene and phenanthrene. The petition was reviewed by EPA and MDEQ and commented on extensively by EPA. EPA approved the final No-Migration Petition with the issuance of the 1992 ESD on June 26, 1992. The study demonstrated that no migration of contaminants and no adverse impact to human health or the environment would occur during operation and closure of the LTU. 40 C.F.R. Section 268.6 allows EPA to approve a waiver of the Land Disposal Restrictions BDAT standard based on a successful No Migration Demonstration and Petition.

Removing the BDAT requirement for pyrene will not compromise the overall protectiveness of the selected remedy. Pyrene is now included in the list of total PAH compounds (no longer considered by EPA to be carcinogenic) whose sum total concentration must be remediated below the risk-based cleanup goal of 1,875 (modified to 1,500 by this ESD). By remediating the total PAHs below this level, EPA has determined that the residual concentrations of PAHs (including pyrene) will be protective of human health and the environment.

Field data available in BNRR's *LTU Annual Operations Reports* also indicate that BDAT requirements for both naphthalene and phenanthrene are achievable with the selected soils remedy. During operation of the Site LTU, remediation levels for these compounds are achieved prior to achievement of remediation levels for total carcinogenic PAHs. Thus, the standard set for total carcinogenic PAHs would ultimately govern the total time required to fully remediate a soil lift within the LTU.

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With a potential for expediting the time required to remediate the contaminated soils at the Site while still maintaining the degree of protectiveness for human health and the environment, and EPA's approval of the No-Migration Petition, EPA is removing the soil treatment levels for pyrene, naphthalene and phenanthrene. As explained above, the degree of protectiveness for human health and the environment will be maintained by remediating the total PAH compounds to 1,875 mg/kg and the carcinogenic PAH compounds to the new risk-based goal of 57 mg/kg. All other requirements for remediating the contaminated soils within the LTU (as listed above) will remain in effect.

Only the initial treatment levels are being changed by this ESD. The ROD requirement for additional treatment of soils, after attaining the new initial treatment levels, until the annual reduction in cPAH is less than 20 percent, remains unchanged. The additional ROD requirement that health risks posed by direct contact with site soils be reduced to at least 1x10-5 also remains unchanged.

Groundwater Remediation Levels

Total non-carcinogenic PAHs

In 1989, the Risk Assessment for the BN Somers site identified a concentration for total PAHs of 50 μg/L as being protective against noncancer health effects. This level was calculated based on the assumption that all PAHs had an RfD equivalent to naphthalene (0.005 mg/kg-d). However, this risk-based value was not selected for incorporation in the ROD due to concerns at the time over carcinogenic promotion or co-carcinogenicity of noncarcinogenic PAHs. Therefore, a cleanup level for total PAHs of 0.300 μg/L was set, using a value one order of magnitude greater than the risk-based cleanup level for carcinogenic PAHs (0.03μg/L).

Currently, carcinogenic promotion by noncarcinogenic PAHs is not considered in estimating potential carcinogenic effects from exposure to PAHs (EPA, 1994c) and a health-based level using RfDs for noncarcinogenic effects is appropriate. As noted above, since issuance of the ROD in 1989, the RfD for naphthalene has been revised from 0.005 to 0.004 mg/kg-d, and many of the PAHs have been assigned individual RfDs. Those PAHs for which no RfD has been assigned have been assumed to be equal to the most potent known RfD (naphthalene = 0.004 mg/kg-d).

The recalculation of the health based clean-up goal is 40 μg/L. To determine compliance levels, exposure point concentrations (EPCs) for individual PAHs are recalculated based on the revised RfDs and converted to naphthalene equivalent concentrations using RfD ratios. These naphthalene equivalent concentrations are then summed to represent total PAHs present in groundwater for comparison to the revised clean-up level.

There is no change in the exposure risk to the public due to this revision in the remediation level for non-carcinogenic PAHs.

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Total phenolics

For total phenolic compounds, the RfD for phenol has been revised to 0.6 mg/kg-d, resulting in a revised clean-up goal of 6000 μg/L which replaces the 1989 ROD level of 15,000. As with the cPAHs and PAHs, RfD values for other phenolic chemicals of concern have been derived (phenol, 2,4-dimethylphenol, 2-methylphenol, 4-methyphenol). Again, EPCs for individual phenolic compounds are converted to phenol equivalent concentrations using ratios of RfDs, which are summed to represent total phenolics present at the site for comparison to the revised clean-up level.

There is no change in the exposure risk to the public due to this change in the remediation level for total phenolics.

Carcinogenic PAHs

Although federal MCLs for cPAHs have been promulgated since the ROD was issued, no change is made to the ROD at this time because: (1) MDEQ is currently revising the Montana WQB-7 standards for these compounds and (2) BNSF will prepare a Technical Impracticability (TI) waiver application relative to groundwater cleanup at the Site. Updated groundwater standards will be addressed as part of the TI waiver analysis and application.

V. SUMMARY OF STATE COMMENTS AND AVAILABILITY OF ADMINISTRATIVE RECORD

As stated above, MDEQ has reviewed the documents that serve as the basis for this determination and has provided comments to EPA on the documents and on this ESD. All of the MDEQ comments were incorporated into the final reports. MDEQ has been provided with the opportunity to review and comment on this ESD and all of their comments have been incorporated.

Documents referenced within this ESD are part of the Administrative Record for the Somers Site. The administrative record will also contain any written public comments that may be received regarding this ESD. The complete administrative record for the Site is available for public review at the following location:

U.S. EPA Montana Office Federal Building, Room 192 301 South Park, Box 10096 Helena, Montana 59626-0096 (406) 441-1150 Mon-Fri, 8:00 a.m. to 5:00 p.m.	Flathead County Public Library 247 1st Avenue East Kalispell, Montana 59901 (406) 756-5690 Mon-Fri, 8:00 a.m. to 4:00 p.m.

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VI. AFFIRMATION OF STATUTORY REQUIREMENTS

Considering the new information that has been developed and the changes that have been made to the selected remedy, EPA, in consultation with MDEQ, believes that the remedy remains protective of human health and the environment, complies with Federal and State requirements that both applicable or relevant and appropriate to this remedial action or involves appropriate waivers of these requirements, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Site.

VII. APPROVAL

Mark A. Simonich

7/13/98

Mark A. Simonich, Director
Montana Department of Environmental Quality

Date

Max H. Dodson

7/21/98

Max H. Dodson, ARA
Office of Ecosystems Protection and Remediation
U.S. Environmental Protection Agency

Date

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U.S. Environmental Protection Agency. 1989b. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual. EPA/540/1-89-002, December 1989, Interim Final. Office of Emergency and Remedial Response, Washington D.C.

U.S. Fish and Wildlife Service. 1994. Wetlands Delineation and Evaluation, Burlington Northern Superfund Site, Somers, Montana. April 1994.

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TABLE 1.0
COMPARISON OF 1989 AND 1995 RISK-BASED REMEDIATION LEVELS FOR BN-SOMERS [a,e]

Contaminants of Concern	Groundwater		Soil	
	1989 Risk Based Goal[d] (μg/L)	Risk-Based 1995 Target Clean-up Concentration (μg/L)	1989 Risk Based Goal (mg/kg)	Risk-Based 1995 Target Clean-up Concentration (mg/kg)
Total Carcinogenic PAHS [b]	0.030 μg/L	0.047 μg/L	36 mg/kg	57 mg/kg
Total PAHs - NonCancer Effects	0.300 μg/L Based on concern over possible co-carcinogenicity	40 μg/L Based on noncancer health effects calculated using naphthalene equivalent concentrations	1,875[c]	1,500
Phenol	—	6000	—	45,000
Total Phenolics	15,000	6000	3,000[c]	45,000

(a) Calculated using toxicity values shown in Table 2.0.
(b) Benzo(g,h,i)perylene assessed as a potential carcinogen in 1989; not classifiable as to human carcinogenicity and assessed as a noncarcinogen in 1995.
(c) Value cited as an excavation concentration.
(d) Values obtained from 1989 ROD for BN-Somers.
(e) Methods for comparing site concentrations to risk-based remediation levels have been revised since 1989. See text for further detail.
— Risk-based value not used as goal in 1989 ROD.

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TABLE 2.0
COMPARISON OF TOXICITY VALUES USED FOR RISK CHARACTERIZATION AT BN-SOMERS 1989 AND 1998 VALUES

Contaminant of Concern	1989 Values[a] RfD (mg/kg-d)	1989 Values[a] oSF (mg/kg-d)$^{-1}$	1998 Values[c] RfD (mg/kg-d)	1998 Values[c] oSF (mg/kg-d)$^{-1}$ [b]
PAHs:				
Naphthalene	0.05 to 0.005[d]		0.004	
Acenaphthylene	0.03		NA	
Acenaphthene	0.20		0.06	
Fluorene	0.07*		0.04	
Phenanthrene	0.07*		NA	
Fluoranthene	0.07*		0.04	
Pyrene	0.06		0.03	
Benzo(a)anthracene	0.07*	11.5	NA	0.73
Chrysene	0.07*	11.5	NA	0.0073
Benzo(b)fluoranthene	0.07*	11.5	NA	0.73
Benzo(k)fluoranthene	0.07*	11.5	NA	0.073
Benzo(a)pyrene	0.07*	11.5	NA	7.3
Indeno(1,2,3-c,d)pyrene	0.07*	11.5	NA	0.73
Dibenzo(a,h)anthracene	0.07*	11.5	NA	7.3
Benzo(g,h,i)perylene[e]	0.07*	11.5	NA	--
2,4-dimethylphenol	NA		0.02	
2-methylphenol	NA		0.05	
4-methylphenol	NA		NA	
Phenol	0.04		0.6	
Zinc	0.21		0.3	

(a) Values from Table 2 of the 1989 ROD
(b) PAH specific Slope Factors calculated from B(a)P by multiplying by RPF (see text)
(c) Values obtained through reviews of IRIS, HEAST and Safe Drinking Water Guidance (EPA, 1995, 1994d, 1994e)
(d) Provided range of RfDs for Naphthalene, however used most stringent (0.005) in calculations
(e) Assessed as a potential carcinogen in 1989; not classifiable as to human carcinogenicity and assessed as a non carcinogen in 1998
* Value assumed equal to average RfD for other noncarcinogenic PAHs
NA Not Available

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TAB 9

PB98-963149
EPA 541-R98-175
March 1999

EPA Superfund
Explanation of Significant Difference for the Record of Decision:

Petrochem Recycling Corp./ Ekotek Plant
Salt Lake City, UT
12/9/1997

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

EXPLANATION OF SIGNIFICANT DIFFERENCES

Petrochem Recycling Corp./Ekotek, Inc., Superfund Site
Salt Lake County, Salt Lake City, Utah

December 1997

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PETROCHEM RECYCLING CORP./EKOTEK, INC., SUPERFUND SITE
EXPLANATION OF SIGNIFICANT DIFFERENCES
DECEMBER 1997

I. INTRODUCTION

This Explanation of Significant Differences (ESD) is being issued by the U.S. Environmental Protection Agency (EPA) to modify certain remediation criteria established in the Record of Decision signed by EPA on September 27, 1996 (ROD), and certain other components of the ROD, as described herein, which will be implemented at the Petrochem Recycling Corp./Ekotek, Inc., Superfund Site, located in Salt Lake City, Utah (Petrochem Site or Site).

The changes to the ROD have been made as a result of new information that EPA received subsequent to the issuance of the ROD. These changes do not fundamentally alter the site-wide remedy presented in the ROD. The site-wide remedy for the Petrochem Site remains protective of human health and the environment. This ESD is issued by EPA, the lead agency at the Site, after consultation with the Utah Department of Environmental Quality (UDEQ), the support agency at the Site.

The modifications to the remedy described in this ESD do not alter the selected remedy in any fundamental aspect regarding scope, cost, or performance. In accordance with Sections 117(c) and 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund), as amended, 42 U.S.C. Section 9601, et seq. ("CERCLA"), and the regulations at 40 C.F.R. Section 300.435(c)(2)(I), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), this ESD has been prepared for the following reasons:

- to provide the public with an explanation of the nature of the changes to the remedy;
- to summarize the circumstances that led to the changes to the remedy; and
- to affirm that the revised remedy complies with all statutory requirements.

This document presents a summary of the changes to the selected remedy and a synopsis of information on the Site. The Administrative Record, which contains the ESD and this documentation supporting the revisions, is available for public review at the locations indicated at the end of this report.

II. SITE HISTORY AND BACKGROUND

a. Location

The Petrochem/Ekotek Site (the Site) is located in Township 1 North, Range 1 West, Section 23, and occupies approximately seven acres in an industrial corridor in the northern section of Salt Lake City, Utah.

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b. Operational History

The Site was originally owned and operated as an oil refinery by O. C. Allen Oil Company, from 1953 to 1968. In 1968, Flinco, Inc. purchased the facility and operated the refinery until 1978. During that time Flinco changed its name to Bonus International Corp. In 1978 Axel Johnson, Inc., acquired the facility and operated it through its Delaware-based subsidiary, Ekotek, Inc. At this time, Ekotek, Inc. converted the Site into a hazardous waste storage and treatment, and petroleum recycling facility. Steven Self and Steve Miller purchased the site from Axel Johnson, Inc. in 1981 and reincorporated as Ekotek Incorporated, a Utah corporation. From 1980 to 1987, the facility operated under Resource Conservation and Recovery Act (RCRA) interim status, and received a hazardous waste storage permit in July 1987 for a limited number of these activities. Ekotek, Inc. declared bankruptcy in November of 1987. Petrochem Recycling Corp. leased the facility in 1987 from Ekotek, Inc. and continued operations until February 1988. The Ekotek bankruptcy estate released the property (Parcel Numbers 0823407001 and 0823407002) pursuant to state statute, Utah Code Annotated Section 59-2-1336. Delinquent County taxes attributed to the property have not been paid. Ownership of the Site is uncertain at present following the bankruptcy proceedings of Ekotek Incorporated, the owner of the Site in 1989. A transfer of title to the property to either the county or a potential purchaser may occur as a result of a final tax sale. The tax sale must be initiated within four and a half years after the initial date of the delinquent taxes.

c. History of Site Investigations

In 1980, Ekotek, Inc., filed a RCRA Part A permit application and achieved Interim Status. A RCRA Part B permit was issued in 1987 to Ekotek, Inc. Site operations were shut down in February 1988, after the issuance to Petrochem Recycling Corporation of a Notice of Violation by the Utah Bureau of Solid and Hazardous Waste and by the Bureau of Air Quality. In November 1988, Region VIII EPA Emergency Response Branch initiated a removal action at the site.

Sources of contamination at the Site included approximately 60 aboveground tanks, 1200 drums and 1500 smaller containers, three surface impoundments, an underground drain field, numerous piles and pits of waste material, underground tanks, incineration furnaces, and contaminated soils. Contaminants associated with on-site sources include a wide range of organic substances such as chlorinated solvents and other volatile organic compounds, polynuclear aromatic hydrocarbons, phthalates, pesticides, Aroclor 1260, dioxin and furans. Heavy metals are also present in on-site sources.

On August, 2, 1989, an Administrative Order on Consent (AOC) for Emergency Surface Removal (Docket CERCLA-VIII-89-25) was issued to 27 Potentially Responsible Parties (PRPs) to undertake actions to clean up the Site. These PRPs operated as members of a voluntary association termed the Ekotek Site Remediation Committee (ESRC). As part of the emergency response, the ESRC removed surface and underground storage tanks, containers, contaminated sludges, pooled liquids, and processing equipment from the Site.

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EPA began site assessment field operations in November 1989, at which time all contaminant sources discussed above were present on-site. Pursuant to section 105 of CERCLA, 42 U.S.C. Section 9605, EPA proposed the Site for listing on the National Priorities List (NPL), set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on July 29, 1991; and listed the Site on the NPL promulgated on October 14, 1992; 57 Fed. Reg. 47180, 47200 (October 14, 1992). Only one operable unit has been designated for the Site.

An Administrative Order on Consent (AOC) for the performance of the Remedial Investigation/Feasibility Study (RI/FS) was signed in July 1992 (Docket No. CERCLA (106) VIII-92-21). Members of the ESRC were Respondents for the RI/FS AOC. The Phase I field investigation was undertaken from December 1992 to March 1993 and Phase II investigations were conducted from August to October 1993. A final RI report was issued in July 1994 and the final FS report was issued in January 1995. Two addenda to the FS were submitted on February 24, 1995 and April 7, 1995.

The hazardous substances present at the site and the data or information documenting a release or threatened release of a hazardous substance at or in connection with the Site is described in the Administrative Record for the Site, including but not limited to the RI Report. The release migration, including present and potential future pathways, possible or known routes of exposure of the hazardous substances, population at risk, and threats to human health and the environment are described in the Administrative Record for the Site, including but not limited to the Baseline Risk Assessment for the Site.

Pursuant to Section 117 of CERCLA, 42 U.S.C. § 9617, EPA published notice of the completion of the FS and of the proposed plan for remedial action on July 19, 1995, in two major local newspaper of general circulation. EPA provided extensive opportunity for written and oral comments from the public on the proposed plan for remedial action. A copy of the transcript of the public meeting is available to the public as part of the administrative record upon which the Ecosystems Protection and Remediation Assistant Regional Administrator based the selection of the response action.

The decision by EPA on the remedial action to be implemented at the Site is embodied in a final Record of Decision (ROD) executed on September 27, 1996. The State had a reasonable opportunity to review and comment on the remedial action and the ROD. The ROD includes EPA's explanation for any significant differences between the final plan and the proposed plan as well as a responsiveness summary to the public comments received. Notice of the final plan was published in accordance with Section 117(b) of CERCLA, 42 U.S.C. § 9617(b). The ROD is supported by an administrative record that contains the documents and information upon which EPA based the selection of the response action.

Since February, 1997, EPA and the ESRC representatives have been in negotiations for an agreement to implement the remedy selected in the ROD. This agreement, in the form of a consent decree for remedial design and remedial action (RD/RA), if agreed upon, will be filed in the U.S. District Court for Utah. Since the time of the ROD, EPA has obtained new information which has resulted in the need for this ESD. The consent decree would provide for implementation of the remedy selected in the ROD including the modifications of this ESD.

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III. DESCRIPTION OF THE ROD

The purpose of the remedy is to eliminate the pathway of direct exposure to soils of an industrial worker through excavation and offsite disposal of hot spot soils; containment onsite of low-level contaminated soils under 42-inch soil cap; eliminate partitioning of LNAPL to the ground water through removal and treatment of LNAPL; and eliminate the potential future ingestion of contaminated drinking water through intrinsic remediation/attenuation of the ground water.

The components of the selected remedy include: Remove/Dispose Hot Spot Soils; Consolidate/Cap Soils that Exceed Soil Performance Standards; Partial Removal/Disposal of Soil and Buried Debris and Cap Remaining Debris; Remove/Treat 100% LNAPL; Intrinsic Remediation of Ground Water; and Access and Land Use Restrictions for the Petrochem/Ekotek Site.

The changes documented in this ESD are based on new information that EPA received subsequent to the issuance of the ROD. EPA determined that the information supports the need to correct and/or clarify certain aspects of the remedy described in the ROD. These changes do not fundamentally alter the overall approach of the site-wide remedy or any individual component of the site-wide remedy. The changes to the performance standards in this ESD may alter the amount of soil which exceeds the Hot Spot performance standards and which must be sent for offsite disposal as well as alter the amount of soil consolidated and contained onsite under the 42 inch cap. The volumes specified in the ROD were estimates. The actual volumes will be determined during the implementation of the remedy.

IV. SIGNIFICANT DIFFERENCES TO THE REMEDY

The significant differences between the remedy described in the 1996 ROD and in this ESD are:

1. The Soil Performance Standard for 2,3,7,8,-TCDD(TEF) will be revised from 1.86E-06 mg/kg to 3.7E-05 mg/kg for cancer risk of 1E-06 (site wide) and the Soil Hot Spot Performance Standard will be revised from 0.186 ug/kg to 3.7 ug/kg for cancer risk of 1E-04 (hot spot);

2. The Soil Performance Standard for PCBs will be revised from 0.15 mg/kg to 2.7 mg/kg (ppm);

3. The Soil <u>Hot Spots</u> Performance Standard for PCBs will be revised from 10 mg/kg to 25 mg/kg (ppm); and

4. The <u>Contingency Measures</u> section of the ROD will be revised to permit, as an alternative to discharge to the POTW, the discharge of ground water to re-injection wells or to a surface water/storm drain via the substantive requirements of a UPDES permit.

Only those changes described in Section IV, Paragraphs 1 through 4 above are being made to the selected remedy described in the 1996 ROD. All other aspects of the selected remedy documented

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in the 1996 ROD remain the same. A more detailed description of the revised components to the remedy follows.

V. DETAILED DESCRIPTION OF CHANGES TO THE ROD

1. Soil Performance Standard for 2,3,7,8,-TCDD(TEF).

The algorithms, exposure assumptions, and toxicity values used in the calculation of the remediation levels for 2,3,7,8,-TCDD(TEF) [dioxin] were re-examined. It was determined that a numerical entry error occurred during the original calculation of the dioxin performance standard. New values, 0.037 ug/kg (3.7E-05 mg/kg) for cancer risk of 1E-06 (site wide) and 3.7 ug/kg (3.7E-03 mg/kg) for cancer risk of 1E-04 (hot spots) were calculated based upon the same equations and assumptions in the August 2, 1994 Baseline Human Health Risk Assessment for the Petrochem Site for the commercial and industrial worker for exposure to soil via ingestion and dermal absorption, but with the correct numerical entries.

The revised Soil Performance Standard (SPS) for TCDD is derived based upon the following formula:

$$SPS = \frac{TR*BW*AT*365\ days/year}{EF*ED*[(SF_0*1\text{-}06*IR) + (SF_0*0.9*1E\text{-}06*SA*AF*ABS)]}$$

TR (target risk) 1E-06
BW (body weight) 70 kg
AT (averaging time) 70 years
EF (exposure frequency) 250 days/year
ED (exposure duration) 25 years
SF_0 (slope factor oral) 1.5E+05 mg/kg-day^{-1}
1E-06 kg/mg (conversion factor)
IR (ingestion rate for soil) 50 mg/day
0.9 (adjustment factor for conversion from administered to absorbed dose for TCDD)
SA (Skin surface area) 3100 cm^2
AF (Soil to skin adherence factor) 0.016 mg/cm^2
ABS (absorption factor) 0.03

The SPS formula augments the risk based concentration (RBC) formula utilized in the risk assessment by incorporating an adjustment factor to convert administered to absorbed dose . Additionally, a default value of 0.87 was utilized in the risk assessment for ABS (fractional absorption factor). The default value was updated to 0.03 as per Dermal Exposure Guidance, (EPA/600/8-91/011E, January 1992). Lastly, based upon a recent update to the Exposure Factors Handbook (EPA/600/P-95/002Ba, August 1996) the AF (Soil to skin adherence factor) was updated from 1 to 0.016 mg/cm^2-day.

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2. Soil Performance Standard for PCBs.

EPA relies upon the Agency's Integrated Risk Information System (IRIS) for calculation of risk-based cleanup concentrations. IRIS, an electronic data base containing EPA's information on human health effects, was revised for polychlorinated biphenyls (PCBs) on June 1, 1997. Specifically, the slope factor for PCBs was revised subsequent to the release of the ROD, and several new slope factors (including those for the central tendency exposure condition) of PCBs became available. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per mg/kg/day. EPA recommends the use of a new slope factor of 2.0 per mg/kg-day, updated from 7.7 mg/kg-day, for the reasonable maximum exposure condition for PCBs in soil that are high risk and persistent. This slope factor is appropriate for deriving Soil Performance Standards for Aroclors 1260 and 1254 (PCB types found at Site) at the Site because these chemicals are high risk and persistent and the medium of exposure is in soil. The revised Soil Performance Standard of 2.7 mg/kg is based upon the same equations and assumptions in the August 2, 1994 Baseline Human Health Risk Assessment for the Petrochem Site for the commercial and industrial worker for exposure to soil via ingestion and dermal absorption, but utilizing in those equations the new slope factor and the updated AF (Soil to skin adherence factor) detailed in Section V.1..

3. Soil Hot Spot Performance Standard for PCBs

EPA carefully reviewed its *Guidance on Remedial Actions for Superfund Sites with PCBs Contamination,* OSWER Directive 9355.4-01, before making its decision to change PCB cleanup levels at the Petrochem Site. The *Guidance* describes how to develop remedial alternatives that are consistent with PCB-related Applicable or Relevant and Appropriate Requirements (ARARs) and "to-be-considered" criteria.

The guidance states that, for sites in *industrial* areas, cleanup actions should be considered when PCB levels range from 10 to 25 parts per million (ppm). Among the reasons for choosing 25 ppm are:

- there is less access in industrial areas than in other areas and, therefore, less frequency of exposure and less risk posed by the PCBs; and
- a 42-inch cap that covers PCB-containing soils further reduces access to the contaminants.

This cleanup level is consistent with the PCB Spill Policy, which recommends a cleanup level of 25 to 50 ppm for sites in *industrial* or other *reduced access* areas." The cleanup level is also consistent with the PCB guidance document. At the Petrochem Site, the PCB level remaining on site will not exceed 25 ppm.

4. Groundwater Contingency Measures: Discharge of Ground Water.

At the time of the ROD it was assumed that the POTW would be able to accept treated ground water

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generated from either the containment and/or the arsenic remediation contingency plans, if invoked. Based upon potential capacity issues at the POTW, an additional alternative may be considered permitting treated ground water to also be discharged to the underlying aquifer via re-injection wells or to a surface water/storm drain. These alternative measures for disposal of treated ground water would be evaluated at the time EPA determines they are needed, depending on whether either or both of the groundwater contingency measures (for containment and for arsenic) are invoked and if, in fact, capacity issues do exist at the POTW for the amounts of ground water being disposed. Discharge to a surface water/storm drain would comply with the requirements of a UPDES permit.

These additional components must also comply with all applicable and relevant and appropriate requirements (ARARs), pursuant to Section 121 of CERCLA. In addition to the ARARs set forth in the ROD, these revised activities must comply with Section 3020 of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901, et seq., which bans the injection of contaminated materials into drinking water formations unless specified conditions are met, designated by EPA as a relevant and appropriate requirement; and the Underground Injection Control program regulations at 40 C.F.R. Parts 144-147, which establish standards for construction and operation of injection wells and provide for the protection of underground sources of drinking water by ensuring that injected waters meet MCLs and risk based concentrations. The UIC regulations are designated by EPA as applicable to the activity described above.

VI. SUMMARY OF STATE COMMENTS AND AVAILABILITY OF ADMINISTRATIVE RECORD

UDEQ has been provided with the opportunity to review and comment on this ESD and the documents that serve as the basis for this ESD. UDEQ commented to EPA on these documents, and supports the changes to the Soil Performance Standard for 2,3,7,8-TCDD(TEF) and the Soil Performance Standard for PCBs. UDEQ, however, does not support the change to the Soil Hot Spot Performance Standard for PCBs based, in part, on its interpretation of EPA's PCB Spill Cleanup Policy. Finally, UDEQ supports the ground water contingency measure change. UDEQ's comments, dated October 30, 1997, can be found in the Administrative Record for the Site.

Documents referenced within this ESD are part of the Administrative Record for the Petrochem/Ekotek Inc. Site. The complete administrative record for the Site is available for public review at the following locations:

EPA Superfund Records Center
999 18th Street, Fifth Floor
Denver, Colorado 80202
Hours: Monday-Friday 8:00am - 4:30pm
Telephone: (303) 312-6473

Mr. Walter Jones
Marriott Library
Western Americana and Special Collections
University of Utah
Salt Lake City, UT 84122
Telephone: (801) 581-8863

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VII. AFFIRMATION OF STATUTORY REQUIREMENTS

Considering the new information that has been developed and the changes that have been made to the selected remedy, EPA, in consultation with UDEQ, believes that the remedy remains protective of human health and the environment, complies with Federal and State requirements that are both applicable or relevant and appropriate to this remedial action or involves appropriate waivers of these requirements, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Site.

VIII. APPROVAL

Max H. Dodson, Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

12/9/97
Date

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TAB 10

CONFIDENTIAL

6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
503.670.1108

ANCHOR QEA

Memorandum

August 2, 2017

To: Bob Wyatt, NW Natural

From: Amy Nelson and Taku Fuji, Anchor QEA, LLC

cc: Patty Dost, Pearl Legal Group

Ryan Barth, Carl Stivers, and Ben Hung, Anchor QEA, LLC

Re: USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor

Introduction

This memorandum summarizes the January 2017 U.S. Environmental Protection Agency (USEPA) updates to the human health toxicity values for benzo(a)pyrene (BaP) and their potential impacts on cleanup levels and remedial action levels (RALs) identified in the January 3, 2017 Record of Decision (ROD; USEPA 2017a) at the Portland Harbor Superfund Site (Site). USEPA's January 19, 2017 updates to *Toxicological Review of Benzo(a)pyrene (CASRN 50-32-8): Executive Summary. Integrated Risk Information System (IRIS)* (USEPA 2017b) include the following toxicity value changes:

- The oral cancer slope factor (CSF) decreased from 7.3 per milligram per kilogram-day (per mg/kg-day) to 1 per mg/kg-day. In general, the use of a lower BaP CSF results in lower BaP and carcinogenic polycyclic aromatic hydrocarbon (cPAH) risk estimates.
- A non-cancer oral reference dose (RfD) of 0.0003 per mg/kg-day was added; previously, USEPA did not identify an RfD for BaP in IRIS. Thus, BaP non-cancer risks had not been previously estimated.

Cleanup Levels

USEPA calculated preliminary remediation goals (PRGs) in the *Portland Harbor Feasibility Study* (FS; USEPA 2016) for each remedial action objective (RAO). In the ROD, USEPA set cleanup levels by media using the PRGs from the FS. Sediment and riverbank soil cPAH cleanup levels (expressed as BaP equivalents) presented in the ROD are based on PRGs developed using the 1987 BaP CSF (representing $1x10^{-6}$ risk level), rather than the 2017 BaP CSF.

This technical memorandum recalculates the cPAH PRGs presented in the FS and ROD using the new BaP CSF.[1] We have not modified any other variable or USEPA's equations themselves.

[1] USEPA cleanup levels (and RALs) incorporate rounding in one or more steps in the calculation, so recalculated concentrations are approximate.

Nearshore Sediment Cleanup Levels

The "riverbank soil/sediment" nearshore sediment cleanup level for cPAH of 12 micrograms per kilogram (µg/kg), as presented in Table 17 of the ROD (USEPA 2017a), is the minimum amount of cPAH PRGs by media developed in the FS and represents the human health sediment direct contact pathway specific to beaches. The USEPA FS also includes a separate RAO 1 cPAH PRG of 106 µg/kg for the sediment direct contact exposure evaluated in the Baseline Human Health Risk Assessment (BHHRA) for nearshore areas (i.e., outside the channel and not at beaches; identified in the FS as "in-water" PRGs). Although ROD Table 17 does not include that in-water value and defaults to the lower 12-µg/kg value based on beach exposures, the 106-µg/kg PRG is used to define "highly toxic" principal threat waste (PTW) concentrations in the ROD and to evaluate risk reduction for USEPA's selected remedy (USEPA 2017a, Table 6 and Appendix IV, Table J.2.2-1c).

If the updated BaP CSF was applied, the cleanup level based on the RAO 1 direct contact PRG applicable to beaches would increase from 12 µg/kg to approximately 85 µg/kg. The risk-based PRG for beach contact (recreational beach user) presented in the ROD is a cancer-based goal that happens to be the same number as the background value (a value USEPA estimated using a total polycyclic aromatic hydrocarbon [TPAH] to cPAH regression equation). Therefore, the updated BaP cleanup level of 85 µg/kg would lead to the risk-based goal being greater than USEPA's background value.

Using the updated BaP CSF, the cPAH RAO 1 in-water sediment direct contact PRG (based on cancer risks for the tribal fisher and applicable to nearshore sediments outside beach areas) would increase from 106 µg/kg to approximately 773 µg/kg.

Navigation Channel Sediment Cleanup Levels

Per USEPA's ROD Table 17 footnote (USEPA 2017a), the cPAH cleanup level of 3,950 µg/kg for navigation channel sediment is based on the RAO 2 sediment PRG protective of clam consumption by humans. Applying the updated BaP CSF to USEPA's cPAH clam PRG equation (USEPA FS Appendix D, as updated in the ROD), the resulting sediment cleanup level would increase from 3,950 µg/kg to approximately 108,000 µg/kg. Due to the log-log biota-sediment accumulation regression equation used in developing this PRG, the increase is not directly 7.3-fold as it is for the sediment direct contact PRGs applied for nearshore sediments.

Surface Water Cleanup Levels

Surface water cleanup levels in the ROD were selected based on the lower of RAO 3 and 7 PRGs from the FS (USEPA 2016). The ROD surface water cleanup level for cPAH (0.00012 µg/L) is equivalent to the RAO 3 PRG, which is based on federal human health water quality criteria protective of fish consumption. This value is lower than the RAO 7 ecological-based value for BaP (0.014 µg/L).

Application of USEPA's updated CSF would affect both the Oregon and federal human health water quality BaP criteria. The updated BaP CSF would increase the federal criteria and therefore, the ROD surface water cleanup level for BaP from 0.00012 µg/L to approximately 0.0009 µg/L. Similarly, the Oregon criteria would increase from 0.0013 µg/L to 0.0095 µg/L. Per the current ambient water quality criteria document for BaP (USEPA 2015), USEPA planned to update the human health criteria for BaP following the finalization of the IRIS update.

USEPA's No Action site-wide average surface water cPAH concentration (approximately 0.0008 µg/L, per ROD Appendix IV Figure 4.2-8b provided in the ROD [USEPA 2017a]) is less than the revised surface water cleanup level of 0.0009 µg/L. Following USEPA's FS evaluation methods, this would mean that the site already achieves the revised cleanup level.

Non-cancer PRGs

Prior to the BaP toxicity value update, a USEPA-approved non-cancer RfD did not exist for BaP and, as such, non-cancer hazards were not quantified in the Site human health risk assessment for BaP (Kennedy/Jenks Consultants 2013). However, USEPA apparently used this new toxicity value[2] to develop non-cancer RAO 1 PRGs for cPAH (FS Table B3-4; USEPA 2017a). These PRGs were not summarized in USEPA FS Section 2 and do not appear to be used in the FS or ROD evaluations. Because cPAH is a chemical sum made up of specific carcinogenic PAHs, it is unclear whether USEPA intended these PRGs to be applied to cPAH or only to BaP. However, the non-cancer cPAH RAO 1 PRGs in Table B3-4 of the USEPA FS are orders of magnitude higher than the cancer-based RAO 1 PRGs (i.e., the minimum non-cancer cPAH PRG is 91,470 µg/kg).

Remedial Action Levels and Principal Threat Waste Highly Toxic Threshold

The selected remedy identified in the ROD (USEPA 2017a) includes RALs and PTW highly toxic sediment concentrations, above which USEPA's remedy requires active remediation. PAH RALs for sediment identified in USEPA's ROD are TPAH concentrations determined by USEPA using RAL curves, the cPAH to TPAH correlation regression analysis, and USEPA's professional judgment regarding the acceptability of surface-weighted average concentrations (SWACs) achieved relative to various PRGs. Therefore, revised RALs cannot be directly recalculated using the updated BaP CSF. Nonetheless, USEPA's RAL determination methods can be mimicked using the updated PRGs through two approaches: 1) a proportional adjustment approach; and 2) a risk-reduction approach.

For the first approach, we used USEPA's correlation relationship between cPAH PRGs and TPAH RALs to estimate revised RALs. For the second approach, we also used post-construction SWACs associated with various RALs and compared them to the revised PRGs to see if higher RALs would

[2] Though USEPA cites the RfD as a 2004 number, it did not exist at that time, and it was not used in the baseline human health risk assessment.

still meet USEPA's interim target risk levels, similar to USEPA's FS methods for post-construction risk estimation. Each of these approaches are detailed below.

Nearshore Sediment RAL

The selected remedy identified in the ROD includes a TPAH RAL of 13,000 µg/kg applicable to nearshore sediments. The ROD cleanup levels associated with the nearshore sediment direct contact include 23,000 µg /kg TPAH (RAO 5 benthic risk PRG) and 12 µg/kg cPAH (RAO 1 beach direct contact PRG). As noted above, USEPA identifies the sediment direct contact PRG for beach sediments as the cleanup level for RAO 1, which is inconsistent with the RAO 1 exposure scenario evaluated in the BHHRA for nearshore sediments outside of beach areas. However, USEPA developed the TPAH RALs based upon the 106-µg/kg cPAH PRG (USEPA 2016, Figure 3.4-2). Further, USEPA's updated calculation of residual and post construction risks (USEPA 2017a, Appendix IV, Appendix J) evaluates achievement of RAO 1 in nearshore sediments for each alternative, including the selected alternative, using the in-water sediment RAO 1 cPAH PRG of 106 µg/kg. Consequently, we used the same PRG for our revised RAL estimates.

Proportional Adjustment Approach

The ROD TPAH RAL of 13,000 µg/kg converts to 1,500 µg/kg cPAH using USEPA's cPAH to TPAH regression, which is approximately 14 times the USEPA's RAO 1 in-water sediment cPAH PRG of 106 µg/kg. Proportionally adjusting USEPA's RAL by applying a 14-fold increase to the revised RAO 1 in-water cPAH PRG (773 µg/kg) results in an estimated revised RAL for the nearshore of 92,000 µg/kg TPAH (converted from 10,800 µg/kg cPAH using the regression and rounding to two significant figures, consistent with USEPA's RALs).[3] Figure 1 shows the sediment management areas (SMAs) associated with an alternative where the only modification to the selected remedy is revision of the nearshore TPAH RAL from 13,000 µg/kg to 92,000 µg/kg. Total SMA acreage (areas exceeding all RALs plus all PTW) decreases from 355 acres for the selected remedy (red area) to 326 acres (yellow plus green areas). Though the proportionally adjusted nearshore TPAH RAL results in only an approximately eight percent decrease in total SMAs, the revised RAL primarily reduces the SMA extents upstream and downstream of Gasco (only in the nearshore area, which is where the revised RAL would be applied).

[3] TPAH RAL for the nearshore sediments is 125 times the USEPA's RAO 1 beach PRG. Proportional adjustment results in a revised cPAH RAL of 10,600 µg/kg (approximately 91,000 µg/kg TPAH).

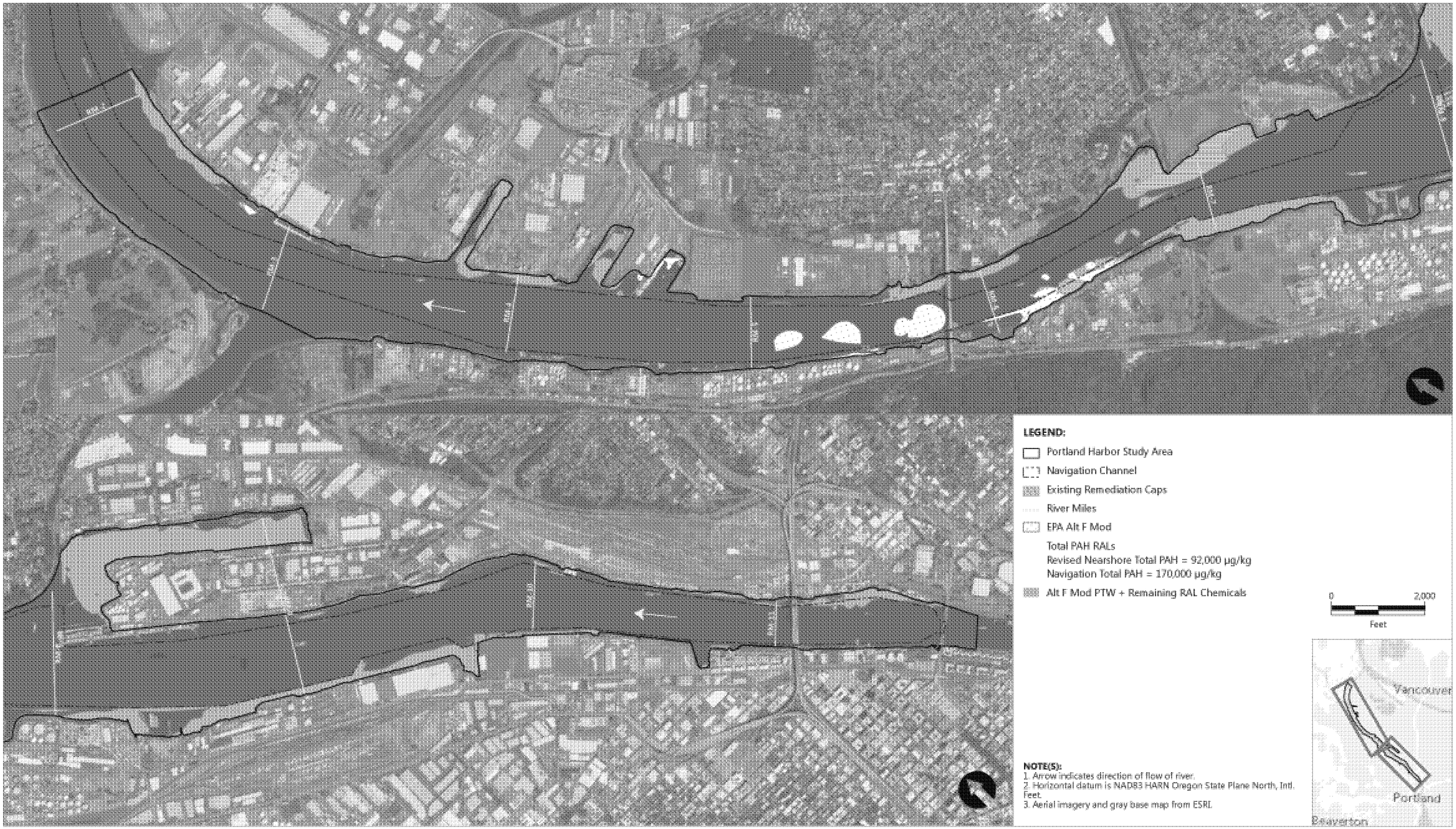

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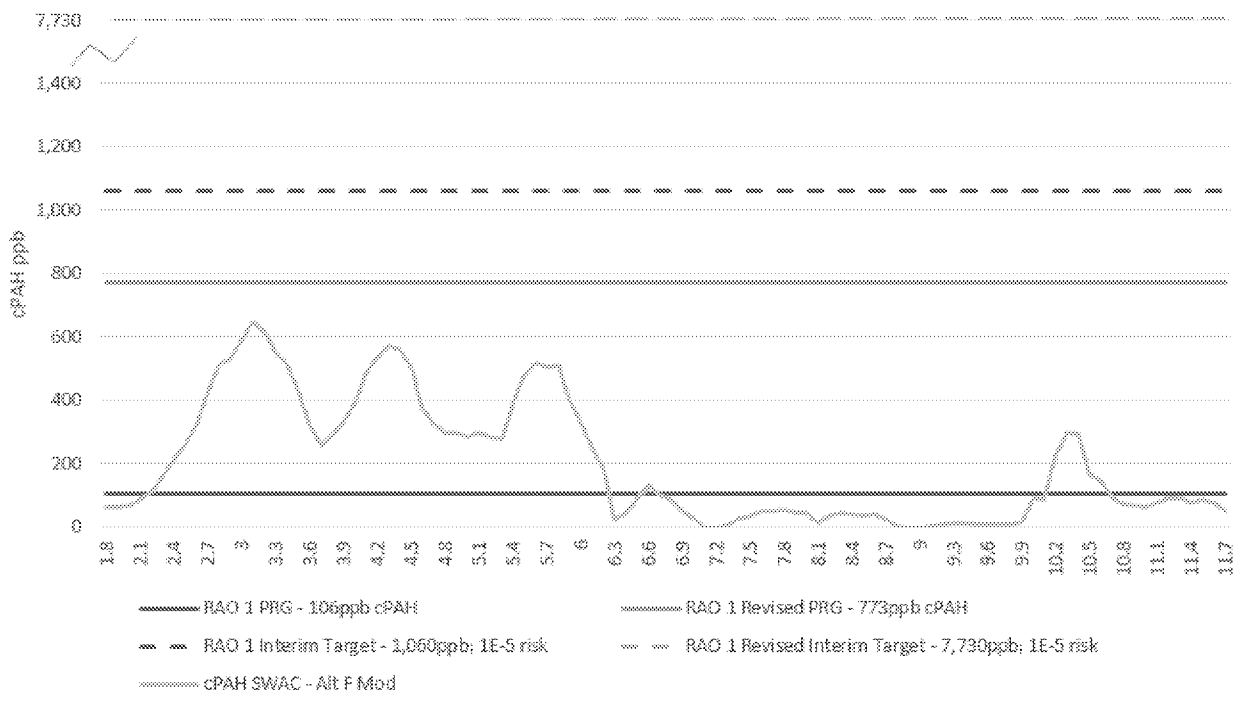
Figure 1
Sediment Management Areas (SMAs) Using Revised Nearshore TPAH RAL
Portland Harbor Record of Decision Review
Gasco Sediments Cleanup Action

Risk Reduction Approach

PRGs were developed at a $1x10^{-6}$ level (USEPA 2016). USEPA set interim targets for risks to evaluate the potential for achievement of PRGs in a "reasonable time frame." For RAO 1, USEPA set the interim target at $1x10^{-5}$ cumulative risk (i.e., the total risk of the contaminants of concern evaluated in USEPA's FS). Therefore, risk reduction from cPAHs for river miles (RMs) where cPAHs compose most of the cumulative risk can be used to develop a revised TPAH RAL, and an interim target-based concentration was estimated from the revised cPAH PRG. These evaluations are discussed below, with a focus in this example on the west side of the river where, according to USEPA's ROD, cPAHs compose most of the cumulative risk in select RMs.

USEPA's selected remedy (Alternative F Modified) in the ROD contains several RM SWACs (as reported in the USEPA FS Appendix J tables provided in the ROD) that exceed USEPA's RAO 1 in-water direct contact cPAH PRG (Figure 2) but meet the interim target at a cancer risk level of $1x10^{-5}$. When the revised PRG is used, all RM SWACs associated with USEPA's selected remedy are less than the revised PRG and much less than the revised $1x10^{-5}$ interim target level.

Figure 2
USEPA-selected Remedy Post-construction cPAH SWACs Using USEPA App J 0.5 RM SWACs – West

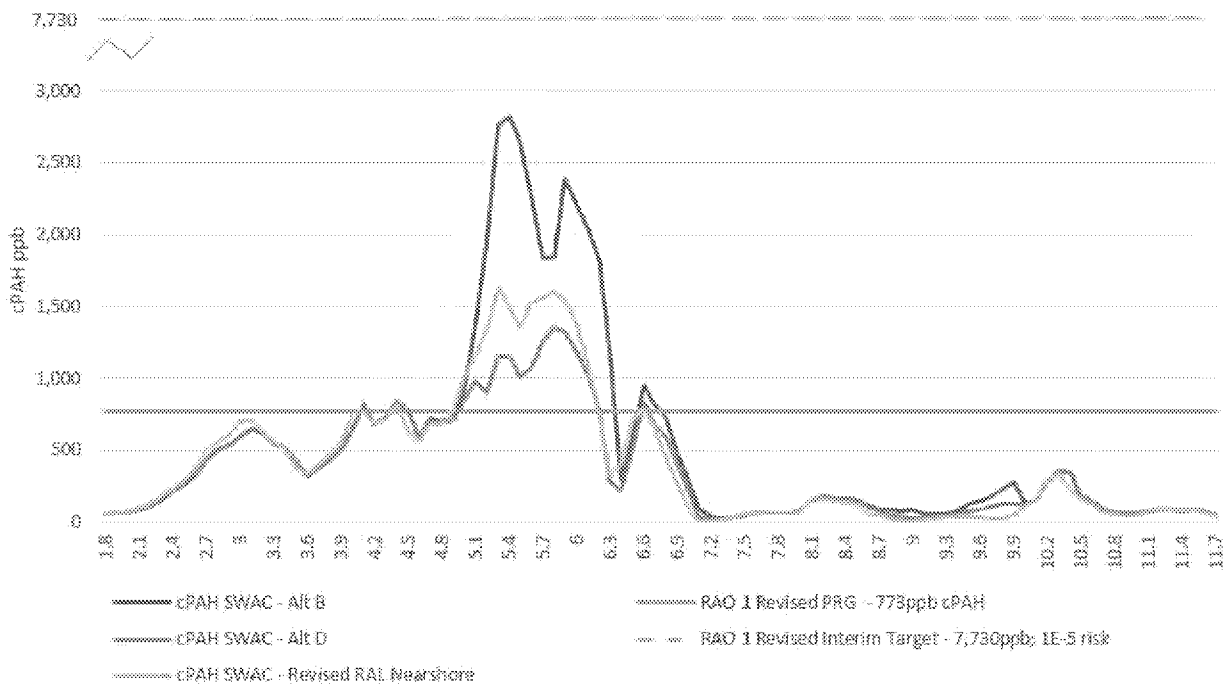


To identify which RAL could be applied and still meet USEPA's interim targets, post-construction SWACs were compared to the revised PRG and interim target level using USEPA's Appendix J SWACs (based on rolling 0.5 RM segments) for Alternatives B and D and Anchor QEA-estimated SWACs for the estimated RAL based on proportional adjustment

As shown in Figure 3, USEPA's Alternative B (RAL of 170,000 µg/kg) meets the revised PRG in most RMs. Similar to USEPA's Alternative D, revision of the nearshore TPAH RAL from 13,000 µg/kg to 92,000 µg/kg results in estimated post-construction SWACs that achieve the revised PRG at more RMs than for Alternative B. All SWACs in Figure 3 are well below the revised interim target.

Based on these SWACs and the revised RAO 1 in-water direct contact cPAH PRG applicable to nearshore sediments (773 µg/kg), a revised TPAH RAL for nearshore sediment that would likely meet USEPA's objectives for risk reduction could increase from 13,000 µg/kg to a range of 92,000 µg/kg to 170,000 µg/kg, a 7- to 13-fold increase.

Figure 3
Post-construction cPAH SWACs Using USEPA App J 0.5 RM SWACs Revised RAL – West



Navigation Channel Sediment RAL

USEPA's selected remedy in the ROD includes a TPAH RAL of 170,000 µg/kg applicable to navigation channel sediments. The cleanup levels associated with the navigation channel include 23,000 µg/kg TPAH (RAO 5 benthic risk PRG) and 3,950 µg/kg cPAH (RAO 2 PRG). As described above, the RAO 2

cPAH cleanup level increases to 108,000 µg/kg using the revised CSF. Potential impacts to the navigation channel TPAH RAL from application of the revised RAO 2 cPAH cleanup level are summarized below.

Proportional Adjustment Approach

The ROD TPAH RAL of 170,000 µg/kg converts to approximately 20,000 µg/kg cPAH using USEPA's cPAH to TPAH regression, which is approximately five times the ROD RAO 2 cPAH cleanup level. Proportionally adjusting USEPA's RAL by applying a five-fold increase to the revised RAO 2 cPAH cleanup level (108,000 µg/kg) results in an estimated revised RAL for the navigation channel of 540,000 µg/kg cPAH (more than 4,000,000 µg/kg TPAH).

Risk Reduction Approach

The revised RAO 2 cPAH cleanup level (108,000 µg/kg) exceeds the ROD cPAH PTW highly toxic threshold (106,000 µg/kg). USEPA's No Action SWACs for all RMs in the navigation channel (per the USEPA ROD, Appendix IV, Appendix J tables) already achieve the revised RAO 2 cPAH cleanup level. Therefore, a TPAH RAL would no longer be needed to be protective of the revised PAH human health cleanup level.

Revised SMAs associated with applying a revised nearshore TPAH RAL of 92,000 µg/kg and eliminating a navigation channel TPAH RAL are shown in Figure 4 as compared to the SMAs associated with USEPA's selected remedy. The RAL revisions eliminate nearly all SMAs in the navigation channel; those remaining are associated with elevated PCB concentrations (green areas). Total SMA extents decreases by approximately 14 percent from 355 acres associated with USEPA's selected remedy to 304 acres through revising nearshore and navigation channel TPAH RALs. The TPAH areas associated with Alternative B (blue areas) are included for comparison with the TPAH areas associated with the revised nearshore and navigation channel RALs (yellow areas).

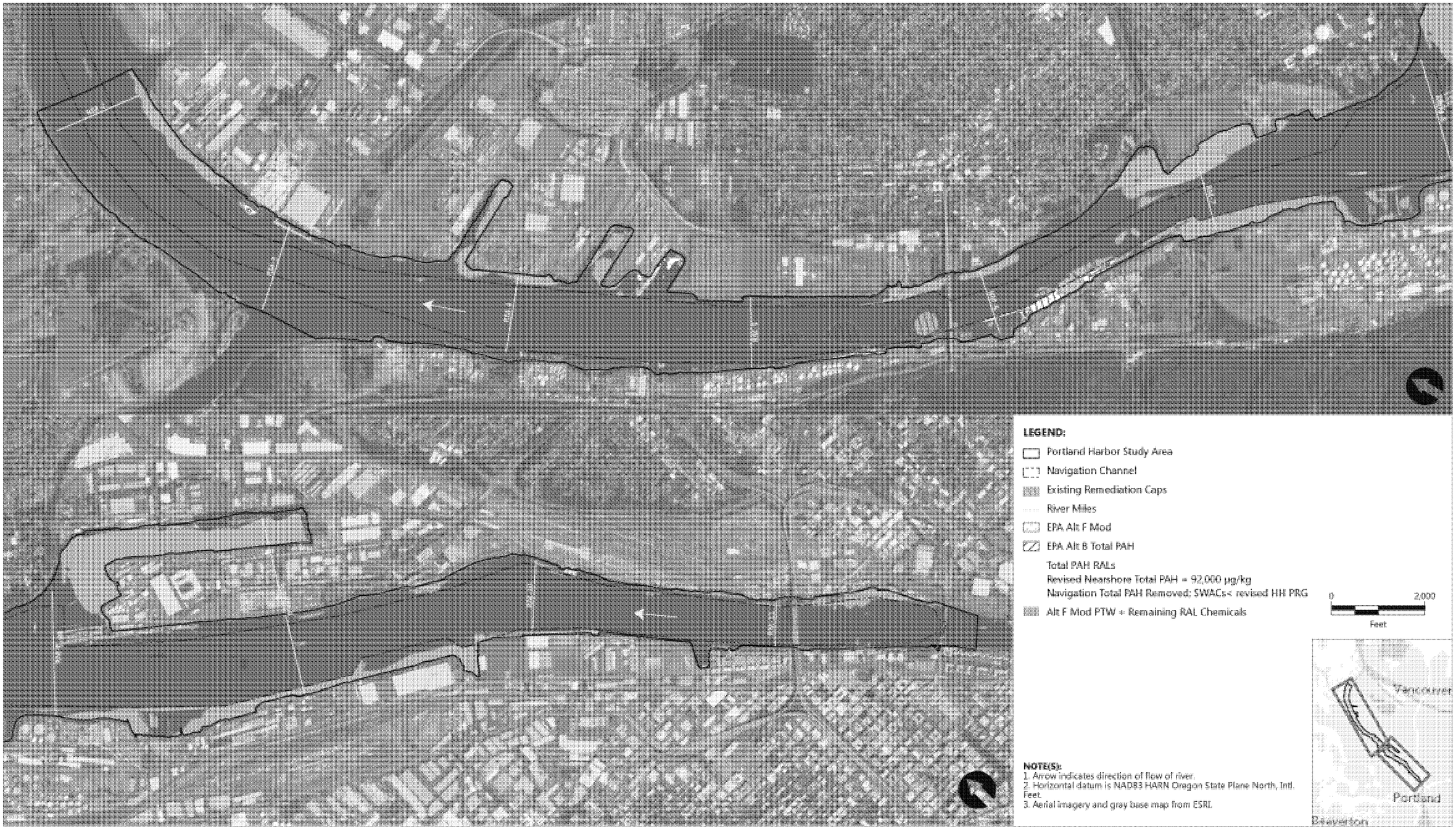


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Figure 4
Sediment Management Areas (SMAs) Using Revised Nearshore and Navigation Channel TPAH RALs
Portland Harbor Record of Decision Review
Gasco Sediments Cleanup Action

Principal Threat Waste

PTW highly toxic is a risk-based action level based on the RAO 1 in-water direct contact cPAH PRG; therefore, a revised threshold can be calculated following USEPA's methods using the revised BaP CSF. The PTW highly toxic cPAH concentration increases from 106,000 µg/kg to 773,000 µg/kg when applying the new BaP CSF. USEPA's No Action sediment concentrations are less than this revised PTW highly toxic threshold; therefore, no PTW highly toxic areas would exist at the Site for cPAHs.

References

Anchor QEA, LLC, 2016. Technical memorandum to: NW Natural. Regarding: Critique of EPA PRGs and RALs. Portland Harbor Feasibility Study. Attachment 2 of NW Natural September 6, 2016 Comments on EPA's June 8, 2016 Proposed Plan and Draft Final Feasibility Study for the Portland Harbor Superfund Site. September 6, 2016.

USEPA (U.S. Environmental Protection Agency), 2015. *Update of Human Health Ambient Water Quality Criteria: Benzo(a)pyrene 50-32-8. Office of Science and Technology*. Office of Water. USEPA/820/R-15/012. June 2015.

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USEPA, 2017a. *Record of Decision. Portland Harbor Superfund Site*. Portland, Oregon. USEPA Region 10. Seattle, Washington. January 2017.

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Appendix A5

TCT Meeting Materials, January 11, 2018

DRAFT

Changes to the Portland Harbor Remedy based on Updated Human Health Toxicity Values for Benzo(a)Pyrene

January 11, 2018

CONFIDENTIAL WORKING DRAFT –
FOR DELIBERATIVE PURPOSES

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Overview

- EPA updated the cancer slope factor (CSF) for benzo(a)pyrene (BAP) after the Portland Harbor ROD was issued
  - Revised from 7.3 mg/kg-day to 1 mg/kg-day
- Potentially changes risk-based direct contact and clam consumption cleanup levels for carcinogenic PAHs (CPAHs) that are based on BAP equivalents
- Potentially changes risk-based highly toxic principal threat waste threshold for CPAHs
- Requires evaluation of potential RAL changes related to cPAH direct contact and clam consumption risk
  - Must also consider impact of potential RAL change on RAOs 3 and 5

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Proposed cPAH CUL Changes

- EPA proposes to change the cPAH cleanup levels based on the updated cancer slope factor (CSF) for benzo(a)pyrene (BAP)
- EPA proposes separate beach and in-water sediment direct contact CULs
  - Updated recreational beach CUL: 12 µg/kg to 85 µg/kg
  - Updated in-water sediment CUL: 106 µg/kg to 774 µg/kg
  - Updated clam consumption CUL: 3950 µg/kg to 107,600 µg/kg
  - Updated highly toxic PTW threshold: 106,000 µg/kg to 774,000 µg/kg
- Total PAH benthic risk CUL (RAO 5) of 23,000 µg/kg is unaffected by this change

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Proposed Nearshore* Total PAH RAL Change

- EPA proposes that the current total PAH nearshore * RAL of 13,000 µg/kg should be changed to 30,000 µg/kg:
  - Change is necessitated based on BAP CSF change
  - EPA conducted an analysis that showed that a total PAH RAL of 30,000 µg/kg addresses all areas with cPAH exceeding 774 µg/kg on a rolling river mile SWAC basis (½ mile increments)
  - Small areas with cPAHs below 774 µg/kg on a SWAC basis but with total PAHs above the proposed 30,000 µg/kg will still remain (e.g., RM 2.8 east, RM 6.5 east and upper end of Swan Island Lagoon)

*Outside the Navigation Channel

Proposed Navigation Channel Total PAH RAL

- EPA proposes that the current total PAH navigation channel RAL of 170,000 µg/kg should be retained:
  - PAH contamination above 170,000 µg/kg is limited to the area between RM 5 -7
  - The current navigation channel RAL is well above the RAO 5 total PAH CUL of 23,000 µg/kg
  - Lack of sediment deposition observed within the navigation channel between RM 5 – 7 may limit achievement of RAO 5 through natural recovery in this reach if the RAL is increased
  - Increase in PAH loading to surface water has been observed downstream of RM 6.3
  - Increasing the total PAH RAL to 230,000 µg/kg (10X the total PAH Benthic CUL) results in minimal change to remedial footprint based on existing surface sediment data and may not achieve the ROD specified protectiveness standards for RAOs 3 and 5

CUL, PTW and RAL Change Summary

Scenario	Application Area	ROD Value	Updated Value
Direct Contact cPAH Beach Sediment CUL (RAO 1)	Beach Areas	12 µg/kg	85 µg/kg
Direct Contact cPAH In-Water Sediment CUL (RAO 1)	Nearshore sediment (excluding beach areas)	Not Included	774 µg/kg
Clam Consumption cPAH Tissue Target Level (RAO 2)	Site-Wide	7.1 µg/kg	51.6 µg/kg
Clam Consumption cPAH Sediment CUL (RAO 2)	Site-Wide	3,950 µg/kg	107,600 µg/kg
Benthic Risk total PAH Sediment CUL (RAO 5)	Site-Wide	23,000 µg/kg	23,000 µg/kg *
Highly Toxic cPAH PTW Threshold	Site-Wide	106,000 µg/kg	774,000 µg/kg
Nearshore total PAH RAL	Nearshore Sediment (Outside the Navigation Channel)	13,000 µg/kg	30,000 µg/kg
Navigation Channel total PAH RAL	Navigation Channel Sediment	170,000 µg/kg	170,000 µg/kg *

* No Change Proposed

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RAL Change Evaluation Summary

Criteria	Retain Nearshore RAL (13,000 µg/kg)	Adjust Nearshore RAL (30,000 µg/kg)	Retain Nav. Channel RAL (170,000 µg/kg)	Adjust Nav. Channel RAL (230,000 µg/kg)
Protective (Achieves RAOs)	Yes	Yes	Yes	No
Remediates areas not posing risk	Yes	Minimal	No	No
Achieves ARARs (WQS)	Potentially	Unknown	Potentially	Unknown
Ease of Implementation	Easy	Moderate	Easy	Moderate
PRP Acceptance	No	Yes	Potentially	Yes
State Acceptance	No	Yes	Yes	No

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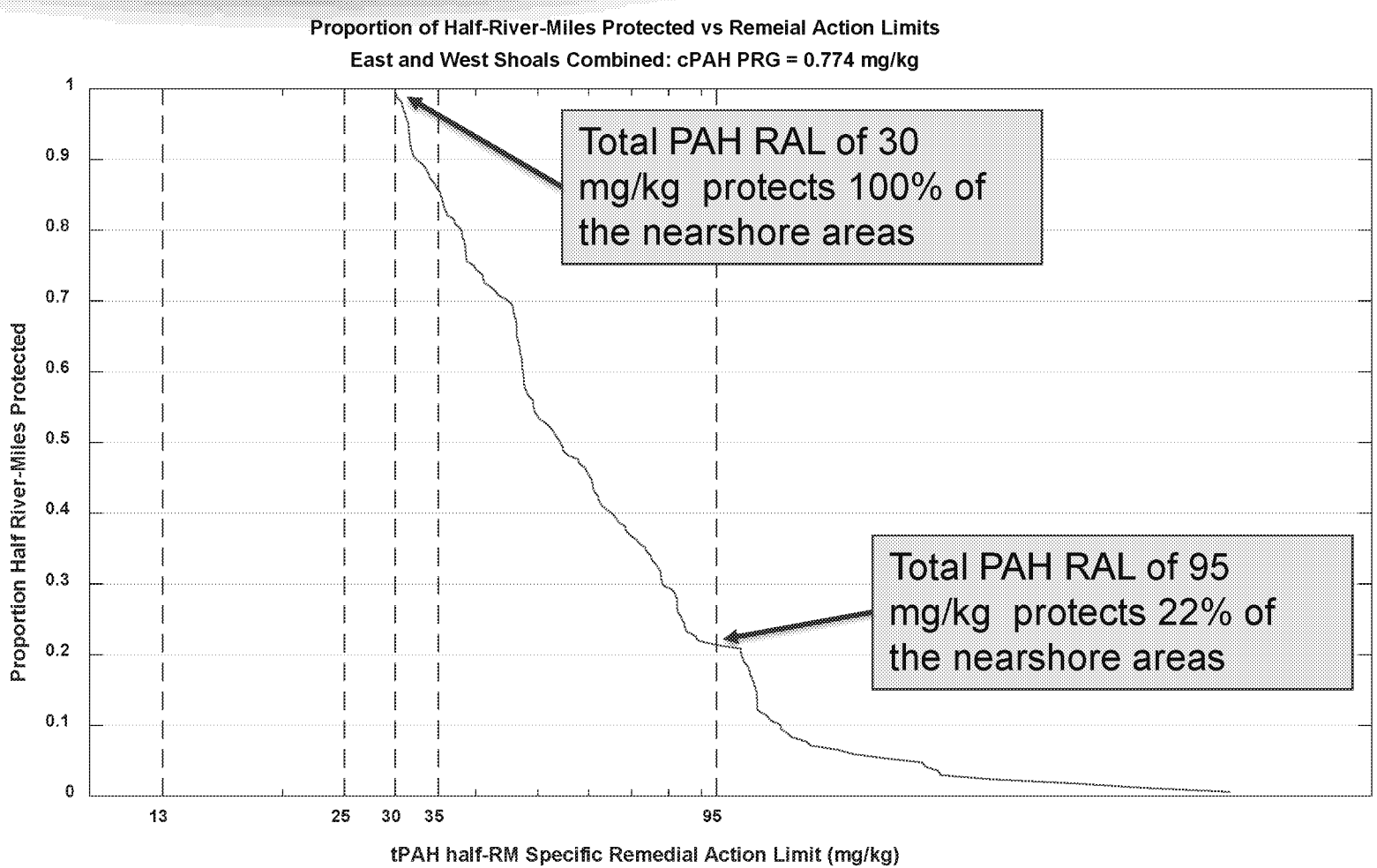
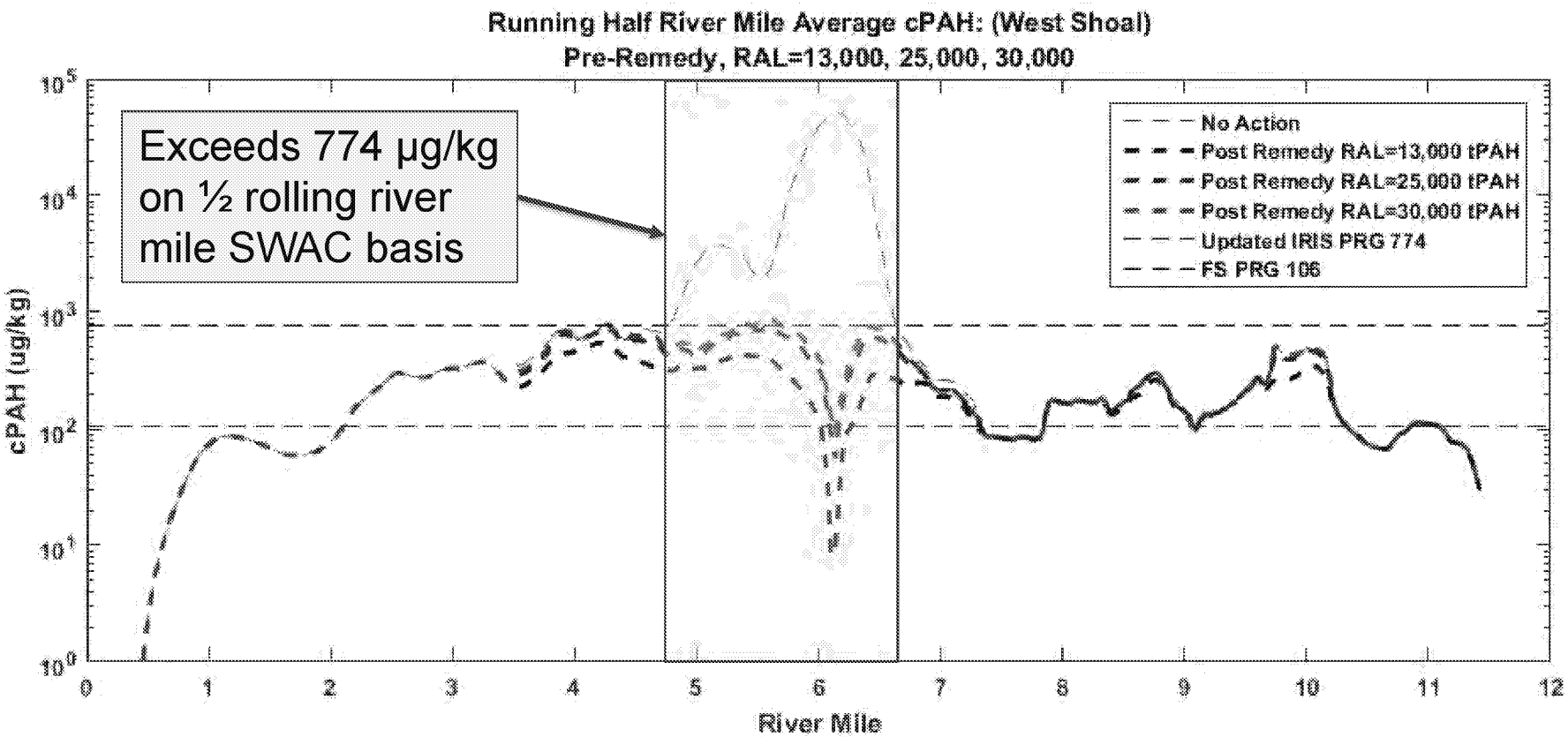
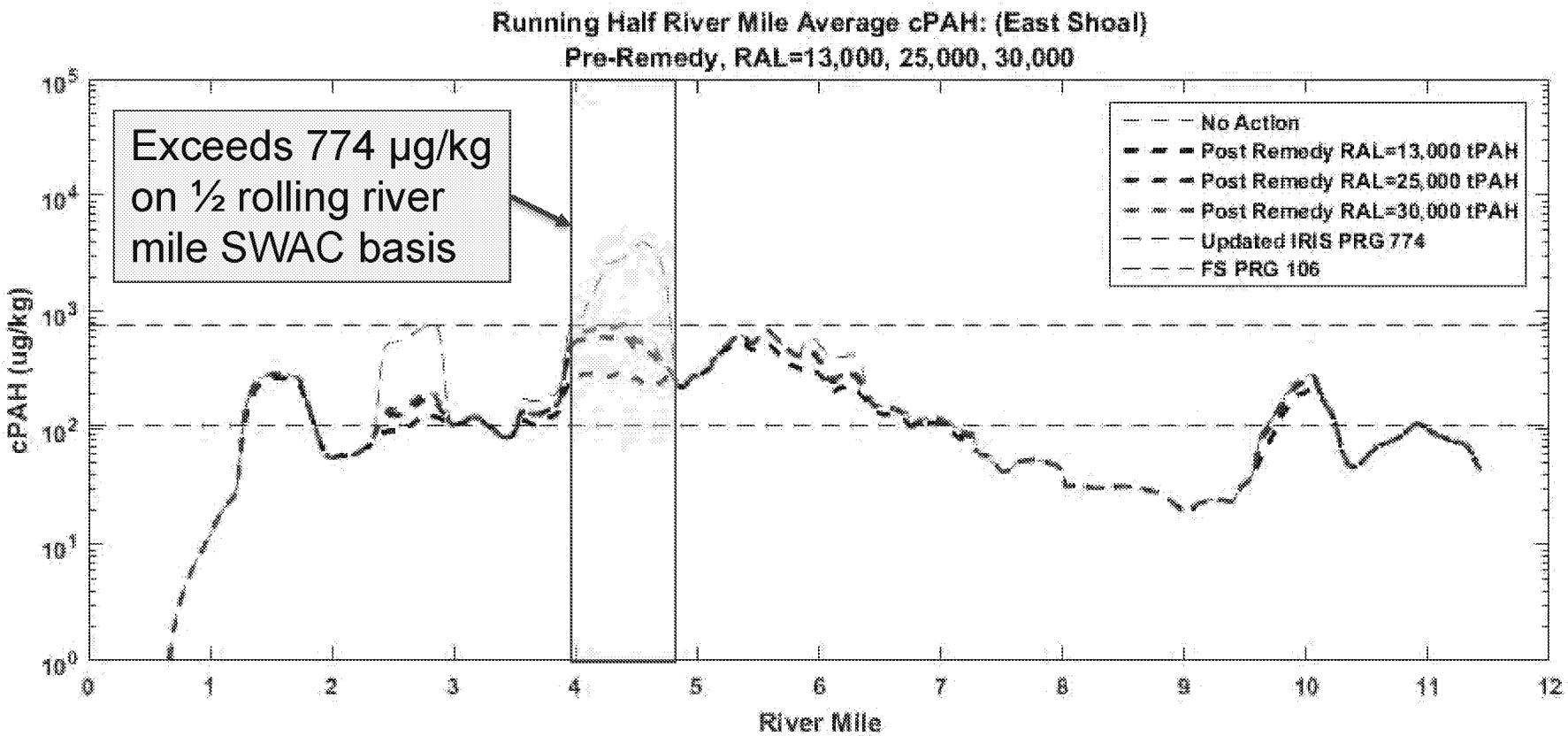
Backup Slides for Discussion

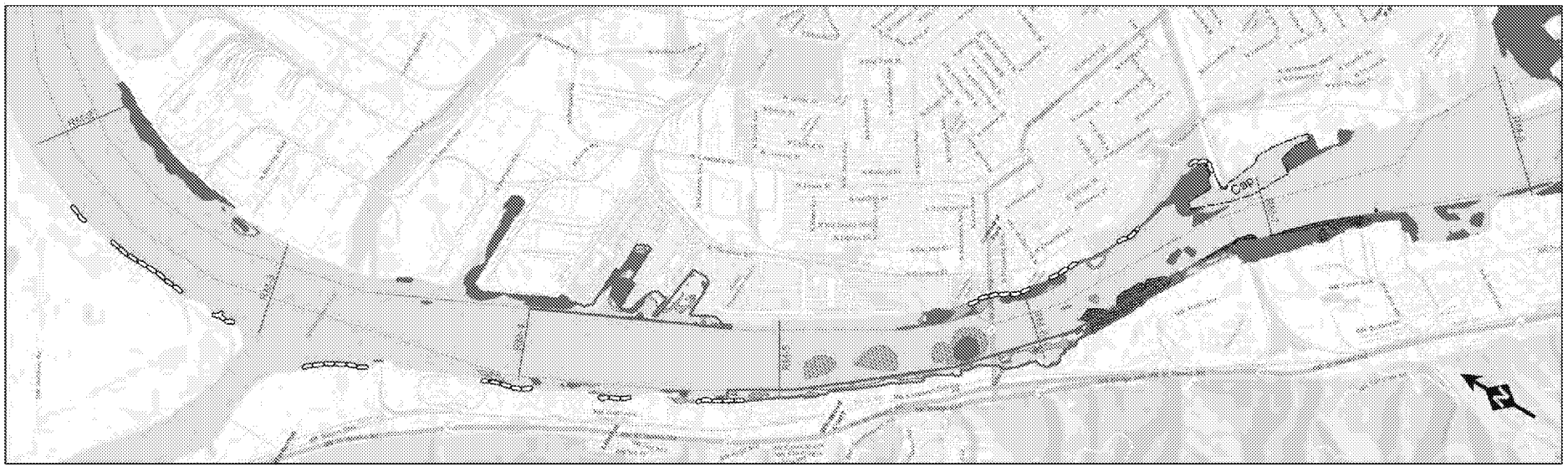

Proportion of Half-River-Miles Protected vs Remeial Action Limits
East and West Shoals Combined: cPAH PRG = 0.774 mg/kg
Proportion Half River-Miles Protected
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
13
25
30
35
95
tPAH half-RM Specific Remedial Action Limit (mg/kg)
Total PAH RAL of 30 mg/kg protects 100% of the nearshore areas
Total PAH RAL of 95 mg/kg protects 22% of the nearshore areas

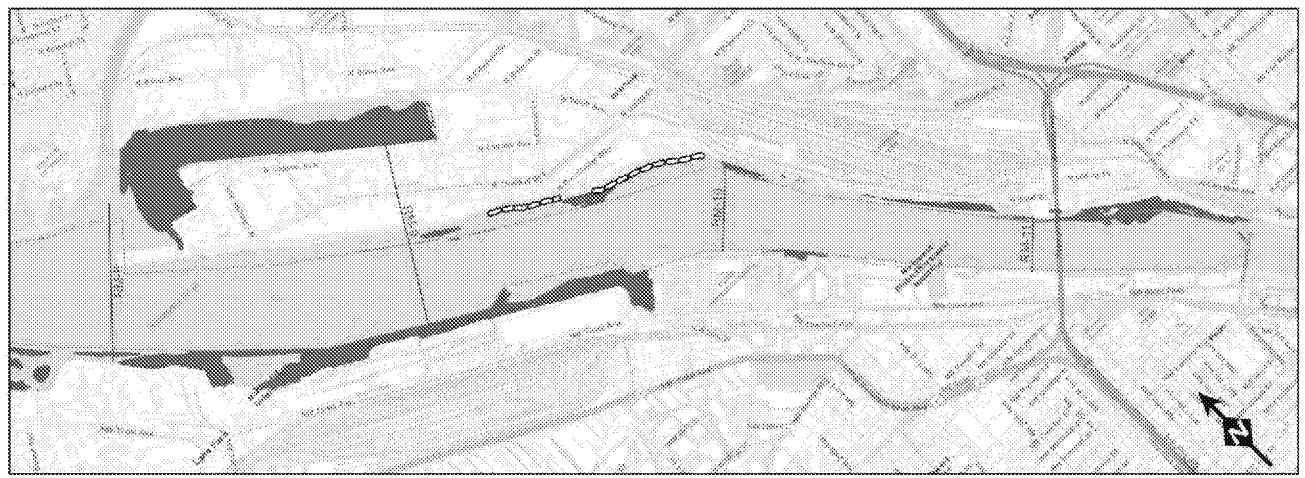


Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario



Note: cPAH ½ rolling river mile SWAC was estimated assuming cleanup above total PAH RAL for each scenario

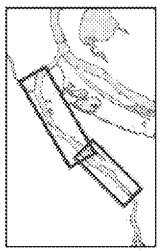




Legend

- Beach areas with cancer risk greater than 1x10-6 for child recreational beach users
- CPAHs that exceed 774 ug/kg in nearshore areas on a rolling river mile SWAC basis
- Remedial Footprint for focused COCs other than PAHs (including PTW)
- Remedial Footprint for PAHs in Nearshore Area – 30 ppm RAL
- Remedial Footprint for PAHs in Nearshore Area – 13 ppm RAL
- Remedial Footprint for PAHs in Navigation Channel – 170 ppm RAL
- PTW (NRC/NAPL)
- Navigation Channel

0 1,000 2,000 3,000 4,000
Feet



Source Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User

Figure X-X. Selected Remedy Footprint comparison

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Date: 1/2/2018

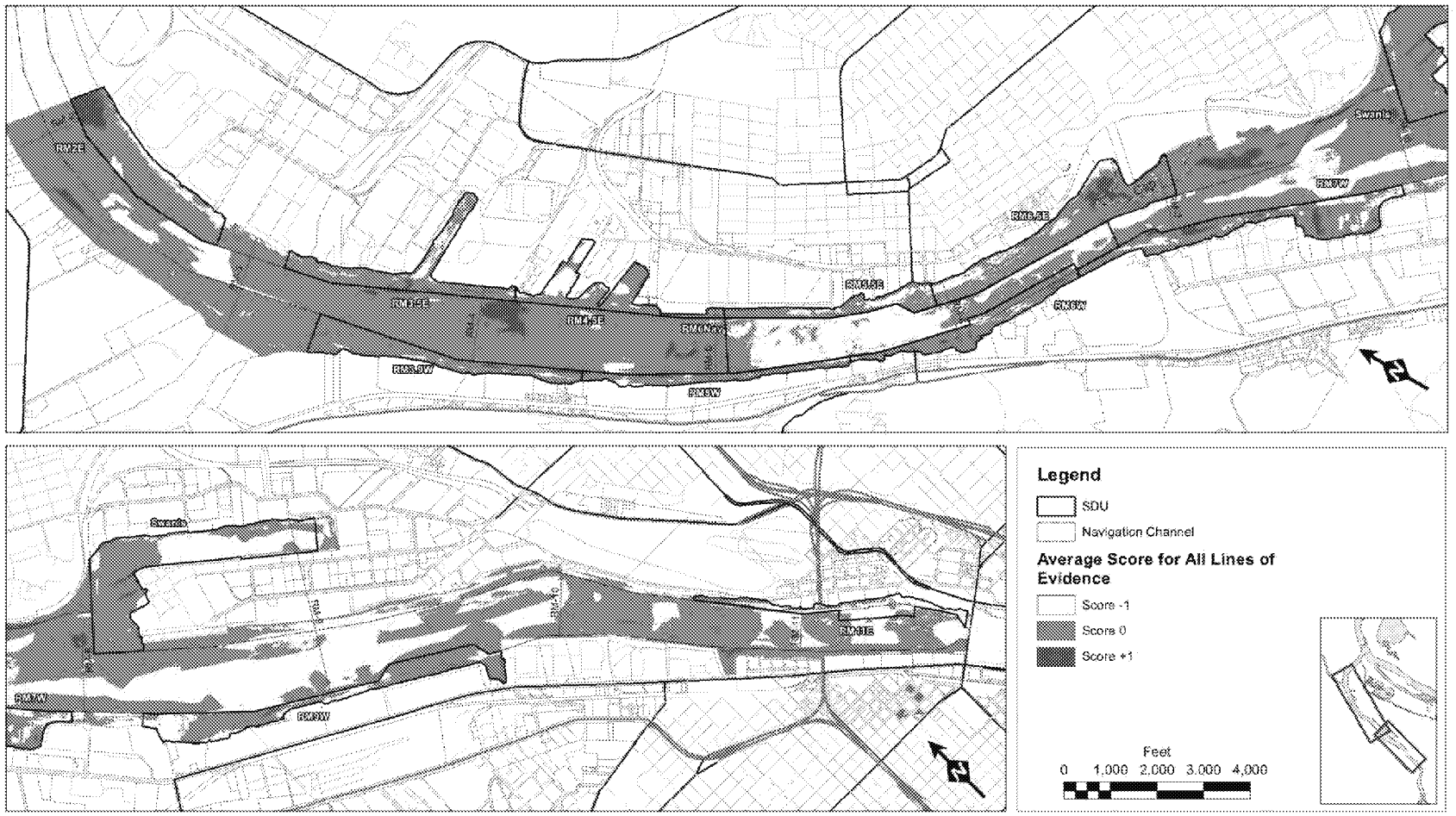

Figure D8-7. Average Score for Six Lines of Evidence

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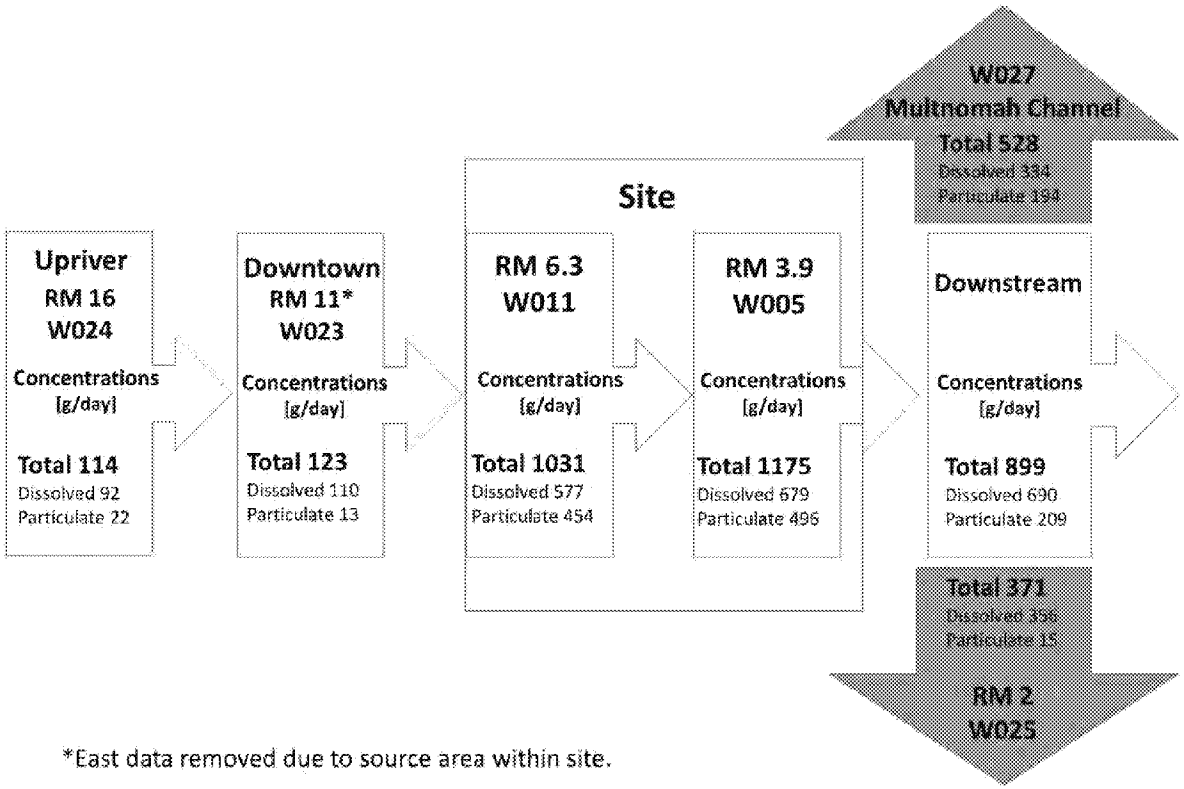
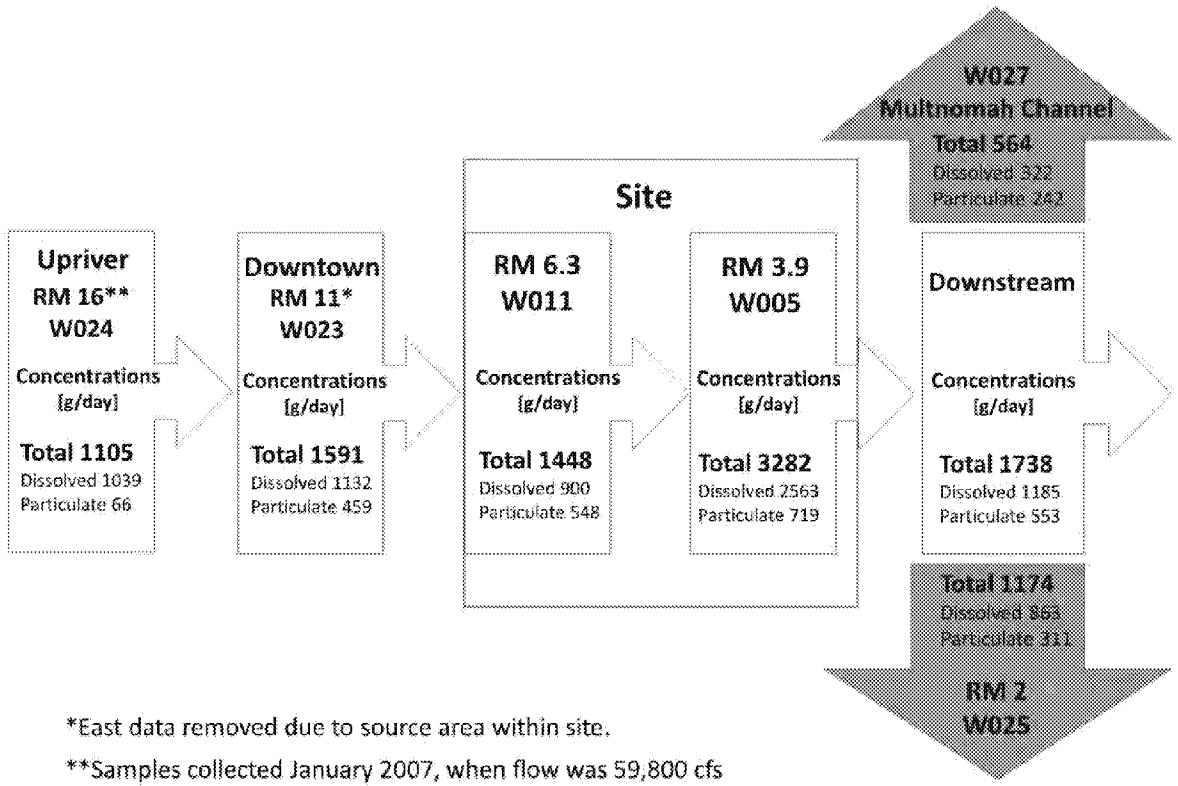


Figure 1.2-23a Portland Harbor Superfund Site PAH Loading Low Flow (Sept 2006) 8,730 cfs



*East data removed due to source area within site.

**Samples collected January 2007, when flow was 59,800 cfs

Figure 1.2-23c Portland Harbor Superfund Site PAH Loading High Flow (Feb-Mar 2007) 60,900 cfs

Remedial Footprint Area Summary

Scenario	Remedial Footprint (Acres)			Notes
	Current Remedy	Nearshore Total PAH RAL Change from 13 to 30 ppm	Remedial Footprint Change	
Total Remedial Area (All focused COCs)	364	340	24	Totals do not include 28 acres of ENR in Swan Island Lagoon
Contribution of PAHs to Remedial Area	66	42	24	Contribution of PAHs based on applicable RAL
Remedial Area below In-Water Sediment cPAH CUL (774 µg/kg)	18	3	15	Nearshore areas that do not pose risk based on comparison to revised in-water cPAH CUL
Navigation Channel NAPL/NRC PTW	6	6	0	No change in NAPL/NRC remedial footprint

Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136).

Human Health Risk:

Within the navigation channel, the current cleanup level is 3,950 ppb CPAHs and is based on the clam consumption exposure pathway. Direct contact with contaminated sediment is not considered a complete exposure pathway in the navigation channel. Surface water exposure pathways (ingestion, inhalation and dermal contact) are complete within the navigation channel. Although it is known that contaminated sediments contribute to surface water COCs, there is not a sediment cleanup levels associated with the protection of drinking water. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling ½ river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

PAH contaminated sediments within the Navigation Channel also pose risks to ecological receptors. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg, a value which is already 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." The areas that exceed the Navigation Channel RAL within the for PAHs are isolated to areas between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may further limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. Sediments within the navigation channel are significantly elevated in cPAH concentration and are likely contribute to cPAH exceedances of the human health and ecological AWQCs. As shown in Figures 3 and 4, taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that the high levels of PAH contamination within the Navigation Channel between RM 5 and 6.6are contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, RAOs 3, 5, and 7 are not affected by the IRIS change. Due to the exceedances of the benthic cleanup levels in the navigation channel between RM 5 and 7, the limited effectiveness of MNR in that area, and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor is not warranted in the navigation channel area.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

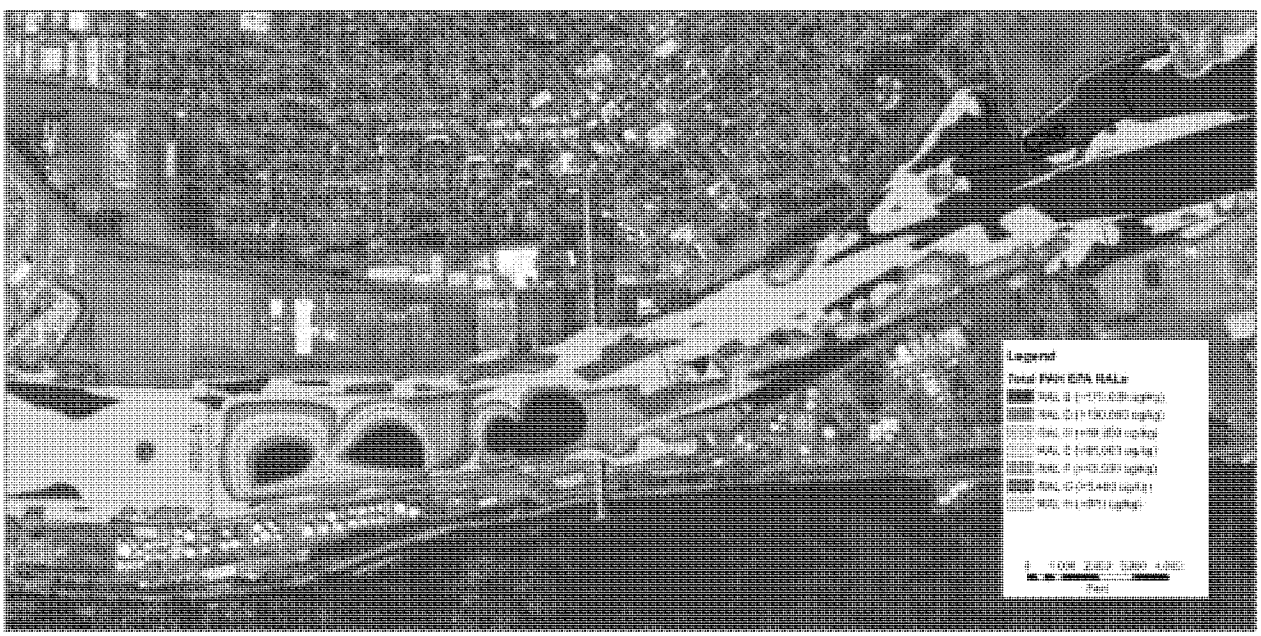


Figure 2 – MNR Average Score for Six Lines of Evidence

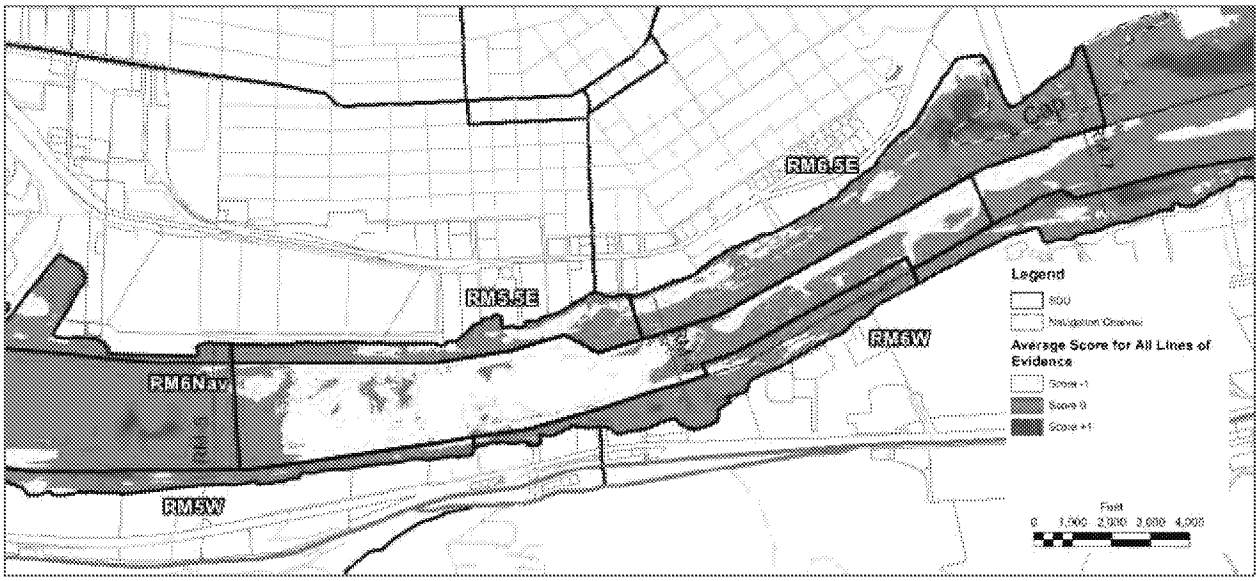


Figure 3 – PAH Loading under Low Flow Conditions

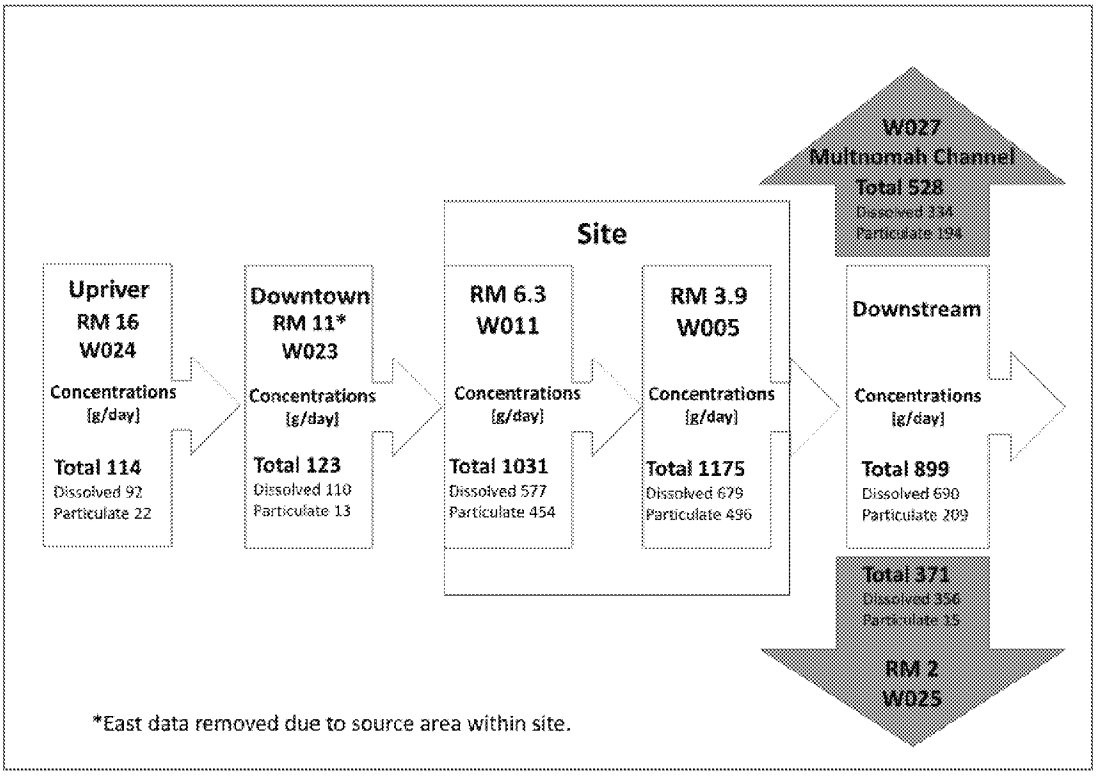
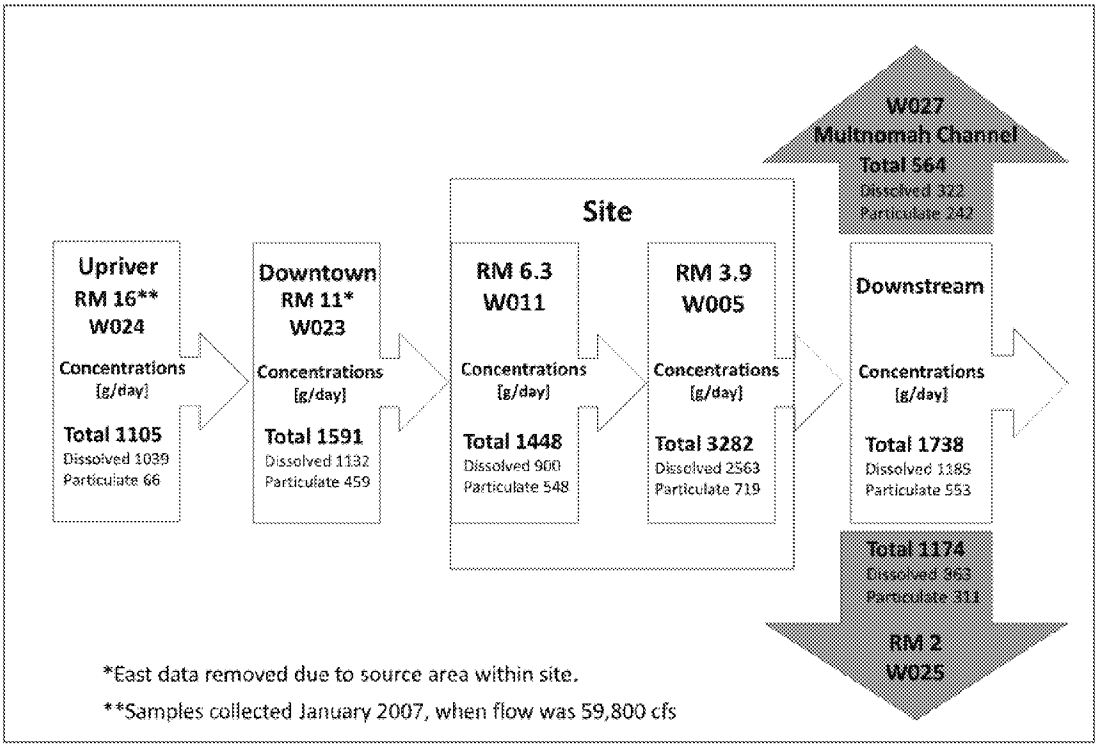


Figure 4 – PAH Loading under High Flow Conditions



Appendix A6

9-7-17 Email from Kevin Parrett (DEQ), Subject: H Benthic Risk - 8-23-17.pptx

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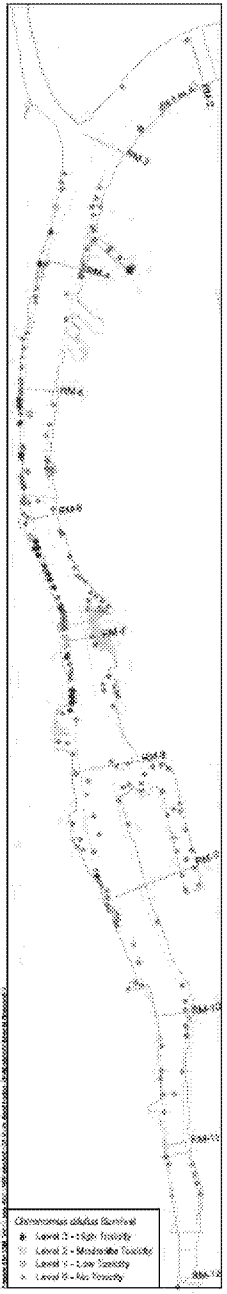
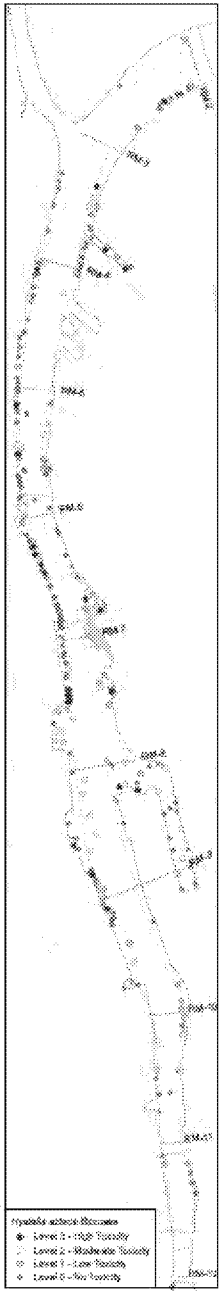
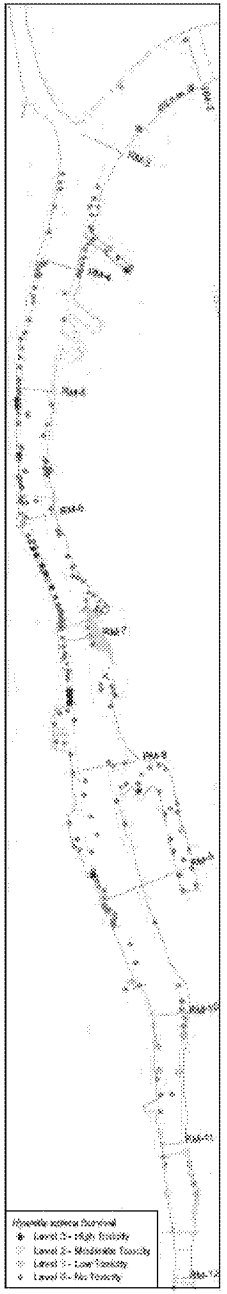


Map 8-2
Chironomus dilutus Survival
Bioassay Results

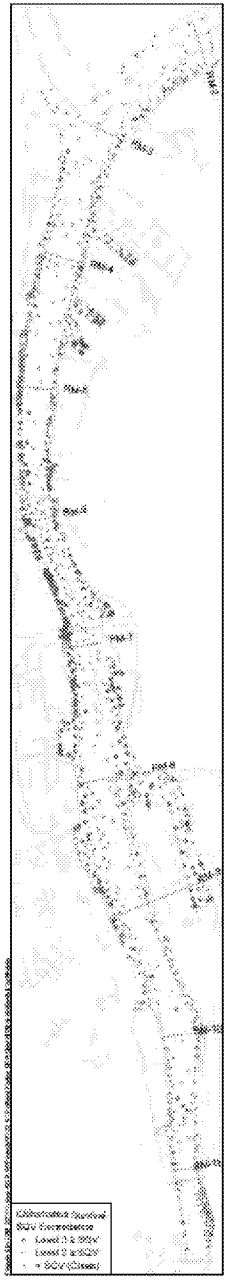
Map 8-3
Chironomus dilutus Biomass
Bioassay Results



Map 8-4
Hyalella azteca Biomass
Bioassay Results



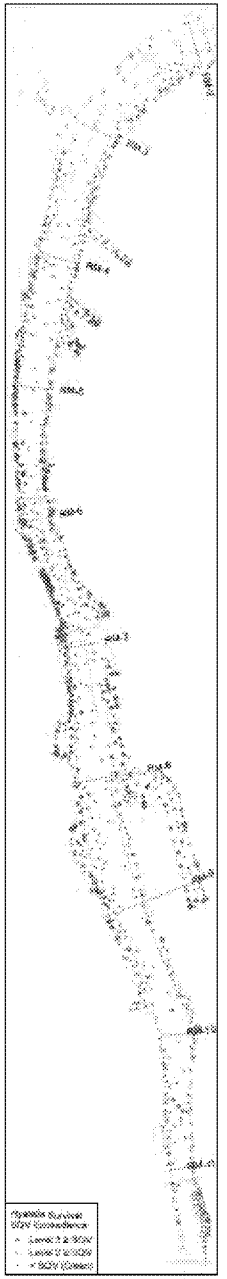
Map 8-5
Hyalella azteca Survival
Bioassay Results



Map 8-7
Exceedance of Site-Specific PRM SQVs
based on Chironomus dilutus Survival

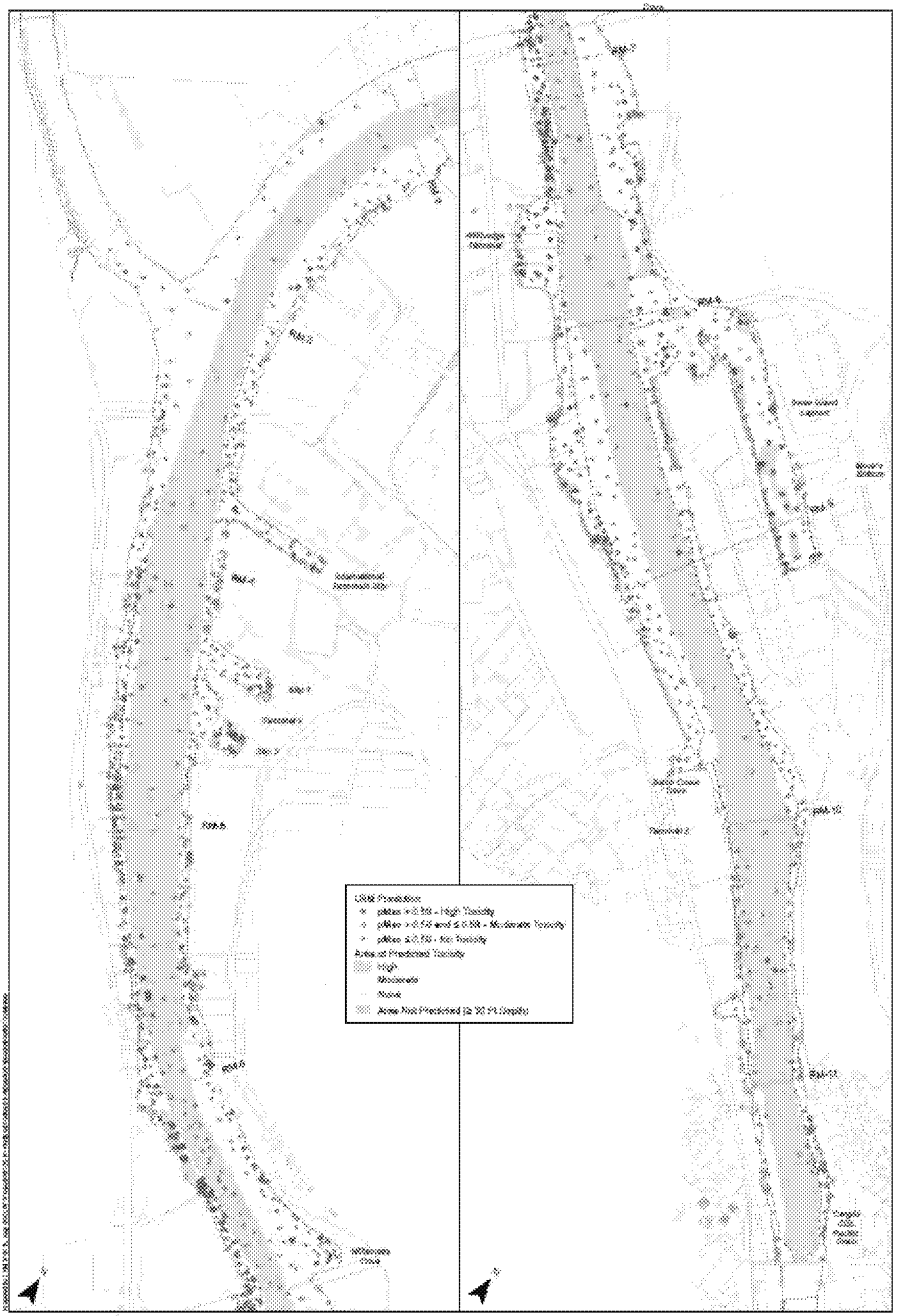
Map 8-8
Exceedance of Site-Specific PRM SQVs
based on Chironomus dilutus Biomass

Map 8-9
Exceedance of Site-Specific PRM SQVs
based on Hyalella azteca Biomass

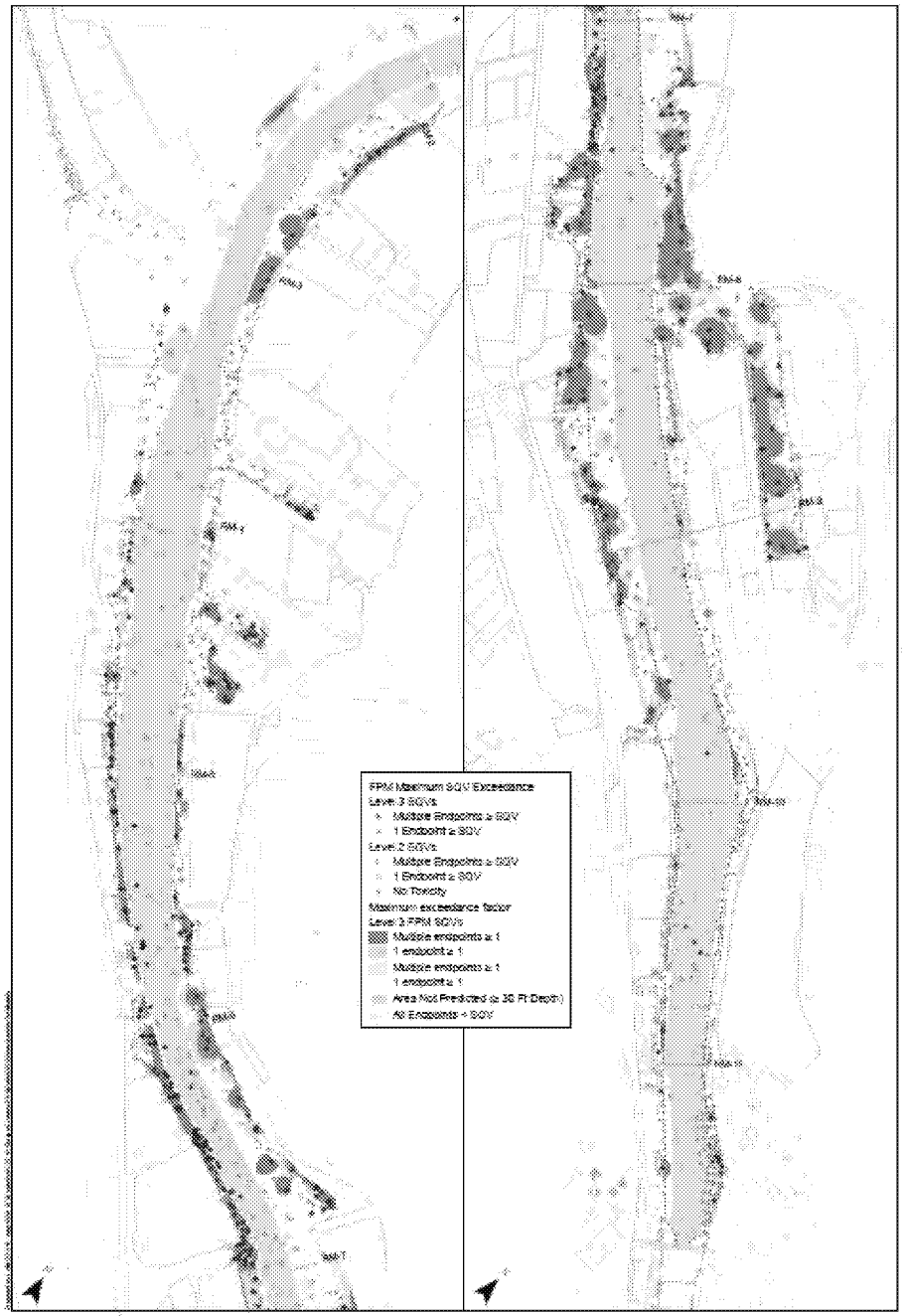


Map 8-10
Exceedance of Site-Specific PRM SQVs
based on Hyalella azteca Survival

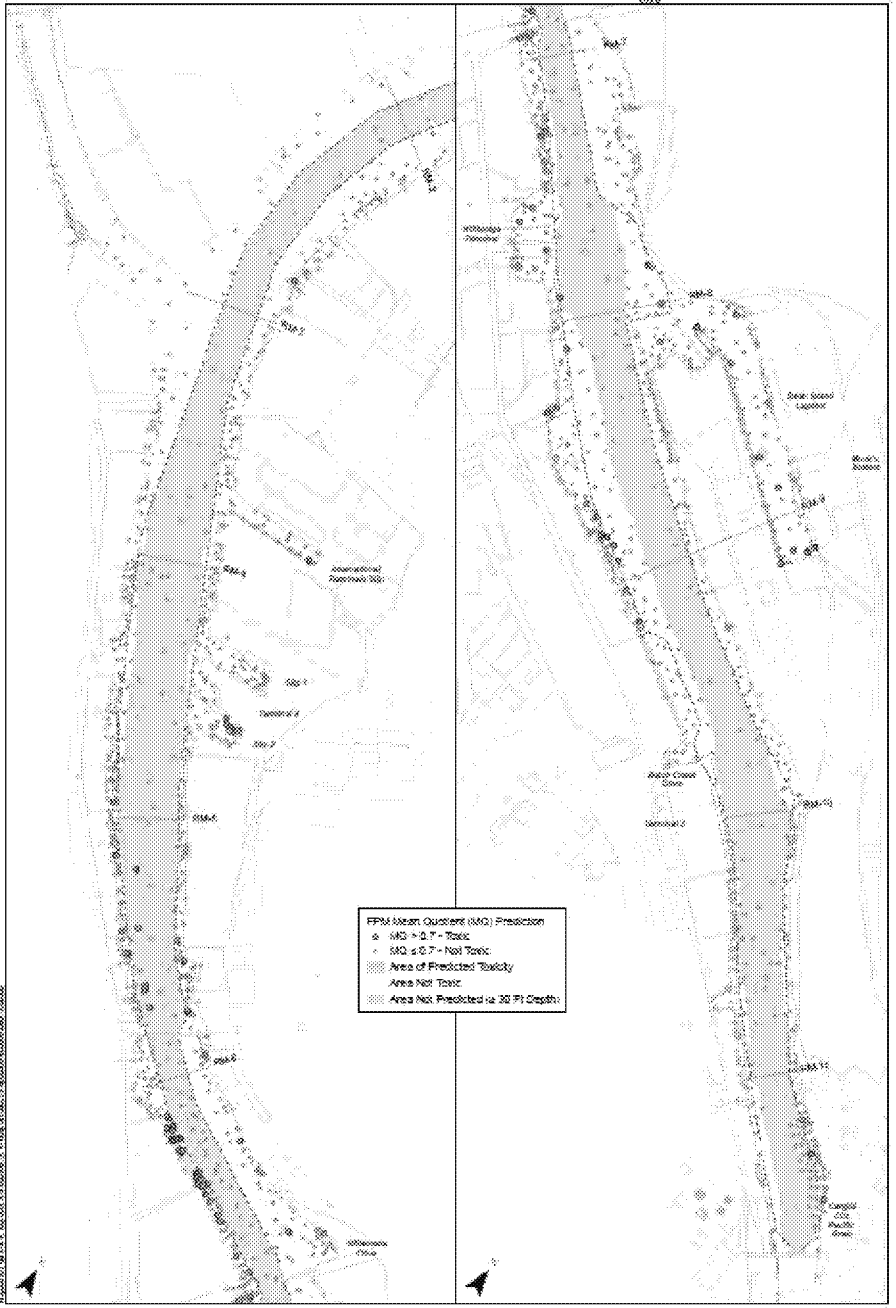
Portland Harbor RI/FS
Baseline Ecological Risk Assessment



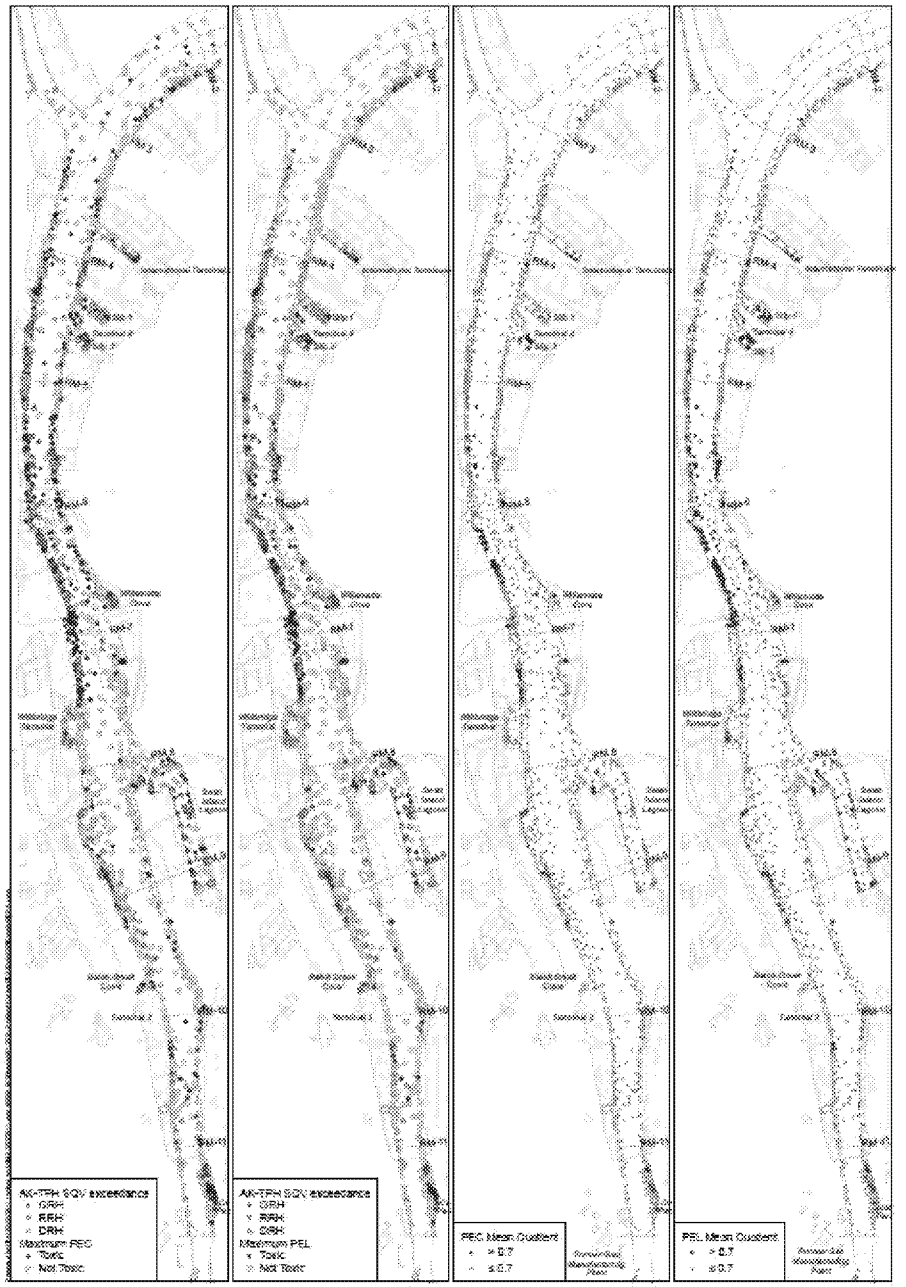
Map 6-11
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Toxicity Predicted from
Site-Specific LRM pMax



Map 6-12
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Number of Endpoints Exceeding FPM SQVs
Based on Maximum Exceedance



Map 6-17
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Toxicity Predicted from
FPM Mean Quotients



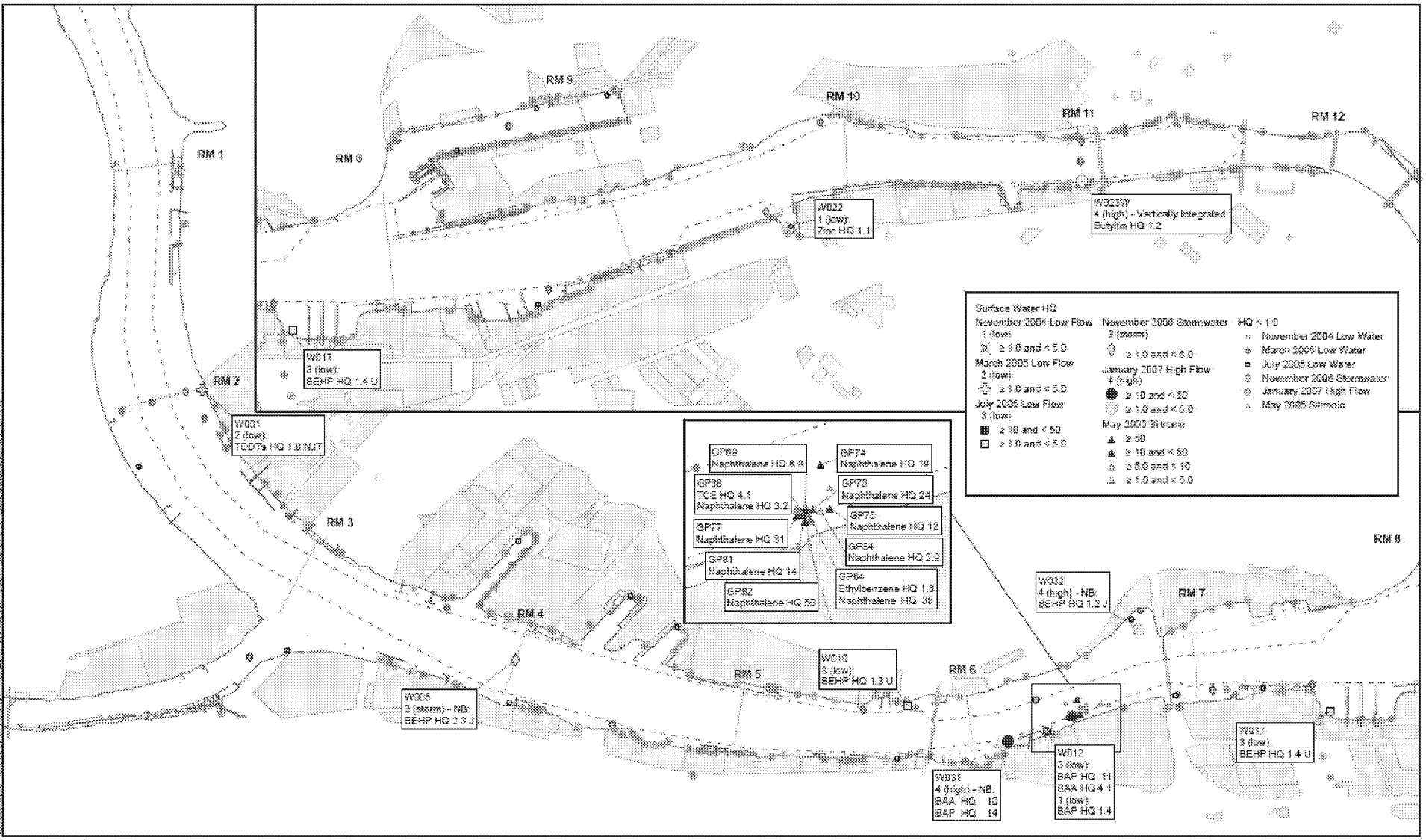
Map 6-18
Maximum Exceedance and Not Low Toxicity Based on PEC

Map 6-19
Maximum Exceedance and Not Low Toxicity Based on PEL

Map 6-20
Exceedance Based on PEC Mean Quotient

Map 6-21
Exceedance Based on PEL Mean Quotient

Portland Harbor RI/FS
Baseline Ecological Risk Assessment



Windward LLC

LWG Lower Willamette Group

0 1,000 2,000 3,000 4,000 5,000 Feet

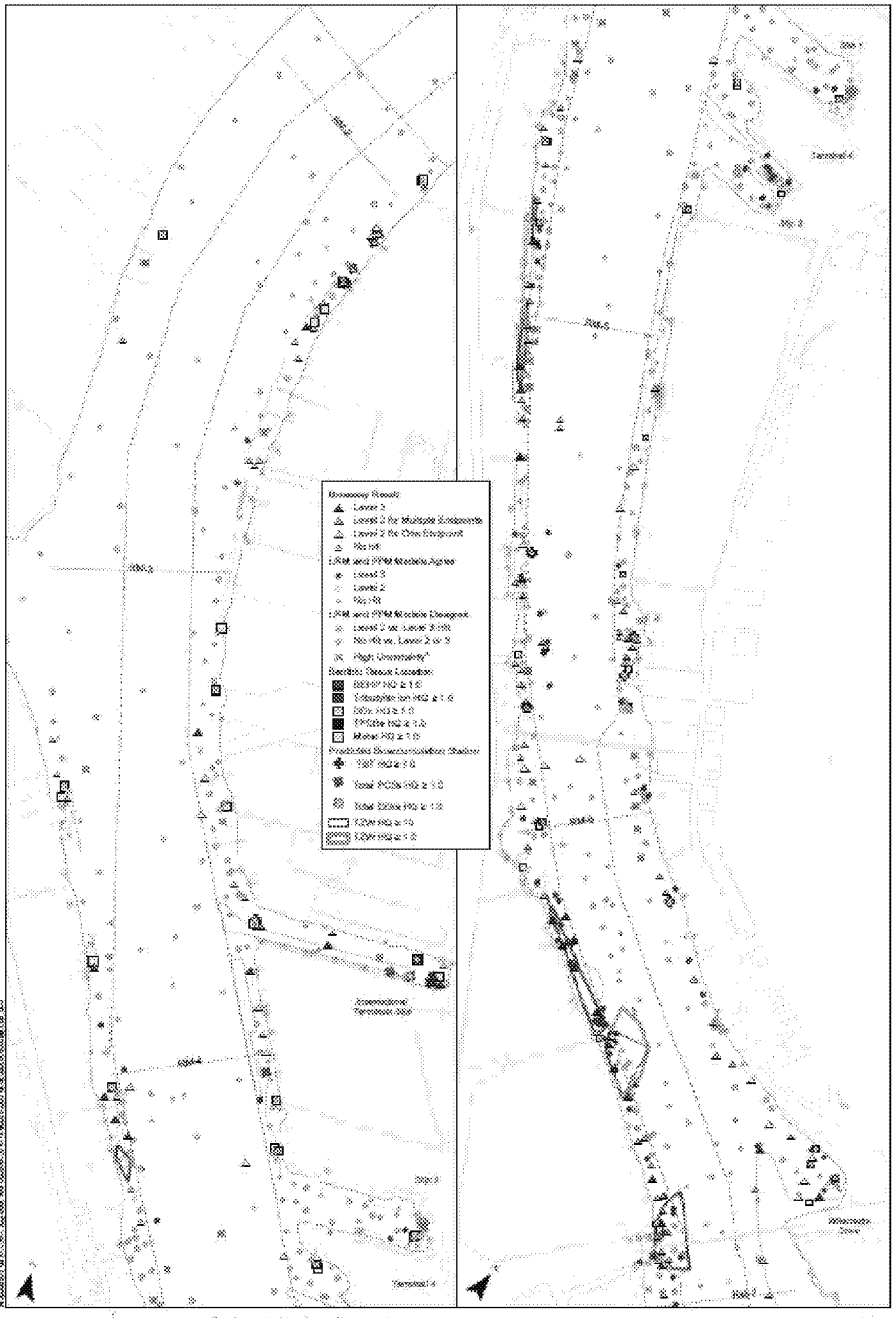
Map Features

Outfalls
- Outfall
- Dock Drain
- Roof Drain

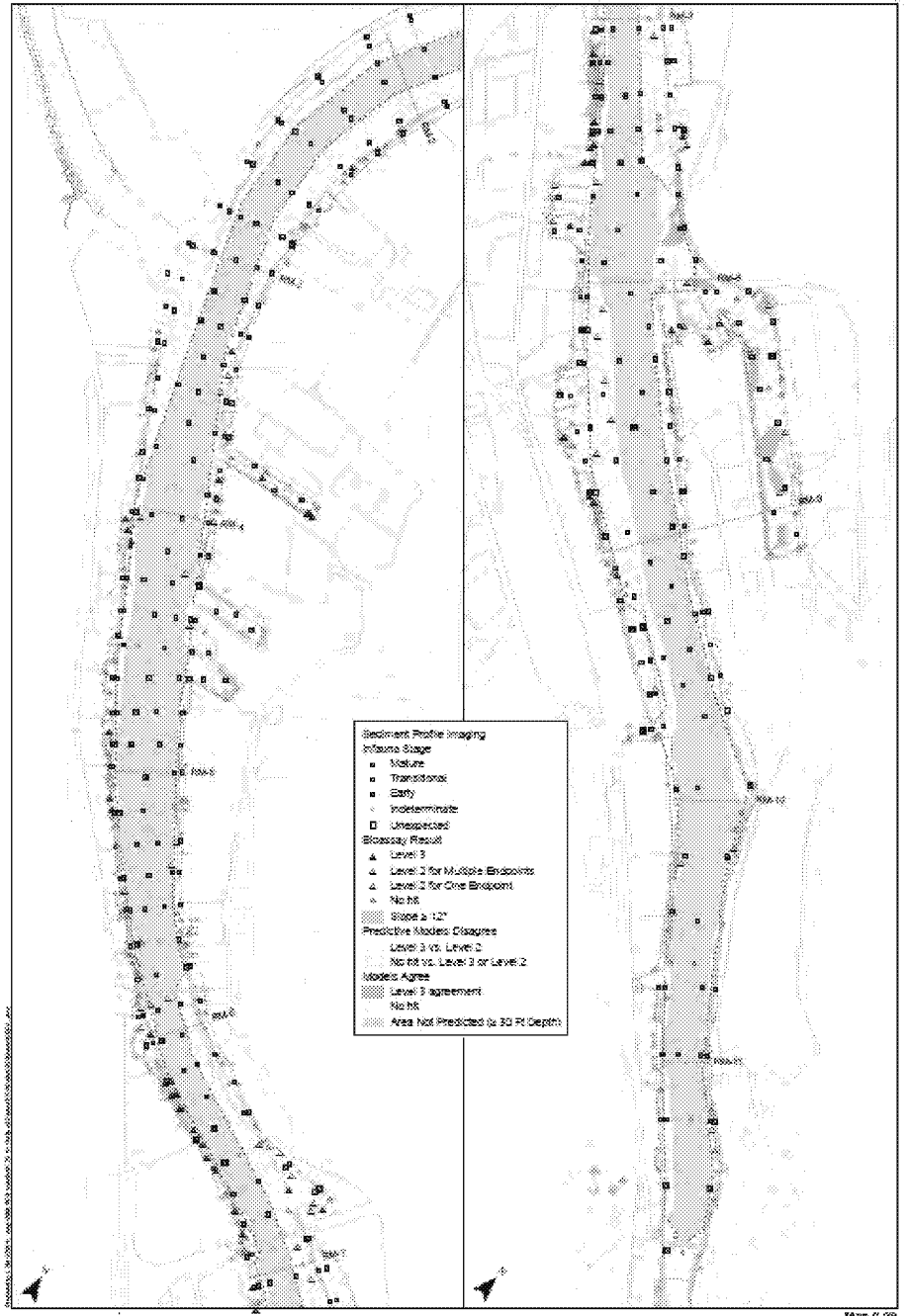
- Bridges
- Docks and Structures
- Upland ECSI Sites (2008)

- River Miles
- Navigation Channel
- River Edge +13 ft NAVD

Map 6-27
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Surface Water HQs for Sampling Locations
in the Portland Harbor Study Area



Map 6-28a
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Weight of Evidence in
RM 1.9 to RM 7



Map 6-29
Portland Harbor RI/FS
Baseline Ecological Risk Assessment
Benthic Infauna Stages and
Empirical and Modeled Toxicity

Appendix A7

9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx

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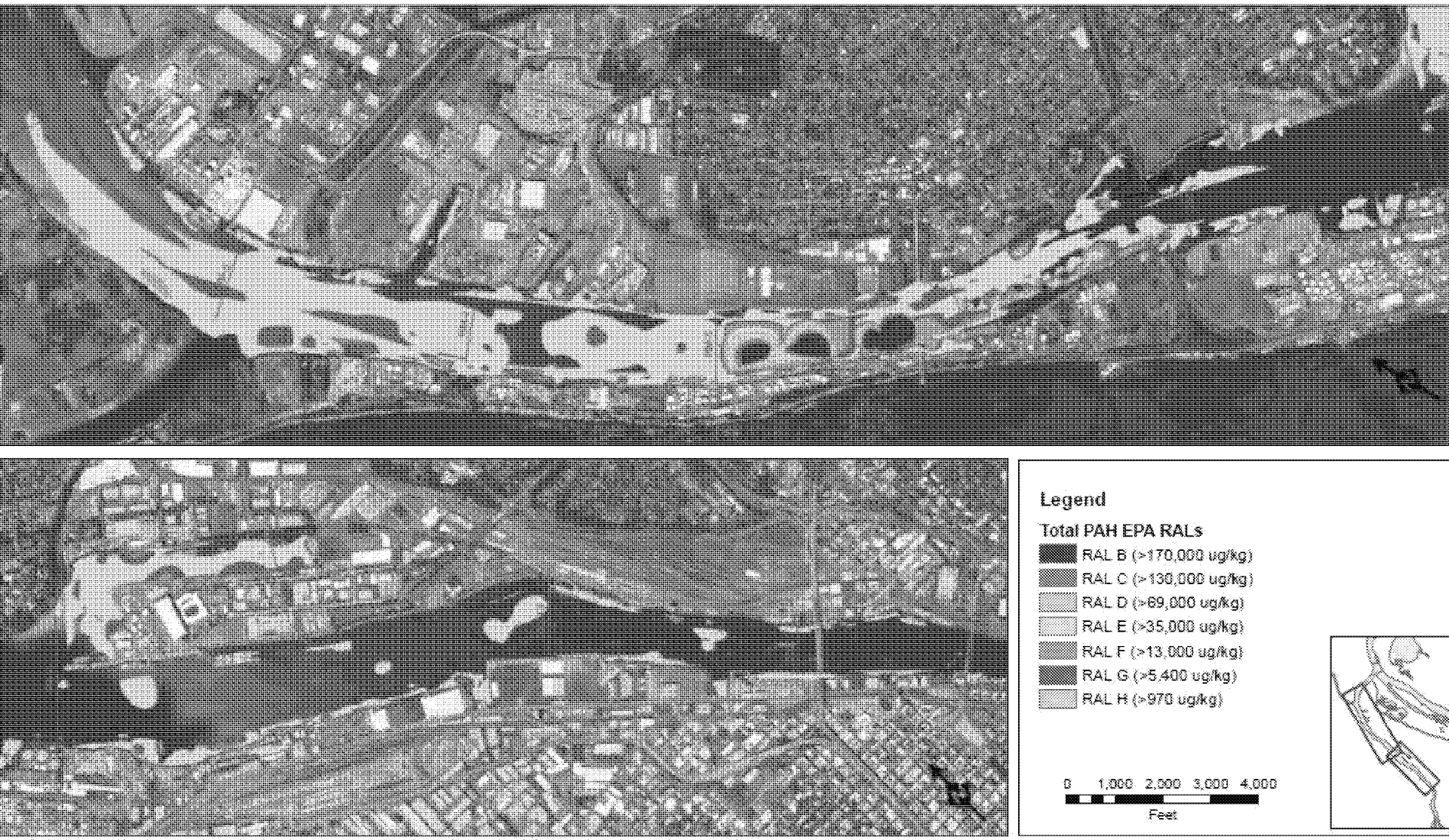


Figure 3.4-8. Total PAH RAL Contours

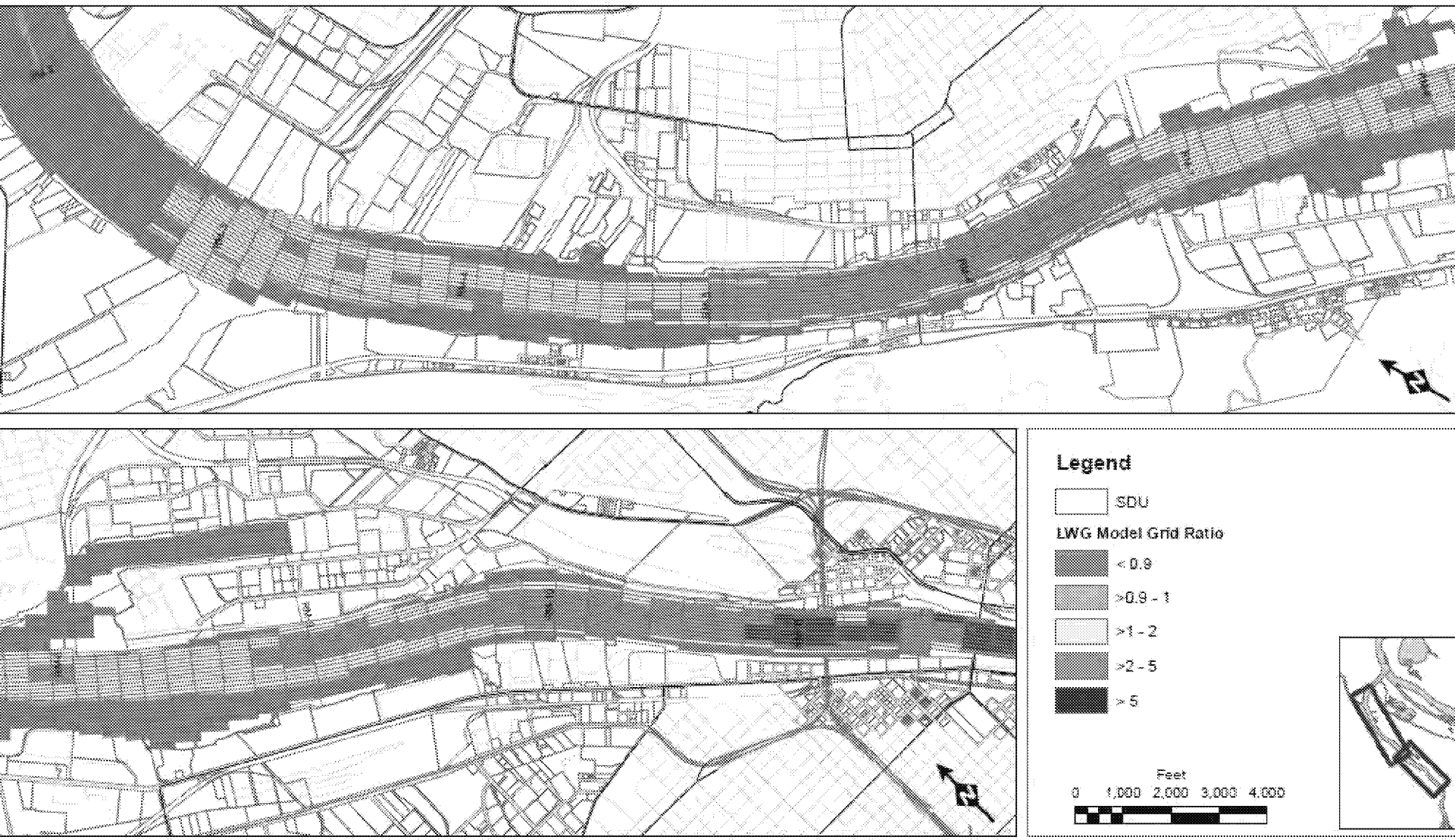


Figure 3.4-18c. Ratio of Bed Shear Stress (Pa) to Critical Bed Stress for Erosion (Pa) at Peak of Two-year Flood

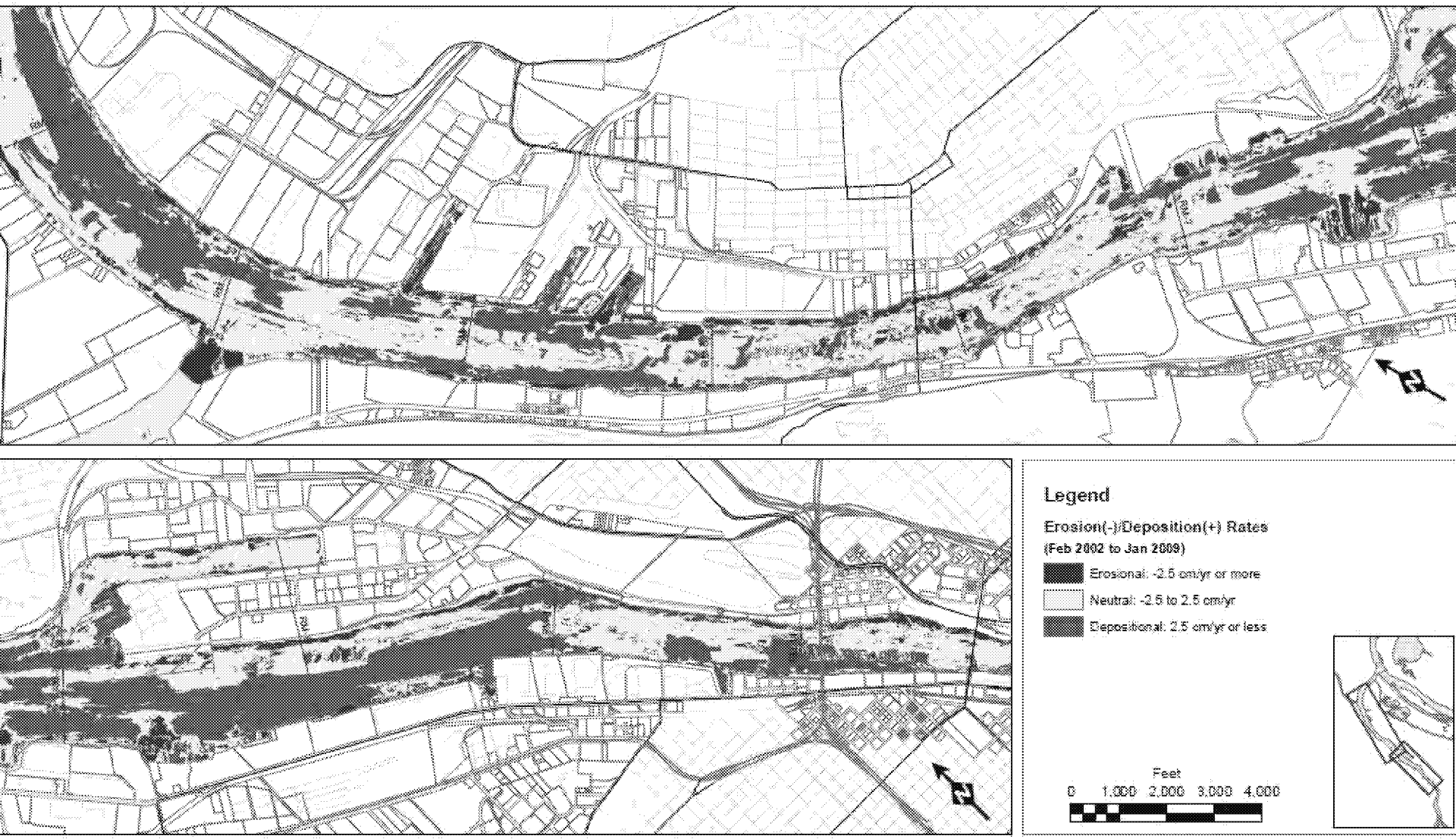
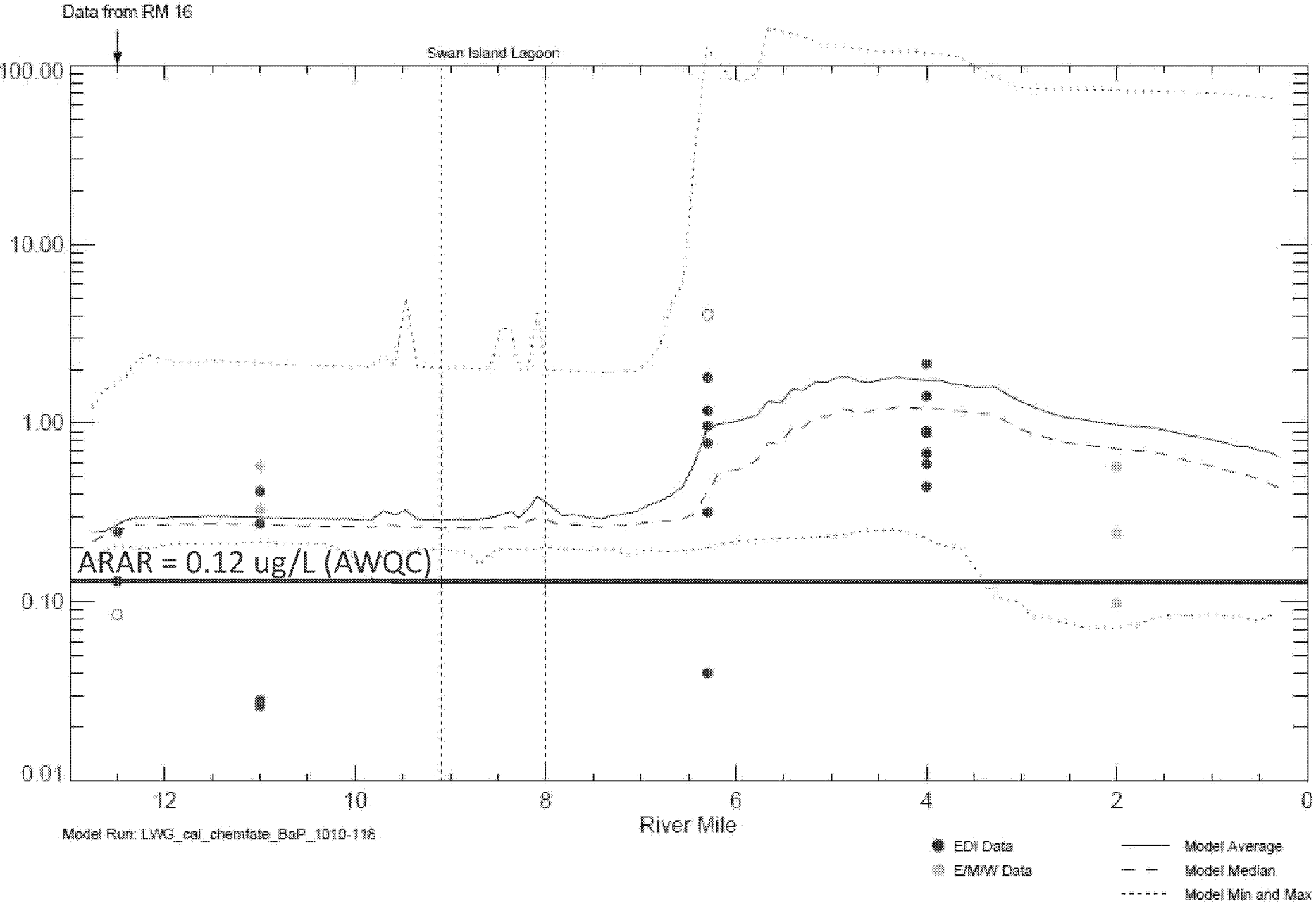


Figure 3.4-20. Sediment Deposition Rates



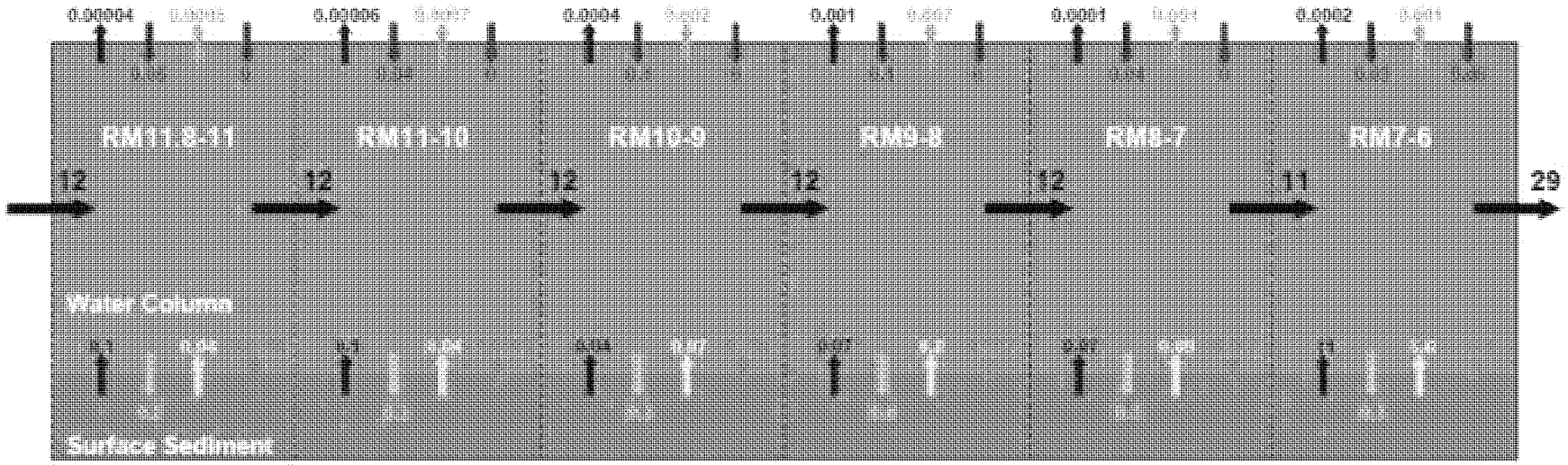
ANCHOR QEA
DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part

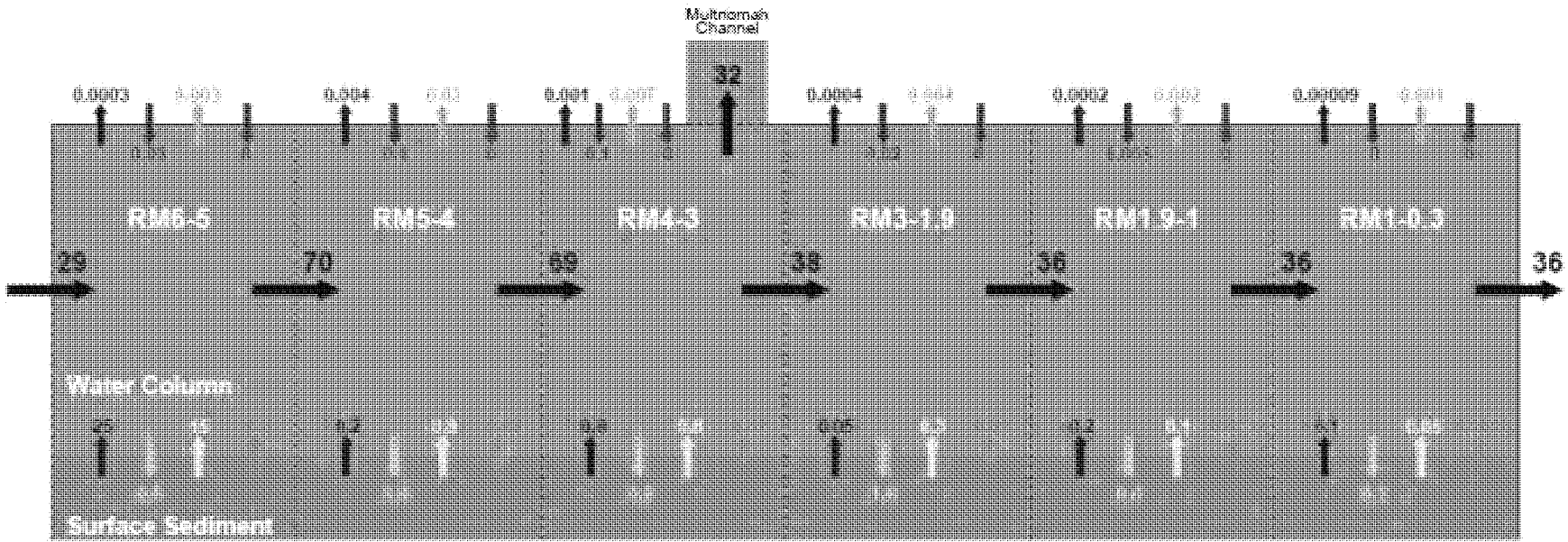
Figure 3.3-2

Portland Harbor RI/F

Draft Feasibility Stu

Units are kilograms/year





Advection + Dispersion
Erosion
Deposition
PW Exchange
Groundwater
Decay
Volatilization
Stormwater Discharges
NPDES Discharges

Appendix A8

Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017

DRAFT

IEc

MEMORANDUM | September 26, 2017

TO Sean Sheldrake, United States Environmental Protection Agency (EPA)

FROM Gail Fricano, Rachel DelVecchio, and Dr. Rita Cabral (Industrial Economics, Inc.)

SUBJECT Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor

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PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" (from Amy Nelson and Taku Fuji, Anchor QEA, to Bob Wyatt, NW Natural).

OVERARCHING CONCERNS

1. The NW Natural memorandum advocates for increasing cleanup levels and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) at the Portland Harbor Superfund Site (PHSS) based on EPA's January 19, 2017, updates to the benzo(a)pyrene cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS). Modifying the cleanup levels and RALs would constitute a major change to the Record of Decision (ROD). In particular, a change to the RALs would warrant a ROD amendment. Issuing a ROD amendment is a very lengthy process that would significantly delay the cleanup schedule, likely by several years. As iterated in past comments to EPA, the Five Tribes urge EPA to achieve a timely and thorough cleanup of the PHSS in order to restore its myriad uses to the public and achieve a healthy ecosystem as quickly as possible. The community has waited long enough for a cleanup plan. We urge EPA to keep on schedule and begin in-water cleanup as soon as possible. We are deeply concerned about the effects of considering changes to the RALs on the project schedule.
2. EPA's cleanup plan was developed with meaningful input from the Five Tribes and other tribal, state, and federal partners, as well as the community and other interested parties. The Five Tribes have frequently provided input on numerous technical issues over many years. In developing the ROD, EPA weighed feedback provided at government-to-government consultations with the Five

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Tribes, as well as our written comments on the Proposed Plan provided during the public comment period. If EPA is considering changing the PAH RALs, a change that would likely require a ROD amendment, the Five Tribes assert our right to request government-to-government consultations with EPA so that our input on such an important potential change may be fully considered.

TECHNICAL COMMENTS

3. NW Natural's proposed change to the navigation channel cleanup level and RAL is based on the ROD remedial action objective (RAO) 2 (clam consumption by humans) cleanup level of 3,950 ug/kg carcinogenic PAH (cPAH). The ROD RAO 5 (benthic risk) cleanup level of 23,000 ug/kg total PAH (TPAH) that is also applicable to the navigation channel is not affected by the CSF update because the CSF is relevant to human health risk and not ecological risk. It appears that converting 23,000 ug/kg TPAH to cPAH using EPA's regression would yield a cPAH concentration of approximately 2,700 ug/kg. This value is substantially lower than NW Natural's proposed cPAH cleanup level of 108,000 ug/kg based on the ROD's RAO 2 cleanup level and the updated CSF. We are uncertain whether we are correctly applying the relevant risk-based concepts in this case, but the cleanup level should always default to the lowest value across RAOs; with the CSF update, the appropriate value for the navigation channel sediment cleanup level may now be based on RAO 5.

4. The ROD cPAH surface water cleanup level is based on the federal human health water quality criteria protective of fish consumption. NW Natural proposes changing the surface water cleanup level by applying the CSF update to the federal criteria. The federal criteria went through an extensive public review process and are published in the Federal Register (80 FR 36986). These criteria constitute applicable or relevant and appropriate requirements (ARARs) for the PHSS. Thus, the published values must be applied at the PHSS and cannot be changed without a rulemaking. Similarly, the Oregon water quality standards are promulgated standards that cannot be changed without a rulemaking.

5. The development of cPAH RALs for the nearshore area and navigation channel based on the updated CSF is not a straightforward exercise. NW Natural's two approaches to revising the RALs, "proportional adjustment approach" and "risk reduction approach," are inconsistent with the approach that EPA presented in the ROD, which instead considers surface-weighted average concentration (SWAC) reductions for a spectrum of RAL options. It may not be appropriate to adjust the RALs based on a direct relationship with cleanup levels. This inconsistency in methodology highlights the importance of careful consideration and discussion among EPA and their tribal, state, and federal partners of methods presented in the NW Natural memorandum, as well as alternative methods.

6. The CSF update to benzo(a)pyrene is only applicable to human health pathways and, as we assert above, is only relevant to sediment unless new federal and state water quality criteria are promulgated. EPA would need to evaluate whether NW Natural's proposed sediment RALs for the nearshore area and navigation channel are likely to achieve the surface water cleanup levels. In addition, as noted above, EPA must determine whether ecological pathways become driving factors of PAH cleanup (i.e., provide the basis for the PAH RAL) if the CSF update is applied to human health-based cleanup levels. Lastly, if PAH RALs were to be changed, EPA must determine the extent to which areas formerly considered PAH-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs) or non-aqueous phase liquid (NAPL)/not reliably contained (NRC) principal threat waste (PTW).

Appendix A9

Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017

DRAFT

IEc

MEMORANDUM | October 11, 2017

TO Michelle Pirzadeh, United States Environmental Protection Agency (EPA)

FROM Gail Fricano and Rachel DelVecchio (Industrial Economics, Inc.)

SUBJECT Terminal 4 Negotiations Regarding Human Health Risk and Remedial Action Levels (RALs)

PURPOSE

This memorandum provides comments on behalf of the Five Tribes[1] on topics raised by the Port of Portland (Port) related to implementation of the Portland Harbor Superfund Site (Site) Record of Decision (ROD) at Terminal 4 (T4). Our comments focus on two issues raised in a series of briefing papers developed by the Port and shared with the United States Environmental Protection Agency (EPA) on August 16, 2017, titled "Terminal 4 Overview" (3 pp. plus figure) and "Human Health Direct Contact Risk at Terminal 4" (3 pp.). The issues are: (1) whether the human health direct contact pathway at T4 is complete, and if not, whether EPA's cleanup standards should be relaxed; and (2) whether navigation channel remedial action levels (RALs) should be applied at T4 rather than the Site-wide RALs. We have serious concerns about the Port's perceptions of and implied proposals regarding these issues, and we urge EPA to fully consider our comments below during upcoming discussions with the Port. In addition, we note that many of the comments we provided to EPA on October 9 related to Pre-RD Group negotiations also apply to discussions with T4, as described below.

HUMAN HEALTH DIRECT CONTACT RISK

The Port asserts that the human health risk exposure pathway may not be complete across the entirety of T4 due to site-specific characteristics including relatively deep (-30 to -40 feet Columbia River Datum) waters, the Baseline Human Health Risk Assessment's determination that beach use was not an applicable exposure scenario at T4, and the active, secure nature of the marine terminal facility that would limit human access to the area. The Port does not propose a specific resolution related to these assertions, but rather requests that EPA work with the Port to create a Remedial Design/Remedial Action process that accounts for these site-specific conditions at T4. The Port implies that cleanup levels should be relaxed because of the alleged lack of direct human contact at T4. The Five Tribes do not support relaxing cleanup levels at T4, and we urge EPA to consider the following points when discussing a path forward with the Port.

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

1. EPA must develop a remedy that is protective of Tribal treaty rights, which provide for Tribal fishing throughout the Site, including T4.
2. The Port asserts that it "operates an active, secure marine terminal facility," and "direct contact exposures are further limited by active marine terminal operations, including frequent vessel calls " (Human Health Direct Contact Risk at Terminal 4 briefing paper, p. 2). While we agree that these characteristics presently limit recreational access to the river, it is unknown whether this area will remain an active, secure facility in the future, for instance, in 100 years or more. The remedy must be protective in perpetuity, and current security measures at T4 do not provide sufficient assurance that recreational users will not access the area in the future. Further, it is uncertain whether these characteristics ensure a complete absence of recreational access, as institutional controls at Superfund sites are widely acknowledged to not be entirely effective. In addition, EPA must ensure that a remedy is protective of workers at T4, who also may be directly exposed to contamination, including contaminated sediments.
3. EPA must develop a remedy that is protective of ecological resources at T4. Regardless of human health direct contact within T4, fish, invertebrates, and other biota inhabit T4. Furthermore, fish that are exposed to contamination within T4 may move out of T4, thereby exposing fishers in other areas of the Site to T4 contamination.

APPLICATION OF RALS

The Port implies that, due to the prevailing navigational use and deep water at Slip 3 within T4, the navigation channel RALs are the appropriate RALs to apply at Slip 3, rather than the Site-wide RALs assigned to this area in the ROD.[2] The Five Tribes do not support the Port's argument. The ROD requires that Site-wide RALs be applied to future maintenance dredge (FMD) areas, such as Slip 3. FMD areas are typically nearshore areas with direct human contact. As noted in the Human Health Direct Contact Risk section above, direct human contact is a complete pathway at T4, including Slip 3. The navigation channel RALs are not protective of direct human contact and must not be applied at Slip 3.

ACHIEVING A TIMELY CLEANUP

We do not support a reexamination of Remedial Investigation/Feasibility Study (RI/FS) and ROD assumptions regarding exposure and their implications for cleanup levels and RALs, either for the Site collectively or for individual areas of the Site. Such an approach reopens analyses that were performed by EPA and potentially responsible parties (PRPs) with substantial input from EPA's Memorandum of Understanding (MOU) partners over a period of more than 10 years. The changes that the Port proposes may reopen the RI/FS

[2] The Port's briefing papers do not specifically assert that navigation channel RALs should be applied at Slip 3. However, they have made this assertion in discussions with EPA.

and at a minimum would reopen the ROD. A ROD amendment would likely be required to change the application of cleanup levels or RALs. Such a change would delay cleanup by at least several years. We strongly urge EPA to adhere to the ROD and achieve a timely cleanup.

REITERATION OF COMMENTS ON PRE-RD GROUP NEGOTIATIONS

The Five Tribes submitted comments to EPA on October 9 expressing significant concerns regarding the process and substance of EPA's negotiations with the Pre-RD Group. Although we have not seen a draft Administrative Order on Consent (AOC) or draft work plan for T4 negotiations, we stress that our comments on the Pre-RD Group negotiations also apply to any discussions or negotiations with T4. Key issues include:

1. EPA must provide the Five Tribes, as well as MOU partners more broadly, the opportunity for meaningful involvement in the cleanup process, consistent with past practices, the MOU signed by EPA and Technical Coordinating Team (TCT) members, and EPA's trust and consultation responsibilities to the Five Tribes. This includes providing MOU partners with sufficient time and opportunity to provide feedback on all drafts of documents and other correspondence related to cleanup and negotiations, including but not limited to position papers, AOCs, scopes of work, work plans, and assertions, positions, and other views or considerations expressed by EPA or the Port by email, verbally, at meetings, or otherwise. The Five Tribes cannot emphasize enough the importance of EPA transparency with the TCT. If EPA is not transparent with the TCT regarding T4 discussions and negotiations and does not provide for meaningful TCT involvement, the Five Tribes will be required to consider invoking dispute resolution provisions in the MOU.
2. Work plans must not be attached to AOCs, but rather developed with full TCT participation and finalized after AOCs are signed.
3. AOCs must require PRPs to fund Tribal Response Costs.
4. The scope of AOCs should encompass Remedial Design and should not be limited to one sampling event.
5. As discussed on the October 10 TCT call, the AOC must not provide PRPs the opportunity to appeal dispute resolutions issued by the Regional Administrator to the EPA Administrator.
6. Work plans must be based on statistically valid designs.
7. Work plan objectives and data uses must be consistent with the ROD.
8. EPA must not entertain PRP efforts designed to reopen the RI/FS, which was developed over more than ten years and represents a joint effort between EPA and the PRPs with significant input from governmental partners, including the

Five Tribes. Efforts to reopen the RI/FS are clearly stall tactics intended to postpone cleanup. EPA must move forward with the current RI/FS in order to achieve a timely cleanup.

Appendix A10

Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017

DRAFT

Administrator McCarthy signed EPA's Portland Harbor Record of Decision on January 3, 2017. On January 19, 2017, EPA announced the release of the *IRIS Toxicological Review of Benzo[a]pyrene (Final Report)* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136). The updated benzo[a]pyrene (BaP) toxicity values provided in the final IRIS report would significantly change the remediation goals established just two weeks earlier in the Portland Harbor ROD, eliminating more than $100 million of unnecessary cleanup.

EPA's ROD sets two (but applies three) sediment cleanup levels for carcinogenic polycyclic aromatic hydrocarbons (cPAHs), calculated as BaP equivalents (BaP eq):

(1) For nearshore areas of Portland Harbor, EPA's ROD identifies a cPAH (BaP eq) cleanup level of 12 µg/kg based upon human health direct contact with sediments. EPA's June 2016 Final Feasibility Study selected cPAH preliminary remediation goals of 12 µg/kg for direct contact with beach sediments and 106 µg/kg for sediments that are mostly or always under water. *See* FS Table 2.2-4. As part of the ROD, EPA provided an updated calculation of residual and post construction direct contact risk estimates that evaluates its selected remedy against the 106 µg/kg cPAH PRG for in-water sediments rather than the 12 µg/kg cPAH PRG for beach sediments. *See*, *Portland Harbor RI/FS Appendix J – Update, Calculation of Residual and Post Construction Risk Estimates*, Table J2.2-2c. This is consistent with EPA's baseline human health risk assessment (BHHRA) for in-water exposures, and so it appears that the 12 µg/kg cPAH cleanup level in ROD Table 17 is an error if applicable to in-water sediments (as opposed to beach sediments). (We note also that "highly toxic" principal threat waste concentrations are based on the 106 µg/kg in-water sediment direct contact PRG, rather than the beach PRG. *See* ROD, Table 6.) The appropriate cleanup level for human direct contact with nearshore sediment, based upon the assumptions and methods of the EPA BHHRA, should be 106 µg/kg.

(2) In deep water areas of the site, principally the navigation channel, EPA selected a cPAH cleanup level of 3950 µg/kg based on human consumption of clams.

See ROD, Table 17.

If the cPAH RGs were recalculated using the updated IRIS cancer slope factor and all of the same assumptions, exposure scenarios and methodologies employed in EPA's FS, the RGs would change significantly:

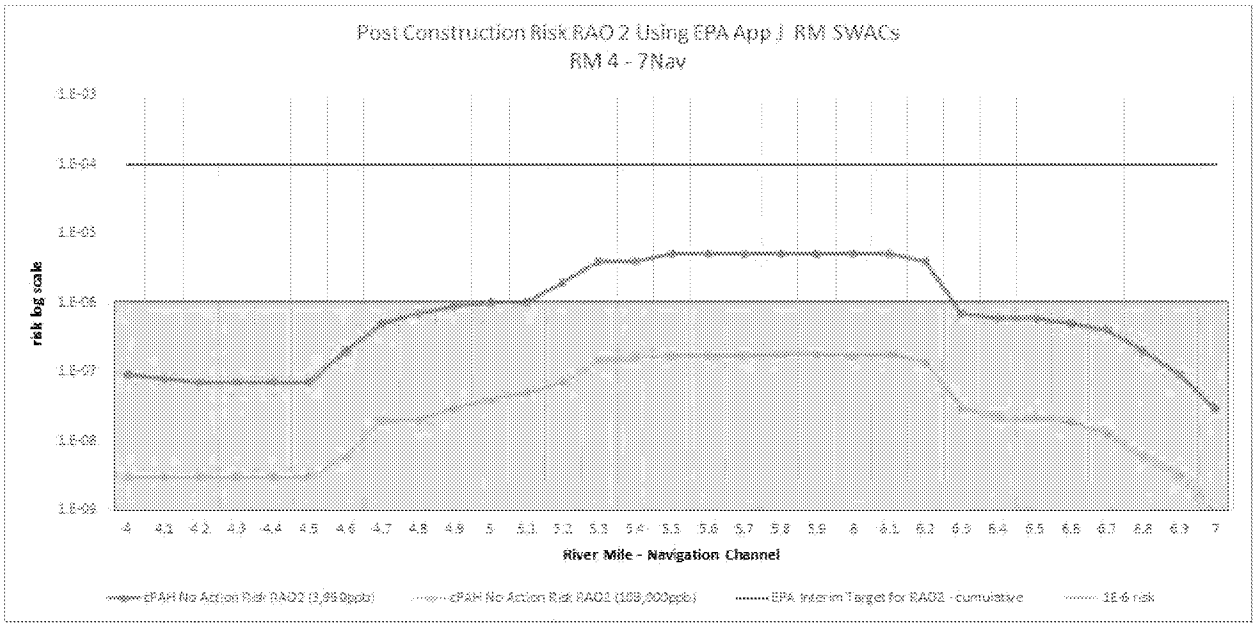
- The in-water sediment direct exposure cPAH RG would increase from 106 µg/kg to 773 µg/kg.
- The beach sediment direct exposure cPAH RG would increase from 12 µg/kg to 85 µg/kg.
- The clam consumption exposure cPAH RG would increase from 3,950 µg/kg to 108,000 µg/kg.

Further, the cPAH "highly toxic" principal threat waste threshold would increase from 106,000 µg/kg to 773,000 µg/kg.

The net result of these changes, based upon the methodologies in EPA's updated calculation of residual and post-construction risks, is that no areas of the site would exceed a 1×10^{-6} cPAH clam consumption risk, and all areas downstream of RM 6 (the approximate downstream edge of the Gasco site) would meet the 1×10^{-5} interim risk threshold for cPAH direct contact based on the no action alternative. In other words, based upon the existing data set, all areas of the site other than in the immediate vicinity

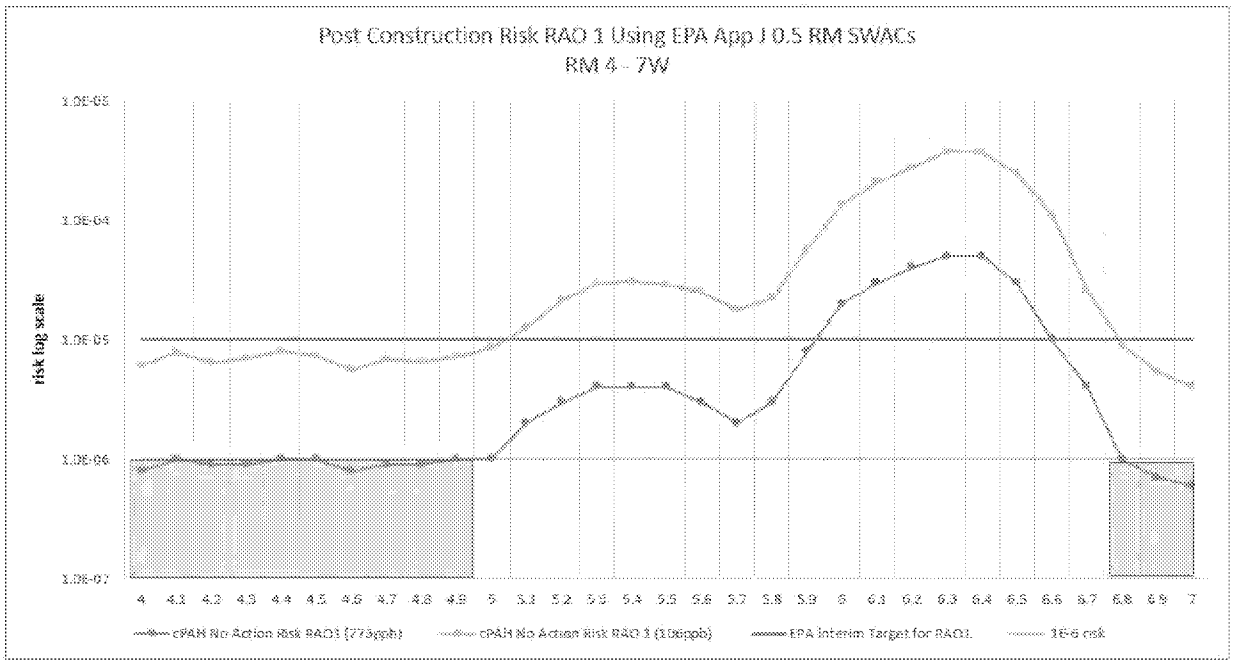
of Gasco do not present cPAH risks outside EPA's acceptable risk range based upon EPA's current BaP cancer slope factor.

Here is a simple graph showing "no action" cPAH clam consumption risks in the navigation channel using EPA's SWACs and methodologies:



The orange line depicts risks calculated by EPA relative to the RG set by EPA's January 6 ROD; the yellow line shows risk using updated RGs with the BaP cancer slope factor published on January 19. We have previously noted our concerns about application of a cleanup level based upon clam consumption in deep waters, including the fact that no such risk was identified in the BHHRA. Even if this were a valid risk scenario, however, no risk would exist based upon EPA's current toxicity values.

This graph shows similar risk comparisons for direct contact with in-water sediment:



Again, based upon the updated cancer slope factor, potential unacceptable risk for BaP in-water sediment direct contact downstream of the immediate vicinity of the Gasco is either below EPA's interim risk threshold or non-existent. No cleanup in these areas is necessary, based upon EPA's best and most current science.

The cPAH cleanup levels in the ROD should be updated now, before significant pre-design or design work begins. Updating the values requires only a straightforward mathematical calculation and does not involve review or revision of any of EPA's assumptions or methodologies in the BHHRA. An Explanation of Significant Difference that makes these corrections now could save millions of dollars of remedial design work and avoid tens, perhaps hundreds, of millions of dollars of unnecessary cleanup.

Appendix A11

Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017

DRAFT

MEMORANDUM

Yakama Nation Fisheries

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Honor. Protect. Restore.

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October 12, 2017

To: Sean Sheldrake, United States Environmental Protection Agency (EPA)
From: Laura Shira, P.E., Environmental Engineer
Re: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site

This memo provides technical comments and concerns on the August 2, 2017, NW Natural memorandum titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor" from Anchor QEA and Pearl Legal Group, to NW Natural. NW Natural advocates for increasing cleanup levels (CULs) and remedial action levels (RALs) for polycyclic aromatic hydrocarbons (PAHs) within the Record of Decision (ROD) at the Portland Harbor Superfund Site (site) based on EPA's January 19, 2017 updates to the benzo(a)pyrene (BaP) cancer slope factor (CSF) in the Integrated Risk and Information System (IRIS).

Although we acknowledge changes to IRIS as science-based, the Yakama Nation has significant concerns about the effects of the proposed changes on the project schedule and the protectiveness of the cleanup. With the limited information we have been presented it is impossible to evaluate the merits of the back-of-the envelope calculations provided by NW Natural. If EPA is considering making changes to the CULs and/or RALs, that process must include an analysis of the pros and cons of these changes with respect to overall project timeline, budgets, and protectiveness; and an in-depth evaluation of how any changes to the ROD resulting from these recommendations will address human and ecological risk at the Portland Site. Modifying the CULs and RALs as suggested would constitute a major change to the ROD. In fact, NW Natural's proposal suggests that modified RALs could potentially decrease the area actively cleaned up by greater than 10% (from 355 acres to as little as 304 acres). The Yakama Nation urges EPA to maintain RALs set in the ROD and keep on schedule for in-water cleanup. However, if EPA is considering changing the PAH RALs, or any changes that would require a change to the ROD including an Explanation of Significant Differences or amendment, the Yakama Nation requires meaningful engagement as prescribed in the 2001 Memorandum of Understanding (MOU) and EPA must offer government to government consultation on proposed changes before a decision is made.

At this point, without adequate information to review, we offer the following preliminary comments.

<u>Technical and Procedural Comments</u>:

The Yakama Nation supports the technical comments submitted on behalf of the Five Tribes by IEc on September 26, 2017. Below are our technical comments:

1. A change to the RALs or even CULs would warrant a change to the ROD which would significantly delay the cleanup schedule, likely by several years. The impacts of significant delays and their associated costs should be considered if this is the path EPA chooses to take.
    a. The water quality standards in the ROD are Federal and State standards that have been promulgated under the Clean Water Act. Until these standards are changed via a formal rule making process the water quality criteria used for CULs and RALs developed in the ROD are applicable or relevant and appropriate requirements and must stand as is.
    b. The update to the IRIS database may affect the water quality standards in future rule making processes but so will other factors that have yet to be determined.
2. In addition, the update to RALs or CULs is not as simple as plugging in a new cancer slope factor for BaP. All of the risks for all COCs associated with each area will need to be re-evaluated to ensure the remedy is protective of human health and the environment. For example:
    a. The revised IRIS data do not affect or consider ecological risk. Proposed changes to the navigation channel CUL and RAL must also consider ecological risk.
    b. NW Natural's proposed sediment CUL and RAL would need to be evaluated to determine whether they are likely to achieve surface water cleanup levels within porewater and the water column.
    c. NW Natural's two approaches to calculating the proposed CULs and RALs are not consistent with EPA's surface-weighted average concentration (SWAC) methodology presented in the ROD.
    d. If the proposed CUL and/or RAL changes are considered, sediment management areas (SMAs) would need to be re-evaluated to determine the extent to which areas formerly considered PAH risk-driven areas now require cleanup due to the presence of other focused contaminants of concern (COCs), non-aqueous phase liquid (NAPL), not reliably contained (NRC), and/or principal threat waste (PTW).

A change in the RAL or CUL would not be a quick process and would likely introduce much uncertainty to where the Portland Harbor remedy is headed. It is likely PRPs would want to delay any work until EPA made a final decision of RALs and CULs, if it chooses to revise either. We must reiterate any change the ROD will require meaningful involvement with the Yakama Nation and EPA must offer to consult on its proposal before it makes a final decision. Because of the gravity of this issue the proposal must be supported by in-depth scientifically sound evaluation that will explain if and how the change to the BaP cancer slope factor will truly justify a significant reduction in the active remediation at the facility or if other factors such as ecological risks and ARARs will negate any major reduction active remediation.

PH NW Natural Proposed CUL and RAL ROD changes (8/2/2017)

Comparison of Portland Harbor ROD vs. NW Natural Proposed Cleanup Levels and Remedial Action Levels.

media		RAO	ROD*	Proposed (NWNatl	Criteria	Chemical
Sediment/soil	riverbank	1 HH - direct contact	12 ug/kg	85 ug/kg	CUL	cPAHs (BaP equiv)
sediment	intermed (btwn be	1 HH - direct contact	***106 ug/kg	773 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nearshore	1 HH - tribal user - direct contact	106 ug/kg	773 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nav channel	2 HH - clam consumption	3,950 ug/kg	108,000 ug/kg	CUL	cPAHs (BaP equiv)
sediment	nav channel	5 ECO - benthic	23,000 ug/kg		CUL	TPAH
sediment	beaches		12 ug/kg		BKGRD	cPAHs (BaP equiv)
sediment	all		106,000 ug/kg		PTW	cPAHs (BaP equiv)
sediment	all		870,000 ug/kg		PTW	TPAH
sediment	nearshore		1,500 ug/kg	10,800 ug/kg	RAL	cPAHs (BaP equiv)
sediment	nearshore (all?)		13,000 ug/kg	**92,000 ug/kg	RAL	TPAH
sediment	nav channel		20,000 ug/kg	540,000 ug/kg	RAL	cPAHs (BaP equiv)
sediment	nav channel		170,000 ug/kg	4,000,000 ug/kg	RAL	TPAH
surface water		3 HH- fish consumption	0.0001 ug/L	0.0009 ug/L	CUL	cPAHs (BaP equiv)
surface water		7 ECO -	0.014 ug/L		CUL	cPAHs (BaP equiv)

NW Natural's proposal, if accepted in full, would result in a decreased SMA area from 355 acreas (ROD) to 304 or 326 acres (proposed).
Table 17, ROD cleanup value
Table 6, ROD PTW value
Table 19, ROD RALs
* if the ROD values listed are not high-lighted, then NWNatural caluculated them or pulled them from elsewhere, including Non-ROD documents
** based on tribal use PRGs of 773 ug/kg
*** PRG used for many of the RAL calcs

Appendix B

Errata Memorandum

DRAFT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
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OFFICE OF
ENVIRONMENTAL CLEANUP

April 3, 2018

MEMORANDUM

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

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

TO: Portland Harbor site file

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

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

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

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

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

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

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

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

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

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

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6. Appendix II, ROD Table 2 and Table 3. Two abbreviations in each table should be updated to include the correct congener for each abbreviation:

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

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

7. Appendix II, ROD Table 4. In the abbreviations list, the abbreviation for HxCDF should be 1,2,3,4,7,8-hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.

8. Appendix II, ROD Table 6. The contaminant listed as 1,2,3,4,6,7,8- HxCDF should be 1,2,3,4,7,8-HxCDF.

9. Appendix II, ROD Table 17. Revisions to this table include:

    a. The groundwater cleanup level of 9.9 µg/L listed for cis-1,2-Dichloroethene should be 70 µg/L.

    b. The fish tissue target concentration of 0.031 mg/kg listed for mercury should be 0.03 mg/kg.

    c. The river bank soil/sediment PAH cleanup level of 23000 µg/kg is a risk-based value so an "R" should be added to the basis column for this contaminant.

    d. The contaminant listed as TPH-Diesel (C10-C12 Aliphatic) should be Aliphatic Hydrocarbons C10-C12.

    e. The contaminant listed as 2,4,5-Trichlorophenol in the table should be 2,4,5-TP (Silvex). The full name for this contaminant, 2-(2,4,5-Trichlorophenoxy)propionic acid, should be added to the abbreviations.

    f. The abbreviation for HxCDF should be hexachlorodibenzofuran instead of 1,2,3,7,8,9-hexachlorodibenzofuran.

10. Appendix II, ROD Table 21. Revisions to this table include:

    a. This table does not have footnote 4 so the "(4)" in first column by Total PAHs should be deleted.

    b. The table should include µg/kg as the units for the values listed in this table.

    c. The additional contaminant listed as 1,2,3,4,6,7,8-HxCDF should be 1,2,3,4,7,8-HxCDF.

11. Appendix II, ROD Table 22. The reference to Oregon Health Authority (OHA) fish advisory regarding allowable fish meals under the no action Alternative A on pages

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

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

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

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

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

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

Attachment

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

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

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

Principal Threat Waste

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

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

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

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

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

6.6.6. River Banks

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

East Side of Willamette River

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

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

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

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

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

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RM 7: Willamette Cove (ECSI Site ID 20662363) – River bank contaminants are PCBs, dioxins/ furans, metals (lead, mercury, nickel, and copper), and PAHs.

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

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

West Side of Willamette River

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

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

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

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

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

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

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

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

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

6.6.7. RCRA Hazardous Waste in Media

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

6.7. Computer Models Used For Fate and Transport

6.7.1. Hydrodynamic and Sediment Transport Models

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

6.7.2. Mass Transfer Model

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

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

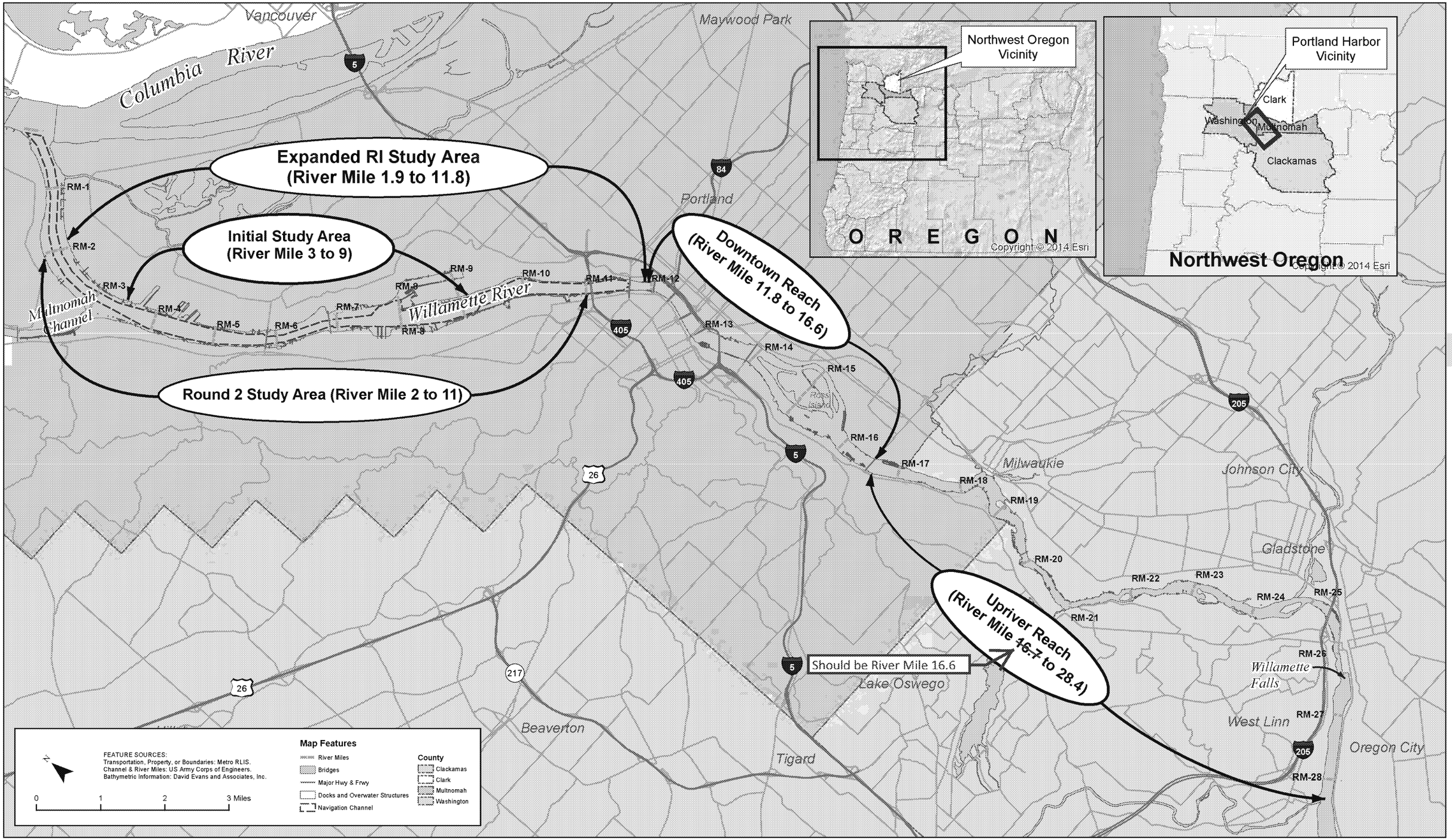

Figure 7. Portland Harbor Study Area and Vicinity

Portland Harbor Superfund Site

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Table 1. Summary of Contaminants of Concern in Sediment

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

Table 1. Summary of Contaminants of Concern in Sediment

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

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

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

Table 2. Summary of Contaminants of Concern in Surface Water

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

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

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

Table 2. Summary of Contaminants of Concern in Surface Water

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

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

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

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

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

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

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

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Table 4. Summary of Contaminants of Concern in Fish Tissue

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

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

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

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

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

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

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Table 17. Summary of Cleanup Levels or Targets by Media

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

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

Abbreviations:
2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex
ARAR - applicable or relevant and appropriate requirement
B - Background-based number
BEHP - bis(2-ethylhexyl)phthalate
BaP eq - benzo(a)pyrene equivalent
C - carbon

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations (continued):
Conc - concentration
cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethene
DDT - dichlorodiphenyltrichloroethane
DDx - DDD + DDE + DDT
HxCDF - ~~1,2,3,7,8,9 -~~hexachlorodibenzofuran
MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbon
PBDE - polybrominated diphenyl ether
PCB - polychlorinated biphenyl
PeCDD - pentachlorodibenzo-p-dioxin
PeCDF - pentachlorodibenzofuran
R - risk-based number
RAO - remedial action objective
TCDD - tetrachlorodibenzo-p-dioxin
TCDF - tetrachlorodibenzofurans
TPH - total petroleum hydrocarbons
µg/kg - microgram per kilogram
µg/L - microgram per liter

Table 21. Sediment RALs and PTW Thresholds for Selected Remedy

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

Notes:
1 – Site wide includes all areas of the Site except the navigation channel. FMD areas are subject to these RALs.
2 – PTW thresholds are based on highly toxic PTW values (10^{-3} risk) except chlorobenzene and naphthalene, which are threshold values for not reliably contained PTW.

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

Table 22. Detailed Comparative Analysis of Remedial Alternatives

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

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
River Banks Addressed (%) (RAO 9)	0% - continued migration from river banks to sediment/ surface water.	32% of river banks addressed	46% of river banks addressed	61% river banks addressed	78% river banks addressed	78% river banks addressed	88% river banks addressed	65% river banks addressed
Benthic Areas Addressed (%) (RAO 5)[2] (IT: 50 % addressed)	0% - No reduction in benthic risk	48% of benthic areas addressed	64% of benthic areas addressed	73% of benthic areas addressed	72% of benthic areas addressed	87% of benthic areas addressed	93% of benthic areas addressed	64% of benthic areas addressed
Consumption of Prey (RAO 6) (IT: Eco HQ=10)	No reduction in HQ.	Does not achieve IT River mile (RM) scale: Maximum HQ = 19 (BEHP) Sediment decision unit (SDU) scale: Maximum HQ=7 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 17 (BEHP) SDU scale: Maximum HQ=5 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 15 (BEHP) SDU scale: Maximum HQ=4 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 5 (BEHP) SDU Scale: Maximum HQ = 3 (BEHP)	Achieves IT for RM and SDU scale RM Scale: Maximum HQ = 3 (BEHP) SDU Scale: Maximum HQ = 1 (BEHP)	Does not achieve IT RM scale: Maximum HQ = 19 (BEHP) SDU scale: Maximum HQ=3 (BEHP)
Direct Contact Surface Water (RAO 7)	Exceedances of surface water cleanup levels would continue.	Not quantifiable. Time to achieve cleanup levels through monitored natural recovery (MNR) uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)								
Chemical-specific ARARs	Would not meet water quality criteria (WQCs) and maximum contaminant levels (MCLs).	Would not be achieved	Complies	Complies	Complies	Complies	Complies	Complies
Location-specific ARARs	No location-specific ARARs	Complies. Addressed during design and implementation	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Action-specific ARARs	No action-specific ARARs	Complies. Addressed during design and implementation. 15 acres of mitigation	Same as Alternative B. 25 acres of mitigation	Same as Alternative B. 35 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 60 acres of mitigation	Same as Alternative B. 86 acres of mitigation	Same as Alternative B. 34 acres of mitigation
LONG-TERM EFFECTIVENESS AND PERMANENCE								

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Magnitude of Residual Risk (Post Construction [PC] Risk) **RAO 1**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Sediment: Post Construction risk: $4.8x10^{-5}$	Sediment: Post Construction risk: $2.2x10^{-5}$	Sediment: Post Construction risk: $1.5x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $1.0x10^{-5}$	Sediment: Post Construction risk: $7.2x10^{-6}$	Sediment: Post Construction risk: $1.8x10^{-5}$
RAO 2 (Allowable Fish Meals at Construction Completion)	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain. ~~OHA f~~Fish advisories would continue.	(see fish meal information under Overall Protectiveness)						
RAO 3 - Direct Contact Surface Water (Risk at Construction Completion vs. Risk at Cleanup Level for each Contaminant of Concern [COC])	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	PCBs – 16 times > cleanup levels TCDD TEQ – 13 times > cleanup level Carcinogenic polycyclic aromatic hydrocarbon (cPAH) – 2 times cleanup level	PCBs – 13 times > cleanup levels TCDD TEQ – 11 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 8 times > cleanup levels	PCBs – 10 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 8 times > cleanup levels TCDD TEQ – 7 times > cleanup levels	PCBs – 6 times > cleanup levels TCDD TEQ – 5 times > cleanup levels	PCBs – 12 times > cleanup levels TCDD TEQ – 9 times > cleanup level cPAH – 2 times cleanup level
RAO 4 **Migration Groundwater to Sediment/Surface Water** **(Contaminated Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed. The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed. Same as Alternative B	68% not addressed. Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed. Same as Alternative B	38% not addressed. Same as Alternative B	67% not addressed. Same as Alternative B
RAO 5[2] **Benthic Organisms** **(Benthic Areas not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	52% not addressed. Degree of recovery is uncertain because it is likely that an insufficient amount of the benthic risk areas will be addressed.	36% not addressed. Same as Alternative B	27% not addressed. Same as Alternative B	28 % not addressed Same as Alternative B	13% not addressed. Same as Alternative B	7% not addressed. Same as Alternative B	36% not addressed. Same as Alternative B

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
RAO 6 **Consumption of Prey**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 5 times TCDF – 6 times PeCDF – 4 times HxCDF – 3 times SDU scale: BEHP – 7 times PCBs – 4 times TCDF – 3 times PeCDF – 2 times HxCDF – 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 17 times PCBs – 3 times TCDF – 4 times PeCDF – 3 times HxCDF – 2 times SDU scale: BEHP – 5 times PCBs – 2 times TCDF – 3 times PeCDF– 2 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 15 times PCBs – 2 times TCDF – 1.4 times SDU scale: BEHP – 4 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 5 times SDU scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 3 times	Maximum HQ is greater than 1 for the following COCs: RM scale: BEHP – 19 times PCBs – 2 times SDU scale: BEHP – 4 times
RAO 7 **Direct Contact Surface Water**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	Not quantifiable. Time to achieve protectiveness through MNR uncertain.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
RAO 8 **Migration Groundwater to Sediment/Surface Water** **(Groundwater Plumes not Addressed)**	Existing risk remains. Ability for natural recovery unlikely since in-river sources remain.	84% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated pore water will be addressed.	77% not addressed Same as Alternative B	68% not addressed Same as Alternative B	61% not addressed Same as Alternative B	54% not addressed Same as Alternative B	38% not addressed Same as Alternative B	67% not addressed Same as alternative B
RAO 9 **Migration River Banks** **(Contaminated River Banks not Addressed)**	Existing risk remains.	68% not addressed The magnitude residual risk is uncertain because it is likely that not all contaminated river banks will be addressed with this alternative.	54% not addressed Same as Alternative B	39% not addressed Same as Alternative B	22% not addressed Same as Alternative B	22% not addressed Same as Alternative B	12% not addressed Same as Alternative B	35% not addressed Same as Alternative B

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Adequacy and Reliability of Controls	No engineering controls ~~OHA ff~~Fish advisories may not prevent human exposure.	Technologies are proven and reliable Operation and maintenance (O&M) of caps Long-term monitoring Periodic inspections and sampling of media and fish Institutional Controls (ICs): - Fish advisories - Land-use restrictions - regulated navigation areas (RNAs) to protect caps RNA Areas Capped: 28.3 acres MNR Area: 1,966 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 55.8 acres MNR Area: 1,900 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,838 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,774 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 150.2 acres MNR Area: 1,634 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 231.4 acres MNR Area: 1,391 acres	Technologies are proven and reliable O&M of caps Long-term monitoring Periodic inspections and sampling of media and fish ICs: Same as Alternative B RNA Areas Capped: 81.0 acres MNR Area: 1,876 acres
REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT								
Treatment Process Used	None	Activated carbon Organophilic clay Solidification/stabilization Thermal desorption	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Amount Destroyed or Treated *In-situ treatment includes areas within and outside of sediment management areas (SMAs).	None	In-situ treatment*: 70 acres Ex-situ treatment: 191,573 cubic yards (cy)	In-situ treatment*: 108 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 109 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 133 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 145 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 184 acres Ex-situ treatment: 191,573 cy	In-situ treatment*: 113 acres Ex-situ treatment: 191,573 cy
Reduction in Toxicity, Mobility, or Volume	None	• Broadcast activated carbon (AC): 6.7 acres • Reactive Caps: 23 acres • Reactive residual layer: 36 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 3.2 acres • Reactive Caps: 40 acres • Reactive residual layer: 61 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 60 acres • Reactive residual layer: 45 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 83 acres • Reactive residual layer: 58 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive caps: 101 acres • Reactive residual layer: 80 acres • Significantly augmented reactive cap: 3.8 acres	• Broadcast AC: 0 acres • Reactive Caps: 64 acres • Reactive residual layer: 46 acres • Significantly augmented reactive cap: 3.8 acres

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Irreversible Treatment	None	Permanent and Irreversible Treatment Activated carbon Low-temperature thermal desorption Solidification/stabilization forms stable solids that are non-hazardous or less-hazardous than the original materials	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B
Type and Quantity of Residuals Remaining after Treatment	Contaminated sediment and soil remains.	Principal threat waste (PTW) addressed: 37 % PTW remaining: 63%	PTW addressed: 57 % PTW remaining: 43 %	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%	PTW addressed: 100% PTW remaining: 0%
SHORT-TERM EFFECTIVENESS								
Community Protection	Continued risks to community from no action. ~~OHA f~~Fish advisories would continue.	Community Impacts: 4 months per year for 4 years. • Temporary noise, light, odors, air quality impacts. • Disruptions to river use • potential for waterborne accidents during construction Addressed with health and safety (H&S) plans and use of best management practices (BMPs). Fish consumption advisories would continue until RAO achieved.	Community Impacts: 4 months per year for 6 years. Same as Alternative B	Community Impacts: 4 months per year for 7 years. Same as Alternative B	Community Impacts: 4 month per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 13 years. Same as Alternative B	Community Impacts: 4 months per year for 19 years. Same as Alternative B	Community Impacts for 4 months per year for 7 years. Same as Alternative E

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Worker Protection	No risk to workers	Risks to workers for 4-5 months per year for 4 years. • Physical hazards during construction. • Increased accident risks from heavy equipment, transport of materials, and increased vessel traffic. Addressed with H&S Plans and BMPs.	Risks to worker for 4-5 months per year for 6 years. Same as Alternative B	Risks to workers for 4-5 months per year for 7 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 13 years. Same as Alternative B	Risks to workers for 4-5 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Environmental Impacts (Impacts of Construction Activities)	Continued impact from existing conditions.	Impact time frame: 4 months per year for 4 years. • Temporary loss of benthos and habitat, increased emissions from construction and transportation equipment. • Exposure to contamination greater than PRGs during MNR period Addressed with BMPs, engineering control measures, emissions control strategies.	Impact time frame: 4 months per year for 6 years. Same as Alternative B	Impact time frame: 4 months per year for 7 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 13 years. Same as Alternative B	Impact time frame: 4 months per year for 19 years. Same as Alternative B	Same as Alternative E.
Time Until Action is Complete	Not applicable.	Construction time: 4 years Estimated time to achieve RAOs is uncertain, but unlikely to occur in a reasonable timeframe.	Construction time: 6 years Same as Alternative B	Construction time: 7 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 13 years Same as Alternative B	Construction time: 19 years Same as Alternative B	Construction time: 7 years Same as Alternative B
IMPLEMENTABILITY								

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Expected Outcomes at Construction Completion	Alternative A	Alternative B	Alternative D	Alternative E	Alternative F Mod	Alternative F	Alternative G	Alternative I
Summary of Alternative	NO ACTION	Cap, dredge, in-situ treatment and enhanced natural recovery (ENR) of: 201 acres of sediments 9,633 lineal feet (lf) of river bank	Cap, dredge, in-situ treatment and ENR of: 267 acres of sediments 13,887 lf of river bank	Cap, dredge, and ENR of: 329 acres of sediment 18,231 lf of river bank	Cap, dredge, and ENR of: 394 acres of sediment 23,305 lf of river bank	Cap, dredge, and ENR of: 533 acres of sediments 23,305 lf of river bank	Cap, dredge, and ENR of: 776 acres of sediments 26,362 lf of river bank	Cap, dredging, and ENR of: 291 acres of sediments 19,472 lf of river bank
Ability to Construct and Operate	No construction or operation	Technologies successfully implemented at other Superfund sites. Material handling: 627,652 cy of sediment/soil 495,931 cy of fill	Same as Alternative B, except: Material handling: 1,181,238 cy of sediment/soil 727,154 cy of fill	Same as Alternative B, except: Material handling: 2,024,222 cy of sediment/soil 957,630 cy of fill	Same as Alternative B, except: Material handling: 3,017,189 cy of sediment/soil 1,339,587 cy of fill	Same as Alternative B, except: Material handling: 4,585,401 cy of sediment/soil 1,565,247 cy of fill	Same as Alternative B, except: Material handling: 7,396,598 cy of sediment/soil 2,257,357 cy of fill	Same as Alternative B, except: Material handling: 1,752,374 cy of sediment/soil 900,271 cy of fill,000 cy of fill
Ease of Doing More Action, if Needed	May require ROD amendment in the future.	Easy	Easy	Easy	Easy	Easy	Easy	Easy
Ability to Monitor Effectiveness	No monitoring required. Ongoing exposure and risks would continue	Monitoring of: RNAs: 28 acres of caps Capped areas (includes river banks): 39 acres MNR: 1,966 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 56 acres of caps Capped areas (includes river banks): 71 acres MNR: 1,900 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 101 acres MNR: 1,838 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,774 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 150 acres of caps Capped areas (includes river banks): 176 acres MNR: 1,634 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 231 acres of caps Capped areas (includes river banks): 260 acres MNR: 1,391 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment	Monitoring of: RNAs: 81 acres of caps Capped areas (includes river banks): 102 acres MNR: 1,876 acres ICs: Fish Advisories COCs: fish tissue, surface water, pore water, sediment
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals necessary.	Approvals and coordination with other agencies possible. Waste left in 2,088 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,032 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,964 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,920 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,780 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 1,596 acres of the Site.	Approvals and coordination with other agencies possible. Waste left in 2,000 acres of the Site.
COST								
Capital Cost	$0	$352,097,000	$556,004,000	$827,465,000	$1,184,607,000	$1,629,407,000	$2,500,545,000	$751,359,000
Periodic Cost	$0	$290,324,000	$397,028,000	$412,332,000	$524,028,000	$549,512,000	$708,114,000	$421,940,000
Present Value Cost	$0	$451,460,000	$653,700,000	$869,530,000	$1,054,200,000	$1,371,170,000	$1,777,320,000	$811,290,000

Table 22. Detailed Comparative Analysis of Remedial Alternatives

Acronyms:

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

Notes:

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

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

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

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

J2.3 POST-CONSTRUCTION RISK ESTIMATES FOR RAO 2

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

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile ~~HQ~~~~Risk~~ Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile ~~HQ~~Risk Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

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

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

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

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

Table J2.3-5f

RAO 2 Rolling River Mile HQ~~Risk~~ Estimates Infant - 2,3,7,8-TCDD

Portland Harbor Superfund Site

Portland, Oregon

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

Appendix C

Oregon Department of Environmental Quality
Letter Supporting EPA's Explanation of Significant Differences

DRAFT

Appendix D

Five Tribes
Letter Supporting EPA's Explanation of Significant Differences

DRAFT

IEc

MEMORANDUM | February 12, 2018

TO Sean Sheldrake, United States Environmental Protection Agency (EPA)

FROM Gail Fricano, Rachel DelVecchio, and Dr. Rita Cabral (Industrial Economics, Inc.)

SUBJECT Proposed Changes to Portland Harbor Superfund Site (PHSS) Remedy due to Updated Human Health Toxicity Values for Benzo(a)pyrene

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OVERVIEW

This memorandum provides technical comments on behalf of the Five Tribes[1] regarding EPA's proposed approach to modifying the PHSS remedy in order to address the Integrated Risk and Information System (IRIS) update to the cancer slope factor for benzo(a)pyrene. Our comments are specific to the approach described in materials provided by EPA (Attachment A) and discussed on a conference call with EPA and the PHSS Technical Coordinating Team (TCT) on January 11, 2018 (referred to as "EPA's proposed approach" in this memorandum).

The Five Tribes support EPA's proposed approach regarding updating cleanup levels and remedial action levels (RALs) in response to the IRIS benzo(a)pyrene revision. They also support EPA's use of an Explanation of Significant Differences (ESD), rather than a Record of Decision (ROD) amendment, to make these changes. EPA's approach and the rationale for the Five Tribes' support are outlined in the following sections. Note that if EPA modifies this approach in any way, the Five Tribes would need to evaluate the modified approach to determine whether they support it.

Notwithstanding their technical support for EPA's proposed approach for modifying the PHSS remedy to address the IRIS update, the Five Tribes are concerned about EPA's recent conduct relating to coordination and consultation with the Five Tribes in derogation of the EPA's trust duty to the Tribes. The Five Tribes hope that EPA will honor the spirit and letter of the Memorandum of Understanding for Portland Harbor Superfund Site and also coordinate and consult with the Five Tribes in a manner consistent with EPA's consultation obligations embodied in Executive Order 13175 and applicable statutes, such as CERCLA § 126(a). The Five Tribes expressly reserve their rights to address the foregoing concerns with EPA leadership.

SUPPORT FOR EPA'S PROPOSED APPROACH

EPA's IRIS posted an updated benzo(a)pyrene cancer slope factor on January 19, 2017. This update reflects the current scientific understanding that this contaminant is less

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[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

carcinogenic than previously known. Subsequently, EPA has contemplated the implications of this update on PHSS cleanup levels and RALs for polycyclic aromatic hydrocarbons (PAHs; carcinogenic PAH (cPAH) cleanup levels and total PAH RALs are based on benzo(a)pyrene). Conceptually, we support updates to the PHSS remedy that reflect best available science and believe that changes to the remedy are warranted in this case.

Below, we briefly describe EPA's proposed approach and our support for each element.

cPAH Cleanup Levels:

EPA proposes increasing the navigation channel cleanup level (based on clam consumption) from 3,950 µg/kg to 107,600 µg/kg.[2] EPA also proposes developing separate cleanup levels for beach and nearshore (i.e., in-water areas outside the navigation channel) sediments. The beach cleanup level (based on direct contact with beach sediments) would increase from 12 ug/kg to 85 ug/kg. The nearshore sediment cleanup level would increase from 106 µg/kg (the previous relevant preliminary remediation goal for direct contact with nearshore sediments outside beach areas) to 774 µg/kg.

We support these revised cleanup levels, which appropriately apply the updated benzo(a)pyrene cancer slope factor to the previous cleanup levels. We also agree that separate nearshore and beach cleanup levels more accurately reflect the Baseline Human Health Risk Assessment risk scenarios.

Principal Threat Waste (PTW):

EPA proposes increasing the highly toxic PTW threshold from 106,000 µg/kg to 774,000 µg/kg. We support this change, which appropriately applies the updated benzo(a)pyrene cancer slope factor to the previous highly toxic PTW threshold.

Total PAH RALs:

EPA proposes increasing the nearshore RAL from 13,000 µg/kg to 30,000 µg/kg and retaining the current navigation channel RAL of 170,000 µg/kg.

We support increasing the nearshore RAL to 30,000 µg/kg. This revised RAL is expected to achieve the revised cleanup levels.[3] At the same time, the revised RAL greatly minimizes remediation of areas that do not pose risk.[4]

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[2] The site-wide total PAH benthic risk cleanup level of 23,000 µg/kg is unaffected by the IRIS update.

[3] The revised RAL would result in achievement of the revised nearshore sediment cPAH cleanup level immediately following construction on a rolling river mile surface area weighted average concentration (SWAC) basis.

We support no change to the navigation channel RAL. Although remediation is no longer required to reduce the clam consumption risk, based on the updated sediment cPAH cleanup level for the navigation channel, it is required to achieve protection of benthic ecological receptors via the sediment pathway and human and ecological receptors via the surface water pathway. Thus, the navigation channel RAL should remain at 170,000 µg/kg.

In summary, EPA's proposed approach incorporates best available science while also remaining protective of human health and the environment and greatly minimizing cleanup of areas that do not pose risk.

MECHANISM FOR IMPLEMENTING CHANGES

The Five Tribes support the use of an ESD to implement the above changes, provided a public comment period is incorporated into the ESD process. We do not support the use of a ROD amendment. A ROD amendment is a lengthy process on the order of several years, while an ESD is a more streamlined process which would allow cleanup to proceed in a more expeditious manner. A ROD amendment may also provide an avenue for parties to challenge other elements of the ROD and advocate for additional changes beyond those related to the IRIS update. The ROD represents over a decade of collaborative decision making and consensus building with the TCT, the potentially responsible parties, and the public. Thus, changes to the ROD should be limited to addressing updates to best available science and other targeted instances.

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[4] The revised RAL would trigger cleanup in a total of 3 acres that already meet sediment cPAH cleanup levels on a rolling river mile SWAC basis.

ATTACHMENT A | MATERIALS PROVIDED BY EPA

Evaluation of Potential Modifications to Total PAH Navigation Channel RAL

The purpose of this memo is to evaluate whether the total PAH Navigation Channel RAL of 170,000 µg/kg identified in the ROD should be modified based on changes in carcinogenic PAH cleanup levels due to the post-ROD change to the benzo(a)pyrene slope factor. Additional information on this change is provided by EPA in the *IRIS Toxicological Review of Benzo[a]pyrene, dated January 2017* (https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136).

Human Health Risk:

Within the navigation channel, the current cleanup level is 3,950 ppb CPAHs and is based on the clam consumption exposure pathway. Direct contact with contaminated sediment is not considered a complete exposure pathway in the navigation channel. Surface water exposure pathways (ingestion, inhalation and dermal contact) are complete within the navigation channel. Although it is known that contaminated sediments contribute to surface water COCs, there is not a sediment cleanup levels associated with the protection of drinking water. Due to the non-linear relationship between PAHs in sediment and clam tissue, reducing the benzo(a)pyrene slope factor by a factor of 7.3 results in an increase in the clam consumption cleanup level from 3,950 µg/kg to 107,600 µg/kg. Surface sediment data collected during the Portland Harbor site indicate that while some individual samples have total carcinogenic PAHs measured as benzo(a)pyrene equivalents (BaP Eq) above 107,600 µg/kg, this concentration is not exceeded on a rolling ½ river mile surface weighted average concentration (SWAC) basis (See Appendix IV of the ROD). ***As a result, remediation of PAH contaminated sediments within the Navigation Channel is not required to protect human health based on the clam consumption exposure scenario (RAO 2).***

Ecological Risk:

PAH contaminated sediments within the Navigation Channel also pose risks to ecological receptors. The Portland Harbor ROD established 23,000 µg/kg as the total PAH sediment cleanup level for protection of the benthic community. The current total PAH remedial action level (RAL) applicable to the Navigation Channel is 170,000 µg/kg, a value which is already 7.4 times the total PAH cleanup level of 23,000 µg/kg.

For RAO 5 (benthic risk), the evaluation of protectiveness and long-term effectiveness and permanence as presented in Table 22 of the ROD was based on the percentage of the site that exceeds 10 times the benthic cleanup level. In addition, Section 15.1.2 of the ROD states "At the end of cleanup construction, the Selected Remedy will address 72% of the area based on 10 times unacceptable benthic risks. The remainder of the benthic risk areas will be left to MNR and evaluated in 5-year reviews." The areas that exceed the Navigation Channel RAL within the for PAHs are isolated to areas between RM 5 and 6.6 (Figure 1). As shown in Figure 2, this area of the Site is less conducive to MNR based on a multiple line of evidence evaluation presented in the Portland Harbor FS that considered sediment deposition rates, consistency of deposition, sediment grain size, propwash potential, subsurface to surface sediment concentration ratios, and wind and wake generated waves. This information suggests that MNR will not be as effective at reducing PAH concentrations in this portion of the site than other areas of the site. ***As a result, increasing the total PAH Navigation Channel RAL may further limit the ability of the Portland Harbor remedy to achieve RAO 5 due to the limited effectiveness of MNR within the Navigation Channel between RM 5 and 7.***

In addition to benthic risk, remediation of PAH contaminated sediments within the Navigation Channel will facilitate achievement of RAOs 3 and 7 which are focused on reducing risks to human health and the environment from ingestion and direct contact with COCs in surface water. Sediments within the navigation channel are significantly elevated in cPAH concentration and are likely contribute to cPAH exceedances of the human health and ecological AWQCs. As shown in Figures 3 and 4, taken from Section 1 of the Portland Harbor FS, total PAH surface water load increases from 1031 to 1175 g/day under low flow conditions and from 1448 to 3282 g/day under high flow conditions between RM 6.3 and 3.9. This suggests that the high levels of PAH contamination within the Navigation Channel between RM 5 and 6.6are contributing to the increased PAH load observed between RM 6.3 and 3.9. Although the source of PAH contamination to the water column likely includes contaminated sediments in both the nearshore area and Navigation Channel, remediation of PAH contaminated sediments within the Navigation Channel is expected to contribute to a reduction of PAH water column concentrations and facilitate progress towards achieving RAOs 3 and 7. ***As a result, increasing the total PAH Navigation Channel RAL may limit the ability of the Portland Harbor remedy to achieve RAOs 3 and 7 downstream of RM 6.3.***

Summary:

Remediation of PAH contaminated sediments within the navigation channel is not required to reduce shellfish consumption risk to achieve RAO 2. However, RAOs 3, 5, and 7 are not affected by the IRIS change. Due to the exceedances of the benthic cleanup levels in the navigation channel between RM 5 and 7, the limited effectiveness of MNR in that area, and due to the contribution of PAH contaminated sediments within the Navigation Channel to surface water loading downstream of RM 6.3, increasing the total PAH Navigation Channel RAL in response to the benzo(a)pyrene slope factor is not warranted in the navigation channel area.

Figure 1 – Distribution of PAHs within the Navigation Channel above 170,000 µg/kg

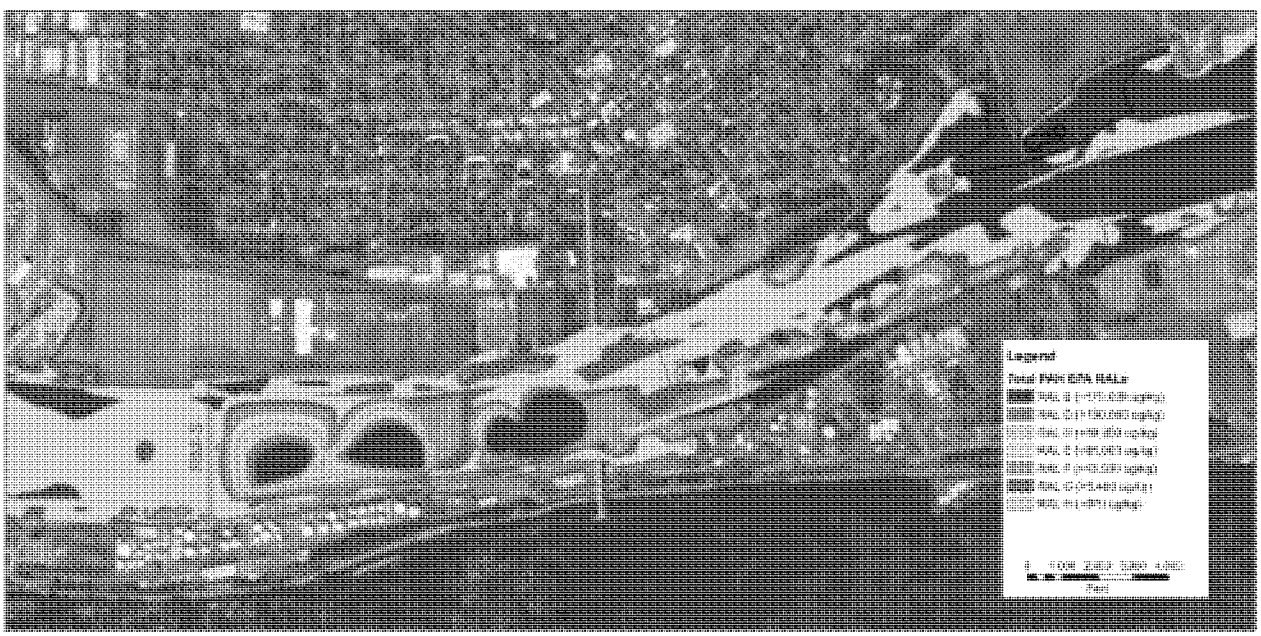


Figure 2 – MNR Average Score for Six Lines of Evidence

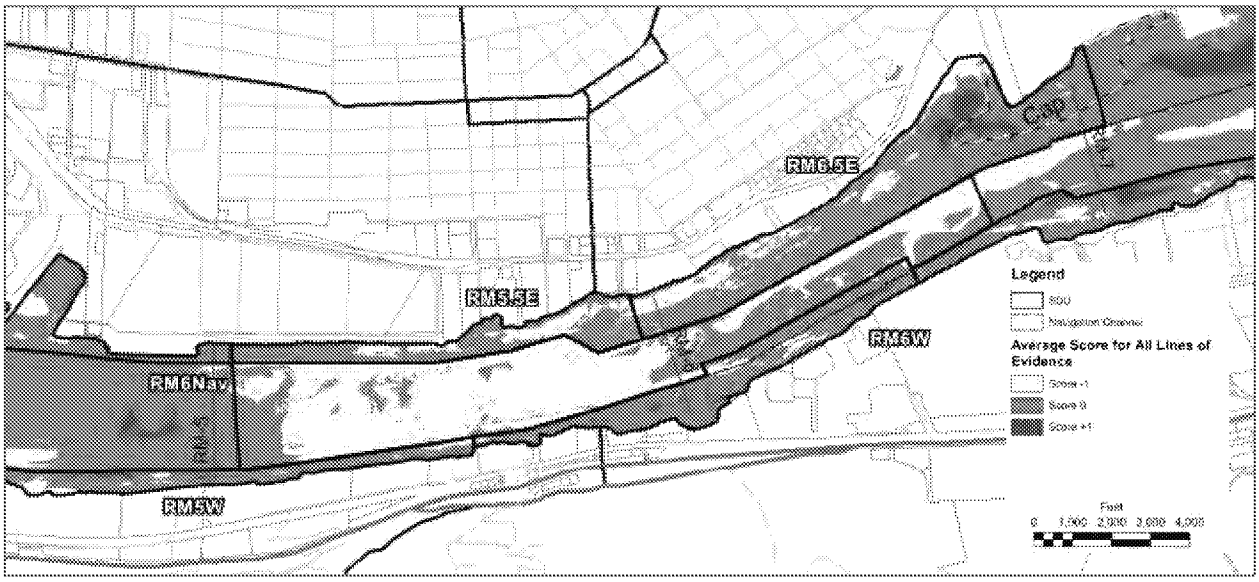


Figure 3 – PAH Loading under Low Flow Conditions

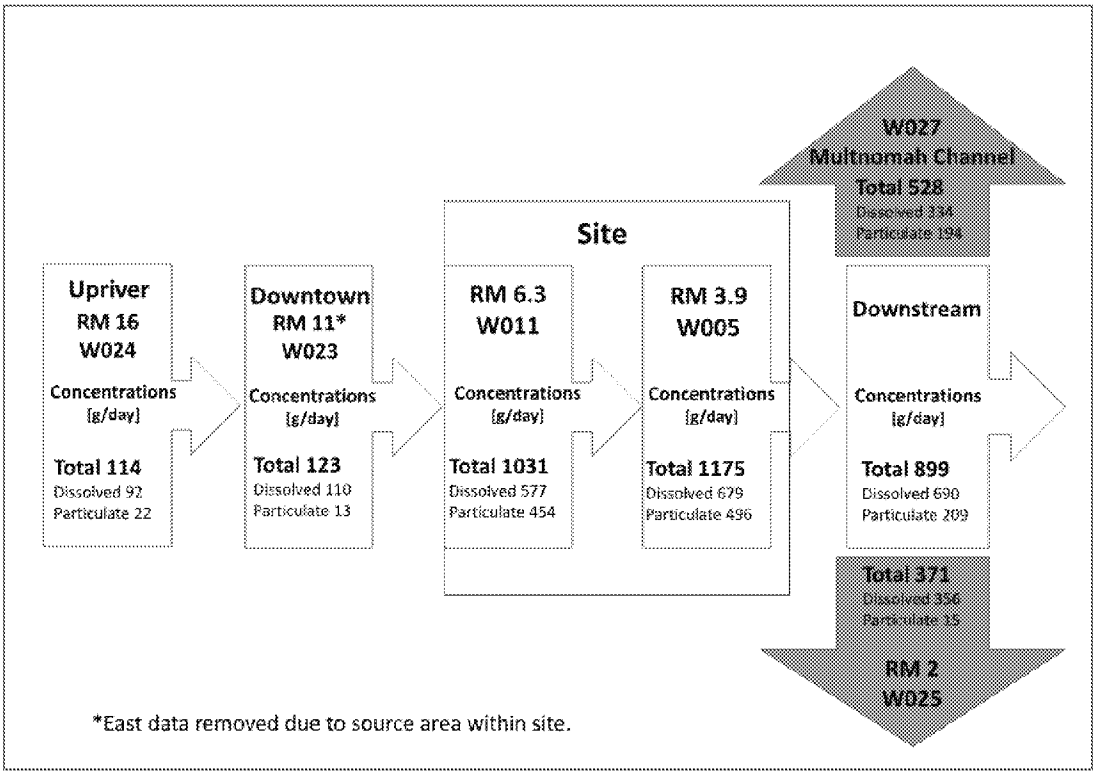
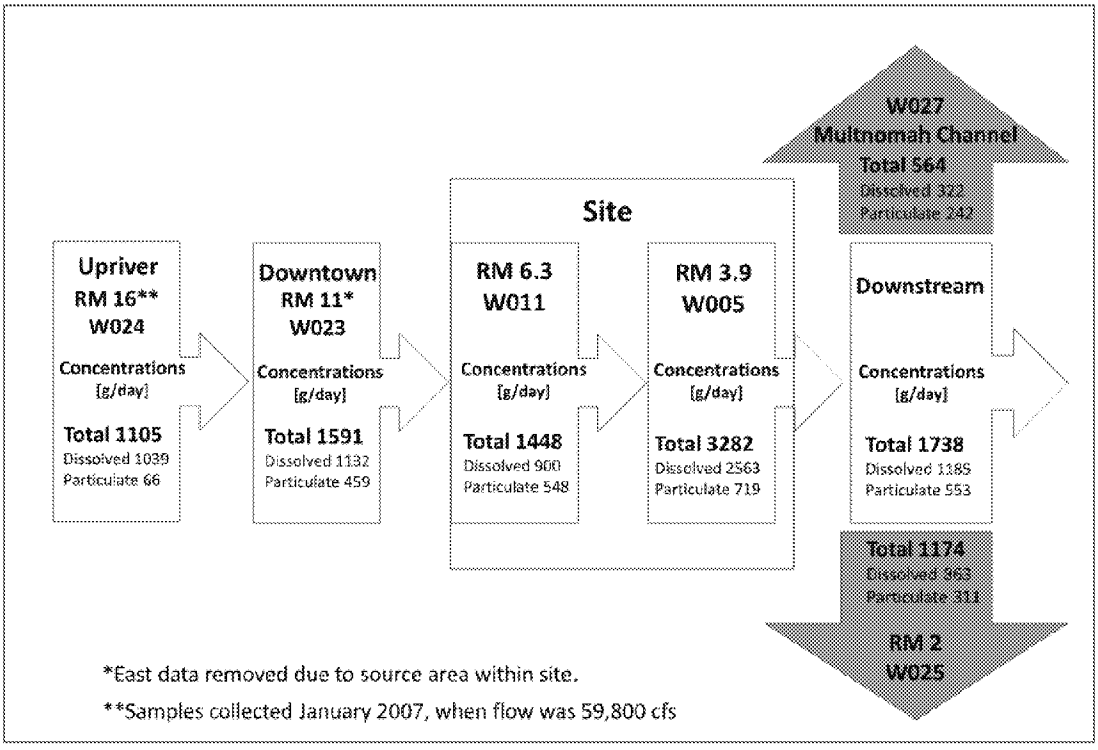


Figure 4 – PAH Loading under High Flow Conditions



Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 3/3/2018 1:09:21 AM
To: Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
CC: Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Mairs, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6942aa5f61c2453082c5b1c3089fce90-Mairs, Stephanie]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Knudsen, Laura [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ee4d40361dc54627953429d619f5c808-Knudsen, Laura]; Skadowski, Suzanne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1713ed42e6e244bc9fcd783d4a8d39ab-Skadowski, Suzanne]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Ingemansen, Dean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=80449989b40b42ec8202ed034c75b237-Ingemansen, Dean]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
Subject: RE: Comments on draft ESD re: (LHC rev) IRIS change attorney client2
Attachments: RE: DEQ letter of support on ESD for iris update (deliberative)

And here are the latest appendices.

Scott, let's lose the confidential stamped figures in the 5T letter unless they are specifically referenced in the body in which case I'll check with Gail about removing those watermarks.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer
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Portland Harbor: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1002155

From: Sheldrake, Sean
Sent: Friday, March 2, 2018 3:35 PM
To: Cora, Lori <Cora.Lori@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>

Cc: Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Laura Knudsen (Knudsen.Laura@epa.gov) <Knudsen.Laura@epa.gov>; Suzanne Skadowski (Skadowski.Suzanne@epa.gov) <Skadowski.Suzanne@epa.gov>; Chu, Rebecca <Chu.Rebecca@epa.gov>; Eva DeMaria (DeMaria.Eva@epa.gov) <DeMaria.Eva@epa.gov>; Zhen, Davis <Zhen.Davis@epa.gov>; Cami Grandinetti (Grandinetti.Cami@epa.gov) <Grandinetti.Cami@epa.gov>; Dean Ingemansen (Ingemansen.Dean@epa.gov) <Ingemansen.Dean@epa.gov>
Subject: RE: Comments on draft ESD re: (LHC rev) IRIS change attorney client

Thanks very much Lori.

Copying the whole group again such that anyone who hasn't commented yet can add to your version.

Thanks everyone.

S

Sean Sheldrake RPM, Unit Diver Officer
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Portland Harbor: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1002155

From: Cora, Lori
Sent: Friday, March 2, 2018 1:58 PM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>; Scott Coffey <coffeyse@cdmsmith.com>
Cc: Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>
Subject: Comments on draft ESD re: IRIS change

Hello, attached are my comments on the draft ESD. It looks like a lot, but overall I think the ESD meets the requirements of the ROD guidance very well. I think at some places there is a lot of assumed knowledge or rationale (or belief that someone can understand the graphs without any explanation) that needs to be spelled out more in the narrative. I'm happy to discuss my comments if any aren't clear.

Lori Houck Cora | Assistant Regional Counsel
U.S. Environmental Protection Agency | Region 10
P: (206) 553.1115 | F: (206) 553.1762 | cora.lori@epa.gov

Follow @EPAnorthwest on Twitter! https://twitter.com/EPAnorthwest

Message

From: Blischke, Eric [blischkee@cdmsmith.com]
Sent: 1/17/2018 6:19:57 PM
To: Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
CC: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]
Subject: RE: SF Deliberative: RE: Question on IRIS change raised by Tribes
Attachments: Map_5-1-1_App F_Final BHHRA_Complete Report.pdf; CPAH_Recreational_Beach_Risk_Estimates.xlsx

Human use beach areas were identified during the RI and sampled using a composite sampling scheme. Unlike the sediment samples, beach samples were collected from a 0 – 15 cm depth interval. It should be noted that the only chemicals found to pose risk in the beach areas were arsenic and cPAHs and that the risk levels for recreational beach users were low (maximum risk level = 2 x 10-5). The attached figure shows the various beaches and risk results as presented in the BHHRA. The attached spreadsheet shows the cPAH risk estimates as presented in the BHHRA and with application of the updated BaP slope factor. Using the revised slope factor, only a handful of beaches pose unacceptable risk (03B031, 04B024, 05B018, 06B030, B003 and B005) with a maximum cPAH risk level of 5 x 10-6. Finally, it should be noted that nearshore RAL exceedances (13,000 ug/kg tPAH or 30,000 ug/kg tPAH) do not encompass beach areas with the possible exception of a portion of beach 04B023 located just upstream of Linnton. This beach does not present unacceptable risk due to PAHs based on the revised BaP slope factor; arsenic risk at this location is 4 x 10-6.

In some of our conversations with Laura, it appears that the Oregon Health Authority has questions about the beaches and what information to provide the public about the risks at these areas. OHA may want data to assess potential risks to recreational users within PH; we may need another vehicle to get this data.

Eric

From: Gustavson, Karl [mailto:Gustavson.Karl@epa.gov]
Sent: Wednesday, January 17, 2018 9:39 AM
To: Coffey, Scott <CoffeySE@cdmsmith.com>
Cc: Sheldrake, Sean <sheldrake.sean@epa.gov>; Blischke, Eric <blischkee@cdmsmith.com>
Subject: SF Deliberative: RE: Question on IRIS change raised by Tribes

Deliberative Process / Ex. 5

Cheers,

Karl

From: Coffey, Scott [mailto:CoffeySE@cdmsmith.com]
Sent: Wednesday, January 17, 2018 11:04 AM
To: Gustavson, Karl <Gustavson.Karl@epa.gov>
Cc: Sheldrake, Sean <sheldrake.sean@epa.gov>; Blischke, Eric <blischkee@cdmsmith.com>
Subject: Question on IRIS change raised by Tribes

Hi Karl.

Last week we had a brief meeting with TCT members to describe the proposed DRAFT decisions on cleanup levels and RALs related to the IRIS update.

A question/concern raised by the Tribes that caught our attention pertained to the additional cleanup level that would be assigned to the Shallower "beach" areas – I believe these are areas shallower than -15 ft msl. The question/concern related to this proposed, added, area-specific cleanup level pertains to the now signed Baseline Monitoring Program and if there is sufficient coverage in this "beach" area with sample data since the Pre-RD group's surface sediment sampling design is randomized. The question being: Is there enough baseline and future sampling data to evaluate achievement of this newly established cleanup level for this specific area?

As you recall, the EPA plan had set transect sample locations that probably had sufficient coverage of "beach" areas, but I'm not sure if the Pre-RD Group's randomized sample locations are sufficiently covering this new evaluation area.

Sean and I would like your thoughts on this and if there is something we should look into related to this question/concern before these decisions get finalized. For instance, should we check with John Kern on sufficient number of beach area samples (statistically) in this randomized sample scheme? Not sure where we go next if the answer is – not sufficient.

Scott

Scott Coffey, L.Hg.
Hydrogeologist
CDM Smith | consulting engineering construction operations
14432 SE Eastgate Way, Suite 100 | Bellevue, WA 98007
phone: (425) 519-8320| mobile (206) 503-1512
email: coffeyse@cdmsmith.com | www.cdmsmith.com

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 8/24/2017 6:41:02 PM
To: Blischke, Eric [blischkee@cdmsmith.com]
CC: Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]; Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]; Ebright, Stephanie [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6fe08cfbe17940aabd4d999a19eada04-Ebright, Stephanie T.]; Chu Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]
Subject: RE: BaP sf deliberative
Attachments: RE: BaP

Deliberative Process / Ex. 5

S

Sean Sheldrake, Unit Diving Officer, RPM
EPA Region 10, 1200 Sixth Ave., Suite 900; Mailstop DOC-01
Seattle, WA 98101
206.553.1220 desk
206.225.6528 cell
http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

Over 47 years of scientific diving in support of EPA's mission

-----Original Message-----
From: Blischke, Eric [mailto:blischkee@cdmsmith.com]
Sent: Thursday, August 24, 2017 9:46 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Scott Coffey <coffeyse@cdmsmith.com>
Subject: RE: BaP

I am available at that time. In the meantime, I have looked at some of the PAH SW data. There are limited samples for the purpose of evaluating PAH loading in the RM 5 - 7 area of the site and much of the data was collected using peristaltic pumps with a lot of non-detected values.

The best data would be the transects at RM 6.3 and RM 3.9 which were collected using XAD samplers (dissolved and total) over a range of flow conditions. This data was used in the PH FS to develop loading estimates. The loading estimates show an increase in load between RM 6.3 and RM 3.9 for PAHs under all flow conditions. Thus, I think that Kevin has a point based on empirical data collected during the PH RI.

I am attaching the PAH loading figures and a SW sample location map from the RI.

Eric
-----Original Message-----
From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
Sent: Thursday, August 24, 2017 9:25 AM
To: PARRETT Kevin <kevin.parrett@state.or.us>
Cc: Blischke, Eric <blischkee@cdmsmith.com>; Coffey, Scott <CoffeySE@cdmsmith.com>
Subject: Re: BaP

Sure Kevin- I have 1-2 today, booked tomorrow other than during your EQc meeting- Monday can work too.

I'll ask Eric to check a time that works for you.

S

Sean Sheldrake
Unit Diving Officer/ RPM
206.225.6528

Sent from my iPhone

> On Aug 24, 2017, at 7:01 AM, PARRETT Kevin <kevin.parrett@state.or.us> wrote:
>
> Hi Sean. Could we talk more about BaP? Maybe you, Eric and me.
>
> -Kevin

Message

From: Hladick, Christopher [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=B82D04419C42423A97BD7624A3A09908-HLADICK, CH]
Sent: 4/14/2018 3:29:40 PM
To: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]
Subject: Re: CONFIDENTIAL - Summary of NWN Meeting with OECA

Thanks Davis

Sent from my iPhone

On Apr 13, 2018, at 4:08 PM, Zhen, Davis <Zhen.Davis@epa.gov> wrote:

FYI

Thanks,

Sent from my iPhone, please excuse typos
****
Davis Zhen, Manager
Environmental Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 900
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

Begin forwarded message:

From: "Mackey, Cyndy" <Mackey.Cyndy@epa.gov>
Date: April 13, 2018 at 1:31:29 PM PDT
To: "Zhen, Davis" <Zhen.Davis@epa.gov>, "Stern, Allyn" <Stern.Allyn@epa.gov>, "Bilbrey, Sheryl" <Bilbrey.Sheryl@epa.gov>, "Grandinetti, Cami" <Grandinetti.Cami@epa.gov>, "Cora, Lori" <Cora.Lori@epa.gov>
Cc: "Nearhood, Jennifer" <Nearhood.Jennifer@epa.gov>, "Patterson, Kenneth" <Patterson.Kenneth@epa.gov>, "Woolford, James" <Woolford.James@epa.gov>
Subject: RE: CONFIDENTIAL - Summary of NWN Meeting with OECA

Two additional issue that were discussed:

(1) NWN mentioned that there is potential for recontamination in performing in "early actions". In this discussion, NWN expressed concern that Arkema design is not proceeding (AOC terminated) and that this could delay NWN's ability to implement remedy action at its facility due to the significant potential for recontamination.

(2) NWN also mentioned PAH issues and provided a map that showed areas (in yellow) that "are already protective of human health based on IRIS update". Ecological risk factors were not mentioned and very little time was spent discussing the PAH issues.

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
1200 Pennsylvania Ave., N.W. (Room-WJC 5206) Washington, DC 20460
202 564-8206 (Direct Line)
202 564-5110 (Office Line)
202 591-6184(Office Cell)

This email is for the intended recipient only and may contain material that is privileged and/or confidential. If you believe you have received this email in error, please notify the sender. Thank you

---

From: Mackey, Cyndy
Sent: Friday, April 13, 2018 3:51 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>; Bilbrey, Sheryl <bilbrey.sheryl@epa.gov>; Grandinetti, Cami <grandinetti.cami@epa.gov>; Lori Cora <Cora.Lori@epa.gov>
Cc: Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Patterson, Kenneth <patterson.kenneth@epa.gov>
Subject: CONFIDENTIAL - Summary of NWN Meeting with OECA

CONFIDENTIAL

All

Below is a brief summary of an OECA meeting with NW Natural Representatives that took place in DC on April 10, 2018.

> EPA participants were Susan Bodine, Cyndy Mackey, Jim Woolford, Nick Falvo and Allyn Stern (by phone).
> Other participants were Elliott Laws, Tom Imeson, Patty Dost, Bob Wyatt and "Marty".
>
> NW Natural representatives stated that they wanted to introduce themselves to Susan and to share their willingness to proceed with RD-RA at the Gasco facility. They stated that they are committed to a Harbor-wide CD process and to continued participation in the allocation process. They then shared that they are concerned about the timeline for RD-RA negotiations and are skeptical the allocation will be completed by December 2019. Given these concerns, they asked EPA to be open to the possibility of localized areas for remedy implementation and specifically stated that are prepared to enter into a CD for the Gasco site with a cash out component for the remainder of the site.
>
> Susan encouraged them to work with the other PRPs and told them that EPA is not interested in breaking up the site into units, at this time. OECA expressed interest in seeing a site-wide approach to the cleanup and expressly stated that any work area breakouts would result in "work" covenants, not site-wide covenants. When pushed to meet again, OECA indicated that any further discussion prior to receipt of a PRP response to the Special Notice Letters seems like it would be premature and counter-productive.

Happy to discuss further, if needed.

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
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202 564-5110 (Office Line)
202 591-6184(Office Cell)

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---

From: Zhen, Davis
Sent: Friday, April 13, 2018 2:00 PM
To: Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Stern, Allyn <Stern.Allyn@epa.gov>
Subject: Quick summary needed for RA on recent meeting with Bodine

Hi Cyndy and Allyn,

In my briefing with Chris yesterday, he was surprised to hear that NWN had a meeting with Susan Bodine earlier in the week and asked for a quick summary of the meeting. Since I am not part of the meeting, could either of you get him a short write up? Thank you.

Thanks,

****
Davis Zhen, Manager
Site Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 155
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

<Portland Harbor Map Provided By NWN 4-10-18.jpg>

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 9/27/2018 10:13:12 PM
To: Mackey, Cyndy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2f2b414786040ee8d75a21fa1c04a9b-Mackey, Cyndy]; DeLeon, Rafael [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8fe1a548ff8420baf320ae05f5bce12-DeLeon, Rafael]; Nearhood, Jennifer [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=20b4526e6bad4a3fa51ed3c14ca51a04-Nearhood, J]
Subject: FW: Portland Harbor Material
Attachments: Portland Harbor Remediation and Remedy Selection - 9 27 2018.docx; R10 Portland Harbor Fact Sheet_FINAL_27-SEPT-2018.docx; PH_ESD_One_Page_Briefing_Paper 9 27 18.docx; PH Map.docx

For AW's visit next week.

Jim Woolford, Director
Office of Superfund Remediation and Technology Innovation
Office of Land and Emergency Management
US Environmental Protection Agency
1200 Penn. Ave., NW
Washington, DC 20460
(Mail Code 5201-P)

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Room 5622
One Potomac Yard (South)
2777 S. Crystal Dr.
Arlington, VA 22202

From: Gartner, Lois
Sent: Thursday, September 27, 2018 5:49 PM
To: Fonseca, Silvina <Fonseca.Silvina@epa.gov>
Cc: Hilosky, Nick <Hilosky.Nick@epa.gov>; Brooks, Becky <Brooks.Becky@epa.gov>; Breen, Barry <Breen.Barry@epa.gov>; Cook, Steven <cook.steven@epa.gov>; Wright, Peter <wright.peter@epa.gov>; Woolford, James <Woolford.James@epa.gov>; Stalcup, Dana <Stalcup.Dana@epa.gov>; Bilbrey, Sheryl <Bilbrey.Sheryl@epa.gov>;

Fleming, Sheila <fleming.sheila@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>
Subject: Portland Harbor Material

Silvina:

Please find attached four Portland Harbor documents, three fact sheets and one map. These documents have not been reviewed by the OLEM IO. Also, I understand that you and Jim discussed the Quendall fact sheet and that you are set in that regard.

Thanks for your patience.

Lois Haas Gartner
Special Assistant
Office of Superfund Remediation
and Technology Innovation
U.S. Environmental Protection Agency
703.603.8711 (desk)
703.581.9794 (cell)

Message

From: Mackey, Cyndy [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=B2F2B414786040EE8D75A21FA1C04A9B-MACKEY, CYNDY]
Sent: 11/30/2018 2:02:46 PM
To: Barbara Washington [Washington.Barbara@epa.gov]
CC: DeLeon, Rafael [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8fe1a548ff8420baf320ae05f5bce12-DeLeon, Rafael]; Patterson, Kenneth [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8124081dc0f5490d983dbd6764b0a3f1-KPATTERS]; Lammie, Benjamin [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a5c77572c39a4546835b057722ff50ce-Blammie]
Subject: FW: Materials for Portland Harbor trip
Attachments: PortlandHarborMap_Upland Properties.pdf; Portland Harbor Remediation Areas.pdf; itinerary december PDX.docx; PH_Remedial-Design_FAQ_References_Final.pdf; 12-4-2018 PH messages clean.docx; 12-5 meeting agenda and TPs.docx; Press Availability Messages 12-5 brief.docx; Community Meeting Q&A and participant list.docx; PH Superfund Site 12.4 Mtng Run of Show (Final Draft 11.29.2018).pdf

Barbara

Please print all these documents (color where appropriate) and put with my Portland Harbor materials (which are on one of the burgundy chairs in my office. Thanks.

Cyndy Mackey
Director, Office of Site Remediation Enforcement
EPA-Office of Enforcement and Compliance Assurance (Mail Code-2271A)
1200 Pennsylvania Ave., N.W. (Room-WJC 5206) Washington, DC 20460
202 564-8206 (Direct Line)
202 564-5110 (Office Line)
202 591-6184(Office Cell)

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---

From: Grandinetti, Cami
Sent: Thursday, November 29, 2018 7:48 PM
To: Cook, Steven <cook.steven@epa.gov>; Woolford, James <Woolford.James@epa.gov>; Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Breen, Barry <Breen.Barry@epa.gov>; Hladick, Christopher <hladick.christopher@epa.gov>; Pirzadeh, Michelle <Pirzadeh.Michelle@epa.gov>; Holsman, Marianne <Holsman.Marianne@epa.gov>; Bilbrey, Sheryl <bilbrey.sheryl@epa.gov>; Zhen, Davis <Zhen.Davis@epa.gov>; Nearhood, Jennifer <Nearhood.Jennifer@epa.gov>; Gustavson, Karl <Gustavson.Karl@epa.gov>; Sheldrake, Sean <sheldrake.sean@epa.gov>; Ingemansen, Dean <Ingemansen.Dean@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>; Hilosky, Nick <Hilosky.Nick@epa.gov>; Brooks, Becky <Brooks.Becky@epa.gov>; Ebright, Stephanie <EBRIGHT.STEPHANIE@EPA.GOV>; Mairs, Stephanie <Mairs.Stephanie@epa.gov>; Clark, Josie <Clark.Josie@epa.gov>; DeMaria, Eva <DeMaria.Eva@epa.gov>; Young, Hunter <Young.Hunter@epa.gov>
Subject: Materials for Portland Harbor trip

Greetings everyone—Attached to this email are several attachments to prepare you for our meetings next week in Portland. I apologize there are so many—I wanted to keep them all in one place for you.
I have listed the items below—the highlighted ones are those with our messages and the itinerary should give you information about what is happening when. Let me know if you have any questions and please distribute to those I missed with my apologies. See you next week in Portland!

Chris and Sheryl—I have hard copies printed out for you and will drop at your desks.

Attached are the following items:

1. Portland Harbor Remediation Areas Map (showing cap/dredge/enhanced recovery areas of the site)
2. Portland Harbor Map (showing upland source areas)
3. Itinerary for December 3-6
4. Remedial Design FAQs (in very small print—sorry!)
5. 12-4 messages and flow for EPA speakers
6. 12-5 agenda with imbedded messages for EPA speakers
7. Press availability messages
8. Community Meeting Q&A and participant list
9. PH Superfund Site Run-of-Show (details of set up and flow of 12-4 meeting)

Cami Grandinetti
Program Manager, Remedial Cleanup Program
US EPA
1200 6th Avenue, Suite 155, ECL-123
Seattle, Wa. 98101
(206) 553-8696 (desk)
(206) 390-8890 (cell)

Message

From: Pirzadeh, Michelle [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=2AE309E0A52A42CD847709B39BC2239A-PIRZADEH, MICHELLE]
Sent: 3/13/2018 5:37:38 PM
To: Tyson, Linda [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d7ad12af04f64468b18e3960f2a77781-Tyson, Lind]; Erikson, Linda [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=216310f1976841b78edc0f6e41fabb90-Erikson, Li]
Subject: Fwd: POSTPONED: Portland Harbor Sr Leadership call

FYI

Sent from my iPhone

Begin forwarded message:

From: "Zhen, Davis" <Zhen.Davis@epa.gov>
Date: March 13, 2018 at 10:05:45 AM PDT
To: Bill Ross <bross@rossstrategic.com>, "Cora, Lori" <Cora.Lori@epa.gov>, "Mackey, Cyndy" <Mackey.Cyndy@epa.gov>, "Hladick, Christopher" <hladick.christopher@epa.gov>, "Woolford, James" <Woolford.James@epa.gov>, "Pirzadeh, Michelle" <Pirzadeh.Michelle@epa.gov>, 'OGRODNIK Katie' <katie.ogrodnik@state.or.us>, 'PARRETT Kevin' <kevin.parrett@state.or.us>, 'Richard Whitman' <richard.whitman@state.or.us>, 'SEIDEL Paul' <paul.seidel@state.or.us>, "Sheldrake, Sean" <sheldrake.sean@epa.gov>, "Bilbrey, Sheryl" <Bilbrey.Sheryl@epa.gov>, "Ingemansen, Dean" <Ingemansen.Dean@epa.gov>, "Mairs, Stephanie" <Mairs.Stephanie@epa.gov>, "Chu, Rebecca" <Chu.Rebecca@epa.gov>
Subject: POSTPONED: Portland Harbor Sr Leadership call

Hi Everyone,

Cami just confirmed with Chris earlier today to postpone this meeting to a later date. I will work with Bill and Kevin to reschedule this meeting. Have a nice day everyone.

Thanks,

****
Davis Zhen
Environmental Cleanup Unit 2
Office of Environmental Cleanup
1200 Sixth Avenue Suite 900
M/S ECL – 122, Seattle, WA 98101
Tel: (206) 553-7660
Cell: (206) 437-5826
****

-----Original Appointment-----
From: Bill Ross [mailto:bross@rossstrategic.com]
Sent: Wednesday, February 14, 2018 4:17 PM
To: Bill Ross; Cora, Lori; Mackey, Cyndy; Zhen, Davis; Hladick, Christopher; Woolford, James; Pirzadeh, Michelle; 'OGRODNIK Katie'; 'PARRETT Kevin'; 'Richard Whitman'; 'SEIDEL Paul'; Sheldrake, Sean; Bilbrey, Sheryl; Ingemansen, Dean; Mairs, Stephanie; Chu, Rebecca

Subject: Portland Harbor Sr Leadership call
When: Tuesday, March 13, 2018 2:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Call-in number Redacted pass code Redacted

Here is the agenda for the March 13 Senior Leaders call. Working with the EPA and DEQ managers of the cleanup, the agenda has been developed to focus on issues in which senior leaders' direction, decision-making and connectivity are essential and hence the call will not be an overall project update briefing. Attendance at the call has been determined by the managers to include those staff essential to the strategic discussion that will ensue at the call.

1. <!--[if !supportLists]--><!--[endif]-->Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
   - **T4 (Port project)** - EPA response to Port request for potential ROD amendments by applying Nav Channel RALs in Slip 3. *Will Port proceed in some fashion if their request is rejected?*
   - **Gasco** - ExxonMobil has communicated with both EPA and DEQ that it believes the AOC needs to be substantially expanded to include downriver PAH contamination. DEQ is drafting a response letter to EM's assertion of inadequate source control. EM also wants to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. *How should EPA and DEQ respond to EM's requests for agency decisions?*
   - **ESD for PAHs** - EPA is preparing an ESD in response to NW Natural's request that the RAL for PAHs be reconsidered in light of the updated risk numbers for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation. *When this commences, how should DEQ indicate its concurrence?*
2. <!--[if !supportLists]--><!--[endif]-->Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation.
3. <!--[if !supportLists]--><!--[endif]-->Timing of next meeting and determination of the value (and frequency) of all hands briefings as well as these more focused strategic discussions.

Message

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/29/2018 3:37:43 PM
To: Gail Fricano [GFricano@indecon.com]
CC: Julie Weis (JWeis@hk-law.com) [JWeis@hk-law.com]; joepitt@ctuir.org; Alanna Nanegos (AlannaNanegos@ctuir.org) [AlannaNanegos@ctuir.org]; NaomiStacy@ctuir.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a9e24e75d3ac47f6a79ead79cc5dedff-NaomiStacy@ctuir.org]; Matthew Johnson (MatthewJohnson@ctuir.org) [MatthewJohnson@ctuir.org]; brandy.humphreys@grandronde.org [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b734be3e26c3481d9416e0aab4ca8ff3-brandy.humphreys@grandronde.org]; holly.partridge@grandronde.org; tomd@ctsi.nsn.us [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=805ff81f08994a6aa8fc5a22ca607422-tomd@ctsi.nsn.us]; Josh Newton [jn@karnopp.com]; Jen Graham (jennifer.graham@ctwsbnr.org) [jennifer.graham@ctwsbnr.org]; MLW@karnopp.com; courtney@crag.org; Rita Cabral [RCabral@indecon.com]; Rachel DelVecchio [RDelVecchio@indecon.com]
BCC: Zhen, Davis [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2a43e2ddfd444abbb0329c0a17d06ec9-Zhen, Davis]; Grandinetti, Cami [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a913b4fe8aed4d16be462417a78d8261-Grandinetti, Carmela]; Chu, Rebecca [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=527cd5b55e9a465894bd6756bd3b291e-Chu, Becky]; DeMaria, Eva [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]; Scott Coffey [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user0c39210c]
Subject: Re: EPA's proposal re: IRIS update (sf)

Gail, understood. Thank you for the clarification. Since the January 11 briefing is not necessarily our final decision I will make it clear during briefings what the Five Tribes support and notify you if there are any changes. In my view having the tribes' position available for the briefings is how our process should work and I very much appreciate this timely feedback.

S

Sean Sheldrake
Unit Diving Officer/ RPM
206.225.6528

Sent from my iPhone

> On Jan 29, 2018, at 5:25 AM, Gail Fricano <GFricano@indecon.com> wrote:
>
> Hi Sean,
>
> Regarding my email below, the Five Tribes also want to convey that we support making the IRIS-related changes via an ESD. We do not want to see the ROD re-opened through a ROD amendment.
>
> And just to clarify, by saying that we support the EPA proposal, I am referring to the proposal EPA presented on the January 11 webinar (materials attached). If EPA modifies this proposal in any way, we would need to evaluate the modified proposal to determine whether we support it.
>
> Thank you.
>
> Gail
>
>
> Gail French Fricano
> Senior Associate
> IEc
> Industrial Economics, Incorporated
> 2067 Massachusetts Ave. Cambridge, MA 02140
> 617.354.0074 x114
> www.indecon.com<http://www.indecon.com/>
>

>
>
> From: Sheldrake, Sean [mailto:sheldrake.sean@epa.gov]
> Sent: Thursday, January 25, 2018 12:53 PM
> To: Gail Fricano
> Cc: Rita Cabral
> Subject: RE: EPA's proposal re: IRIS update (sf)
>
> Gail,
>
> Thank you very much for relaying that support on behalf of the Five Tribes. It's very helpful to know at this point, and I think receiving such a memo in coming weeks should work in conjunction with our briefings relaying that support verbally, if that's okay with the Five Tribes.
>
> I'll emphasize that this support doesn't waive any current or future consultation requests.
>
> S
>
> Sean Sheldrake, Unit Diving Officer, RPM
> EPA Region 10, 1200 Sixth Ave., Suite 900; Mailstop DOC-01
> Seattle, WA 98101
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> 206.225.6528 cell
> http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor
> [FB icon]<https://www.facebook.com/EPADivers>[scidive_round]<https://www.epa.gov/scientific-diving>[flickr icon for signature block]<https://www.flickr.com/photos/usepagov/sets/72157629017469667/with/14530254926/>
> Over 48 years of scientific diving in support of EPA's mission
>
> From: Gail Fricano [mailto:GFricano@indecon.com]
> Sent: Thursday, January 25, 2018 5:16 AM
> To: Sheldrake, Sean <sheldrake.sean@epa.gov<mailto:sheldrake.sean@epa.gov>>
> Cc: Rita Cabral <RCabral@indecon.com<mailto:RCabral@indecon.com>>
> Subject: EPA's proposal re: IRIS update
>
> Hi Sean,
>
> I met with the Five Tribes yesterday, and we agreed that IEc would draft a memo indicating support for EPA's proposal regarding the IRIS update. Because we are scrambling to get you comments on the FSPs, we won't be able to get to the memo for another couple weeks, but I did want to give you notice that it is coming. The memo will focus on the technical aspects of EPA's proposal, and the Five Tribes reserve the right to request consultation regarding the process surrounding the proposal, including EPA's interactions with the TCT.
>
> Please let me know if you have any big concerns about the timing of our memo.
>
> Thank you.
>
> Gail
>
> Gail French Fricano
> Senior Associate
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> <image004.png>
> <image006.png>
> <image008.png>
> <Total_PAH_Navigation_Channel_RAL_Text_1-5-18.docx>
> <CPAH_Slope_Factor_Change_TCT_1-11-18_v2.pptx>

Message

From: Coffey, Scott [CoffeySE@cdmsmith.com]
Sent: 5/4/2018 8:25:29 PM
To: Sheldrake, Sean [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d16e2780a4094bba82daaa5283a71572-Sheldrake, Sean]; Cora, Lori [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c8850941bf1540c796559dce75c2f5ee-Cora, Lori]
CC: Blischke, Eric [blischkee@cdmsmith.com]; Foster, Malena L. [fosterml@cdmsmith.com]
Subject: RE: latest ESD- delib2
Attachments: Portland_Harbor_DRAFT ESD_2018-04-25_RLSO.DOCX

Hi Lori.

DEQ gave us an extensively marked up PDF (mostly editorial) Some comments have been a bit more time consuming to address. Eric tracked his revisions and response to their comments in the attached RLSO word version. Below are some highlights from Eric's emails to me after he reviewed their comments and then after he addressed them. Hope this helps with your current review. Scott

April 25th Eric wrote:

Hi Scott – I have gone through the DEQ comments. They are generally straight forward. Some that are less straight forward:

DEQ is requesting an additional figure that shows the new remedial footprint in addition to the current Figure 8.
DEQ is asking about a potential new IC addressing beach exposures. The status of this is unclear to me.

Also, DEQ suggests that the lipid content value presented on page 22 is inconsistent with the BHHRA. The value 0f 0.22 was taken directly from Appendix B of the ROD and seems to have been verified by Lynn Woodberry's calculation check. That said, clam lipid values as presented in the PH data base range between 0.84 and 4.63 % with an average of 2.1% so a lipid content of 0.022 seems right. The pre-IRIS change clam PRG value of 3,950 ug/kg is the value we have been using for a long time now so I do not want to make this change. Something else must be going on with this equation.

I can go ahead and start updating the document. I assume that the latest version is on PW.

Eric

Follow-up email after Eric addressed DEQ comments:

HI Scott – I have updated the ESD in response to ODEQ comments and placed on PW. The document is also attached. I made changes in response to almost all ODEQ comments. I also included the basis for the change or for not making a change as a comment.

There are a few ODEQ comments that affect the tables and figures. These changes have not been made.

Figure 2 and Figure 3. These need to be swapped (i.e., Figure 3 should become Figure 2 and Figure 2 should become Figure 3 based on order of appearance in the document – RALs first then PTW). I have made the changes to the text but the figures need to be updated accordingly.
ODEQ has requested a number of additional figures. The figure and the page where the figure would be first referenced are outlined below:

- *A figure showing the location of the recreational beach areas (page 22)*
- *A figure showing the change in riverbank area (page 27)*
- *A figure showing the final remedial footprint in addition to our Figure 8 (page 28)*

ODEQ has requested changing the title to Table 6. I do not think we need this change since the title is consistent with the ROD table title.

I am still scratching my head regarding the clam BSAR equation but since we have verified the calculation and it matches what is presented in Appendix B, I recommend no change.

Eric

Since Eric addressed these comments last week, we have started to make changes to the figures and tables and re-assembling the PDF with DEQ emails added to the Appendix A record. We have also added the captured "Reading Room Event comments from the Tribes" in a memo that is now added to the Appendix A records list. I am also adding some language in the riverbank section to clarify that despite active remediation areas shrinking in certain adjacent ROD riverbanks, these riverbank areas will **still require ROD riverbank characterization consistent with other ROD riverbanks shown in Figure 8 of the ROD** that didn't have active remediation offshore.

We should have this updated ESD document to you by early next week (targeting Monday).

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Friday, May 04, 2018 1:08 PM
To: Cora, Lori <Cora.Lori@epa.gov>; Coffey, Scott <CoffeySE@cdmsmith.com>
Cc: Blischke, Eric <blischkee@cdmsmith.com>; Foster, Malena L. <fosterml@cdmsmith.com>
Subject: RE: latest ESD- delib2

Lori, will ask that all changes be highlighted in rlso as well as some added explanation on the DEQ changes to assist your review. Thank you. S

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https://www.facebook.com/EPADivers
https://www.epa.gov/superfund/portland-harbor

From: Cora, Lori
Sent: Friday, May 4, 2018 10:40 AM
To: Scott Coffey <coffeyse@cdmsmith.com>; Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Blischke, Eric <blischkee@cdmsmith.com>; Foster, Malena L. <fosterml@cdmsmith.com>
Subject: RE: latest ESD- delib

Can you highlight DEQ's comments for me?

Lori Houck Cora | Assistant Regional Counsel
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From: Coffey, Scott [mailto:CoffeySE@cdmsmith.com]
Sent: Friday, May 04, 2018 10:30 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: Cora, Lori <Cora.Lori@epa.gov>; Blischke, Eric <blischkee@cdmsmith.com>; Foster, Malena L. <fosterml@cdmsmith.com>
Subject: RE: latest ESD- delib

Yes. The last version was April 10, but we now have incorporated DEQ comments (fairly extensive) and a couple of those comments Eric and I need to discuss with you.

We should have this updated draft ready for you to look at today, but it will have those unresolved DEQ comments.

Is there a good time for you to chat with Eric and I about those? Also want to resolve the Sed Trap statement for Davis to send to the Pre-RD Group, so we could take care of that as well during the call?

Scott

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Friday, May 04, 2018 9:42 AM
To: Coffey, Scott <CoffeySE@cdmsmith.com>
Cc: Cora, Lori <Cora.Lori@epa.gov>
Subject: latest ESD- delib

Hi Scott, looking at the last draft, it doesn't look like the tech assignment update made it in? I think with a revamped color scheme that might be more legible, we definitely need to include this (unless there are team objections).

Thank you.

S

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https://www.epa.gov/superfund/portland-harbor

DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES

Portland Harbor Superfund Site

Portland, Oregon

U.S. Environmental Protection Agency Region 10

Seattle, Washington

April 2018

TABLE OF CONTENTS

Commented [BE1]: TOC and footnotes Font was changed to address ODEQ formatting comment.

[TOC \o "1-3" \h \z \u]

DRAFT

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Appendices

Appendix A Supporting Documentation and Information

- A1 Updated Record of Decision Tables 17 and 21
- A2 Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018
- A3 Discussion and Response to August 2, 2017 NW Natural Memo titled "USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels and Remedial Action Levels in Portland Harbor", March 2, 2018
- A4 Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017
- A5 TCT Meeting Materials, January 11, 2018
- A6 9-7-17 Email from Kevin Parrett (DEQ), Subject: PH Benthic Risk - 8-23-17.pptx
- A7 9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx
- A8 Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017
- A9 Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017
- A10 Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017
- A11 Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017

Appendix B Errata Memorandum

Appendix C Oregon Department of Environmental Quality Letter Supporting EPA's Explanation of Significant Differences

Appendix D Five Tribes Letter Supporting EPA's Explanation of Significant Differences

DRAFT

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List of Figures

ESD Figure 1 Site Area

ESD Figure 2 Principal Threat Waste

ESD Figure 3 Total PAH Remedial Action Level Contours

ESD Figure 4a Running Half River Mile Average cPAH (West)

ESD Figure 4b Running Half River Mile Average cPAH (East)

ESD Figure 5 Proportion of Half-River Miles Protected vs. Remedial Action Levels

ESD Figure 6 Total PAH RAL Curve

ESD Figure 7 Natural Recovery Summary Score

ESD Figure 8 Revised Remedial Footprint Summary

ESD Figure 9a RAO 1 Risk Level – RM Basis (West)

ESD Figure 9b RAO 1 Risk Level – RM Basis (East)

ESD Figure 9c RAO 1 Risk Level – RM Basis (Swan Island Lagoon)

ESD Figure 10a RAO 2 Risk Level – RM Basis (West)

ESD Figure 10b RAO 2 Risk Level – RM Basis (East)

ESD Figure 10c RAO 2 Risk Level – RM Basis (Navigation Channel)

ESD Figure 10d RAO 2 Risk Level – RM Basis (Swan Island Lagoon)

ESD Figure 10e RAO 2 Hazard Index Child – RM Basis (West)

ESD Figure 10f RAO 2 Hazard Index Child – RM Basis (East)

ESD Figure 10g RAO 2 Hazard Index Child – RM Basis (Navigation Channel)

ESD Figure 10h RAO 2 Hazard Index Child – RM Basis (Swan Island Lagoon)

ESD Figure 10i RAO 2 Hazard Index Infant – RM Basis (West)

ESD Figure 10j RAO 2 Hazard Index Infant – RM Basis (East)

ESD Figure 10k RAO 2 Hazard Index Infant – RM Basis (Navigation Channel)

ESD Figure 10l RAO 2 Hazard Index Infant – RM Basis (Swan Island Lagoon)

ESD Figure 11 RAO 6 Hazard Index – SDU Basis

ESD Figure 12 Human Health Beach Exposure Risk Summary

DRAFT

List of Tables

ESD Table 1 Carcinogenic PAH Cleanup Levels and Highly Toxic PTW Thresholds

ESD Table 2 RAO 1 Risk Summary – RM Basis

ESD Table 3 RAO 2 Risk and Hazard Index Summary – RM Basis

ESD Table 4 RAO 5 Benthic Risk Summary

ESD Table 5 RAO 6 Fish and Wildlife Risk Summary

ESD Table 6 RAO 3 and 7 Surface Water Reduction Summary

ESD Table 7 RAO 4 and 8 Percent Groundwater Plume Area Addressed

ESD Table 8 Percentage Contaminated River Bank Addressed by Each Alternative

ESD Table 9 Human Health Beach Exposure Risk Summary

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ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
BaP	benzo(a)pyrene
BaPeq	benzo(a)pyrene equivalent
BEHP	bis(2-ethylhexyl)phthalate
bml	below mud line
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CRD	Columbia River datum
CSF	cancer slope factor
CUL	cleanup level
CWA	Clean Water Act
cy	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DDx	DDT+DDD+DDE
DEQ	Oregon Department of Environmental Quality
dioxins	polychlorinated dibenzo-p-dioxins
DMM	disposed material management
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FMD	future maintenance dredge
FS	feasibility study
ft	feet
mg/kg	milligram per kilogram
mg/kg-day	milligram per kilogram per day
MGP	manufactured gas production
MNR	monitored natural recovery
MOU	memorandum of understanding
NAPL	non-aqueous-phase liquid
NCP	National Contingency Plan
NPL	National Priorities List
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
PTW	principal threat waste
RAL	remedial action level

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RAO	remedial action objective
RM	river mile
ROD	Record of Decision
SDU	sediment decision unit
Site	Portland Harbor Superfund Site
SMA	sediment management area
SWAC	surface area weighted average concentration
TBT	tributyltin
tribes	Native American tribes
USC	United States Code
µg/kg	microgram per kilogram
%	percent

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DRAFT PROPOSED EXPLANATION OF SIGNIFICANT DIFFERENCES PORTLAND HARBOR SUPERFUND SITE

April 2018

1.0 INTRODUCTION

1.1 Site Name and Location

The Portland Harbor Superfund Site (the Site), as listed on the National Priorities List (NPL) (Superfund Site ID#: ORSFN1002155), includes an in-river and an upland portion. The Site was listed on the NPL in December 2000 mainly due to concerns about contamination in the sediments and the potential risks to human health and the environment from consuming the fish. The Site is in Multnomah County, Oregon, and is an urban and industrial section of the City of Portland that runs along the river north of, and downstream of, the central downtown area. The in-river portion of the Site covers approximately 2,190 acres and extends from river mile (RM) 1.9 (upriver end of the Port of Portland's Terminal 5) to RM 11.8 (near the Broadway Bridge) and is shown on the proposed Explanation of Significant Differences (proposed ESD) Figure 1.

1.2 Lead and Support Agencies

The lead agency for the in-river portion of the Site is the United States Environmental Protection Agency (EPA), in consultation with the support agency, the Oregon Department of Environmental Quality (DEQ). After listing the Site on the NPL, EPA entered into a 2001 Memorandum of Understanding (MOU) with DEQ, six federally recognized Native American tribes (tribes), two other federal agencies, and one other state agency.[1] Under the MOU, DEQ is the lead agency for addressing contamination in the upland portions of the Superfund site, and EPA is the support agency.

1.3 Statement of Purpose

The Record of Decision (ROD), which documents the selected in-river remedy, was signed on January 3, 2017 (EPA 2017a). The Selected Remedy is summarized in Section 2.3 below. This proposed ESD includes changes to the remedy to the Selected Remedy and the reasons for such changes that are significant but not fundamental changes. This proposed ESD is issued in accordance with §117(c) of the Comprehensive Environmental Response, Compensation, and

[1] Government parties that signed the MOU include DEQ, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Grand Ronde Community of Oregon, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Nez Perce Tribe, the National Oceanic and Atmospheric Administration, the U.S. Department of the Interior (National Marine Fisheries Service and U.S. Fish and Wildlife Service), and the Oregon Department of Fish and Wildlife.

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Liability Act (CERCLA), 42 United States Code (USC) §9617(c), and the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) §300.435(c)(2)(i).

The purpose of the proposed ESD is to document changes to the sediment cleanup levels (CULs) and target tissue level for shellfish for carcinogenic polycyclic aromatic hydrocarbons (cPAHs) measured as benzo(a)pyrene equivalents (BaPeq). This proposed ESD also documents a change to the remedial action level (RAL) for total polycyclic aromatic hydrocarbons (PAHs) for areas of the Site outside of the Navigation Channel.

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA, 2017b). The toxicological review was prepared under the auspices of EPA's Integrated Risk Information System (IRIS) program and developed a revised oral cancer slope factor based on a review of publicly available studies. IRIS is an EPA data base containing human health risk information. Consistent with EPA guidance (EPA 1989), information in IRIS supersedes all other sources of toxicity information for conducting human health risk assessments under CERCLA. The toxicological review modified the oral cancer slope factor (CSF) for benzo(a)pyrene (BaP) from 7.3 to 1 milligram per kilogram per day (mg/kg-day). The CSF change means that BaP is less toxic for people who come into contact with or ingest BaP than previously analyzed.

Commented [BE2]: Revised data base to database in response to ODEQ comment.

Given this new toxicity information, EPA has determined that modifying the cPAH (BaPeq) CULs and total PAH RAL for contaminated sediments outside the Navigation Channel will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by approximately $35 million. Supporting information and analysis for this proposed ESD are contained in figures and tables included in Appendix A.

For completeness and expediency, this ESD also includes an Errata Memorandum dated April 3, 2018 as Appendix B. The Errata Memorandum documents minor corrections to various tables, figures and text items in the Portland Harbor ROD and are not considered significant differences.

1.4 Administrative Record

This proposed ESD and supporting documents will become part of the Site Administrative Record file, in accordance with the NCP, §300.825. The EPA Portland Harbor website is the main repository for all administrative records for the Site: [HYPERLINK "https://www.epa.gov/superfund/portland-harbor"] The proposed ESD and supporting documents will be available at the following locations:

Multnomah County Central Library
801 SW 10th Avenue
Portland, OR 97205
(503) 988-5123
Monday 10 am–8 pm

St. Johns Library
7510 N. Charleston Avenue
Portland, OR 97203
(503) 988-5123
Monday, Tuesday 12 pm–8 pm

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Tuesday, Wednesday 12 pm–8 pm
Thursday, Friday, Saturday 10 am–6 pm
Sunday 10 am–5 pm

Kenton Library
8226 N. Denver Avenue
Portland, OR 97217
(503) 988-5123
Monday, Tuesday 12 pm–8 pm
Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Superfund Records Center
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-4494 or (800) 424-4372
Monday through Friday 9 am–4 pm

Wednesday through Saturday 10 am–6 pm
Sunday 12 pm–5 pm

EPA Region 10 Oregon Operations Office
805 SW Broadway
Suite 500
Portland, OR 97205
(503) 326-3250
Monday through Friday 9 am–4 pm

2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

2.1 Site History

The Willamette River is the 19th largest river in the United States and one of 14 American Heritage Rivers in the country. It flows into the larger Columbia River, which eventually flows into the Pacific Ocean. Even though the Willamette River is nearly 100 river miles from the Pacific Ocean, there are tidal influences within the Site, and it is a large and dynamic river.

Since the late 1800s, the Portland Harbor section of the lower Willamette River has been extensively modified to accommodate a vigorous shipping industry. Modifications include redirection and channelization of the main river, draining seasonal and permanent wetlands in the lower floodplain, and dredging to maintain the navigation channel, access to docks, and wharf facilities. Constructed structures, such as wharfs, piers, floating docks, and pilings, are common in Portland Harbor where urbanization and industrialization are most prevalent.

The federal navigation channel, with an authorized depth of -40 feet (ft) Columbia River datum (CRD), extends from the confluence of the lower Willamette River with the Columbia River to RM 11.6. In 1999, Congress authorized the Willamette River to be deepened to -43 ft; however, this has not yet occurred. Swan Island Lagoon was created in the 1930s when dredge spoils were used to fill in part of the channel and connect Swan Island to the mainland.

While the harbor area is heavily industrialized, it is located within a region characterized by commercial, residential, recreational, and agricultural uses. Land use along the lower Willamette River includes marine terminals, manufacturing and other commercial operations, public

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facilities, parks, and open spaces. In addition to industrial activities, the Willamette River and surrounding watershed historically offered access to abundant natural resources in the river and on land. Many of these resources are still present such as fish, marine mammals, waterfowl, land mammals, and native plants.

The Willamette River is also important to many tribes. Fish are among the resources most frequently utilized by the tribes in the Portland Basin and the Willamette Valley. Culturally significant species include salmonids, lamprey (eels), eulachon (smelt), and sturgeon. Native people also fished for a variety of other resident species, including mountain whitefish, chiselmouth, northern pikeminnow, peamouth, and suckers. Tribes have reserved hunting, fishing (particularly salmon and sturgeon species), and certain gathering rights through Treaties with the United States.

2.2 Summary of Contamination

Sources of Contamination

Historically, contaminants from many facilities entered the river system from different activities, including but not limited to ship building and repair; ship dismantling; wood treatment and lumber milling; storage of bulk fuels; manufactured gas production (MGP); chemical manufacturing and storage; metal recycling, production, and fabrication; steel mills, smelters, and foundries; and electrical production and distribution. These activities resulted in direct discharges from upland areas through stormwater and wastewater outfalls; releases and spills from commercial operations occurring over the water; municipal combined sewer overflows; and indirect discharges through overland flow, bank erosion, groundwater, and other nonpoint sources. In addition, contaminants from offsite sources have reached the Site through surface water and sediment transport from upstream and through atmospheric deposition. Operations that continue today along the river banks include bulk fuel storage, barge building, ship repair, automobile scrapping, recycling, steel manufacturing, cement manufacturing, operation and repair of electrical transformers (including electrical substations), and many smaller industrial operations.

Contaminants of Concern

The human health and ecological risk assessments identified 64 contaminants of concern (COCs) that contribute a significant amount of risk to the human and ecological receptors. COCs by media are listed in Tables 1 through 5 in Appendix II of the ROD. A subset of all COCs, called focused COCs, was developed to simplify analysis and evaluation of remedial alternatives. The focused COCs include polychlorinated biphenyls (PCBs), PAHs, dioxins and furans, and DDx, which represents collectively dichlorodiphenyltrichloroethane (DDT) and its primary breakdown products dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethene (DDE).

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Principal Threat Waste

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

PTW was identified based on cancer risk (highly toxic) or non-aqueous phase liquid (NAPL) within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment. A capping model was used to determine whether there were concentrations of PTW that could not be reliably contained.

Contaminated Media

The environmental media contaminated by COCs include surface sediment (0 to 30 centimeters [cm] below mud line [bml]), subsurface sediment (below 30 cm bml), suspended sediment, surface water, groundwater, biota, and river banks. The surface sediment sample interval (0 to 30 cm bml) is designed to capture that portion of the sediment column that has the potential to be disturbed or transported under typical annual conditions. River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. The following nature and extent of contamination discussion focuses on sediments, surface water, and river banks. A full description of site contamination is included in Section 6 of the ROD.

Nature and Extent of Contamination

Surface and Subsurface Sediment

Contamination in subsurface sediment was identified as deep as 17 ft bml in the navigation channel and 19 ft bml in the sediment future maintenance dredge (FMD) areas. FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. In the intermediate region, defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD, the maximum depth of contamination was estimated to be 34 ft bml, but most contamination was less than 10 ft. In the shallow region, defined as shoreward of the riverbed elevation of 4 ft below mean low water, the maximum depth of contamination was estimated to be 33.5 ft bml. Based on contaminant distribution trends, some general patterns emerged among subsets of different contaminants that reflect fate and transport processes at the Site as well as the relative importance of regional versus site sources, as described below. Additional details are included in the ROD (EPA 2017a).

Sediment contaminant concentrations were greatest in nearshore areas. Concentrations of contaminants were generally higher in nearshore and off-channel areas such as slips,

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embayments, and shallow areas, and near some known or suspected sources, as compared to sediments in the navigation channel, Multnomah Channel, and downstream areas.

Organic contaminant concentrations were greater in subsurface sediments. Concentrations of organic contaminants tended to be higher in subsurface sediments than in surface sediments. Concentrations of total PCBs, total DDx, total PAHs, hexachlorobenzene, total chlordanes, aldrin and dieldrin, gamma-hexachlorocyclohexane (Lindane), lead, and tributyltin (TBT) were higher in subsurface than in surface sediments, indicating that historical inputs were likely greater than current inputs. Subsurface contamination was detected as deep as 34 ft. In contrast, arsenic, copper, chromium, mercury, and zinc did not have large concentration ranges and generally showed similar levels in surface and subsurface sediments. Other exceptions included areas where higher surface sediment concentrations appeared to be associated with ongoing Site sources, low rates of sediment deposition, and physical sediment disturbance (e.g., from boat scour).

Regional inputs exhibited uniform concentrations across the area. Contaminants that may have been derived predominantly from regional or upstream inputs showed widespread surface sediment distributions without distinct, isolated areas of higher concentrations. Examples of this were arsenic, chromium, and mercury, which occurred at relatively low concentrations throughout the Site with no apparent strong concentration gradients.

Areas of high concentrations were present throughout the Site and generally were located near likely upland sources. A number of contaminants exhibited relatively high sediment concentrations in distinct areas offshore of known or likely sources. These areas were separated by large areas with relatively lower concentrations lacking obvious concentration gradients. Contaminants that exhibited this trend included total PCBs, dioxins, bis(2-ethylhexyl)phthalate (BEHP), butylbenzyl phthalate, pentachlorophenol, hexachlorobenzene, total chlordanes, Lindane, copper, zinc, and TBT.

Some contaminants had areas of high concentrations that were more common in the lower (downstream) half of the Site. Total DDx and total PAHs exhibited elevated concentrations in some locations of the river. Concentrations of certain metals were correlated to sediment grain size. A comparison of metals concentrations to the distributions of percent fines in the Site showed that where sediments were comprised of less than 40 percent (%) fines, chromium and copper concentrations were relatively low (above RM 10, between RM 5 and 7, and in the Multnomah Channel; RI Map 3.1-3). A similar, but less pronounced, correspondence existed between sandy sediments and zinc concentrations.

Multiple contaminants co-occurred. In most areas of the Site, multiple COCs are comingled. At all of the highest surface sediment concentration areas, more than one contaminant is found. This degree of contaminant co-occurrence reflects the variety of sources to the in-river portion of the Site and the history of upland Site development, including wastewater and stormwater conveyance systems and industrial and commercial activities.

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Surface Water

Concentrations of contaminants in surface water vary spatially and with river flow. Surface water concentrations in the Site were generally higher than those entering the upstream boundary of the Site (at RM 16) under all flow conditions. The highest contaminant concentrations in surface water within the Site were found near known sources where concentrations in sediment were also highest, such as the areas adjacent to the Gasco and Arkema facilities (RM 6 through RM 7.5W). Surface water samples collected at the downstream end of the Site (RM 2 and Multnomah Channel) showed higher concentrations of PCBs, dioxin/furans, DDx, BEHP, chlordanes, and aldrin than concentrations of these contaminants entering the Site from upstream. This pattern indicates that contamination from the Site is being transported to the Columbia River.

River Banks

River banks are defined as the area from the top of bank down to the river. Contaminants detected in river bank material at levels that pose a risk to human health, the environment, or for recontamination to any implemented remedy, include the focused COCs and other contaminants. The ROD (EPA 2017a) provides a detailed summary of river bank contaminants on the east and west sides of the river.

Remedial Action Objectives

The remedial action objectives (RAOs) for the Portland Harbor Superfund Site, listed in Section 9 of the ROD, are media-specific goals for protecting human health and the environment. The CULs for COCs associated with these RAOs are identified in Table 17 in the ROD. CULs are the long-term contaminant concentrations that need to be achieved by the remedial alternatives to meet RAOs. The nine RAOs developed to address the human health and ecological risks posed by the contamination at the Site are presented below.

Human Health RAOs

- RAO 1 – Sediment: Reduce cancer and non-cancer risks to people from incidental ingestion of and dermal contact with COCs in sediment and beaches to exposure levels that are acceptable for fishing, occupational, recreational, and ceremonial uses
- RAO 2 – Biota: Reduce cancer and non-cancer risks to acceptable exposure levels (direct and indirect) for human consumption of COCs in fish and shellfish
- RAO 3 – Surface Water: Reduce cancer and non-cancer risks to people from direct contact (ingestion, inhalation, and dermal contact) with COCs in surface water to exposure levels that are acceptable for fishing, occupational, recreational, and potential drinking water supply
- RAO 4 – Groundwater: Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for human exposure

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Ecological RAOs

- RAO 5 – Sediment: Reduce risk to benthic organisms from ingestion of and direct contact with COCs in sediment to acceptable exposure levels
- RAO 6 – Biota (Predators): Reduce risks to ecological receptors that consume COCs in prey to acceptable exposure levels
- RAO 7 – Surface Water: Reduce risks to ecological receptors from ingestion of and direct contact with COCs in surface water to acceptable exposure levels
- RAO 8 – Groundwater: Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for ecological exposure

Human Health and Ecological RAO

- RAO 9 – River Banks: Reduce migration of COCs in river banks to sediment and surface water such that levels are acceptable in sediment and surface water for human health and ecological exposures

2.3 Selected Remedy in the ROD

Key components of the Selected Remedy are described below. A full description of the Selected Remedy is provided in the ROD.

EPA's remedial strategy for the in-river portion of the Site is to address all contaminated media and complete exposure pathways that pose unacceptable risk to human health or the environment, including sediment, biota, surface water, groundwater, and river banks. The Selected Remedy utilizes a combination of technologies to address contaminated sediment. The same technologies will be used in adjacent river banks if determined the river banks should be remediated in conjunction with the sediment action. Although the Selected Remedy does not directly address surface water, EPA anticipates that taking action on sediment and river banks, in conjunction with control of upland sources conducted under DEQ authority, will reduce contaminants concentrations in all media to acceptable levels and reduce ongoing source of contaminants to Multnomah Channel and the Columbia River.

The Selected Remedy addresses all areas where contaminant concentrations exceed the CULs through a combination of dredging, capping, enhanced natural recovery (ENR), monitored natural recovery (MNR), and institutional controls. CULs were selected after evaluating concentrations protective of human health or the environment from the risk assessment, applicable or relevant and appropriate requirements (ARARs), and background values. Sixty-four COCs found in sediment, surface water, groundwater, and tissue were identified. For each contaminant and in all media such as sediments and surface water, the lowest number protective of human health or the environment was selected unless the available background value was

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higher, in which case the background value was selected. Table 17 in the ROD provides the CULs and tissue targets as well as the basis for the selected number. The CULs for the Site are expected to reduce unacceptable risk within the river by setting standards for sediment, biota, surface water, groundwater, and river banks. Remediation of the sediment will reduce loading and resuspension of contamination to surface water, which collectively will reduce fish and shellfish exposure to the contamination.

Areas to be capped or dredged called Sediment Management Areas (SMAs) are defined by remedial action levels (RALs) and PTW for the Selected Remedy (Table 21 in the ROD). SMAs for the Selected Remedy are shown on Figure 30 in the ROD. The SMAs represent areas with contaminant concentrations in surface sediment where natural recovery is not occurring or is not likely to be effective in reducing concentrations of COCs within a reasonable time frame. RALs are contaminant-specific sediment concentrations of focused COCs used to define areas for more active cleanup and will reduce contaminant concentrations and risks more effectively than ENR or MNR from current site wide average concentrations. Technology assignments and the approximate areas that will be remediated through dredging, capping, ENR, and areas where COC concentrations will be reduced through MNR are shown on Figures 31a-e in the ROD.

The COCs used to define the SMA boundaries are PCBs, total PAHs, DDx and selected dioxin/furan congeners. These focused COCs encompass the majority of the spatial extent of contaminants posing the majority of the risks as identified in the baseline risk assessments. In the Feasibility Study (FS), RALs were developed by considering the volume or acreage of material that would be addressed to achieve reductions of contaminant concentrations (and therefore risk) throughout the Site. The relationships between RAL concentrations and resulting site-wide spatially-area weighted average concentrations (SWACs) or "RAL curves" were developed by plotting acres remediated against the post remediation surface weighted average surface sediment concentration. A range of RALs consisting of seven different concentrations bracketing the distribution of contamination were selected for each focused COC. The selected RALs are a function of the distribution of surface sediment data at the Site and reflect uncertainties in the distribution of contamination and the interpolation method utilized.

Each remedial alternative evaluated in the FS has a different set of sediment RALs. The lowest RALs are in Alternative H; therefore, the areas that are capped and/or dredged increase in acres from Alternatives B through H. A summary of RALs for the focused COCs used to develop Alternatives B through H are presented in Table 18 in the ROD.

The Selected Remedy applies Alternative F RALs to nearshore sediments[2] and Alternative B RALs to the federally authorized navigation channel. Total PAH RAL contours presented in the Portland Harbor FS (EPA 2016b) are shown on proposed ESD Figure 2-3. For PAHs, RALs were based on total PAHs rather than cPAHs because total PAHs were selected as a focused COC for the Site. The relationship between total PAHs and cPAHs is presented in Appendix D of the FS.

Commented [BE3]: Footnote defining nearshore sediments has been added in response to ODEQ comment.

Commented [BE4]: Revised to clarify that these are the FS total PAH RAL contours.

Commented [BE5]: Swap Figure 2 and 3 based on order discussed in ESD document.

[2] Nearshore sediments include all sediments outside the navigation channel. This includes beach sediments as well as areas designated in the FS as shallow areas, intermediate areas and future maintenance dredge areas.

The total PAH RALs for the Selected Remedy are 13,000 µg/kg for nearshore sediments and 170,000 µg/kg for the federally authorized navigation channel.

The Selected Remedy in the ROD includes a total constructed area of 394 acres of sediment and 23,305 lineal feet of river bank and allows 1,774 acres of sediment to naturally recover. The Selected Remedy includes 365.4 acres of capping and dredging contaminated sediment and 28.2 acres of ENR. Of that, approximately 215.2 acres of sediment will be dredged to varying depths. Additionally, 23,305 lineal feet of river bank are assumed to be excavated and covered with either an augmented reactive cap or an engineered cap using beach mix or vegetation after excavating approximately 123,000 cubic yards (cy) of contaminated material from river banks. The dredged material removed from the Site will be managed under disposed material management (DMM) scenario 2, with approximately 3,017,000 cy of contaminated sediment and 123,000 cy of soil sent to offsite disposal facilities. Material testing will be used to determine the appropriate disposal facility, Subtitle D or C. Ex-situ treatment is assumed for approximately 191,500 cy of sediment and river bank soil prior to disposal and is based on complying with federal and state regulations and the 2004 dispute decision on MGP waste. The need for, and extent of, ex-situ treatment will be based on the offsite disposal requirements and material testing during design and construction. It is assumed that all other dredged material will not require treatment prior to disposal.

The various river areas and their remedy components are discussed in detail below. The final technology assignment will be identified in the remedial design after collection of additional sampling data. The technology assignment will be identified as indicated in the decision tree on Figure 28 in the ROD.

Navigation Channel

The Selected Remedy in the federally authorized navigation channel includes dredging to avoid constructing a cap or residual layer within the authorized dredge depth. Contaminated sediment will be dredged to the depth of the Alternative B RAL concentrations or PTW concentrations shown in Table 21 in the ROD, whichever is lower. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging and include the surrounding area that may have been impacted by dredge residuals. If RALs are not achieved or PTW is present below the feasible depth limit of the excavation technology, as approved by EPA, a cap is assumed to be placed after dredging. Navigation and maintenance dredge depth requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the authorized depth of the navigation channel, including an over dredge allowance/buffer zone. Implementing the Selected Remedy in the navigation channel will need to consider, and be coordinated with, cleanup conducted in the rest of the Site to minimize recontamination. This cleanup may occur at the same time or later than the other cleanup actions.

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Future Maintenance Dredge Areas

FMD areas are those locations in the river that are periodically dredged to allow continued marine activity. Contaminated sediment will be dredged to the depth of the sitewide RAL concentrations shown in Table 21 in the ROD or to a depth required to allow placement of a cap or backfill sufficient to be effective over the long term. Where RALs are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. A reactive residual layer (sand plus activated carbon) is assumed after dredging if PTW that can be contained lies below the feasible limits of excavation. Maintenance dredge depth requirements will need to be considered during design and implementation of the Selected Remedy such that the final constructed elevation is below the maintained depth, including an over dredge allowance or buffer zone.

Intermediate Region

The intermediate region is defined as outside the horizontal limits of the navigation channel and FMD areas to the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet Clean Water Act (CWA) (Section 404) and federal floodway requirements as well as climate change impacts. In the intermediate region, contaminated sediment will be dredged to the depth required to achieve RALs (see Table 21 in the ROD) and remove PTW or to a depth required to allow placement of cap or backfill material sufficient to be effective over the long term. The elevation of the top of the cap will be no higher than the pre-design elevation to avoid impacts to the floodway. EPA estimates the dredging depth required to accommodate a cap will generally be 5 feet. The final depth will be determined in remedial design. Where RAL concentrations are achieved through dredging, placement of a residual layer will occur as soon as is practicable following dredging within the prism and surrounding area that may have been impacted by dredge residuals. In the intermediate regions, residual layers will consist of sand (amended with activated carbon if determined to be appropriate) to prevent the transport and release of contaminants from dredge residuals. NAPL or PTW that cannot be reliably contained will be dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped. During design and construction, the final elevation of capped and dredged areas will be considered such that the leave surface of the constructed remedy is appropriate for the post-construction use of each specific area. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the

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floodway. If appropriate to protect sensitive species, a habitat layer will be incorporated into the constructed remedy.

Shallow Region

The shallow region is defined as shoreward of the riverbed elevation of approximately -2 ft CRD. In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet CWA (Section 404) and federal floodway requirements as well as climate change impacts. Contaminated sediment in this area will be dredged to the depth required to remove all NAPL or PTW that cannot be reliably contained (see Table 21 in the ROD) unless it is present below the feasible depth limit of excavation technology in which case it will be capped. Where PTW is not present but the depth of excavation to achieve RAL concentrations is greater than 5 feet, the area will be dredged to 5 feet with placement of a cap and backfilled to grade. Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. In the shallow regions, a habitat layer, such as beach mix, will be used for the final layer of clean cover in both residual management areas and capped areas to bring the surface back to the original (pre-dredge) elevation and to maintain the natural habitat.

River Bank Region

River banks are defined as areas from top of bank down to the river that may be contaminated along the shoreline next to contaminated in-river shallow areas. Remediation of contaminated river banks is included in the Selected Remedy where it is determined that it should be conducted in conjunction with the in-river actions and to protect the remedy (Figure 9 and Table 21 in the ROD). Other river banks may be included in the remedial action if contamination contiguous with contaminated river sediment is found during remedial design sampling. Engineered caps or vegetation with beach mix will be placed as the final cover based on area-specific designs, which will account for appropriate slope according to the programmatic or site-specific Biological Opinion, as appropriate. NAPL or PTW that cannot be reliably contained, if present, will be fully excavated and not capped unless it is present below the depth limit of excavation technology, as approved by EPA. In those locations, a significantly augmented cap will be constructed below the habitat layer. The state may also undertake actions at some river banks that are the subject of this ROD to expedite source control of contaminated upland areas, as necessary. Those actions will be consistent with the Selected Remedy and meet CERCLA requirements.

3.0 BASIS FOR THE PROPOSED ESD

On January 19, 2017, EPA released an updated *Toxicological Review of Benzo(a)pyrene* (EPA 2017b). The updated toxicological review modified the oral CSF for BaP from 7.3 to 1 mg/kg-day resulting in a lower risk estimate associated with exposure to BaP and other cPAHs. Given

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that humans have less cancer risk from exposure to BaP, the modified CSF has potential implications for the risk-based human health CULs, target tissue levels, and highly toxic PTW thresholds for cPAHs measured as BaPeq selected in the January 3, 2017 ROD (EPA 2017a). CULs for cPAHs were calculated using a CSF to achieve a 1 x 10^{-6} cancer risk level and the PTW thresholds were set at a 1 x 10^{-3} level based on the CUL[3].

Although not directly related to a CSF or a measurement of risk, EPA evaluated potential implications of the BaP slope factor change on the total PAH RALs selected in the ROD to determine whether any areas slated for active cleanup primarily or solely due to cPAH risk from direct contact with contaminated sediments or shellfish consumption no longer presented risk or may no longer require active cleanup. However, while undertaking this review, EPA also considered the effect of these changes on other human health and ecological RAOs. In particular, EPA evaluated impacts to surface water CULs and whether ecological risks presented by PAHs, carcinogenic or not, would be adequately addressed if changes to cPAH CULs and/or the total PAH RALs were implemented.

3.1 Changes to the Sediment Cleanup Levels, Shellfish Target Tissue Levels, and Highly Toxic PTW Thresholds

Human health sediment CULs and shellfish target tissue levels as well as the highly toxic PTW threshold for PAHs in the ROD are based on cPAHs. As a result, the change in the CSF for BaP has a direct effect on the risk-based sediment CULs and target tissue levels for cPAHs. These changes are summarized below.

cPAH Direct Contact Sediment CULs

The Portland Harbor baseline human health risk assessment included in the *Final Remedial Investigation Report* (RI Report – EPA 2016a) evaluated a range of direct contact exposure scenarios for beach sediment and in-water sediment. Potentially exposed populations evaluated under the beach exposure scenarios included dockside workers, transients, recreational beach users, high frequency fishers, and tribal fishers. Potentially exposed populations evaluated under the in-water sediment exposure scenarios included in-water workers, high frequency fishers, tribal fishers, diver wet suit, and diver dry suit.

Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in an increase in the direct contact sediment CUL specified in the ROD by a factor of 7.3. The ROD selected a cPAH (BaPeq)

[3] Risks are probabilities that usually are expressed in scientific notation (e.g., 1 x 10^{-6}). An excess lifetime cancer risk of 1 x 10^{-6} indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10^{-4} to 10^{-6} established in the NCP. EPA's goal of protection for cancer risk is 10^{-6}, and risks greater than 10^{-4} typically will require remedial action. Highly toxic PTW is generally based a 10^{-3} risk level.

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sediment CUL of 12 micrograms per kilogram (µg/kg) for nearshore sediments based on the recreational beach sediment exposure scenario. Increasing the beach sediment PRG of 12 µg/kg by a factor of 7.3 results in a revised beach sediment PRG and CUL of 85 µg/kg.

Commented [BE6]: Added a note about the increase in the beach CUL in response to ODEQ comment.

The ROD applied the cPAH recreational beach sediment CUL to all nearshore sediments outside the navigation channel. EPA evaluated whether a sediment CUL based on the tribal fisher exposure scenario should be applied to nearshore sediments outside of the navigation channel where recreational beach exposures are not expected to occur. The in-water sediment preliminary remediation goal (PRG) based on the tribal fisher exposure scenario is 106 µg/kg. Increasing the in-water sediment PRG of 106 µg/kg by a factor of 7.3 results in a revised nearshore sediment PRG and CUL of 774 µg/kg.

cPAH Shellfish Consumption Target Tissue Levels

The ROD included target tissue levels for cPAHs in shellfish tissue of 7.1 µg/kg based on the shellfish consumption exposure scenario, herein after referred to as shellfish target tissue levels. Reducing the BaP CSF from 7.3 to 1 mg/kg-day results in a proportional increase in the target tissue level from 7.1 to 51.6 µg/kg. This target tissue level would apply to shellfish tissue throughout the Site. The ROD did not include target tissue levels for cPAHs in fish tissue.

Commented [BE7]: Clarified that target tissue levels were not developed for cPAHs in fish tissue in response to ODEQ comment. If we have not already made this change, there should be a footnote for the cPAH target tissue level that it is based on shellfish consumption. This footnote is included in FS Appendix B table B3-5.

cPAH Shellfish Consumption Sediment Cleanup Levels

The ROD selected a shellfish consumption sediment CUL of 3,950 µg/kg based on human consumption of clams. The shellfish consumption sediment CUL for cPAHs of 3,950 µg/kg is applicable to the entire Site, whereas the direct contact sediment CUL is only applicable to nearshore sediment areas because direct contact exposure pathways are not considered to be complete within the navigation channel at the Site.

For the shellfish consumption sediment CUL, the target tissue level increases by a factor of 7.3. However, the relationship between cPAH (BaPeq) shellfish (clam) tissue levels and sediment levels is a non-linear relationship represented by the following equation presented in Appendix B of the FS (EPA 2016b):

$$ln(PRG_{sed}) = \frac{((ln(C_{tissue}) - (\ln(f_{lipid}) - \ln(CF) + 2.47)}{0.6} + ln(f_{oc}) \quad \text{(Equation 1)}$$

Where:

PRG_{sed} = Risk-based sediment preliminary remediation goal, dry weight (µg/kg)
C_{tissue} = Risk-based acceptable tissue concentration, wet weight (µg/kg)
CF = Correction factor of 2.3
F_{oc} = Fraction organic carbon, dry weight (0.0171)
F_{lipid} = Fraction of lipid in shellfish (clam) tissue, wet weight (0.22)

Commented [BE8]: ODEQ commented that this should be 0.022. However, this value is consistent with Appendix B and we have confirmed the calculation. Change not made but we may need to look into this further.

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Because of the non-linear relationship between bulk sediment BaP concentrations and shellfish (clam) tissue BaP concentrations, revising the acceptable tissue concentration from 7.1 to 51.6 µg/kg and solving for PRG_{sed} increases the shellfish consumption cPAH sediment CUL from 3,950 to 107,600 µg/kg.

cPAH Principal Threat Waste Thresholds

The ROD (EPA 2017a) identified the presence of PTW at the Site. PTW types identified include source material in the form of NAPL, highly toxic material based on a 1 x 10^{-3} risk level, and material that is not reliably contained. The presence of NAPL and not reliably contained PTW associated with PAH contamination is unaffected by the BaP slope factor change. However, the highly toxic PTW threshold for cPAHs of 106,000 µg/kg increases by a factor of 7.3 to 774,000 µg/kg due to the BaP slope factor change.

As noted above, PTW types identified at the Site include source material in the form of NAPL, highly toxic material based on a 1 x 10^{-3} risk level, and material that is not reliably contained. Increasing the highly toxic PTW threshold from 106,000 to 774,000 µg/kg will limit the presence of highly toxic PTW at the Site. Areas of PTW identified in the Portland Harbor ROD (EPA 2017a) are shown on proposed ESD Figure 33.

Commented [BE9]: Clarified that this is the PTW area from the ROD.

Commented [BE10]: Need to swap Figure 2 and 3 based on order of appearance.

Application of Sediment Cleanup Levels

The ROD established a cPAH CUL of 12 µg/kg for nearshore sediments based on a recreational beach exposure scenario that included both child and adult exposures. The ROD also established a sediment CUL of 3,950 µg/kg applicable to the navigation channel based on the clam consumption exposure scenario.

EPA has re-evaluated application of the nearshore sediment CUL based on the recreational beach exposure scenario and determined that two cPAH direct contact CULs should apply to nearshore sediments. The updated cPAH direct contact beach CUL of 85 µg/kg will apply to recreational beaches based on existing or reasonably anticipated future use. EPA also developed a cPAH direct contact CUL of 774 µg/kg based on the tribal fisher exposure scenario. The cPAH direct contact tribal fisher CUL for in-water sediment of 774 µg/kg will apply to the remainder of nearshore sediments (including non-recreational beach areas). The updated cPAH shellfish consumption CUL of 107,600 µg/kg will apply to the federally authorized navigation channel. This change does not affect the sediment CUL for any other COC at the Site.

Commented [BE11]: ODEQ has recommended a figure that shows recreational beach exposure areas. If we do this, we should note that the figure is based on exposure scenarios evaluated in the BHHRA.

Changes to the direct contact sediment CULs, the shellfish consumption target tissue level, the shellfish consumption sediment CUL, and highly toxic PTW threshold for cPAHs (BaPeq) are summarized in proposed ESD Table 1.

3.2 Changes to Total PAH Remedial Action Level

EPA evaluated whether a change to the total PAH RALs for the Selected Remedy was appropriate based on the change to the BaP CSF. This evaluation considered both the total PAH nearshore sediment RAL of 13,000 µg/kg and the total PAH navigation channel RAL of 170,000 µg/kg. The navigation channel RAL is applicable to all contaminated sediments within the federally authorized navigation channel while the nearshore RAL is applicable to all sediments outside the navigation channel.

The evaluation considered whether the Selected Remedy RALs would result in the remediation of PAH contaminated sediment that no longer poses unacceptable risk to human health due to the BaP CSF change based on an evaluation of post construction risk. The evaluation also considered whether a change in the total PAH RAL would affect the ability of the remedy to attain all other RAOs specified in the ROD. The evaluation considered both the tribal fisher and recreational beach exposure scenarios (RAO 1) and other RAOs where PAHs are identified as a COC (RAOs 2, 3, 5 and 7). The evaluation did not consider groundwater RAOs (RAOs 4 and 8) since these will be dependent on engineered caps applied along with the adequacy of source control actions.

Nearshore Total PAH RAL

cPAH Direct Contact In-water Sediment Risk (RAO 1): Updating the direct contact cPAH sediment CUL from 106 µg/kg to 774 µg/kg without adjustment of the nearshore total PAH RAL will result in the remediation of some sediments that do not exceed 774 µg/kg as measured on a one-half rolling river mile SWAC basis. As shown on proposed ESD Figures 4a and 4b, one-half rolling river mile SWACs, if the Alternative F total PAH RAL is used, would exceed 774 µg/kg between approximately RM 4.8 and 6.6 in nearshore sediments along the west shore of the Willamette River (West Shoal) and between approximately RM 3.9 and 4.9 along the east shore of the Willamette River (East Shoal).

EPA conducted an evaluation to determine the percentage of nearshore half-river miles protected based on a range of total PAH RALs. This evaluation is consistent with the direct contact residual risk evaluation presented in Appendix IV of the Portland Harbor ROD. EPA evaluated increasing the total PAH RAL for the Selected Remedy of 13,000 µg/kg by a factor of 7.3 to 95,000 µg/kg (the factor of 7.3 represents the magnitude of the change to the BaP CSF). As is shown in proposed ESD Figure 5, a total PAH RAL of 95,000 µg/kg will protect 22% of nearshore half-river miles. Figure 5 also shows that a total PAH RAL of 30,000 µg/kg will protect 100% of the nearshore half-river mile by achieving the updated direct contact cPAH CUL of 774 µg/kg as measured on one-half rolling river mile SWACs throughout the Site. Based on the results of this evaluation, EPA determined that revising the nearshore total PAH RAL from 13,000 µg/kg to 30,000 µg/kg was appropriate.

cPAH Direct Contact Beach Exposure (RAO 1): In general, the remedial footprint for the Selected Remedy as presented in the ROD does not include beach areas. The exception to this is

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a beach area near Linnton at approximately RM 4.8 along the east bank of the Willamette River (Beach 04B024) and a beach area near Cathedral Park at approximately RM 5.9 along the west bank of the Willamette River (Beach 05B018). The baseline human health risk assessment (EPA 2016a) determined that the risk associated with these beaches was 54 x 10^{-5} and 1 x 10^{-5}, respectively. Updated risk estimates based on the BaP CSF change are 18 x 10^{-5} and 41 x 10^{-6}, respectively. These risk estimates are within EPA's risk range and do not need to be addressed through active remediation. In addition, it is expected that risks to human health in beach areas will be further reduced through natural recovery processes. As a result, revising the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg based on the initial fisher in-water sediment exposure scenario will not significantly affect the ability of the remedy to protect recreational beach users. Long-term monitoring will be performed to verify that the Selected Remedy is protective of recreation beach exposures.

Commented [BE12]: Risk estimates have been revised to reflect total risk rather than cPAH risk in response to ODEQ comment. More information about changes in beach risk is presented near the end of Section 4 and in Table 9 and Figure 12.

Commented [BE13]: Added clarification about the basis for the RAL change in response to ODEQ comment.

cPAH Shellfish Consumption Risk (RAO 2): As noted above, the BaP CSF change will increase the shellfish consumption cPAH sediment CUL from 3,950 to 107,600 µg/kg. However, this concentration is not exceeded on a rolling river mile basis within the Site. As a result, this CUL is already met at the Site based on existing data so no RAL is needed to address human health risks associated with this exposure.

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the selected remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): The total PAH sediment CUL for benthic risk as presented in Table 17 of the ROD is 23,000 µg/kg. The Selected Remedy is estimated to address 72% of benthic risk areas based on 10 times unacceptable benthic risks at the end of construction with the remainder to be addressed through MNR. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, PAHs in sediment present unacceptable risk to the benthic community. Therefore, changes in total PAH RALs must be evaluated to determine the effect on the attainment of RAO 5 and the CUL. Because the revised total PAH RAL of 30,000 µg/kg is only slightly above the total PAH CUL for protection of the benthic community of 23,000 µg/kg, increasing the total PAH RAL from 13,000 µg/kg to 30,000 µg/kg will have a minimal effect on attainment of RAO 5 or the post-construction metric of 10 times the benthic risk CUL.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Revising the total PAH nearshore RAL from 13,000 µg/kg to 30,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

Based on its evaluation, EPA determined that the nearshore RAL should be revised from 13,000 to 30,000 µg/kg to avoid remediation of PAH-contaminated sediments that no longer pose a risk to human health for direct contact based on the changes to the nearshore sediment cPAH CUL.

Commented [BE14]: ODEQ commented that this information is lost here and should be presented at the beginning of the section. However, this information is already presented above. Change not made.

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EPA has also determined that increasing the total PAH RAL from 13,000 to 30,000 µg/kg will not have a significant effect on the ability of the remedy to protect recreational beach users or to attain RAOs 2, 3, 5, or 7. The total PAH RAL curve utilizing the revised total PAH RAL is shown on proposed ESD Figure 6. The change in the remedial footprint associated with this change is estimated to be 17 acres.

Navigation Channel RAL

EPA evaluated whether the change in BaP CSF necessitated revising the total PAH RAL of 170,000 µg/kg applicable to the navigation channel. This evaluation considered the effect of the RAL change on post-construction risk estimates and whether the change would affect attainment of the RAOs established for the Site. The evaluation focused on RAOs 3, 5, and 7. The evaluation did not consider RAO 1 because the human health direct contact exposure pathway is considered incomplete within the navigation channel and did not consider RAO 2 because the cPAH shellfish consumption sediment CUL is not exceeded on a SWAC basis within the navigation channel.

cPAH Human Health Surface Water Risk (RAO 3): The BaP CSF is not expected to result in a change to the ARAR based surface water CULs specified in Table 17 of the ROD. Increasing the total PAH ~~nearshore navigation channel~~ RAL above 170,000 µg/kg will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 3.

Total PAH Benthic Risk (RAO 5): As noted above, the total PAH sediment CUL, as presented in the ROD, is 23,000 µg/kg. Although the change in BaP CSF does not affect the benthic risk total PAH CUL, changes in total PAH RALs must be evaluated to determine the effect on attainment of RAO 5. The total PAH RAL applicable to the navigation channel of 170,000 µg/kg is well above the total PAH CUL for protection of the benthic community of 23,000 µg/kg. As a result, any evaluation in changes to the navigation channel RAL must consider the effectiveness of MNR to achieve the total PAH CUL.

As shown on proposed ESD Figure 23, the total PAH navigation channel RAL is exceeded within the navigation channel only between approximately RM 5.1 and RM 6.6. An evaluation of natural recovery processes at the Site determined that the navigation channel between RM 5 and RM 7 is generally not conducive to natural recovery. A multiple line of evidence natural recovery framework considered changes in sediment bed elevation based on two bathymetric surveys conducted in May 2003 and January 2009, the consistency in changes in sediment bed elevation based on five bathymetric surveys conducted between January 2002 and January 2009, sediment grain size, the potential for propeller wash induced erosion, the ratio of subsurface to surface sediment concentrations, and the erosion potential associated with wind and vessel wake generated waves. The results of this multiple line of evidence natural recovery framework are shown on proposed ESD Figure 7. Areas that are conducive to natural recovery are scored as +1, whereas areas where natural recovery is unlikely to be effective are scored as -1. Areas where

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natural recover is neither favorable nor unfavorable are scored as 0. As shown on proposed ESD Figure 7, natural recovery processes are generally unfavorable within the navigation channel between RM 5.1 and RM 6.6. As a result, increasing the navigation channel RAL above 170,000 µg/kg may limit the ability of the remedy to achieve the total PAH CUL of 23,000 µg/kg over time.

Based on its evaluation, EPA determined that the total PAH RAL of 170,000 µg/kg applicable to the navigation channel should not be revised because it may affect the ability of the Selected Remedy to achieve the total PAH CUL of 23,000 µg/kg for protection of the benthic community (RAO 5). This is because the selected total PAH RAL of 170,000 µg/kg is well above the total PAH CUL and the lack of natural recovery processes within the navigation channel between RM 5 and RM 7 where the total PAH RAL is exceeded.

PAH Ecological Surface Water Risk (RAO 7): Risk to aquatic life is unaffected by the change in the BaP CSF. Increasing the ~~Revising the~~ total PAH nearshore RAL above 170,000 µg/kg to will reduce the remedial footprint, and may result in a slight reduction in the ability of the Selected Remedy to attain RAO 7.

Commented [BE15]: Revised in response to ODEQ comment.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES

This section describes the significant differences between the Selected Remedy presented in the Portland Harbor ROD and the proposed changes to the Selected Remedy resulting from proposed change in sediment CULs, shellfish target tissue levels, and highly toxic PTW thresholds for carcinogenic PAHs and remedial action levels for total PAHs.

Summary of Significant Changes

EPA has considered the effect of the change in the CSF for BaP on the Selected Remedy for the Site and evaluated the effect of the changes on the ability of the remedy to attain the RAOs established in the ROD and the cost of the remedy. The following changes to the remedy are being made to the Selected Remedy and other expected outcomes from the changes are summarized below:

- Update the beach sediment CUL for cPAHs from 12 to 85 µg/kg. This sediment cleanup level is based on the recreational beach exposure scenario as described in Sections 8.1.2.3 and 8.1.4.1 of the ROD and applicable to recreational beach sediments only based upon existing or reasonably anticipated future use.
- Include a direct contact sediment CUL for cPAHs of 774 µg/kg applicable to nearshore sediments (see ROD Table 17 in Appendix A). This sediment CUL is based on the tribal fish~~er~~ direct contact exposure scenario and applicable to all near nearshore sediments, except for recreational beach areas.

Commented [BE16]: Revised in response to ODEQ comment.

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- Update the shellfish consumption sediment CUL for cPAHs from 3,950 to 107,600 µg/kg. This sediment CUL is based on a subsistence fisher exposure scenario and applicable to the entire Site.
- Update the target tissue level for cPAHs in shellfish tissue from 7.1 to 51.6 µg/kg. This target tissue level for shellfish is based on a subsistence fisher exposure scenario and applicable to the entire Site. Target fish tissue levels were not developed for cPAHs and are unaffected by this ESD.
- Update the highly toxic PTW threshold for cPAHs from 106,000 to 774,000 µg/kg. This PTW threshold is applicable to the entire Site.
- Update the total PAH RAL applicable to sediments outside the navigation channel from 13,000 to 30,000 µg/kg.
- For beaches where recreational use is possible based on existing and reasonably anticipated land use and any sediment CULs are significantly exceeded, signage or other educational institutional controls may be used until CULs are achieved.

Commented [BE17]: Revised to address ODEQ comment that we should clarify how fish tissue targets are impacted.

Commented [BE18]: ODEQ commented on the potential for beach ICs. Because the status of these efforts is unclear to me, I have not made any changes in response to this comment. This comment requires further discussion with EPA.

All other elements of the Selected Remedy remain unchanged, including the surface water and groundwater CULs, total PAH sediment CULs, and total PAH RALs applicable to navigation channel sediments. EPA has determined that these changes will maintain the protectiveness of the Selected Remedy while reducing the estimated cost of the Selected Remedy by approximately $35 million. A discussion of changes in scope, performance, and cost is summarized below.

SMA Footprint Changes

Revising the remedial action level for total PAHs from 13,000 to 30,000 µg/kg results in a change to the remedial footprint for the Selected Remedy as depicted on proposed ESD Figure 8. Although this change is based solely on PAHs, post-construction concentrations and risk estimates for other COCs at the Site are also affected. Changes are limited to areas where cleanup is driven solely by PAHs and includes Terminal 4, the west side of the Willamette River between RM 4 and RM 7, the upper portion of Swan Island Lagoon, and the east side of the Willamette River between RM 2.5 and RM 3. The amount of PTW addressed by the remedy is unchanged.

RAO Evaluation

Sediment RAOs

RAO 1 (Human Health Direct Contact): The changes in post-construction risk estimates resulting from this change are presented in proposed ESD Table 2 and on proposed ESD Figures 9a through 9c. RAO 1 post-construction risk estimates are presented on a ½ rolling river mile basis. For RAO 1, direct contact risk, the greatest change in the post-construction risk, occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 6×10^{-7} to 1×10^{-6}, whereas at RM 4.5 East, post-construction risks are estimated to

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increase from 2 x 10^{-6} to 3 x 10^{-6}. Because direct contact non-cancer risk is acceptable, changes in non-cancer hazard indices were not calculated.

RAO 2 (Human Health Shellfish Ingestion): The changes in post-construction risk estimates are presented in proposed ESD Table 3 and on proposed ESD Figures 10a through 10l. RAO 2 post-construction risk estimates are presented on a rolling river mile basis. For RAO 2, shellfish consumption risk, the greatest change in the post-construction risk occurred at RM 6.5 West and RM 4.5 East. At RM 6.5 West, post-construction risks are estimated to increase from 2 x 10^{-5} to 4 x 10^{-5}, whereas at RM 4.5 East, post-construction risks are estimated to increase from 8 x 10^{-5} to 1 x 10^{-4}. Post-construction non-cancer hazard indices quotients also increase. The largest estimated hazard index increases are from 0.8 to 1.7 for a child and from 25 to 48 for an infant at RM 6.5.

RAO 5 (Benthic Organisms): The changes in post-construction benthic risk estimates are presented in proposed ESD Table 4. For RAO 5, revising the total PAH RAL will reduce the percentage of the Site achieving 10 times the benthic risk CULs from 72% to 69% of the Site following construction.

RAO 6 (Fish and Wildlife Prey Consumption): The changes in post-construction fish and wildlife prey consumption are presented on a sediment decision unit (SDU) basis in proposed ESD Table 5 and on proposed ESD Figure 11. The maximum changes were observed in SDU 4.5 East and SDU 6 West. The total hazard index increased from 1.2 to 1.5 for both SDU 4.5 East and SDU 6 West.

Surface Water and Groundwater RAOs

RAOs 3 and 7 (Human Health and Aquatic Life Surface Water): The changes in post-construction reductions in surface water concentration are summarized in proposed ESD Table 6. Reductions in surface water concentrations associated with the Selected Remedy were estimated in the ROD to range between 26% and 91%, depending on the chemical following construction. Revised reductions are expected to range between 25% and 91%, depending on the chemical following construction. In all cases, changes in the reduction in surface water concentrations are 1% or less. For example, reductions in cPAH surface water concentrations were estimated as 78% for the Selected Remedy. Based on the changes to the Selected Remedy, the reduction in cPAH surface water concentrations is estimated as 77%. It is estimated that all surface water COC concentrations will be reduced to 10 times the CULs. Consistent with the ROD, it is expected that CULs (both risk-based and ARAR-based surface water levels) will be achieved over time through a combination of in-river cleanup with source control actions within the Site and actions taken to address toxic media within the watershed.

Commented [BE19]: ODEQ commented that the title to Table 6 could be confusing. However, the title is consistent with Table K3-4 in the ROD, it has not been revised.

RAOs 4 and 8 (Human Health and Aquatic Life Groundwater): The area of groundwater plumes addressed by the in-water portion of the updated remedy following construction is estimated to be reduced from 39% to 32% as shown in proposed ESD Table 7. Consistent with the ROD, the

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remainder of the contaminated groundwater will be dependent on the adequacy of source control actions.

River Banks and Principal Threat Waste

The lineal feet of river bank addressed by the updated remedy is estimated to be reduced from 23,305 to 22,592 lineal feet as shown on proposed ESD Table 8. This represents a reduction from 78% to 75% of contaminated river banks. Consistent with the ROD, the remaining river bank areas are expected to be addressed through other cleanup actions (i.e., upland source control measures).

Commented [BE20]: ODEQ has requested a figure showing this reduction.

No change to the amount of PTW addressed by the updated remedy is expected.

Human Health Beach Exposure

In addition to changes in post construction risk, changes in the results of the human risk assessment associated with the change in the CSF for BaP were also evaluated for the human health direct contact beach exposure scenario. Beach areas at the Portland Harbor site were evaluated for dockworkers, transients, recreational beach users and tribal, high frequency and low frequency fishers. The evaluation focused on the exposure scenario that presents the maximum risk for each beach area (tribal fisher or dockworker). The evaluation shows that human health ~~risk estimates~~ beach exposure risk estimates decline between 0 and 86.57% depending on the contribution of cPAHs to the total risk at each beach area. The results of this evaluation are shown in proposed ESD Table 9 and Figure 12.

Commented [BE21]: ODEQ requested confirmation that this is true. It is true. Tribal fisher exposures drive the risk at beach areas even though the beach PRG was based on recreational exposures. The basis for this is unclear to me but that is what the record shows.

Commented [BE22]: Revised to address ODEQ comment on wording and percent reduction.

Remedial Quantities and Cost

EPA evaluated the changes in remedial quantities and cost associated with changing the total PAH RAL applicable to nearshore sediments outside the navigation channel. EPA determined that this change would reduce the total nearshore remedial footprint by 17 acres, reduce the capping area by 8 acres, and reduce the dredging volume by 43,800 cy. This results in a decrease in the present value cost for the Selected Remedy of approximately $35 million. This represents a 3.4% decrease in the overall present value cost of the Selected Remedy. Cost assumptions are included in Appendix A.

5.0 SUPPORT AGENCY COMMENTS

DEQ has reviewed and ~~agrees to accepted~~ the modifications to the CULs for cPAH (BaPeq) and RALs for total PAHs for the Selected Remedy. The support agency letter of concurrence is included in Appendix C of this proposed ESD.

The Five Tribes support EPA's approach regarding updating CULs for cPAH (BaPeq) and RALs for total PAHs in response to the BaP revision in a proposed ESD. The Five Tribes are the

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Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon. The letter of concurrence is included in Appendix D of this proposed ESD.

6.0 STATUTORY DETERMINATIONS

The Selected Remedy for the Portland Harbor Superfund Site, as modified by this proposed ESD, continues to satisfy the statutory requirements of CERCLA §121, 43 USC 9621 to protect human health and the environment, comply with federal and state requirements that are applicable or relevant and appropriate to the remedial action, are cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

7.0 PUBLIC PARTICIPATION COMPLIANCE

The public participation requirements set out in the NCP, 40 CFR §300.435(c)(2), have been met by adding the ESD and supporting information to the administrative record established under §300.815. EPA will publish a notice that briefly summarizes the final ESD, including the reasons for such differences in a major local newspaper of general circulation. EPA also recognized that there is strong community interest in the Portland Harbor Superfund Site and that there was a need for additional public participation opportunities regarding the proposed ESD. As a result, the proposed ESD and supporting administrative record were made available to the public through a 30-day public comment period. In addition, EPA held a public meeting to discuss the changes to the Selected Remedy in the proposed ESD.

8.0 REFERENCES

Environmental Protection Agency (EPA). 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002. December.

EPA. 2016a. *Final Remedial Investigation Report, Portland Harbor Remedial Investigation/Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. February 8.

EPA. 2016b. *Draft Final Portland Harbor Feasibility Study*. Environmental Protection Agency Region 10, Seattle, WA. June.

EPA. 2017a. *Record of Decision for the Portland Harbor Superfund Site*, Portland, Oregon. January 3.

EPA. 2017b. *Toxicological Review of Benzo[a]pyrene*. Integrated Risk Information System, National Center for Environmental Assessment, Office of Research and Development. Washington, DC. January 19.

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Appendix A

Supporting Documentation and Information

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Appendix A1

Updated Record of Decision Tables 17 and 21

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Appendix A2

Memorandum of Evaluation of Cost Impacts to Alternative F Modified, February 23, 2018

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Appendix A3

Discussion and Response to August 2, 2017 NW Natural Memo, March 2, 2018

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Appendix A4

Memorandum from Patty Dost, Pearl Legal Group PC, Subject: Portland Harbor cPAH Cleanup Levels, November 28, 2017

DRAFT

Appendix A5

TCT Meeting Materials, January 11, 2018

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Appendix A6

9-7-17 Email from Kevin Parrett (DEQ), Subject: PH Benthic Risk - 8-23-17.pptx

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Appendix A7

9-7-17 Email from Kevin Parrett (DEQ), Subject: PAH Water Impacts.pptx

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Appendix A8

Memorandum from Five Tribes with Comments, Subject: Review of NW Natural Memorandum on USEPA Updates to Human Health Toxicity Values for Benzo(a)pyrene and Potential Effects on Cleanup Levels in Portland Harbor, September 26, 2017

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Appendix A9

Memorandum from Five Tribes with Comments on TCT Meeting, Subject: Terminal 4 Negotiations Regarding Human Health Risk and Remedial Actions Levels (RALs), October 11, 2017

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Appendix A10

Elliott Laws Memorandum on cPAH Cleanup Level Issues, June 30, 2017

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Appendix A11

Memorandum from Yakama Nation, Subject: Review of NW Natural Memo on proposed updates to Record of Decision cleanup level and remedial action level for Benzo(a)pyrene at the Portland Harbor cleanup site, October 12, 2017

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Appendix B

Errata Memorandum

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Appendix C

Oregon Department of Environmental Quality
Letter Supporting EPA's Explanation of Significant Differences

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Appendix D

Five Tribes
Letter Supporting EPA's Explanation of Significant Differences

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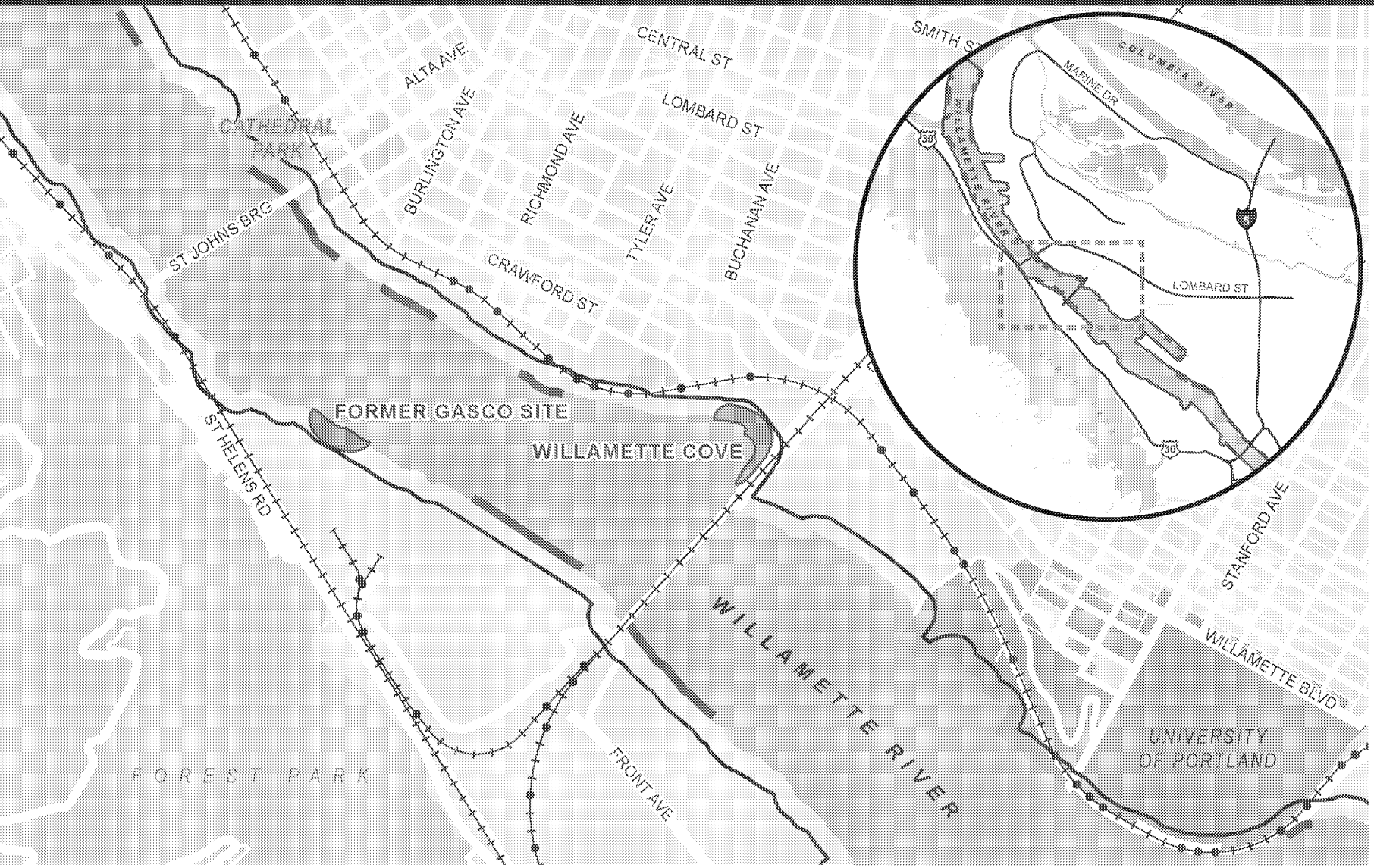
PORTLAND HARBOR

Guide to Recreational Use: Chemical Risks in Portland Harbor Superfund Site

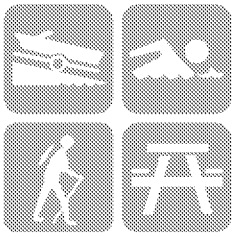
More Information
<OHA Contact>
(503) ###-####
www.websitehere.org



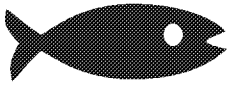
Shoreline Areas To Avoid

Other Shoreline Areas Evaluated

In-water Recreation Not Expected to Harm Heatlh



Recreational Activities Not Expected to Harm Health Except in Red Colored Areas on Map



EATING RESIDENT FISH CAN CAUSE HEALTH HAZARDS.
For information about eating fish in the Portland Harbor Superfund Site, go to: <OHA website>.

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STAY SAFE!
Keep in mind many factors affect your safety on the river, including temperature, currents and debris in the river, boat traffic, as well as your skills and ability in the water.

Know the water, know your abilities, and stay safe while enjoying the river.

Additional resources:
River conditions – U.S. Coast Guard, <website for info>.
Combined Sewer Overflow warnings – City of Portland www.portlandoregon.gov/bes
Algae blooms – Oregon Health Authority, <website for info>.

The following Agencies coordinated on producing this map: Oregon Health Authority, Oregon Department of Environmental Quality, City of Portland, United States Environmental Protection Agency.

Annie von Burg, City of Portland
Sara Greenfield, Oregon Dept. of Environmental Quality
Laura Knutsen, Environmental Protection Agency

RE: Requesting map of safe swimmable, fishable and recreatable areas in Portland

The Big Pipe was a wonderful improvement and in combination with many efforts taken over the past half century to cleanup bacterial contamination that was dumped into the Willamette River. It has greatly improved the safety for residents of the City of Portland to recreate on and swim in the river. Even though most sources of direct pollution into the river have been controlled, there remain concerns that need to be addressed in regards to the contaminated and carcinogenic chemicals that still reside in the Willamette particularly within the city limits.

After many years of study of the Portland Harbor Superfund and Record of Decision, it is difficult to doubt that the chemical problems in the river still present a problem. While the *Recreational Index Report* from ATSDR to Oregon Health Authority addressed the issue of GASCO beaches, the report about the chemical problems at Willamette Cove were not included. Also, the report about GASCO did discuss the possibility of cancer-causing PAH's, it omitted that it was also possible to develop skin irritations from PAHs as indicated on the Oregon State University, Superfund Research website.

The Oregon Health Authority rendered and posted its opinion on the fish advisory, saying that the nontransient fish such as carp, small-mouth bass, catfish and others should not be eaten by women of child-bearing age and children. It is also recommended that the rest of the population should restrict their eating of the nontransient fish to less than 8 ounces per month.

To educate the community and clarify levels of risk, I would like to see maps created with indicators where swimming and recreation carry a greater risk to health for families such as GASCO and Willamette Cove. Ideally, OHA, DEQ, and EPA would work with BES to design maps that would indicate the positive places to swim, paddle, fish and recreate. It would be an asset if new anglers knew where to catch healthy fish in a simple manner such as dots or color coding on a map. A map for quick reference, and an included short directory of additional resources would be very helpful.

Of course, it should be based on sound science and not just be a public relations piece to placate people nor should it overly alarm them. If the public is simply informed, they can make their own decisions about what is safe and desirable for their family.

In addition, with all of the new families moving into Portland, few if any are aware that ten miles of the Portland Harbor Superfund exists. After sixteen years, it is still astonishing how many established residents are not aware of its presence. It is time to inform Portlanders and all Oregon that there is 10 miles of a Superfund within City limits. Many Superfunds across the nation have posted signs apprising residents of the fact that the Superfund exists, and many of those not as large as the one in the Willamette.

Also needed are large signs within the parks and other nearshore locations within the Superfund so people can simple be made aware that there is a Superfund near the bank and in the ten miles of the Willamette River. The goal is not to frighten or disturb residents but simply inform them. They deserve that.

While I thank each of these agencies for their effort to contribute to health of our families, it would be best in this situation if all of them could form a consensus and create a map or maps, to be available in print format as well as kept current online and designed to be consistent with the public messaging in the media.

See sample map from California beaches. Also, in San Diego, daily the news announces which beaches are safe from e coli contamination and clearly states which beaches have a problem.

Sincerely,

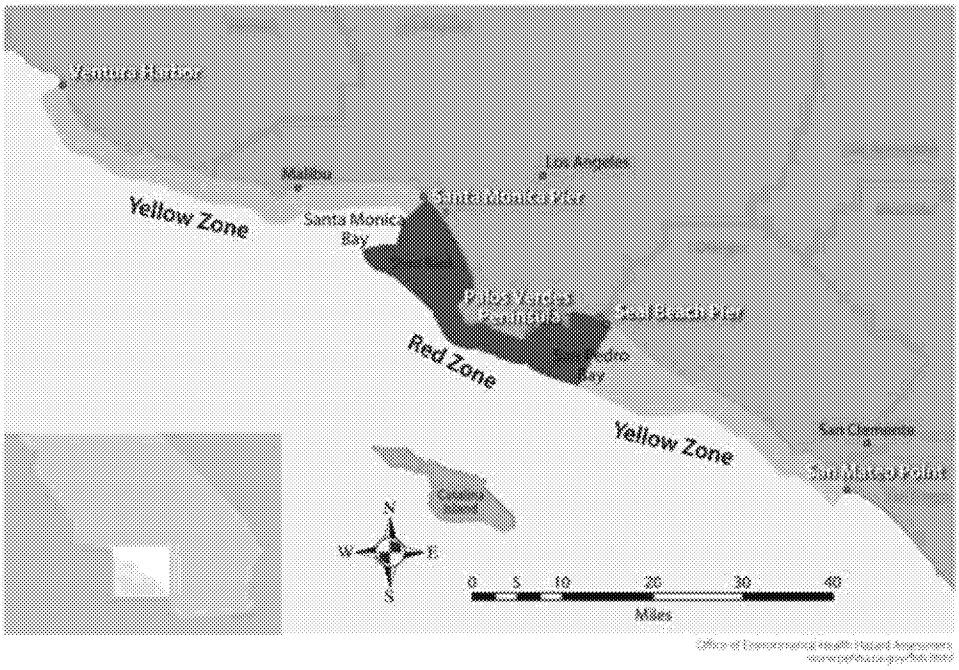
Jackie Calder, Co-Chair
Portland Harbor Community Advisory Group
Personal Privacy / Ex. 6

Borrowed from a California website:
http://pvsfish.org/index.php/contaminated-fishing-areas

[HYPERLINK "http://pvsfish.org/index.php/contaminated-fishing-areas"] Fishing Areas

What fish are safe to eat depends on the area your fish is coming from. Fishing areas in the red zone include [HYPERLINK "http://pvsfish.org/index.php/cabrillo"], [HYPERLINK "http://pvsfish.org/index.php/seal-beach"], White Point, [HYPERLINK "http://pvsfish.org/index.php/pier-j"], [HYPERLINK "http://pvsfish.org/index.php/belmont"] and Point Vicente as well as the piers in [HYPERLINK "http://pvsfish.org/index.php/santa-monica"], [HYPERLINK "http://pvsfish.org/index.php/venice"], [HYPERLINK "http://pvsfish.org/index.php/marina-del-rey"], [HYPERLINK "http://pvsfish.org/index.php/redondo"]and [HYPERLINK "http://pvsfish.org/index.php/hermosa"]. Some fishing areas in the yellow zone include the piers in Ventura, Malibu, Huntington Beach and San Mateo Point.
Refer to the [HYPERLINK "http://pvsfish.org/index.php/contaminated-fishing-areas"] below to reduce [HYPERLINK "http://pvsfish.org/index.php/health"] associated with the exposure to DDTs and PCBs found in fish commonly caught off the Los Angeles and Orange County Coasts. [HYPERLINK "http://pvsfish.org/index.php/health-effects-of-eating-contaminated-fish"] associated with the exposure to DDTs and PCBs include cancer, [HYPERLINK "http://pvsfish.org/index.php/contaminated-fishing-areas"] and effects on the [HYPERLINK "http://pvsfish.org/index.php/contaminated-fishing-areas"] and [HYPERLINK "http://pvsfish.org/index.php/contaminated-fishing-areas"].
Do not eat white croaker, barred sand bass, barracuda, black croaker or topsmelt caught in the red zone.
Find out what fish are safe to eat by clicking on the [HYPERLINK "http://pvsfish.org/index.php/fish-consumption-advisory"]or the [HYPERLINK "http://pvsfish.org/index.php/other-areas"] below.

Map of yellow and red zones for fish caught from Ventura Harbor to San Mateo Point



Memorandum

DRAFT

Date: April 5, 2018

To: File

From:

Eric Blischke, CDMSmith for EPA
Kim Hack, DEQ
Todd Hudson, OHA
Laura Knudsen, EPA
Jim McKenna, State of Oregon
Madi Nowak, DEQ
Cindy Ryals, City of Portland
Julie Sifuentes, OHA
Jessica Terlikowski, City of Portland

CC: Annie Von Burg, City of Portland

Re: Recreational Use Map For Portland Harbor, Technical Discussions

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As a result of an October 9, 2017 email request from Jackie Calder of the Portland Harbor Community Advisory Group to EPA, the City of Portland BES, and DEQ "requesting map of safe swimmable, fishable and recreatable areas in Portland" (sic), an inter-Agency group is producing a Portland Harbor map to guide the public on chemical risks from recreational use exposures within the Superfund Site.

The draft map is largely based on public health assessments (PHAs) for recreational use performed by the OHA, which conclude that recreational use at the beaches at Willamette Cove and Gasco were the only areas within the Harbor that result in potentially unacceptable risk from chemical exposure. Based on OHA's work, areas and exposures that generally do not result in potentially unacceptable risk include:

- Recreational boating within the Superfund Site
- Recreational swimming within the Superfund Site
- Recreating at any other beaches/shoreline areas evaluated (except Gasco and Willamette Cove) within the Superfund Site

Fish ingestion was not considered a recreational use for the purposes of this discussion, however, consuming fish at the Portland Harbor site may result in unacceptable risks. The ~~but the~~ draft map provides a weblink to information about current fish advisories for the Lower Willamette River including the Portland Harbor Site.

This memorandum documents some of the technical issues discussed and decisions made by the inter-Agency group. Most of the discussion topics compare the OHA PHA and the EPA Baseline Human Health Risk Assessment (BHHRA).

Overall map recommendations

Commented [CL1]: What file?

Commented [BE2]: This memo should come from Cindy not the entire work group. See related comment below.

Commented [CL3]: Do you mean human health risks?

Commented [CL4]: Are you doing this map using all the same definitions and exposure assumptions for recreational use as our BHHRA did? If not, isn't that a problem?

Commented [BE5]: This sentence should be revised to note that the City of Portland is taking the lead on this effort with support from EPA, OHA, ODEQ and the Governor's office.

Commented [BE6]: There should be a statement here that the procedures used by OHA differed from the procedures used in the baseline HHRA for the PH site.

Commented [BE7]: I still have issues with stating categorically that recreational boating and swimming do not pose risk. There could be risk if boating and swimming activities at the Willamette Cove and GASCO beaches involve contact with contaminated sediments.

Commented [CL8]: Is this consistent with conclusions of our BHHRRA? Assume this means direct contact and ingestion of sediment and surface water?

Commented [BE9]: Not sure what area the fish advisories cover but we should describe.

The OHA conclusions are not inconsistent with the BHHRA conclusions for the Portland Harbor. At Gasco and Willamette Cove, the PHA results are slightly more conservative than the BHHRA.

Definition of Acceptable Risk

The PHA used a cancer risk threshold of 1 x 10^{-4} to identify unacceptable risk. The EPA BHHRA used a cancer risk threshold of 1 x 10^{-6}. ~~However, u~~Under CERCLA, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1 x 10^{-4} and 1 x 10^{-6} while the 1 x 10^{-6} risk level represents the point of departure for determining remediation goals. Risks greater than 1 x 10^{-4} typically will require remedial action.~~However, under CERCLA,~~ ~~risks between 1 x 10^{-6} and 1 x 10^{-4} are subject to risk management, whereas active cleanup is only required when risks exceed 1 x 10^{-4}.~~

In the BHHRA, there were no recreational use risks that exceeded 1 x 10^{-4}, but some recreational exposures exceeded the 1 x 10^{-6} threshold. Active remedy is not identified at any beaches in the Record of Decision (ROD), including beaches where recreational use risks were between 1 x 10^{-6} and 1 x 10^{-4}.

Representatives from EPA, DEQ, OHA, and the City indicated that for the purposes of highlighting areas to avoid on the recreational use map, a threshold of 1 x 10^{-4} would be acceptable.

Risk Assessment Field Data

The PHA used environmental sampling data from "the Comprehensive Round 2 Report prepared by the Lower Willamette Group (LWG) under the direction of the EPA. The EPA collected water, soil, sediment, and fish samples throughout the 9.8-mile length of the current study area from 2002-2005".

The PHA evaluated recreational exposure to beach sediment, in-water sediment, and surface water. These are the same exposure media and data used for the BHHRA.

Shoreline Areas Evaluated

Both the PHA and BHHRA use the term "beach" to indicate shoreline areas that have potential for human exposures, although the areas may not resemble traditional beaches. These shoreline areas were selected based on a survey done of the Site to determine potential human use areas for evaluation in the BHHRA. The survey was conducted under EPA oversight to inform the BHHRA, and included considerations of areas that may be accessed only by boat, as well as areas that may be accessed primarily by houseless individuals. It was assumed that shoreline areas not identified during this process have low or unlikely potential for human exposure. Many of the shoreline areas in the Site do not have potential human access because of heavy riprap, shoring, or other structural or natural barriers.

Representatives from EPA, DEQ, OHA, and the City agreed to use the term "shoreline area" instead of "beach", to facilitate communication with the public for the purposes of the recreational use map.

Methodology to Screen COPCs

One of the first steps in risk assessment is to screen out chemicals which are unlikely to be contributing significantly to health risk. To identify chemicals of potential concern (COPCs), the PHA used screening levels consistent with OHA established methodology, which are conservatively protective of human health. The standard OHA screening levels are different than the screening levels used in the BHHRA, so the list of COPCs for Portland Harbor recreational use differs slightly between the two methods. However, both methods are appropriate for their respective Agencies and considered to be a protective approach.

Commented [BE10]: This overall recommendation should come at the end of the memo. Greater detail should be included.

Commented [CL11]: But it is inconsistent with our ROD. We said we needed to address beaches if over Cleanup levels for COCs that present a direct contact risk.

Commented [BE12]: I have revised to be consistent with the NCP and statements in the ROD. There should also be some discussion in this paragraph about the ODEQ standard of 1 x 10-6 for individual chemicals and 1 x 10-5 for multiple chemicals.

Commented [CL13]: But that is not the remedy decision we made. We did not make remedy decisions protecting only to 10-4 or even 10-5.

Commented [BE14]: I am not sure this is true. There could be some beach areas that will require active remediation near Linnton and Cathedral Park. The need for active remediation will determined based on new data and comparison to RALs.

Commented [CL15]: So what that they don't exceed RALs which are not risk-based. We selected cleanup levels to be applied at beaches and we presumably will be holding PRPs on the hook to get to those CULs.

Commented [BE16]: This should say that this determination was based on the OHA evaluation.

Commented [CL17]: This must be further explained. Shouldn't we be indicating that excessive use of any of the beaches EPA assessed and found risk people should not use as much as 94 days a year for how many hours we said was a reasonable maximum exposure in the BHHRA?

Commented [BE18]: It should be noted that the evaluation at Willamette Cove was not based on the beach data but rather additional data collected by during the RI/FS as well as data collected by the City as part of its investigations of Willamette Cove.

Commented [BE19]: Beach areas were identified in the PH RI/FS and BHHRA as areas where "direct contact with human receptors could occur (only reasonably accessible ...

Commented [BE20]: It should be noted in this paragraph that range of beach exposures were evaluated in the PH BHHRA including transients, dockside workers and ...

Formatted: Highlight

Commented [CL21]: This statement is being debated and examined right now for purposes of the ESD, but it is not what the ROD says currently.

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Commented [CL22]: I really don't understand how we can say this and still require PRPs to achieve the direct contact CULs for recreational beaches we selected in the ...

Exposure Parameters and Risk Modeling
For the exposure assessment and risk modeling, the PHA and BHHRA approaches are highly consistent.

The values used for the exposure parameters are slightly different in the PHA and BHHRA, but both used reasonable assumptions for recreational use. While most of the exposure values are the same, in some cases the values used in the PHA are the central tendency (CTE) values used in the BHHRA, as opposed to the reasonable maximum exposure values (RME).

Both the PHA and BHHRA evaluated risks to both adult and children.

Commented [CL23]: Riverbanks discussion can't remain, it undermines our ROD. Riverbanks were identified based on potential for recontamination of the in-water cleanup. It's apples and oranges. But we can't say there is no risk to human health on riverbanks if they exceed relevant direct contact/ingestion CULs.

~~**Figure 9 of the ROD**~~

~~Figure 9 of the ROD highlights specific bank areas of the Harbor that it defines as "Properties with Known Contaminated Riverbanks". In anticipation of questions from the public regarding this figure, the group discussed what this figure represents.~~

Commented [BE24]: The riverbank data was collected under DEQ-led investigations. These riverbank areas contain contamination "at levels that pose a risk to human health, the environment, or for recontamination to any implemented remedy." The identification of these areas was not necessarily based on the recreational beach exposure scenario evaluated in the BHHRA but considered other risk pathways and recontamination potential. However, there is clearly some overlap between the ROD Figure 9 and the beach areas evaluated in the BHHRA (e.g., Willamette Cove and Evraz Oregon Steel Mills).

~~It appears as though this figure was produced from data that was not evaluated in the RI/FS for the Portland Harbor, but was based on a screening evaluation performed by EPA based on data obtained from DEQ. It is unclear whether the data used to produce the figure is current/accurate, as it may not consider remedial activities that occurred since the data was collected.~~

~~A risk assessment was not performed on the bank areas highlighted on the map, and therefore the figure does not indicate human health risk. The ROD states: "Cleanup levels for RAO 9 (river bank soil) were selected as the lowest sediment cleanup level for each COC to ensure that sediment would not be re-contaminated" (ROD, p. 58). This indicates that the highlighted river bank areas are flagged as a recontamination risk, and not as a human health risk for recreational or other use.~~

Commented [BE25]: This is not necessarily true – see above. Also, ODEQ may have conducted risk assessments on these areas in conjunction with their upland investigations.

~~Representatives from EPA, DEQ, OHA, and the City agreed that the content of Figure 9 is not~~ directly related to ~~informative for a map of human health risks~~ associated with ~~from recreational use.~~

DRAFT

Appointment

From: Sheldrake, Sean [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D16E2780A4094BBA82DAAA5283A71572-SHELDRAKE, SEAN]
Sent: 1/4/2018 5:42:02 PM
To: Eva DeMaria (DeMaria.Eva@epa.gov) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0c04d60f20714b4bb58b49524bfe83d7-DeMaria, Eva]

Subject: FW: Parallel meeting invite to provide materials for PAH discussion on January 4th
Attachments: 12-7-17_Portland Harbor cPAH Cleanup Levels Memo.docx; PAH_RAL_CUL_Evaluation.docx; Beach_Sediment_Risk_Summary.pdf; Attachment_1_CPAH_RRM_greater CUL.XLSX; Figure_2_cPAH_RRM_774 CUL_Comp.pdf; Figure_1_SMA-Selected-Remedy-minus-PAHs.pdf; RollingRiverMileStratifiedNaturalNeighborGrid (RAL 13000 25000 30000) Revised 2017_12_12.pptx; FigX-X_SMAs-based-on-PAHs-30ppm_20180102.pdf; PercentProtective_HalfRM_106_prg.pptx; Total_PAH_Navigation_Channel_RAL_Text_12-21-17.docx; CPAH_Slope_Factor_Change_1-3-17.pptx
Location: Redacted

Start: 1/4/2018 5:30:00 PM
End: 1/4/2018 7:30:00 PM
Show Time As: Tentative

Importance: High

-----Original Appointment-----
From: Coffey, Scott [mailto:CoffeySE@cdmsmith.com]
Sent: Friday, December 15, 2017 9:54 AM
To: Coffey, Scott; Sheldrake, Sean; Gustavson, Karl; Blischke, Eric; John Kern; Chu, Rebecca; Grandinetti, Cami; Zhen, Davis
Cc: PARRETT Kevin
Subject: Parallel meeting invite to provide materials for PAH discussion on January 4th
When: Thursday, January 04, 2018 9:30 AM-11:30 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Redacted
Importance: High

Technical materials for PAH discussion/decision making meeting – Updated 1/3/18.
Eric's review summary and response on the three main points presented in the 11/28/2017 memo from Patty Dost to Elliott Laws (**MS Word file titled – 12-7-17_Portland Harbor cPAH Cleanup Levels Memo**)
Eric's rolling river mile evaluation which looks at where active remediation is designated (footprint) against the cPAH cleanup levels, including IRIS adjusted values. Eric presents a summary (MS Word file) of the cPAH questions that have been raised during relevant CUL and RAL adjustment discussions and provides answers gleaned from this analysis (**5 files immediately below**)
John Kern's analysis per Karl's direction to develop a statistically based Adjusted RAL for the nearshore (**Powerpoint slide titled: RollingRiverMileStratifiedNaturalNeighborGrid……)**
A supplemental John Kern analysis per Karl's request to show proportion of half RM protected at the 106 PRG as a function of selected RALs. (**Powerpoint slide titled: PercentProtective_HalfRM_106_prg.pptx**)
Updated GIS PAH coverage map showing footprint of SMA related to Total PAHs, the differences if nearshore TPAH RAL is revised to E-RAL and Stat based RAL of 30ppm
Slide summary of PAH decisions – those agreed upon, ongoing considerations/factors, Options with ranking summary table
Rationale Summary for retaining B-RAL in Nav Channel

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 1/28/2019 7:21:59 PM
To: Gustavson, Karl [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=242318f48f264976aeeb0008f0a44210-Gustavson, Karl]
CC: Brigid Lowery [Lowery.Brigid@epa.gov]; Fitz-James, Schatzi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=91ad13b033f14eda8364bded00eafa8c-Fitz-James, Schatzi]; 'Jennifer Hovis' [Hovis.Jennifer@epa.gov]; 'Doug Ammon' [Ammon.Doug@epa.gov]; Libelo, Laurence [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da33642e6438407daf4c35afe870046b-Libelo, Laurence]; Stalcup, Dana [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=70b76eb4c1c54ae585333e7fbcc83fed-Stalcup, Dana]
Subject: FW: NW Natural Response to EPA December 17, 2018 Letter
Attachments: 2019-01-28 NW Natural Response to EPA 2018-12-17 Letter.pdf

Sharing

Jim Woolford, Director
Office of Superfund Remediation and Technology Innovation
Office of Land and Emergency Management
US Environmental Protection Agency
1200 Penn. Ave., NW
Washington, DC 20460
(Mail Code 5201-P)

Our mission is to return the most contaminated areas of the country to communities for safe reuse in a healthy environment.

Phone: (703) 603 8960– Main Office Line

Physically located at:

Room 5622
One Potomac Yard (South)
2777 S. Crystal Dr.
Arlington, VA 22202

From: Jen Mott [mailto:jmott@anchorqea.com]
Sent: Monday, January 28, 2019 2:19 PM
To: Zhen, Davis <Zhen.Davis@epa.gov>
Cc: rjw@nwnatural.com; Hladick, Christopher <hladick.christopher@epa.gov>; Cook, Steven <cook.steven@epa.gov>; Woolford, James <Woolford.James@epa.gov>; Mackey, Cyndy <Mackey.Cyndy@epa.gov>; Bilbrey, Sheryl <Bilbrey.Sheryl@epa.gov>; Grandinetti, Cami <Grandinetti.Cami@epa.gov>; Cora, Lori <Cora.Lori@epa.gov>; Sheldrake,

Sean <sheldrake.sean@epa.gov>; pdost@pearllegalgroup.com
Subject: NW Natural Response to EPA December 17, 2018 Letter

Mr. Zhen,

On behalf of NW Natural, I am submitting the attached response to EPA's December 17, 2018 letter.

If you have any questions, please contact Bob Wyatt at rjw@nwnatural.com.

Jen Mott ☺
Project Coordinator
Anchor QEA, LLC
jmott@anchorqea.com
6720 SW Macadam Ave, Suite 125, Portland, OR 97219
(503) 972-5014
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January 28, 2019

Davis Zhen
United State Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 155
Seattle, WA 98101-3123

RE: EPA Request for Remedial Design Proposals
Portland Harbor Superfund Site

Dear Mr. Zhen:

Please accept this as NW Natural's response to EPA's March 16, 2018 and December 17, 2018 letters inviting remedial design proposals for the Portland Harbor Superfund Site. As you know, NW Natural is already performing remedial design at the Gasco Sediments Site under an Administrative Settlement Agreement and Order on Consent dated September 28, 2009. Our work at Gasco is well underway. We anticipate completing remedial design investigations during the spring and summer of 2019, and we currently expect to submit final design documents to EPA in 2021.

NW Natural appreciates EPA's willingness to break the site into manageable work areas, and we understand EPA's interest in accelerating the pace of remedial design work throughout Portland Harbor. We believe, however, that, instead of requiring harborwide remedial design immediately, EPA should prioritize those areas that contribute the most to human health or environmental risk, and where remedial work can be commenced in the reasonable future. Focusing on areas presenting the highest potential risks will allow those areas to proceed quickly to construction following entry of consent decrees while allowing space for the ongoing Portland Harbor allocation to work out performance and responsibility in lower priority areas.[1] We encourage EPA to reschedule its meeting with the allocation group as soon as possible to explore how the allocation schedule aligns with the completion of remedial design work both planned and in progress.

NW Natural's strong preference remains to implement the Gasco cleanup as part of a harborwide settlement with EPA, and so we need the allocation to be successful. We are extremely concerned that broad enforcement action by EPA has the potential to undermine

[1] We also note that EPA has proposed to update cleanup levels and remedial action levels for cPAHs. Several parties submitted comments on EPA's proposed Explanation of Significant Differences, and EPA should consider those comments and finalize the ESD before requiring additional remedial design commitments in areas defined primarily by PAH concentrations.

the allocation and result in litigation that will delay, rather than expedite, the cleanup. We believe that providing incentives (including forbearance from enforcement action) to parties who are willing to or are already performing remedial design work is EPA's best path to move the site as a whole toward cleanup as quickly as possible. If EPA needs to use its enforcement authority to start remedial design in certain high priority areas, it should target that enforcement specifically to those areas and associated responsible parties and should not take action against parties who are cooperating with EPA and already performing design work in priority areas.

EPA and NW Natural have worked collaboratively during the last two years to develop site-specific technical approaches for a successful cleanup at Gasco. We have experienced firsthand EPA's willingness to implement flexibilities built into the Portland Harbor Record of Decision. We have shared our experience working with EPA with other responsible parties and will continue to do so. We are also committed to communicating with EPA and other responsible parties to ensure efficiency and consistency in Portland Harbor remedial design work where appropriate.

In summary, we appreciate EPA's ongoing work with us on the design for the Gasco site, and we hope that EPA will consider the relative risks associated with different areas of the site as it establishes schedules and deadlines for remedial design throughout the Portland Harbor. EPA should not require parties, such as NW Natural, who have already stepped forward to address priority areas, to risk enforcement or litigation that will only serve to delay the initiation of cleanup.

We would be happy to discuss this request with EPA, and we look forward to continued progress on the remedial design for Gasco.

Sincerely,

Bob Wyatt

cc: Steven Cook, EPA
Chris Hladick, EPA
Jim Woolford, EPA
Cyndy Mackey, EPA
Sheryl Bilbrey, EPA
Cami Grandinetti, EPA
Lori Cora, EPA
Sean Sheldrake, EPA

Message

From: Woolford, James [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9A70358E7660435CBE6AFA87B7B9B71B-WOOLFORD, JAMES]
Sent: 3/13/2018 6:13:47 PM
To: Gartner, Lois [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df96a1a787694d9181c3055a8ea6ed90-Lgartn02]
Subject: Fwd: POSTPONED: Portland Harbor Sr Leadership call

Sent from my iPhone, please excuse spelling errors.

Thanks, Jim.

Begin forwarded message:

> **From:** "Zhen, Davis" <Zhen.Davis@epa.gov>
> **Date:** March 13, 2018 at 1:05:45 PM EDT
> **To:** Bill Ross <bross@rossstrategic.com>, "Cora, Lori" <Cora.Lori@epa.gov>, "Mackey, Cyndy" <Mackey.Cyndy@epa.gov>, "Hladick, Christopher" <hladick.christopher@epa.gov>, "Woolford, James" <Woolford.James@epa.gov>, "Pirzadeh, Michelle" <Pirzadeh.Michelle@epa.gov>, 'OGRODNIK Katie' <katie.ogrodnik@state.or.us>, 'PARRETT Kevin' <kevin.parrett@state.or.us>, 'Richard Whitman' <richard.whitman@state.or.us>, 'SEIDEL Paul' <paul.seidel@state.or.us>, "Sheldrake, Sean" <sheldrake.sean@epa.gov>, "Bilbrey, Sheryl" <Bilbrey.Sheryl@epa.gov>, "Ingemansen, Dean" <Ingemansen.Dean@epa.gov>, "Mairs, Stephanie" <Mairs.Stephanie@epa.gov>, "Chu, Rebecca" <Chu.Rebecca@epa.gov>
> **Subject: POSTPONED: Portland Harbor Sr Leadership call**
>
> Hi Everyone,
>
> Cami just confirmed with Chris earlier today to postpone this meeting to a later date. I will work with Bill and Kevin to reschedule this meeting. Have a nice day everyone.
>
> Thanks,
>
> **********
> Davis Zhen
> Environmental Cleanup Unit 2
> Office of Environmental Cleanup
> 1200 Sixth Avenue Suite 900
> M/S ECL – 122, Seattle, WA 98101
> Tel: (206) 553-7660
> Cell: (206) 437-5826
> **********
>
> -----Original Appointment-----
> **From:** Bill Ross [mailto:bross@rossstrategic.com]
> **Sent:** Wednesday, February 14, 2018 4:17 PM
> **To:** Bill Ross; Cora, Lori; Mackey, Cyndy; Zhen, Davis; Hladick, Christopher; Woolford, James; Pirzadeh, Michelle; 'OGRODNIK Katie'; 'PARRETT Kevin'; 'Richard Whitman'; 'SEIDEL Paul'; Sheldrake, Sean; Bilbrey, Sheryl; Ingemansen, Dean; Mairs, Stephanie; Chu, Rebecca
> **Subject:** Portland Harbor Sr Leadership call

When: Tuesday, March 13, 2018 2:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Call-in number Redacted, pass code Redacted

Here is the agenda for the March 13 Senior Leaders call. Working with the EPA and DEQ managers of the cleanup, the agenda has been developed to focus on issues in which senior leaders' direction, decision-making and connectivity are essential and hence the call will not be an overall project update briefing. Attendance at the call has been determined by the managers to include those staff essential to the strategic discussion that will ensue at the call.

1. <!--[if !supportLists]--><!--[endif]-->Pending issues on the development/implementation of the AOCs for the SMAs to begin remedial design (RD) work in 2018:
   - **T4 (Port project)** - EPA response to Port request for potential ROD amendments by applying Nav Channel RALs in Slip 3. *Will Port proceed in some fashion if their request is rejected?*
   - **Gasco** - ExxonMobil has communicated with both EPA and DEQ that it believes the AOC needs to be substantially expanded to include downriver PAH contamination. DEQ is drafting a response letter to EM's assertion of inadequate source control. EM also wants to present its views to the TCT at this time. Some of the Pre-RD Group's sampling efforts might have bearing on this and the question of specific liability is first and foremost up to the allocation process which is still ongoing. *How should EPA and DEQ respond to EM's requests for agency decisions?*
   - **ESD for PAHs** - EPA is preparing an ESD in response to NW Natural's request that the RAL for PAHs be reconsidered in light of the updated risk numbers for benzo(a)pyrene. DEQ supports EPA's position. The next step is for EPA to announce the decision and seek public comment and engage in tribal consultation. *When this commences, how should DEQ indicate its concurrence?*
2. <!--[if !supportLists]--><!--[endif]-->Consideration of the draft protocol establishing the relationship of EPA and DEQ on sharing technical oversight (and other) responsibilities of ROD implementation.
3. <!--[if !supportLists]--><!--[endif]-->Timing of next meeting and determination of the value (and frequency) of all hands briefings as well as these more focused strategic discussions.