Agenda

2012 ANNUAL REGIONAL SEDIMENT EVALUATION TEAM / SEDIMENT EVALUATION FRAMEWORK (SEF) MEETING

October 17, 2012

Galaxy Conference Room
US Army Corps of Engineers, Seattle District Office
4735 E. Marginal Way S, Seattle, WA

9:30 to 9:45 – Welcoming Remarks: LTC Kevin Stoll, Deputy Commander, Seattle District and Teena Reichgott, Manager, Sediment Mgmt. and Environmental Review Program, USEPA Region 10

9:45 to 10:00 – District/State Sediment Evaluation Program Updates
WA Dredged Material Management Program, Lauran Warner
Portland Sediment Evaluation Team, James McMillan
Walla Walla District, Russ Heaton

10:00 to 10:30 – Sediment Characterization of the Post-Dredge Surface: Comparison of In-Situ and Post-Dredge Grab Samples in Freshwater and Marine Sediments in the Lower Columbia River Basin and Puget Sound, Michelle Hollis, Port of Portland

10:30 to 10:50 – Break

10:50 to 11:20 – NOAA Fish Screening Levels for PAHs, Lyndal Johnson, NOAA NW Fisheries Science Center

11:20 to 11:40 – Puget Sound Sediment Reference Material, Justine Barton, USEPA Region 10

11:40 to 12:00 – Status of Washington State Sediment Management Standards Rulemaking, including Freshwater Screening Levels and Bioaccumulatives – Laura Inouye, WA Dept. of Ecology

12:00 to 1:00 – Lunch Break

1:00 to 1:20 – Regional Superfund Update (Puget Sound) – Shawn Blocker, Cleanup Program, USEPA Region 10

1:20 to 1:50 – Best Management Practices (BMPs): Examples from Navigation Dredging at Contaminated Sites, Clay Patmont or Tom Wang, Anchor QEA

1:50 to 2:45 – Views from SEF users and the public: *Possible speakers include Washington Public Ports Association (WPPA) and Pacific Northwest Waterways Association (PNWA) and any other presentations and comments submitted by the public.*

2:45 to 3:00 – Closing Remarks

Dredged Material Management Program

Dredging Year 2012

Lauran Warner
US Army Corps, Seattle

DMMP Purpose

Given:

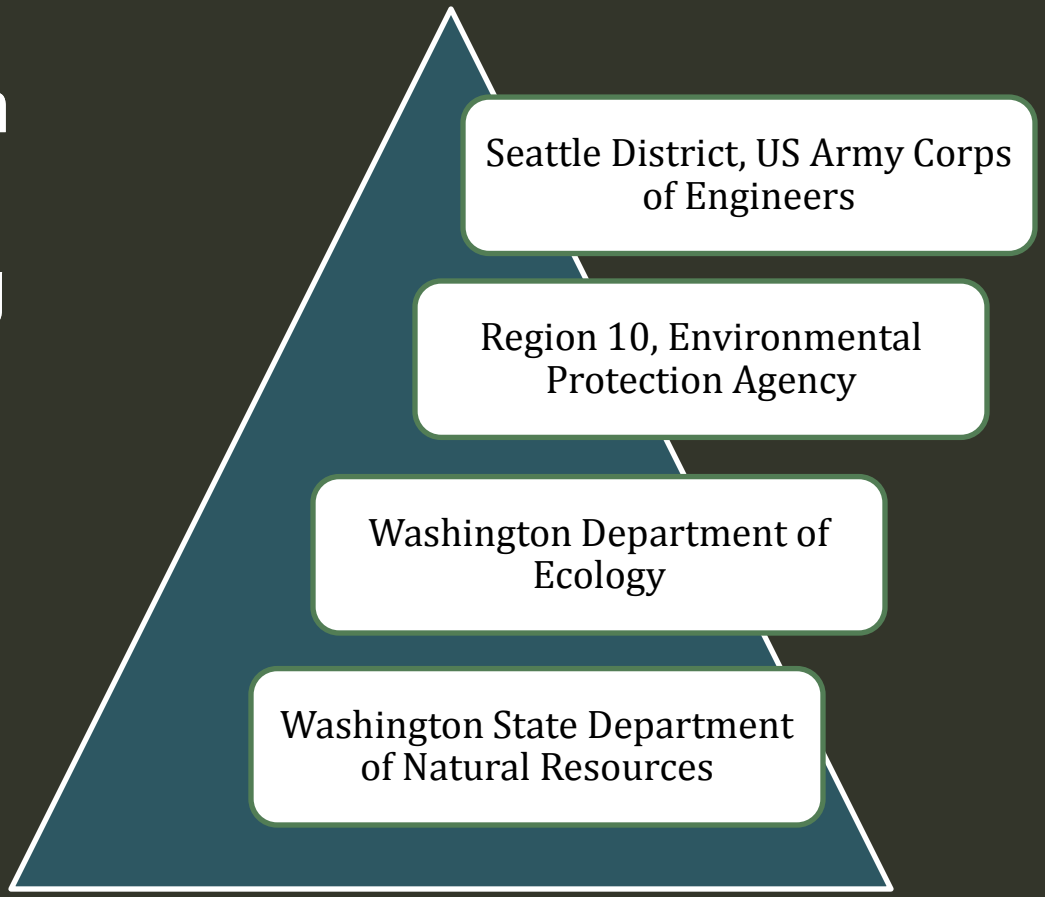
existing regulations, current guidelines, and project proposal

Evaluate:

potential dredged material for suitability for open-water disposal and/or beneficial reuse

DMMP Agencies

Agencies with jurisdiction over dredging and disposal, all working together to streamline oversight.



DMMP 101

DY 2012 = 16 June 2011 to 15 June 2012

Decision Documents:

- Suitability Determinations
- Others:
  - Recency Extension
  - Exclusion from Testing
  - Volume Revision
  - Antidegradation Determination
  - Other projects and/or changes that require documentation

Washington Disposal Sites

Puget Sound:

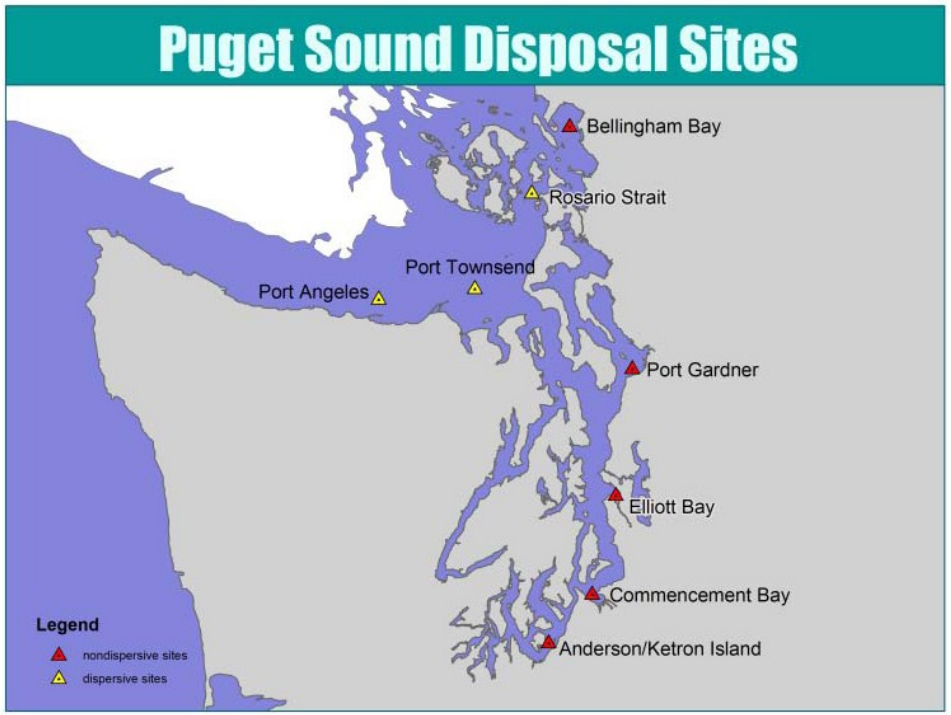
- 8 disposal sites
  - 5 non-dispersive sites
  - 3 dispersive sites

Coastal Washington: Grays Harbor / Willapa Bay:

- All dispersive sites
- 4 estuarine and 1 ocean disposal
- Flowlane disposal in Willapa

Lower Columbia River:

- All dispersive sites
- Flowlane disposal

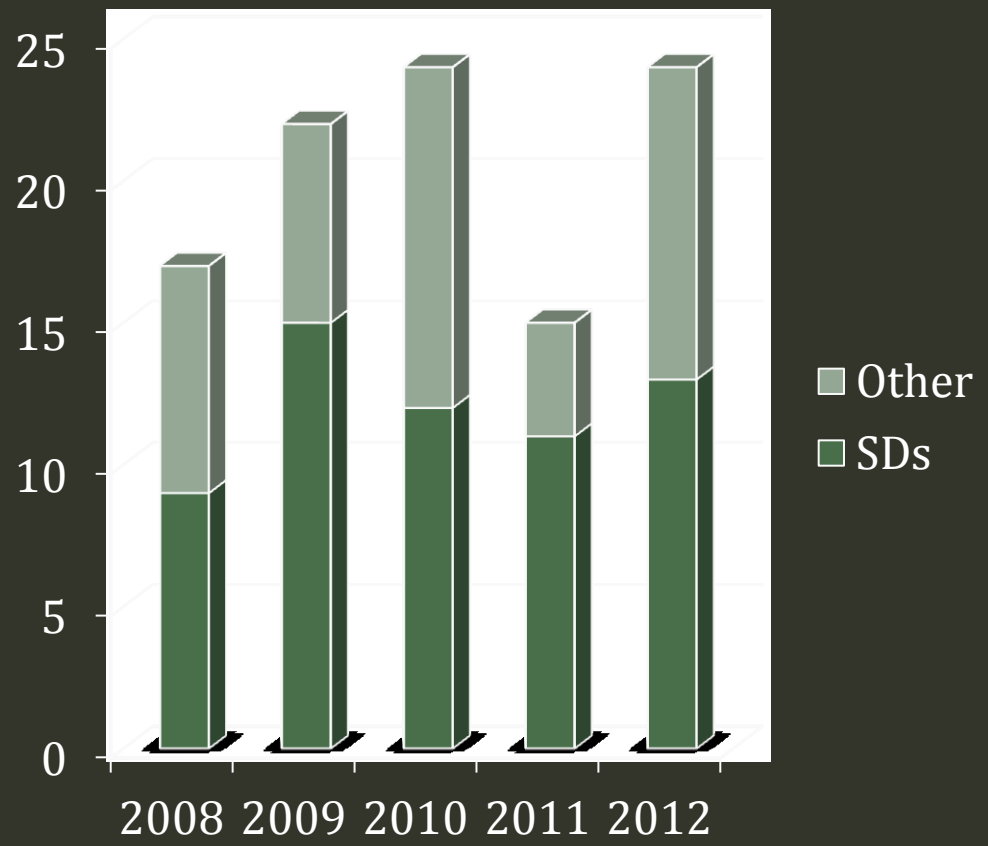


DY12 Completed Actions

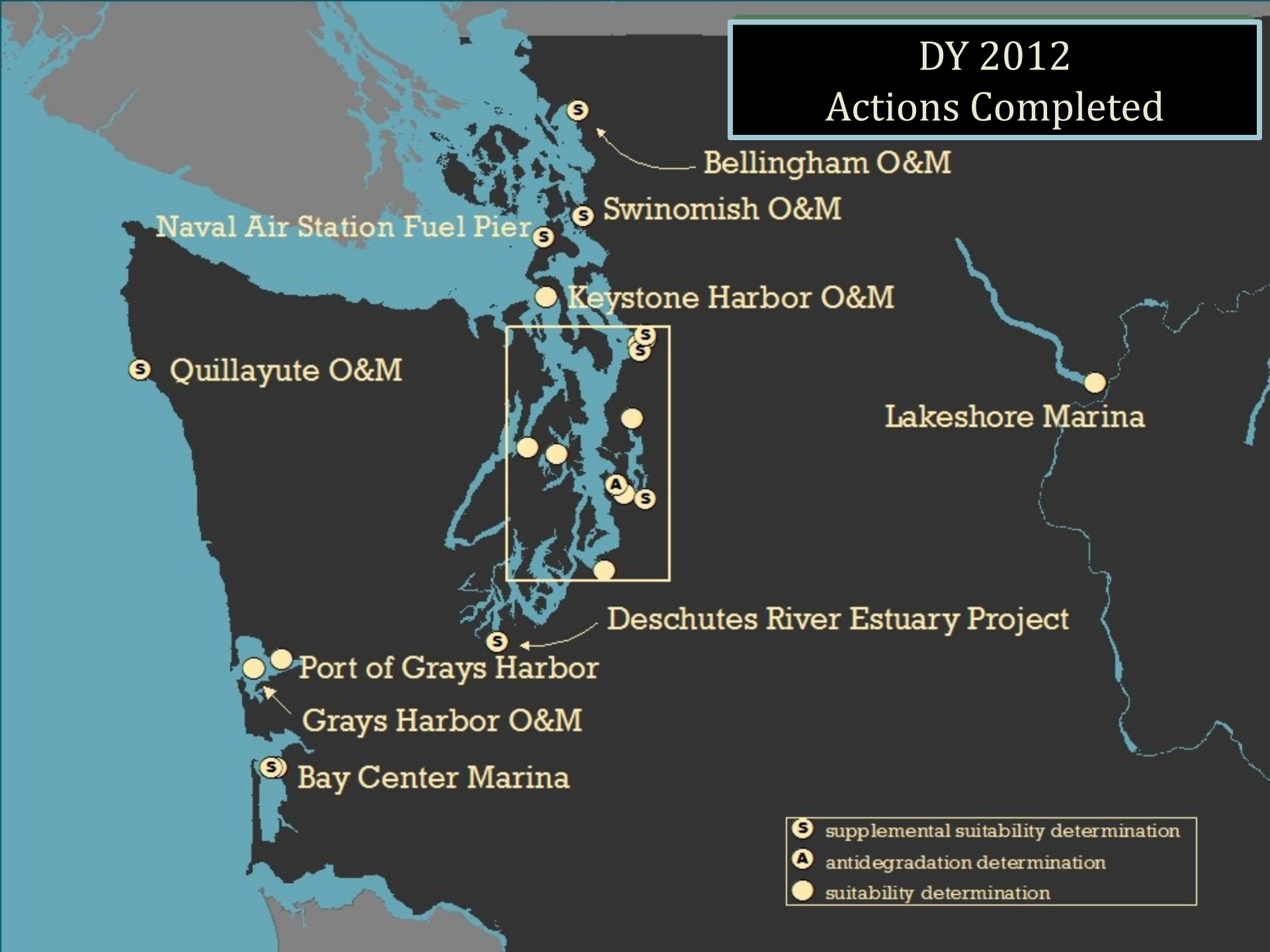
Suitability Determinations (13)

Others:

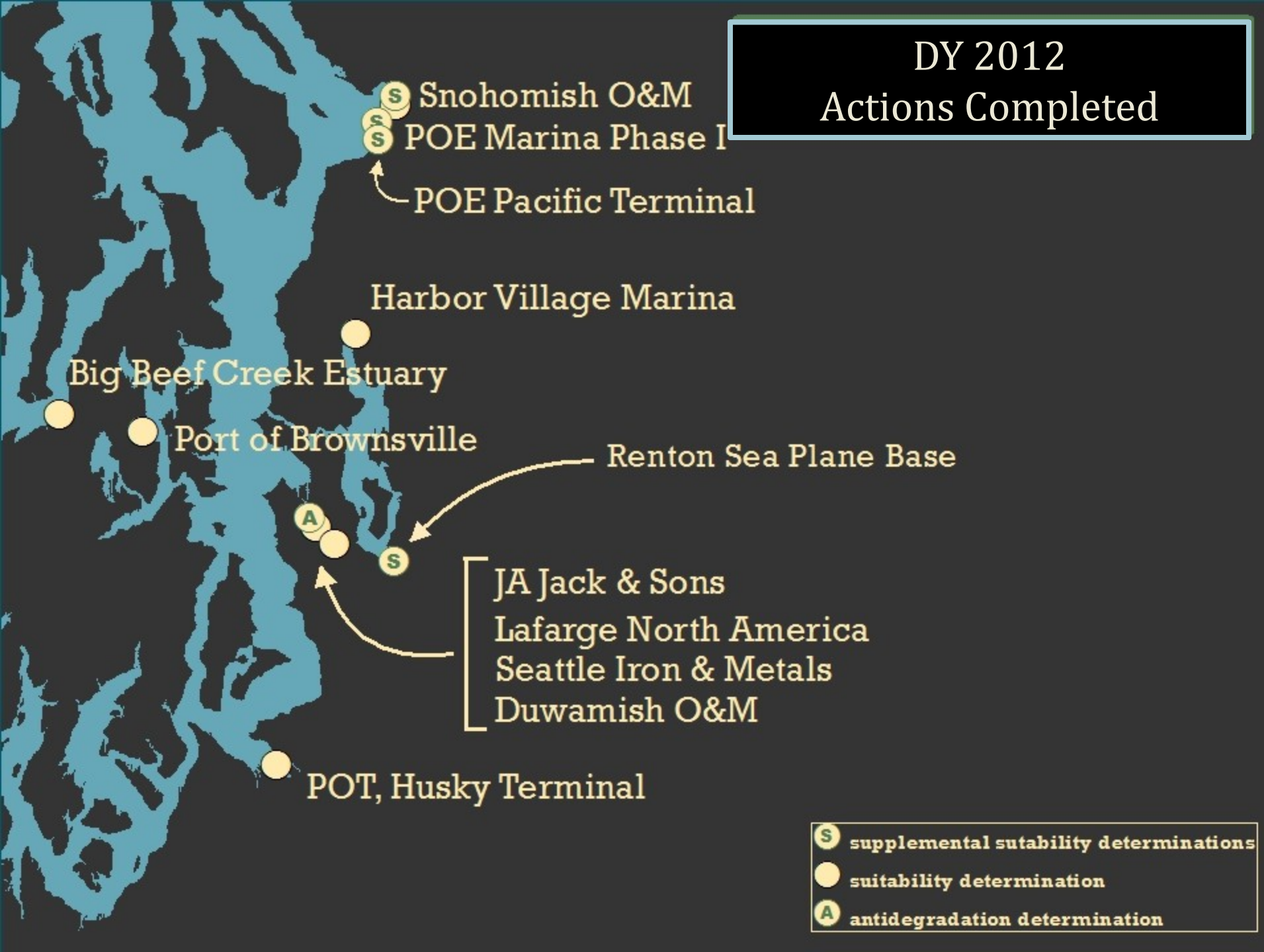
- Dioxin (1)
- Volume Revision (5)
- Recency (3)
- Antidegradation (1)
- Ranking (1)
- Progress Memo (1)



DY 2012
Actions Completed



DY 2012
Actions Completed



Dioxin Testing 2012

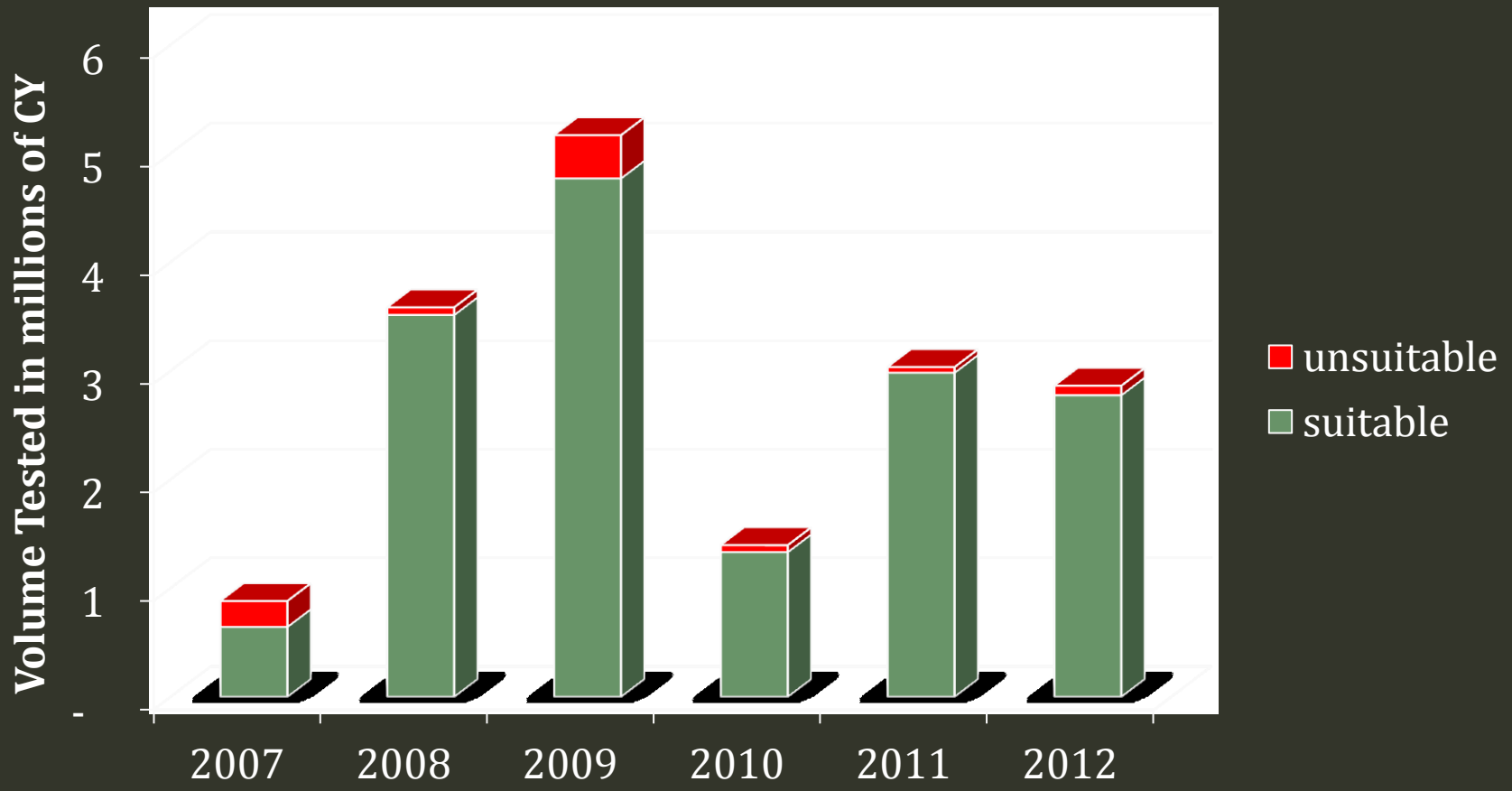
2 projects had failures based on dioxin alone

- Port of Tacoma: Husky Terminal, Blair WW
- Bellingham Bay: dioxin-only characterization of Federal Navigation Channels (I&J; Squalicum)

3 projects included dioxin failure, but other COCs as well

5 projects passed dioxin guidelines for all material

Suitability by Volume Tested



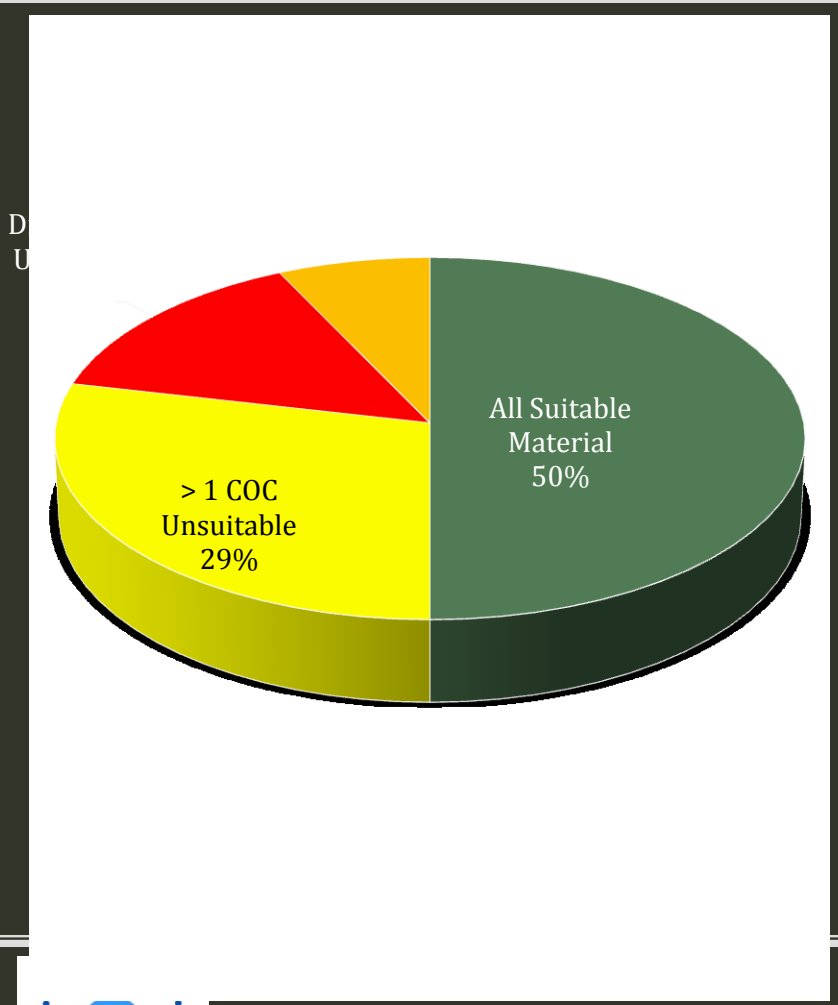
DY 12 Testing

Out of 24 completed actions:

- 14 - chemical testing
- 10 - included dioxin testing
- 2 - bioassay testing
- *No* bioaccumulation testing

Suitability Overview

- 7/14 projects had at least *some* unsuitable
- 4/14 projects failed ALL project material
- Half of all projects (3/6) w/unsuitable material came from Duwamish



Projects w/unsuitable material

PROJECT	SUITABLE	UNSUITABLE	REASON	COMMENTS
Harbor Village Marina, Lake WA (Kenmore)	0	7,427 cy	PCBs, dioxins	Antideg. failure
Lafarge NA, Duwamish River	0	24,000 cy	PCBs, dioxins	Antideg. failure
Port of Tacoma, Husky Terminal (Blair WW)	26,150 cy	15,950 cy	Dioxins	VWA approach
Seattle Iron & Metals, Duwamish River	0	28,000 cy	PCBs, dioxins	Antideg. failure
USACE – Duwamish Navigation Channel	123,463 cy	3,630 cy	Bioassays	No SL exceedances
Lakeshore Marina, Lake Chelan	0	8,000 cy	Pesticides	Upland BU
TOTALS	**149,613 cy**	**87,007 cy**		

Some Present Projects …

Puget Sound area

- **Lower Duwamish (subsurface)**
- **Port of Anacortes**
- **Kenmore (N Lake WA)**

Coast & Columbia

- **Grays Harbor Deepening**
- **Longview Fibre (Longview, WA)**
- **Christensen Shipyard (Vancouver, WA)**
- **Snake River projects**

For More Information:

http://www.nws.usace.army.mil/

Under "Most Requested"

Click "Dredged Material Management"

Portland Sediment Evaluation Team FY12 Summary

Regional Sediment Evaluation Team Annual Meeting

Seattle, WA October 17, 2012

James McMillan, Portland District

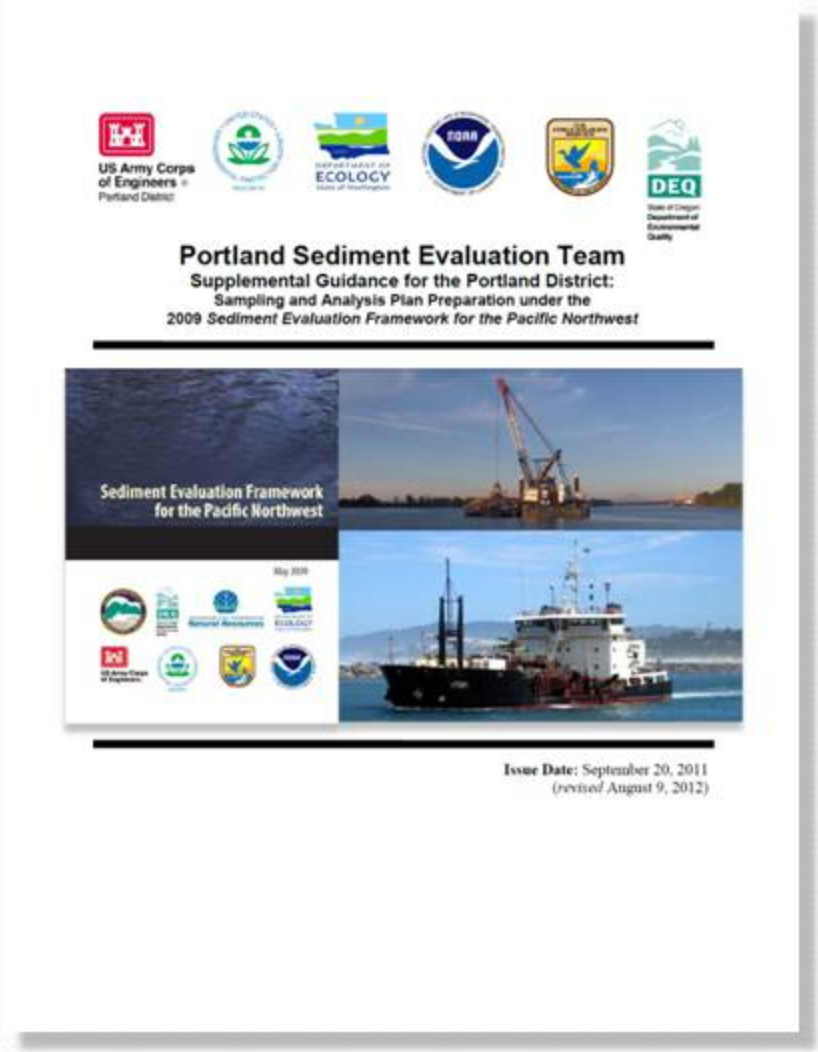
US Army Corps of Engineers
Portland District

DEPARTMENT OF ECOLOGY
State of Washington

DEQ
State of Oregon Department of Environmental Quality

FY12 PSET News

PSET Sampling and Analysis Plan Guidance revised August 9, 2012:



Portland Sediment Evaluation Team

Supplemental Guidance for the Portland District:
Sampling and Analysis Plan Preparation under the
2009 *Sediment Evaluation Framework for the Pacific Northwest*

Sediment Evaluation Framework for the Pacific Northwest

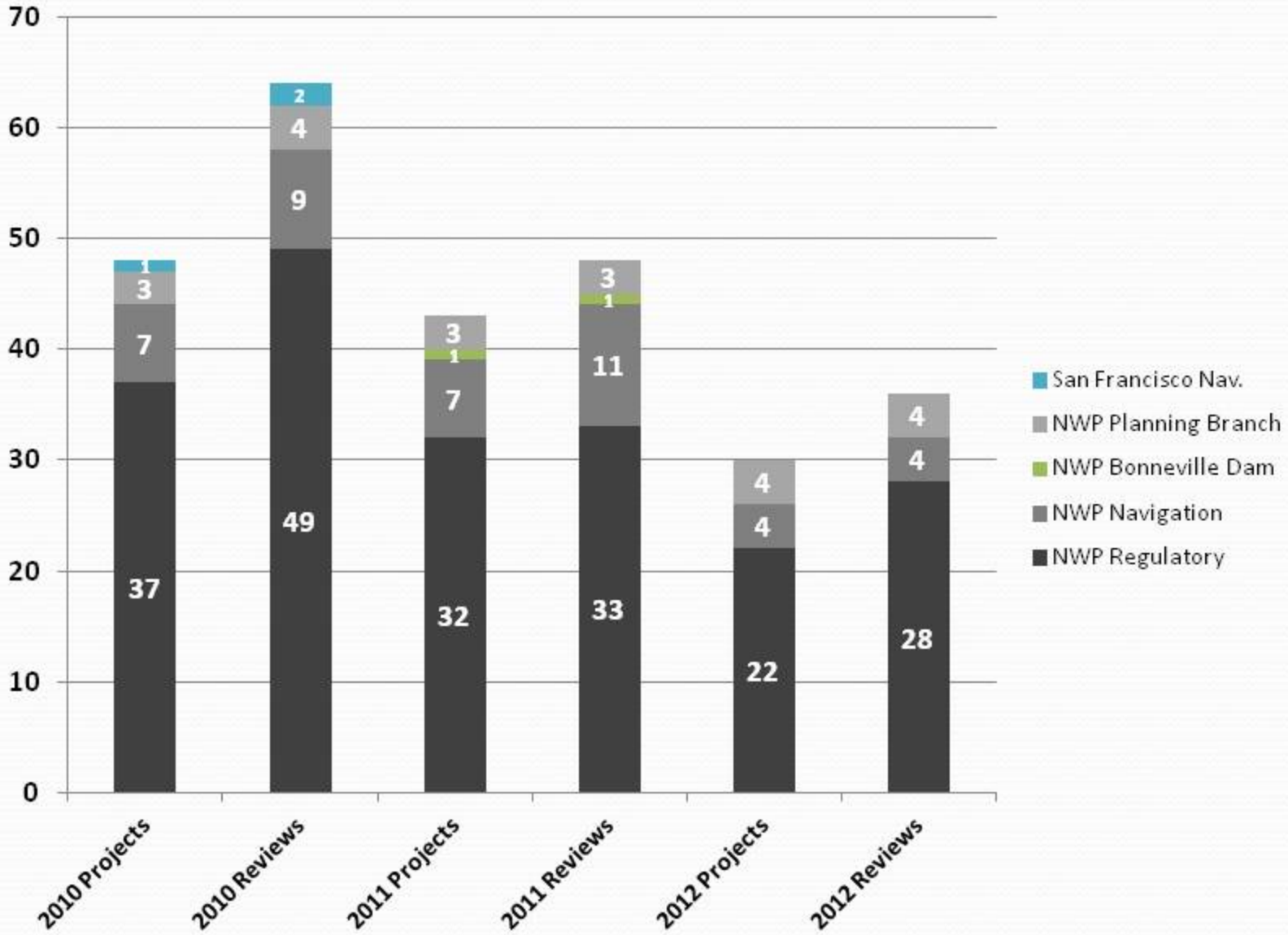
Issue Date: September 20, 2011
(*revised* August 9, 2012)

&

New RSET and PSET Webpage:

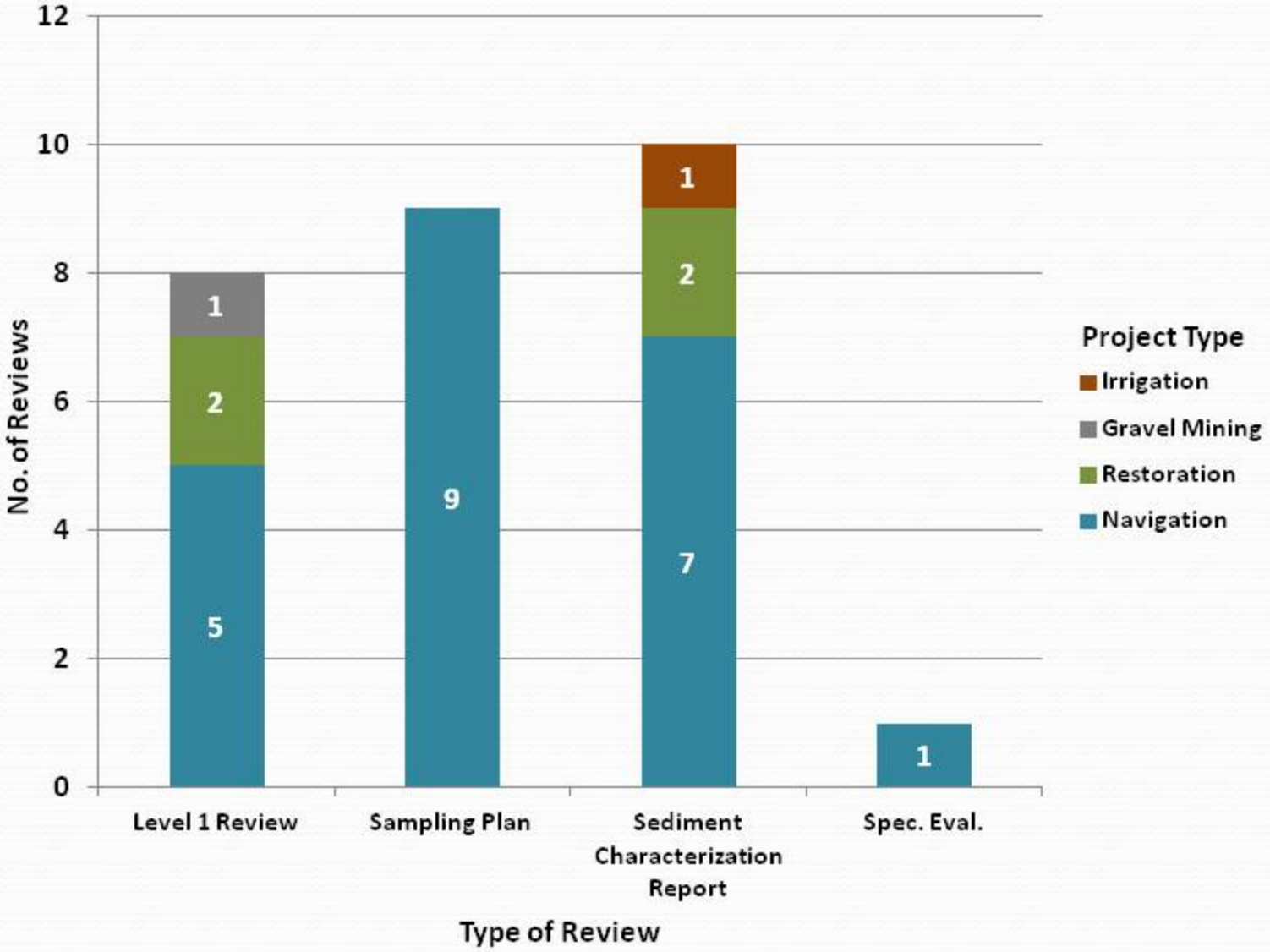
http://www.nwp.usace.army.mil/Missions/Environment/DredgedMaterialManagement.aspx

FY10-12 Numbers of Projects and Reviews* by PSET

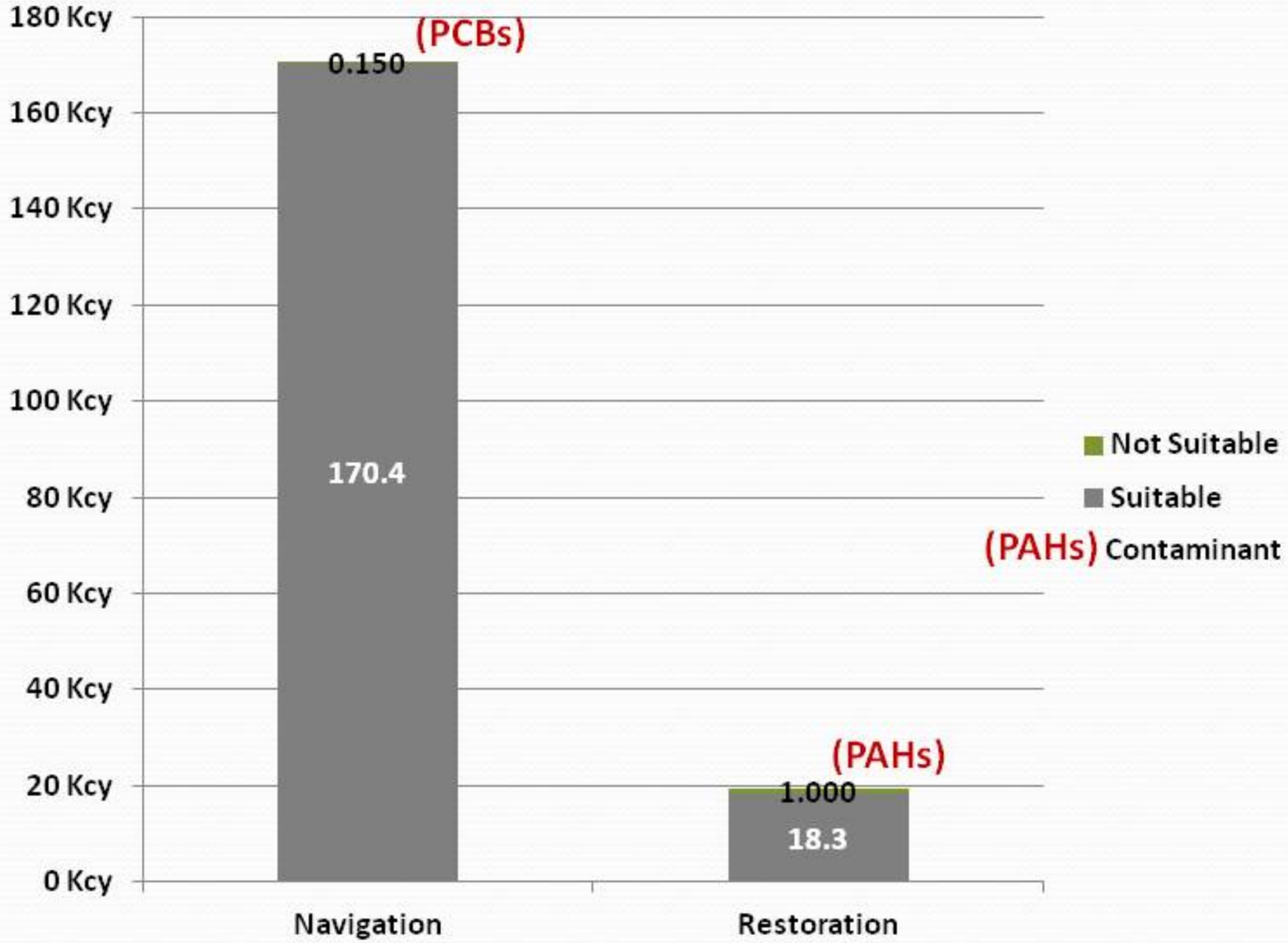


* "Review" = individual submittal resulting in a tech memo (e.g., a sampling plan); some projects have more than one submittal in a year.

FY12 PSET Workload Summary: Portland District Regulatory Branch



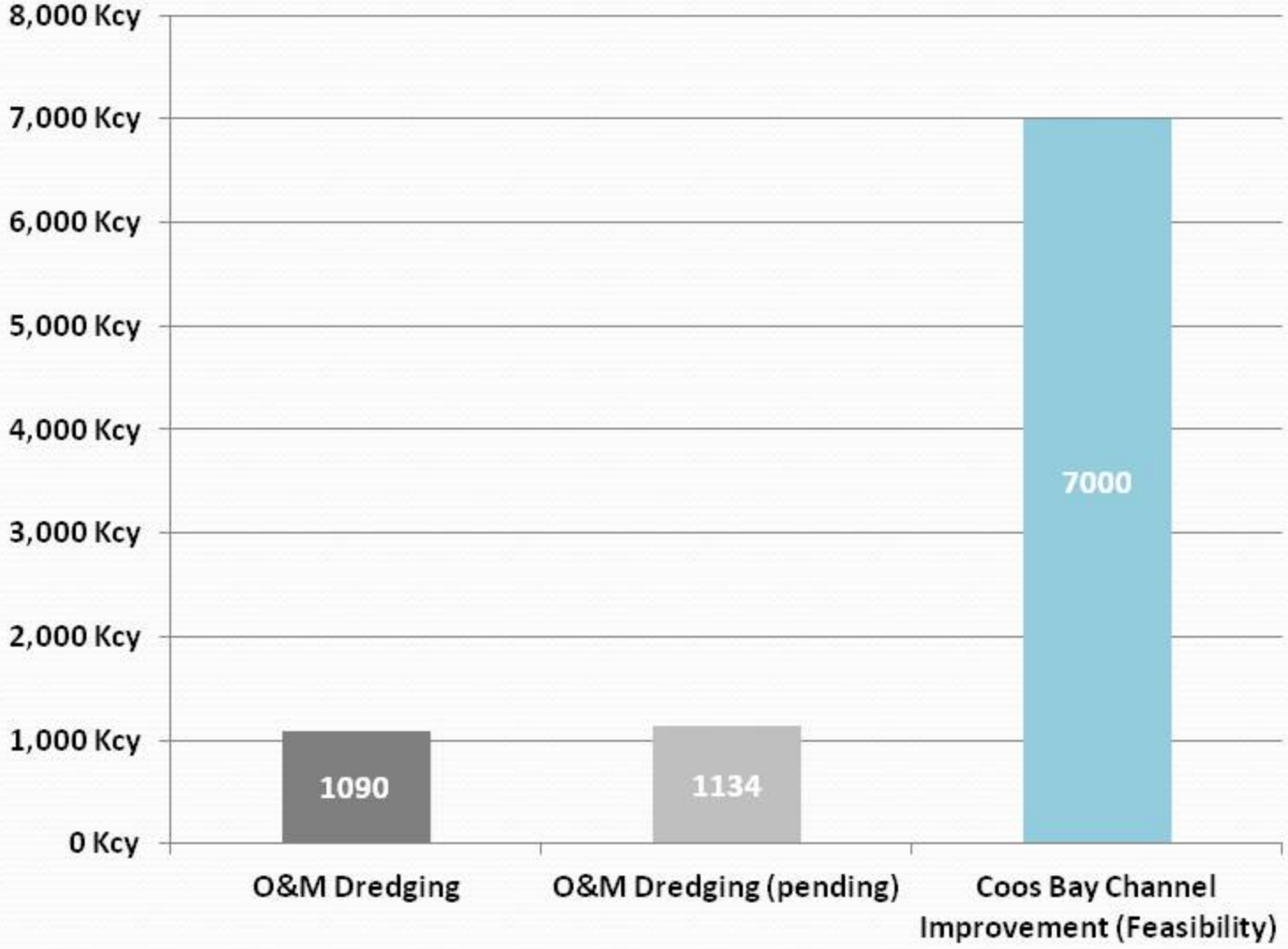
FY12 Portland District Regulatory Branch PSET Suitability Determinations



FY12 PSET Workload Summary: Portland District Civil Works Programs

- Level 1 Site History Information (1 total):
  - O&M Dredging: Desdemona Channel Realignment (Lower Columbia FNC)
- Sampling and Analysis Plans (4 total):
  - O&M Dredging: Rogue R. FNC
  - CW Restoration Projects:
    - Johnson Ck/Springwater Corridor (SAP approval)
    - Dairy Creek (review suspended)
    - Springfield Millrace (SAP mod)
- Sediment Characterization Reports (3 total):
  - O&M Dredging:
    - Siuslaw FNC
    - Old Mouth Cowlitz R. Fed Nav Channel
  - Feasibility Study: Coos Bay Channel Improvement
- Pending SCR Reviews: Coquille & Umpqua FNCs

FY12 Portland District Civil Works PSET Suitability Determinations



Questions?

james.m.mcmillan@usace.army.mil

(503) 808-4376

http://www.nwp.usace.army.mil/Missions/Environment/DredgedMaterialManagement.aspx

US Army Corps of Engineers
Portland District

DEPARTMENT OF ECOLOGY
State of Washington

DEQ
State of Oregon Department of Environmental Quality

Walla Walla District Update

Eric Braun
Senior Navigation Program Manager
Northwestern Division

17 Oct 2012
RSET Annual Meeting

US Army Corps of Engineers
BUILDING STRONG®

Programmatic Sediment Mgmt Program (PSMP) Purpose

- Identify / evaluate ways to manage sediment in lower Snake River reservoirs to meet authorized project purposes; examine sediment sources and transport means.
- Determine how to reduce sediment build-up, manage it in the reservoirs, and identify structures and/or operations changes to reduce maintenance and provide authorized purposes.
- Actions will be consistent w/authorized project purposes
  - Commercial navigation
  - Irrigation water withdrawals
  - Recreation
  - Flow conveyance

PSMP Schedule Revision

- Original schedule:
  - PSMP/EIS complete in Dec 2012
  - Followed by a separate NEPA action for channel maintenance
  - Channel maintenance targeted for Dec 2013 – Mar 2014

- Current Schedule
  - Channel Maintenance still targeted for Dec 2013 -2014
  - Channel maintenance will be included in the PSMP/EIS, not evaluated under a separate NEPA action
  - Adding dredging to the EIS delayed public review to Dec 2012 (versus Jun 2012) release of Draft EIS

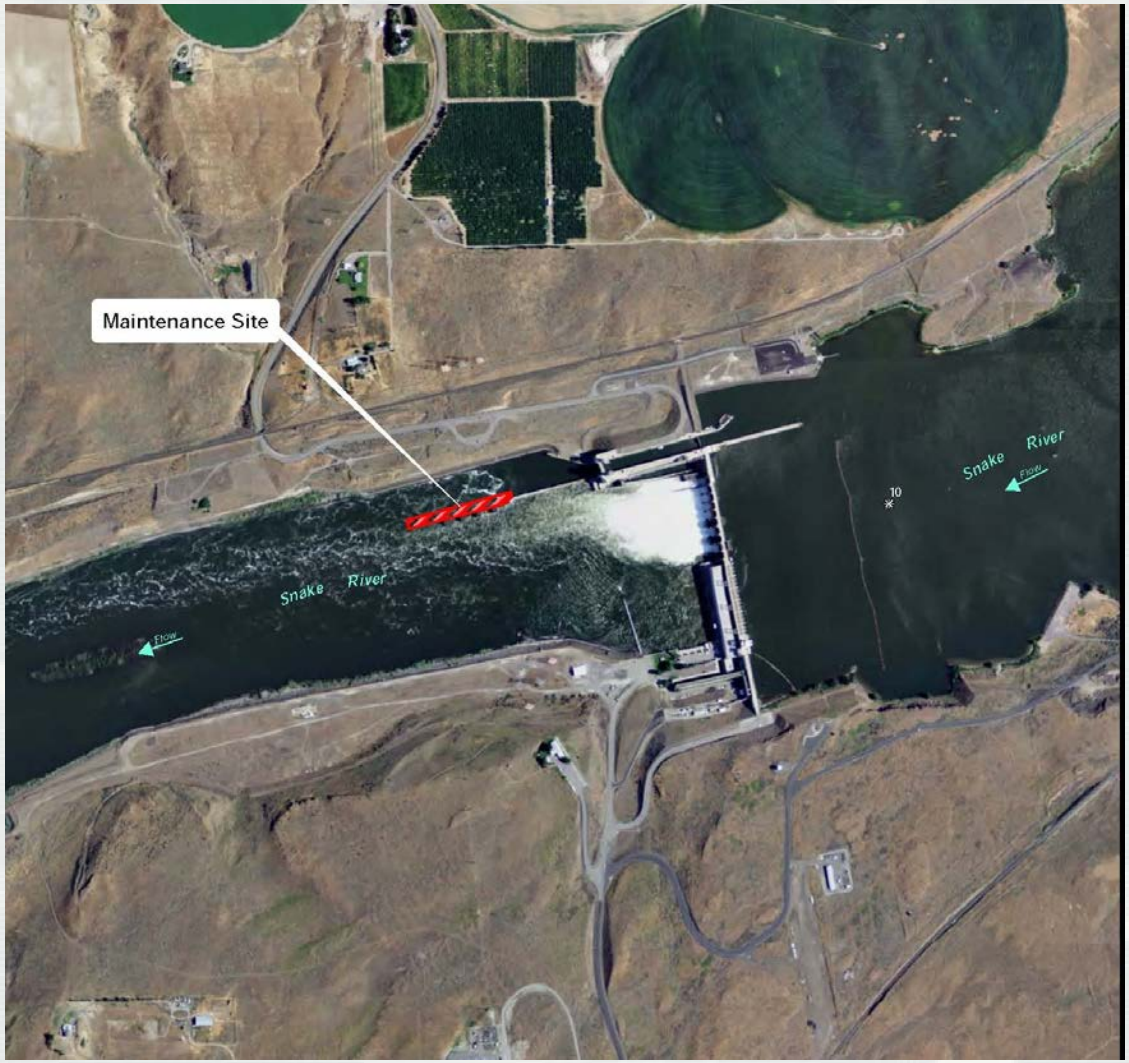
Proposed 2013/2014 Action

- One proposed site is the downstream navigation lock approach for Ice Harbor Dam (Snake RM 9.5)

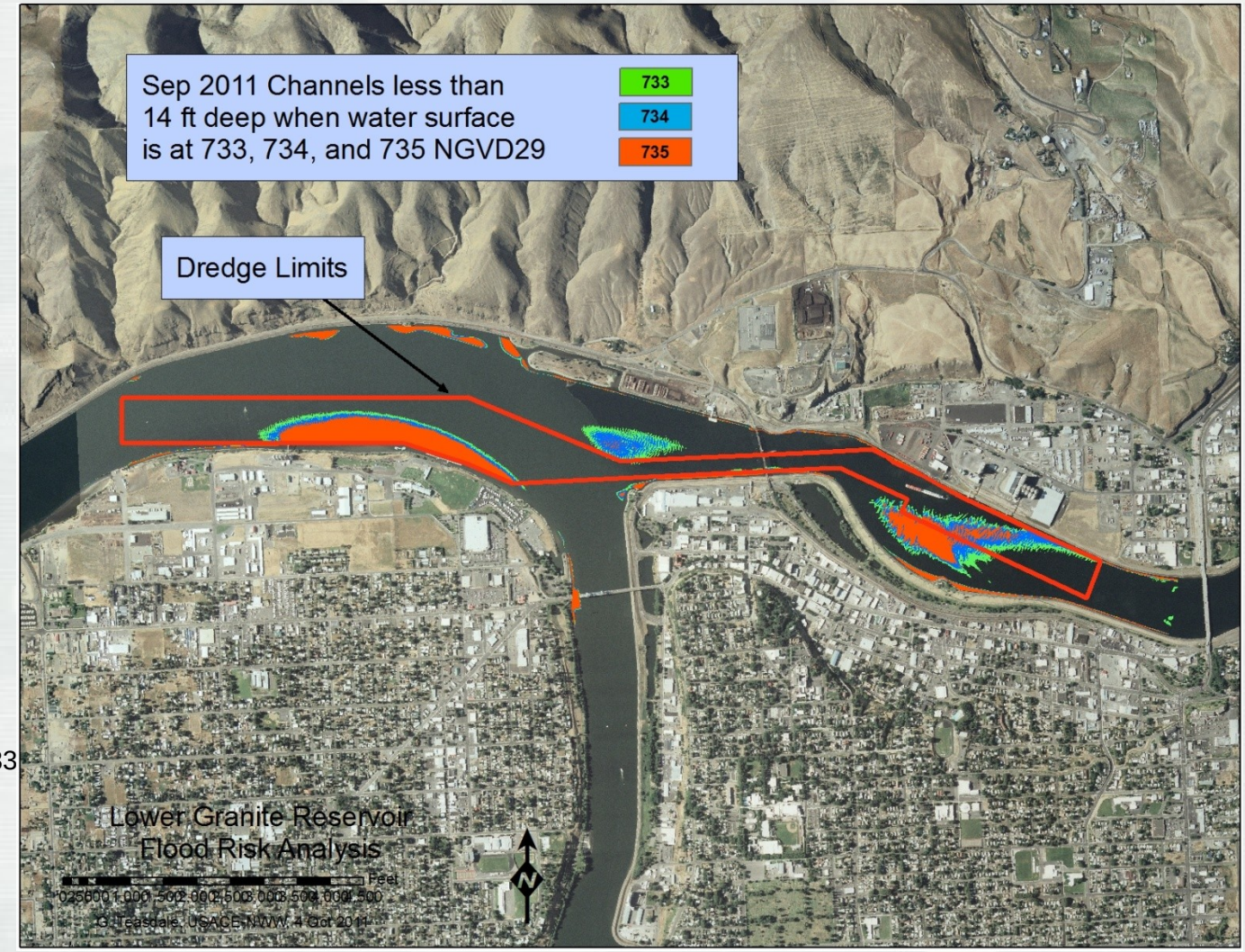
- Sites in Lower Granite Pool
  - Federal channel (Snake RM 138 to Clearwater RM 2)
  - Berthing area for the Port of Lewiston (Clearwater RM 1-1.5)
  - Berthing area for the Port of Clarkston (Snake RM 137.9 and 139)
  - Port of Lewiston
  - Port of Clarkston

- Snake River Mile (RM) 116 just upstream of Knoxway Canyon, is the proposed in-water discharge site of the dredged materials.

Ice Harbor Approach in Snake River



Confluence of Snake and Clearwater Rivers



MOP is elevation 733

Proposed 2013/2014 Action

- Sediment Quality Report filed with DMMO on 10/10/2012
  - The sediments within the dredge template proposed for dredging in 2013/2014 meet the chemical and physical criteria for open and unconfined in-water placement and beneficial uses.
  - The guidelines provided by the 2009 SEF and the 2012 Draft freshwater SMS in WAC Chapter 173-204 indicate that there would be no biochemical impacts to listed fish species, pelagic zooplankton, or benthic macro invertebrates from the proposed action.
- Port of Clarkston Crane Dock Sampling Plan has been submitted to DMMO in separate action

Characterizing the Post-Dredge Surface: Comparison of In-Situ (Pre-dredge) and Post-Dredge Grab Samples at Three Sites in the Willamette River, Portland Harbor, Oregon

Regional Sediment Evaluation Team Annual Meeting

Seattle, WA October 17, 2012

James McMillan, Portland District

Michelle Hollis, Port of Portland

Laura Inouye, Washington Department of Ecology

Jonathan Freedman, US Environmental Protection Agency, Region 10

US Army Corps of Engineers Portland District

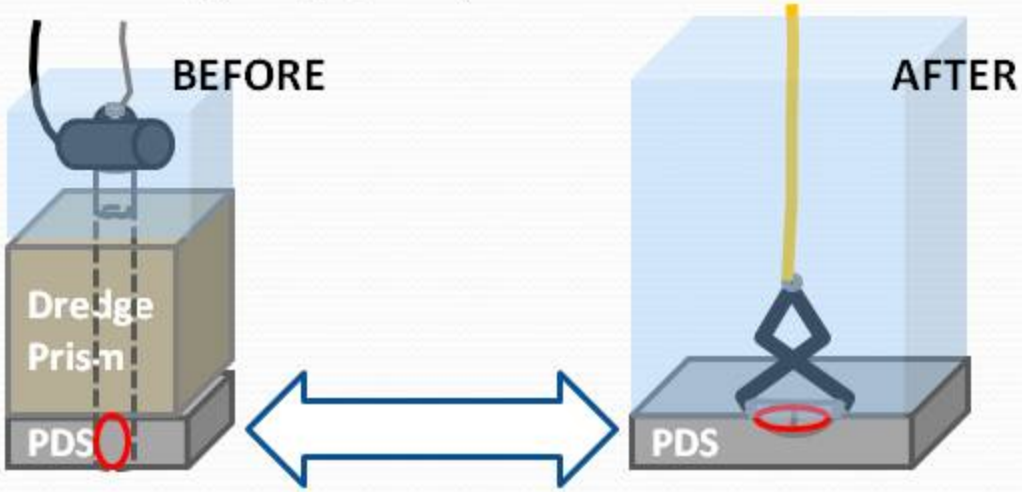
PORT OF PORTLAND Possibility. In every direction.

DEPARTMENT OF ECOLOGY State of Washington

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 10

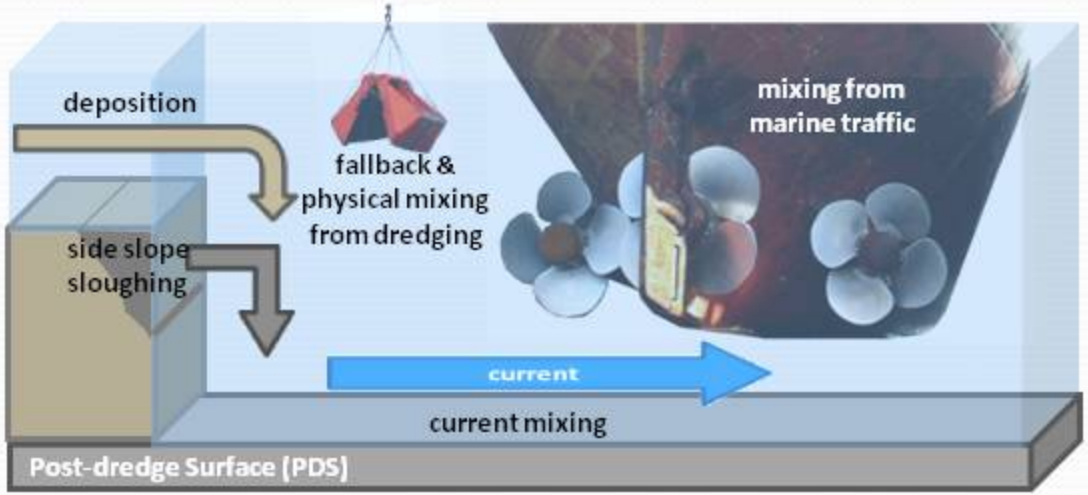
Purpose

- Compare concentrations from pre-dredge core samples and post-dredge grab samples at 3 sites
- Examine contributions to post-dredge surface (PDS) chemistry based on site conditions
- Use findings to inform risk-based regulatory decision making for dredging projects in the Portland Harbor



Problem

- Core samples measure the pre-dredge condition
- The in-situ core sample characterizing the PDS is often used in regulatory decision making
- BUT, in-situ PDS samples don't account for:
  - Fallback from the dredge
  - Physical mixing during dredging
  - Side-slope sloughing
  - Current mixing within the dredge area
  - Deposition during/after dredging
  - Mixing caused by natural processes and marine traffic



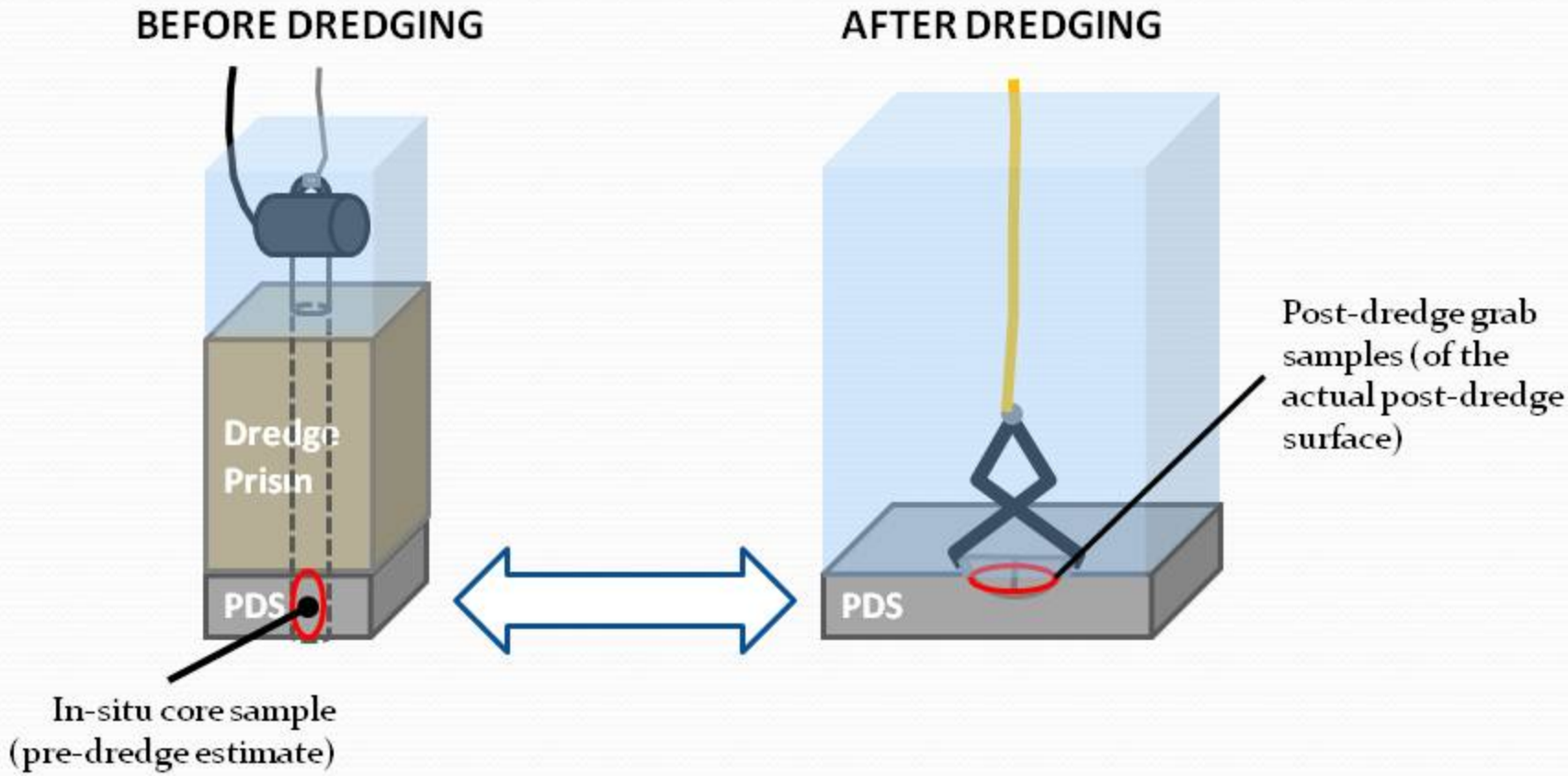
(After ERDC, 2008 *The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk* [TR-08-4])

Regulatory Review of Post-Dredge Surface

- Regulatory agencies want to know what's being dredged AND what will be exposed after dredging
- Regulatory concerns regarding:
  - Endangered species
  - State water quality parameters (sediment-water column interface)
  - State anti-degradation policies
    (i.e., exposed surface >> dredge prism = **BAD**)
- State and federal permits may require:
  - Monitoring after dredging
  - Physical isolation of the PDS
    - Placement of a clean sand cover
    - Natural infill (of cleaner sediment)

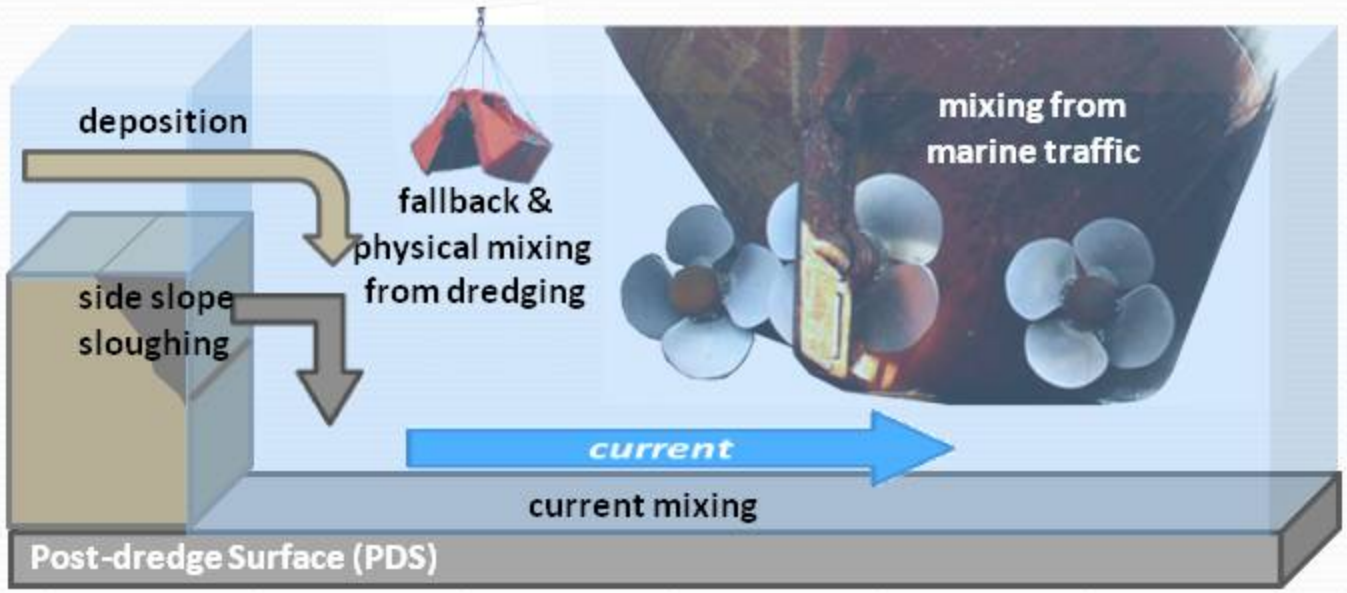
Methods

Compared **concentrations** of chemicals of concern:



Methods *(cont.)*

Examined factors contributing to PDS chemistry:



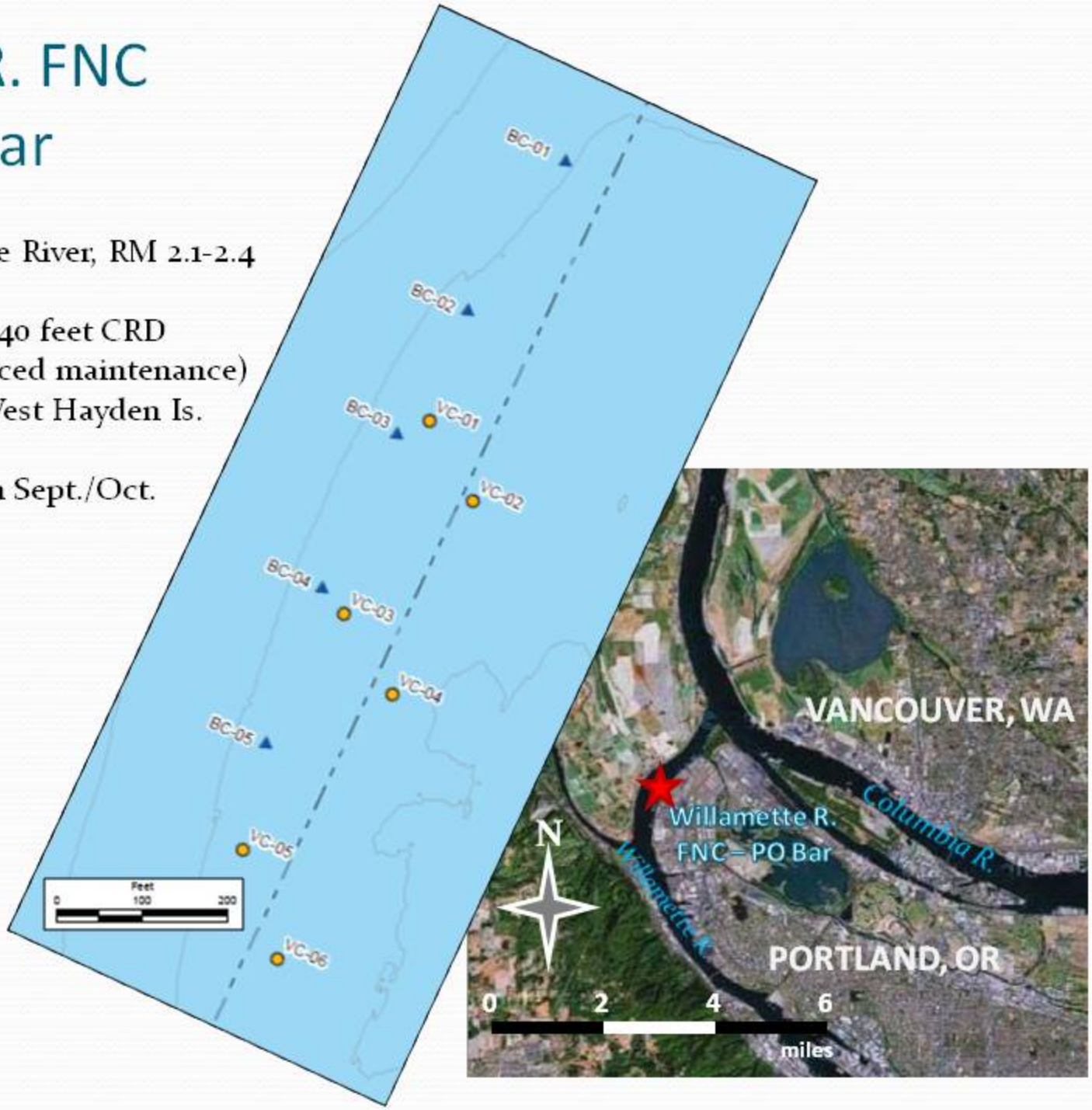
(After ERDC, 2008 *The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk* [TR-08-4])

Freshwater Sites (3)

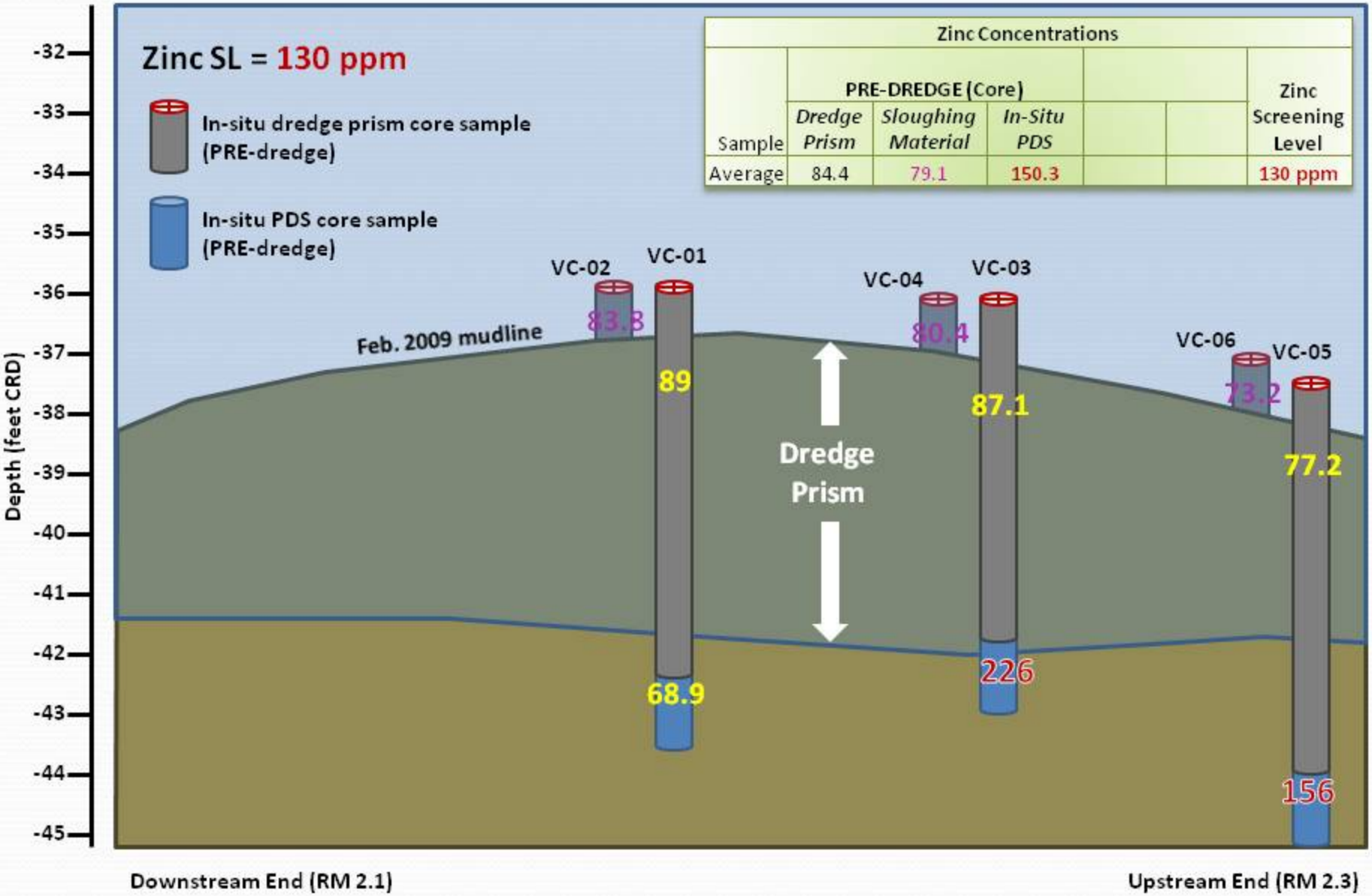
Willamette R. FNC
Post Office Bar

DETAILS

- Location: Willamette River, RM 2.1-2.4
- Volume: 52,300 cy
- Depth: Dredged to -40 feet CRD
  (plus 2 feet advanced maintenance)
- Disposal: Upland, West Hayden Is.
  Placement Site
- Project completed in Sept./Oct.
  2011

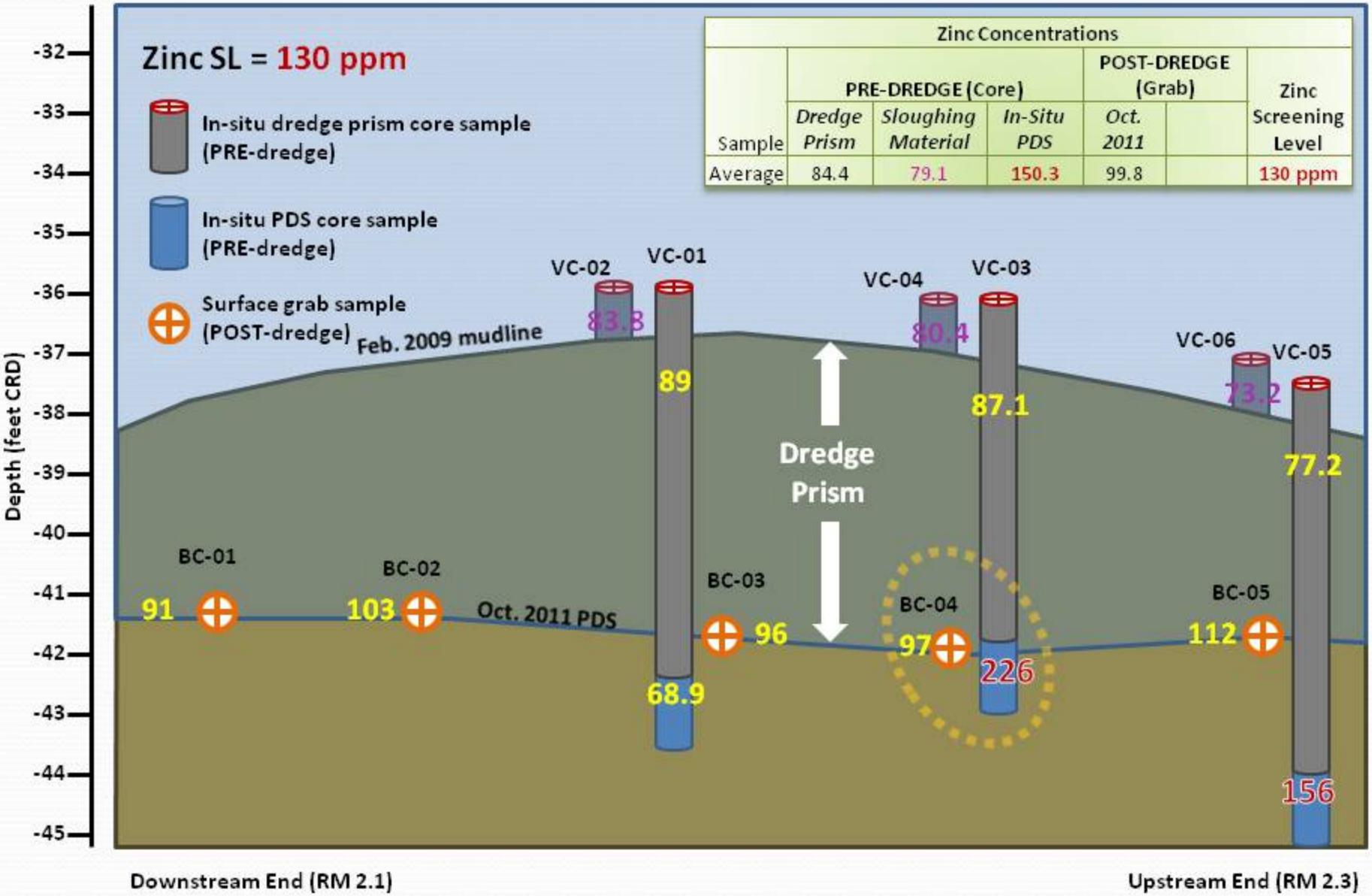


ZINC: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge



Zinc Concentrations						
	PRE-DREDGE (Core)					Zinc Screening Level
Sample	*Dredge Prism*	*Sloughing Material*	*In-Situ PDS*			
Average	84.4	79.1	150.3			130 ppm

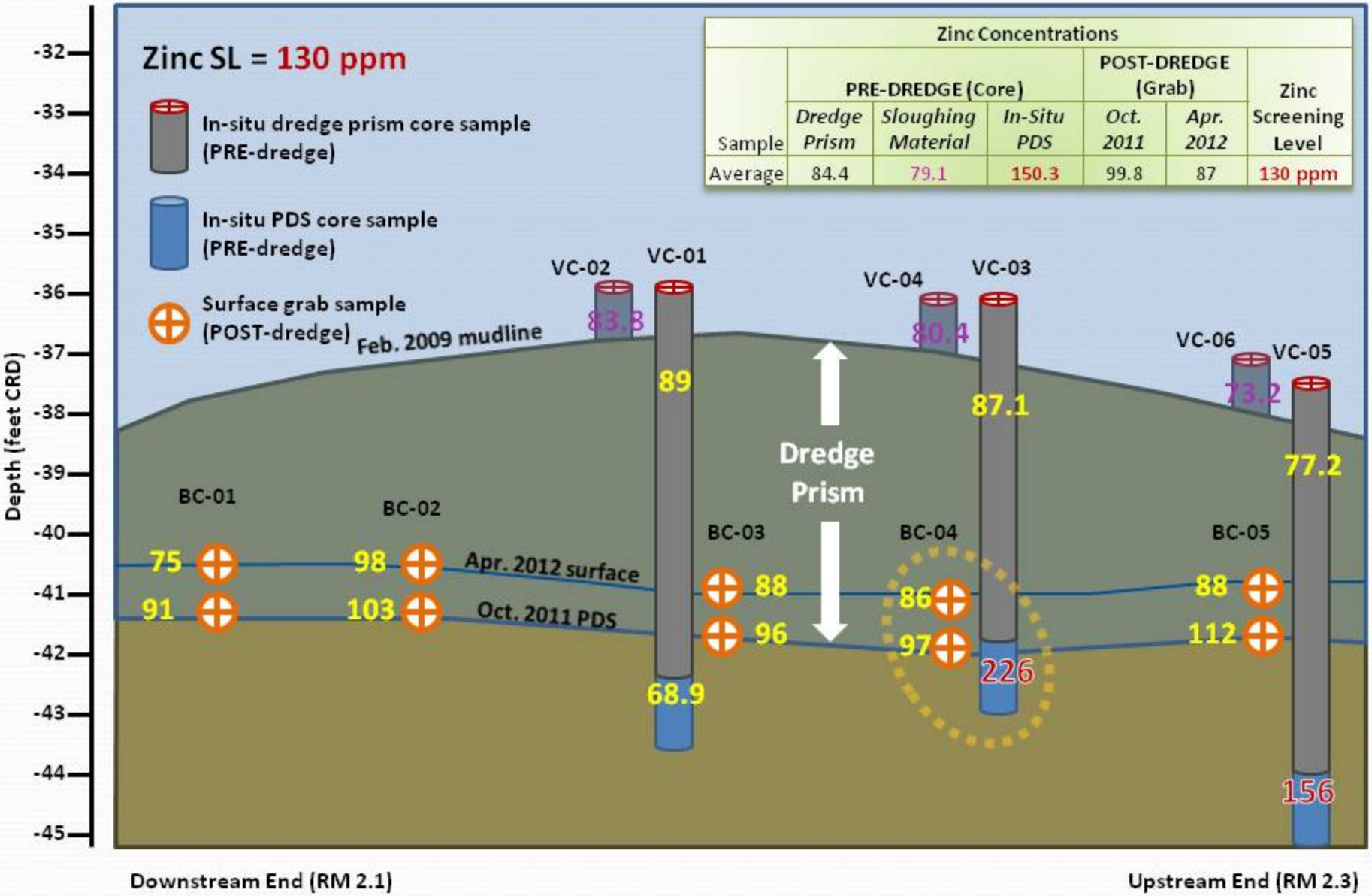
ZINC: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge; 2011 post-dredge



Zinc Concentrations

Sample	PRE-DREDGE (Core) Dredge Prism	PRE-DREDGE (Core) Sloughing Material	PRE-DREDGE (Core) In-Situ PDS	POST-DREDGE (Grab) Oct. 2011	POST-DREDGE (Grab)	Zinc Screening Level
Average	84.4	79.1	150.3	99.8		130 ppm

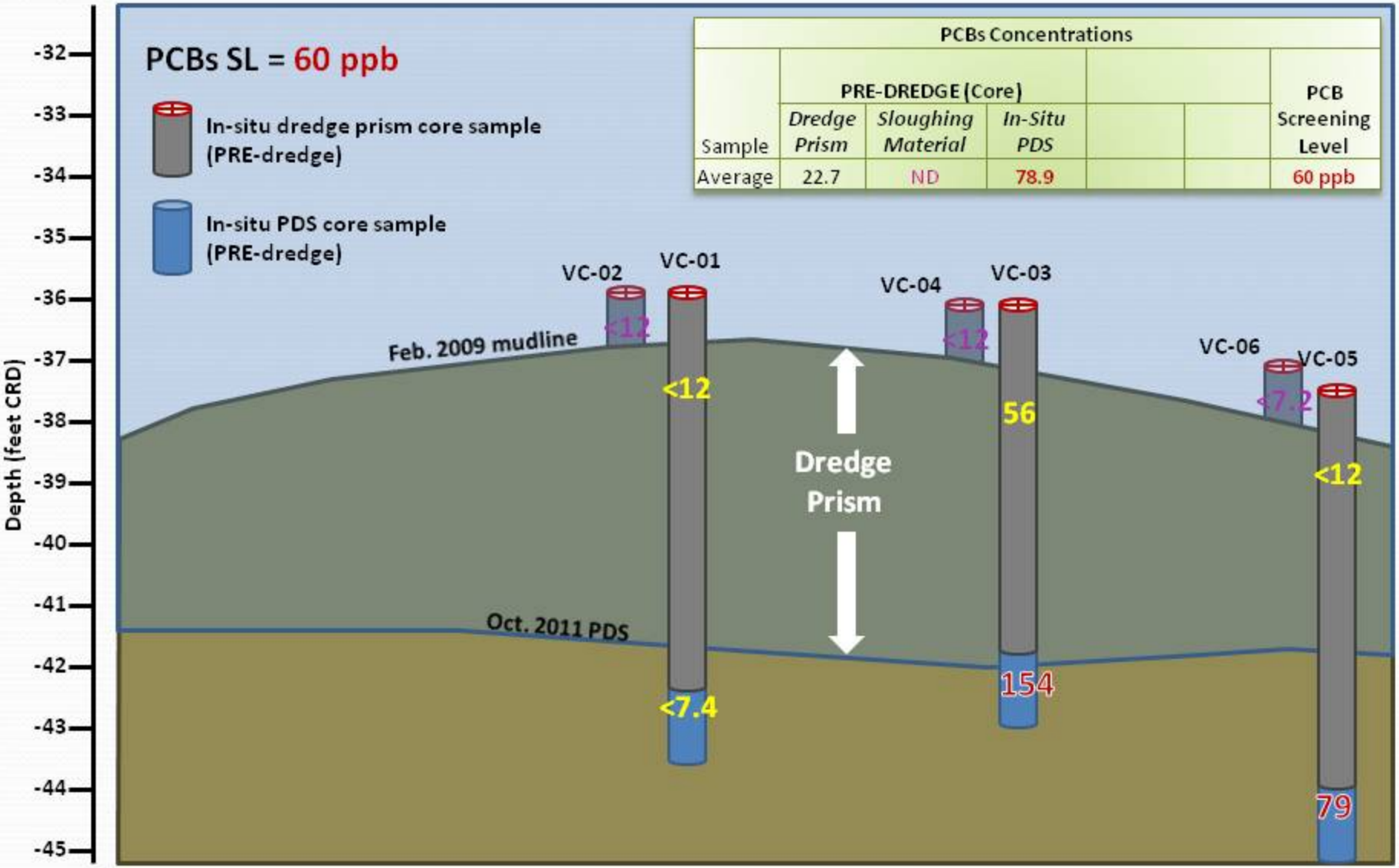
ZINC: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge; 2011 & 2012 post-dredge



Zinc Concentrations

Sample	PRE-DREDGE (Core) Dredge Prism	PRE-DREDGE (Core) Sloughing Material	PRE-DREDGE (Core) In-Situ PDS	POST-DREDGE (Grab) Oct. 2011	POST-DREDGE (Grab) Apr. 2012	Zinc Screening Level
Average	84.4	79.1	150.3	99.8	87	130 ppm

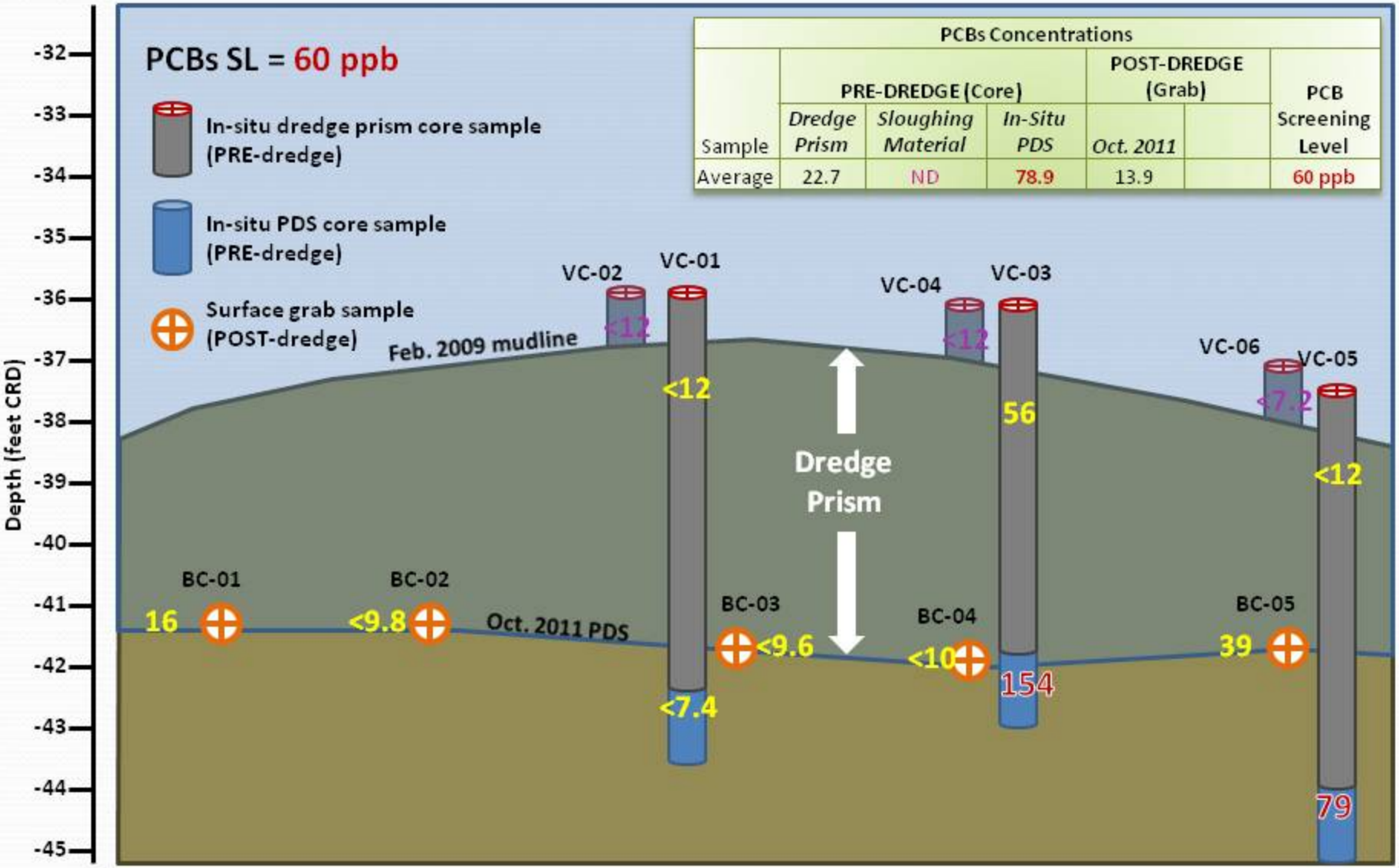
PCBs: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge



PCBs Concentrations

Sample	PRE-DREDGE (Core) Dredge Prism	Sloughing Material	In-Situ PDS			PCB Screening Level
Average	22.7	ND	78.9			60 ppb

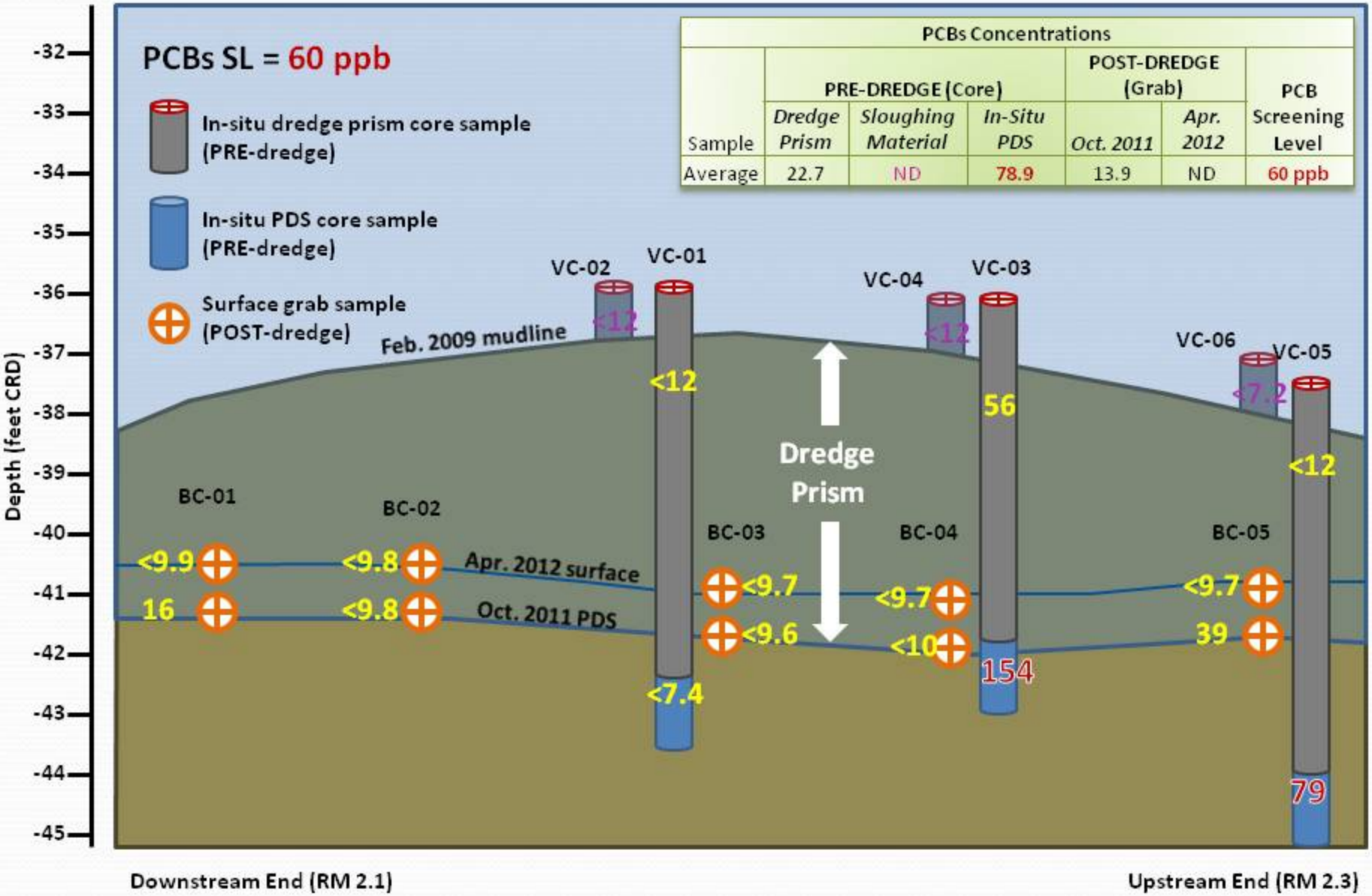
PCBs: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge; 2011 post-dredge



PCBs Concentrations

Sample	PRE-DREDGE (Core) Dredge Prism	PRE-DREDGE (Core) Sloughing Material	PRE-DREDGE (Core) In-Situ PDS	POST-DREDGE (Grab) Oct. 2011	POST-DREDGE (Grab)	PCB Screening Level
Average	22.7	ND	78.9	13.9		60 ppb

PCBs: WILLAMETTE R., POST OFFICE BAR – 2009 pre-dredge; 2011 & 2012 post-dredge



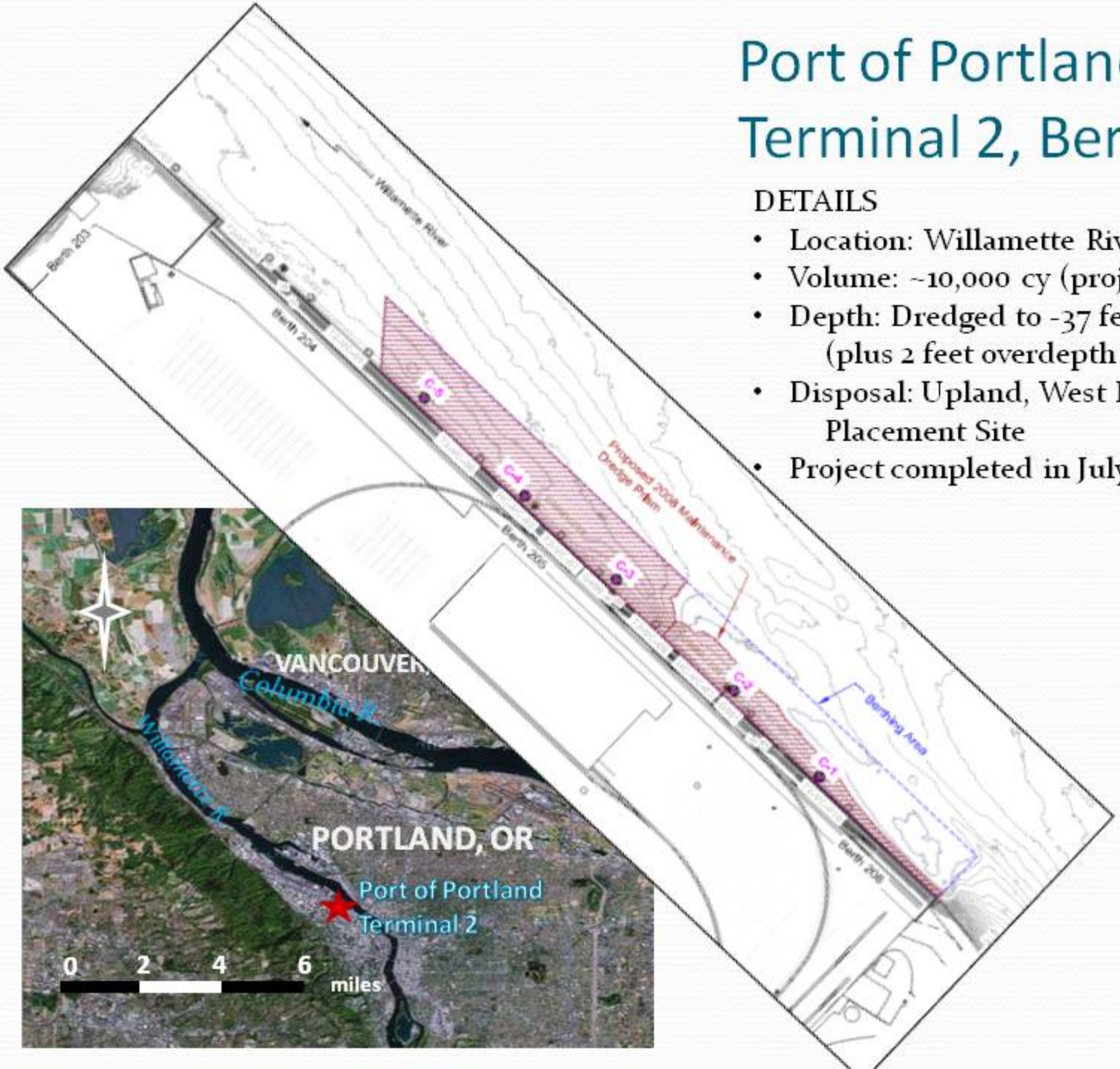
PCBs Concentrations

Sample	PRE-DREDGE (Core)			POST-DREDGE (Grab)		PCB Screening Level
	Dredge Prism	*Sloughing Material*	*In-Situ PDS*	*Oct. 2011*	*Apr. 2012*	
Average	22.7	ND	78.9	13.9	ND	60 ppb

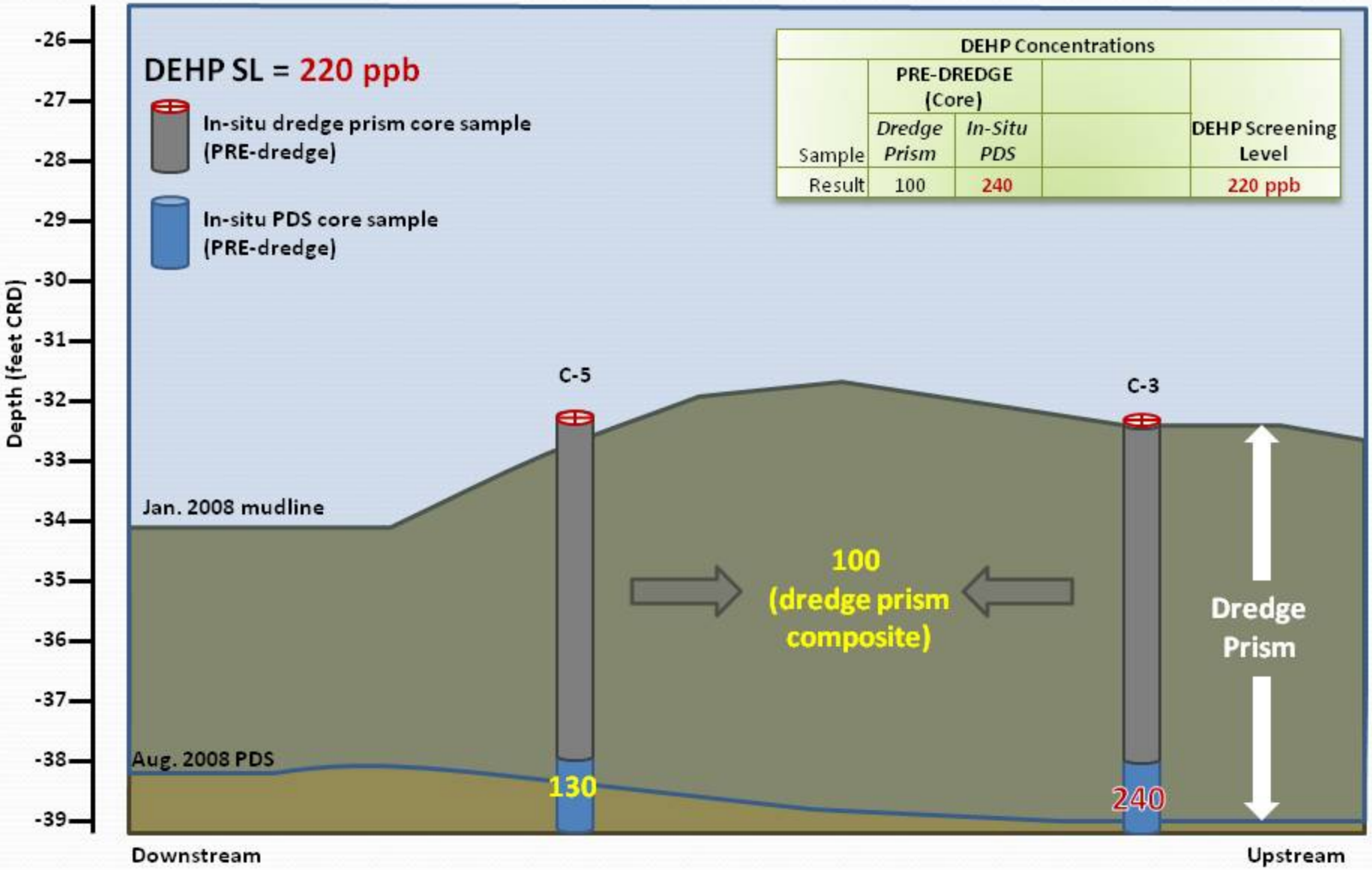
Port of Portland
Terminal 2, Berth 205

DETAILS

- Location: Willamette River, RM 10
- Volume: ~10,000 cy (project total 12,424 cy)
- Depth: Dredged to -37 feet CRD
  (plus 2 feet overdepth allowance)
- Disposal: Upland, West Hayden Island
  Placement Site
- Project completed in July/Aug. 2008

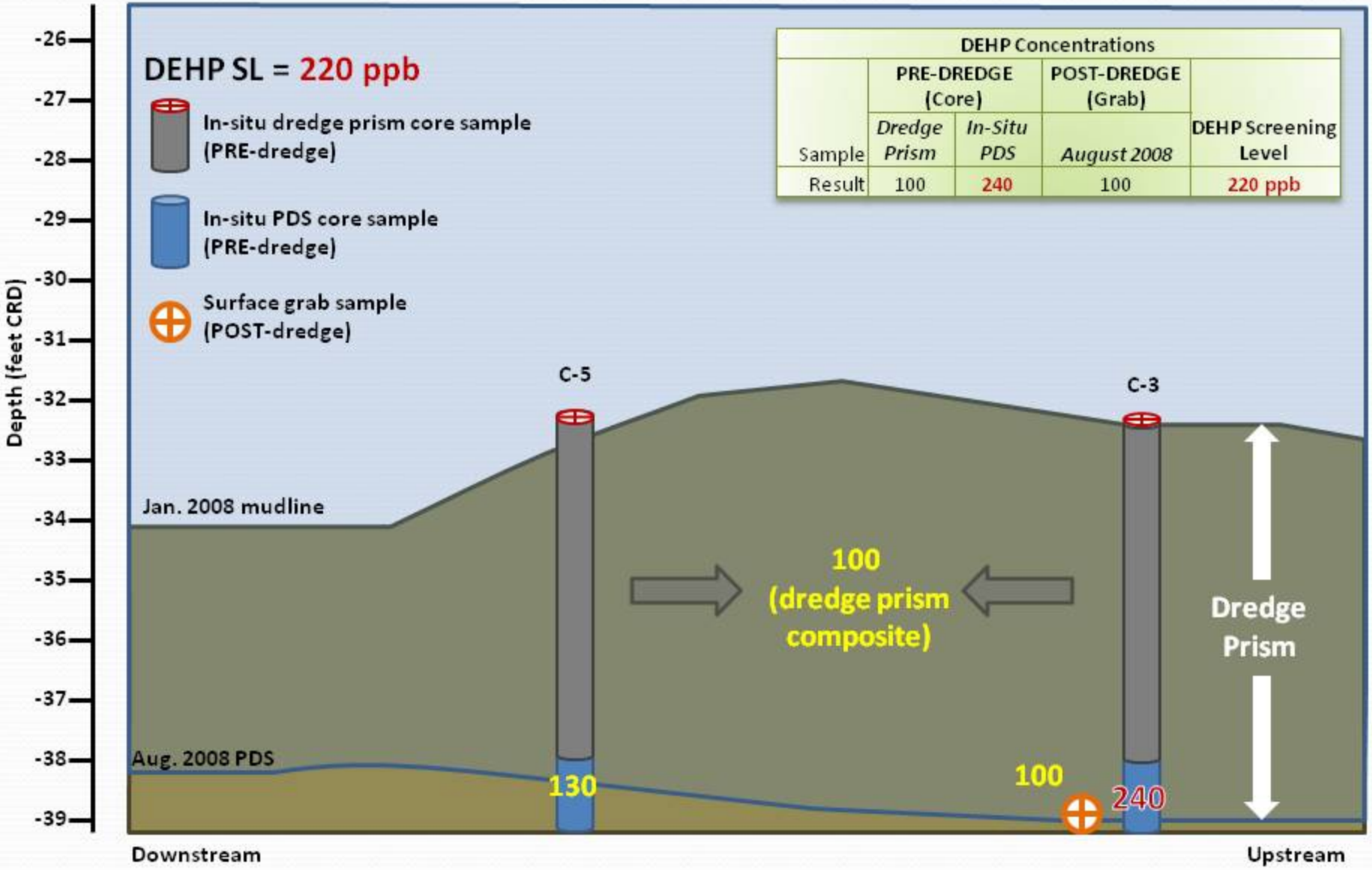


DEHP: PORT OF PORTLAND, TERMINAL 2 – January 2008 pre-dredge



DEHP Concentrations				
	PRE-DREDGE (Core)			
Sample	*Dredge Prism*	*In-Situ PDS*		DEHP Screening Level
Result	100	240		220 ppb

DEHP: PORT OF PORTLAND, TERMINAL 2 – January 2008 pre-dredge; August 2008 post-dredge



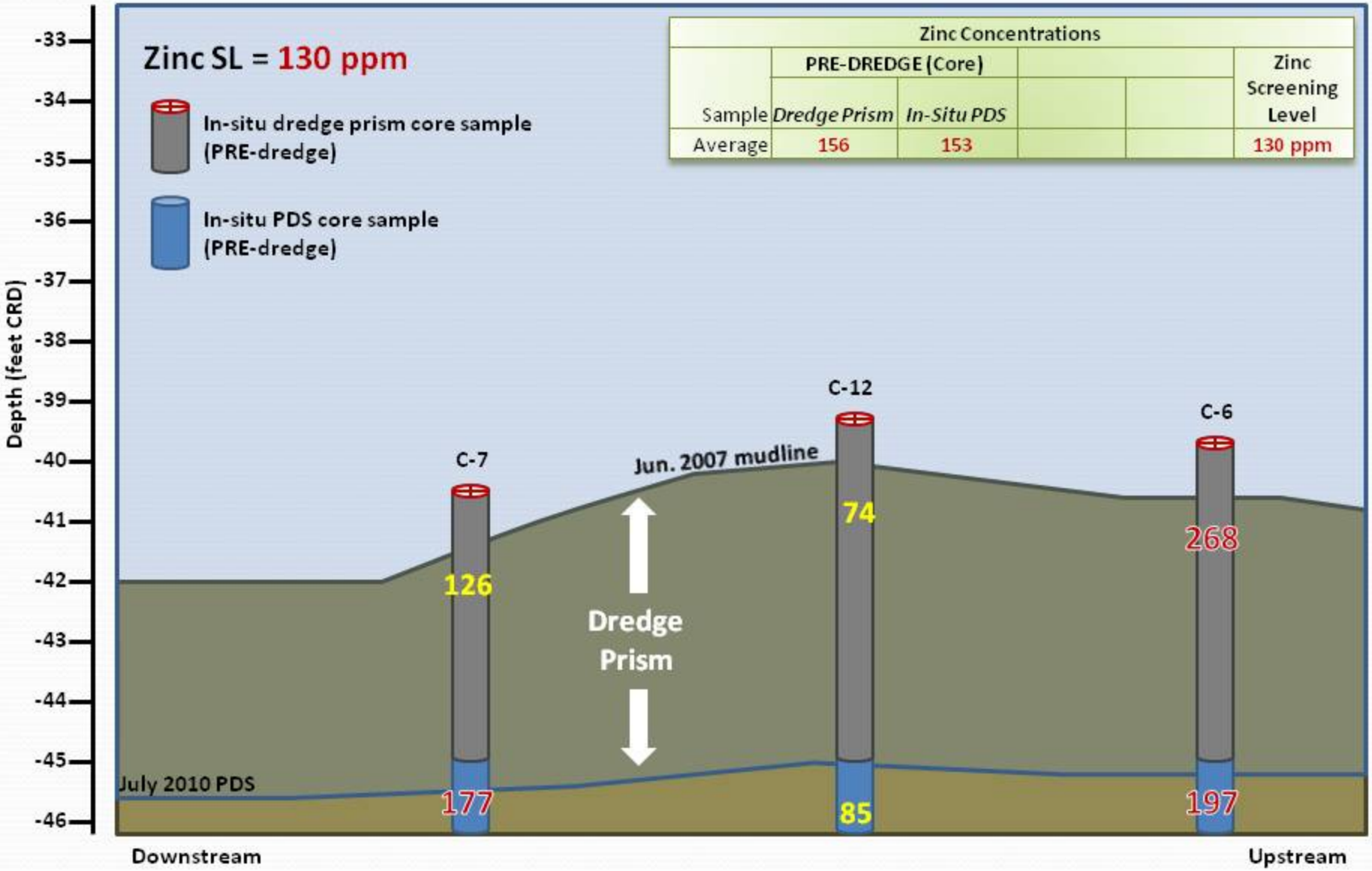
DEHP Concentrations				
	PRE-DREDGE (Core)		POST-DREDGE (Grab)	
Sample	*Dredge Prism*	*In-Situ PDS*	*August 2008*	DEHP Screening Level
Result	100	240	100	220 ppb

Port of Portland
Terminal 5, Berth 501

DETAILS

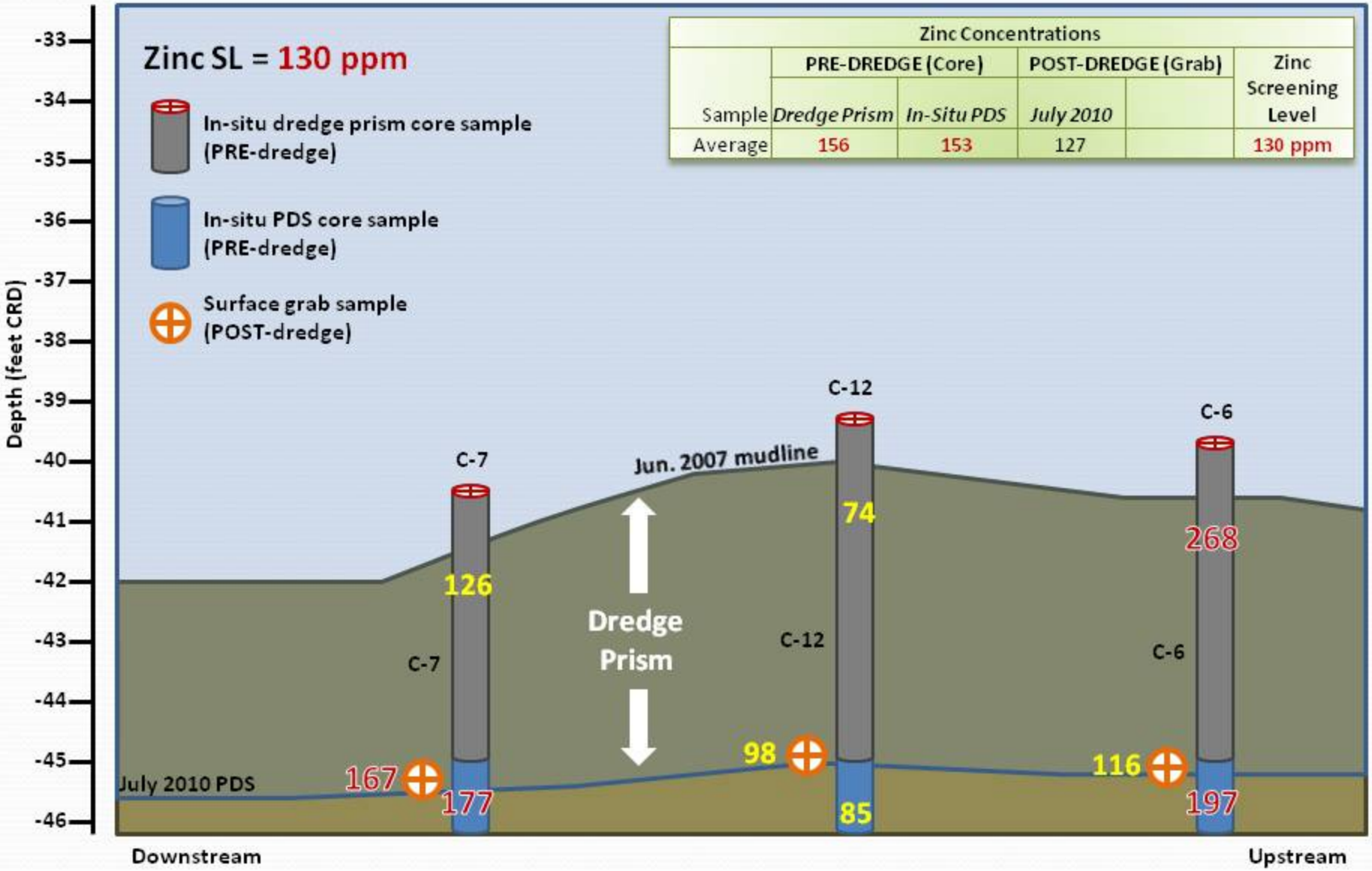
- Location: Willamette River, RM 1-2
- Volume: 12,246 cy (project total 25,000 cy)
- Depth: Dredged to -43 feet CRD
  (plus 3 feet overdepth allowance)
- Disposal: Upland, West Hayden Island
  Placement Site
- Project completed in July/Aug. 2010

ZINC: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge



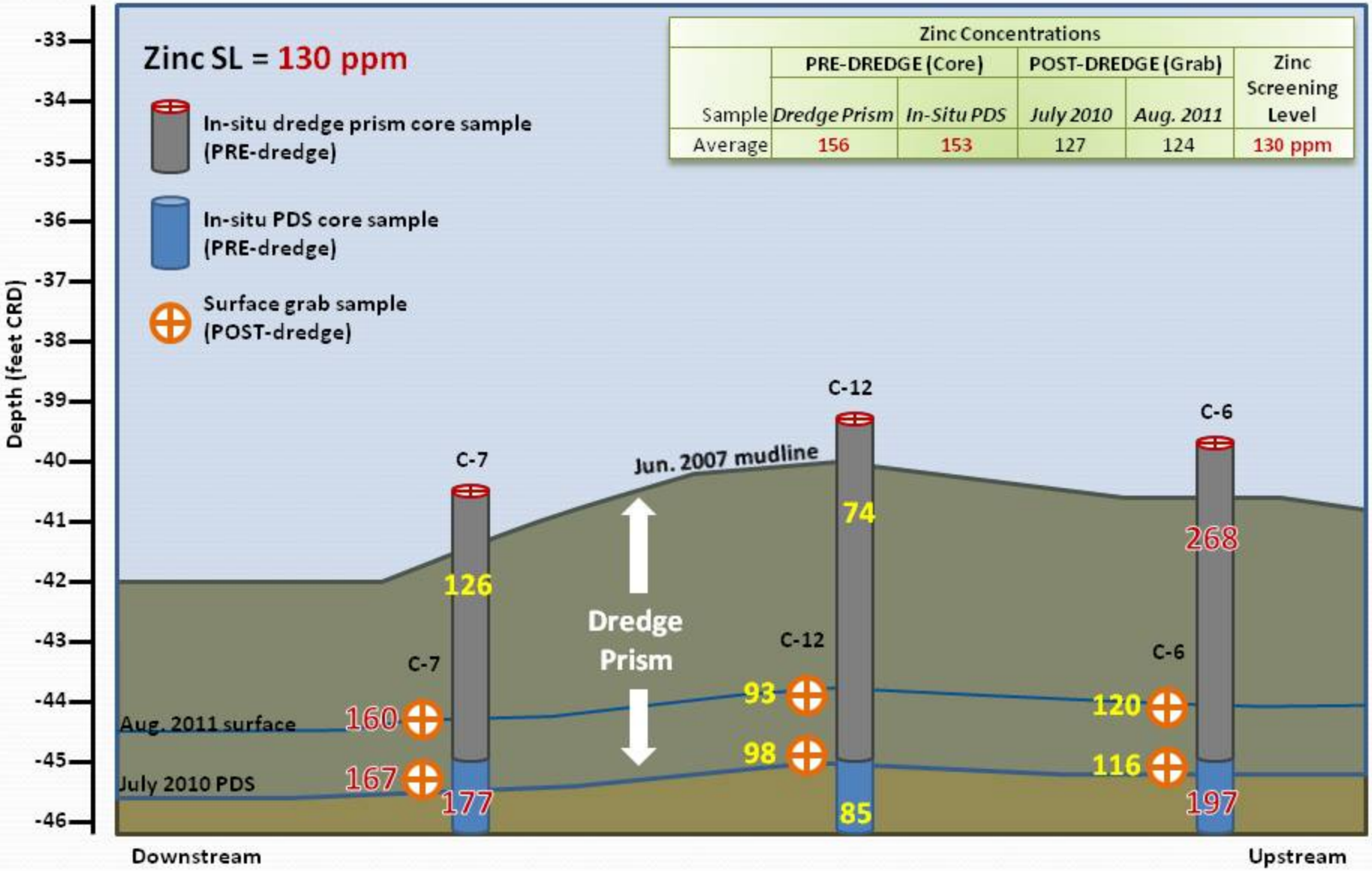
Zinc Concentrations					
	PRE-DREDGE (Core)				Zinc Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*			
Average	156	153			130 ppm

ZINC: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge; 2010 post-dredge



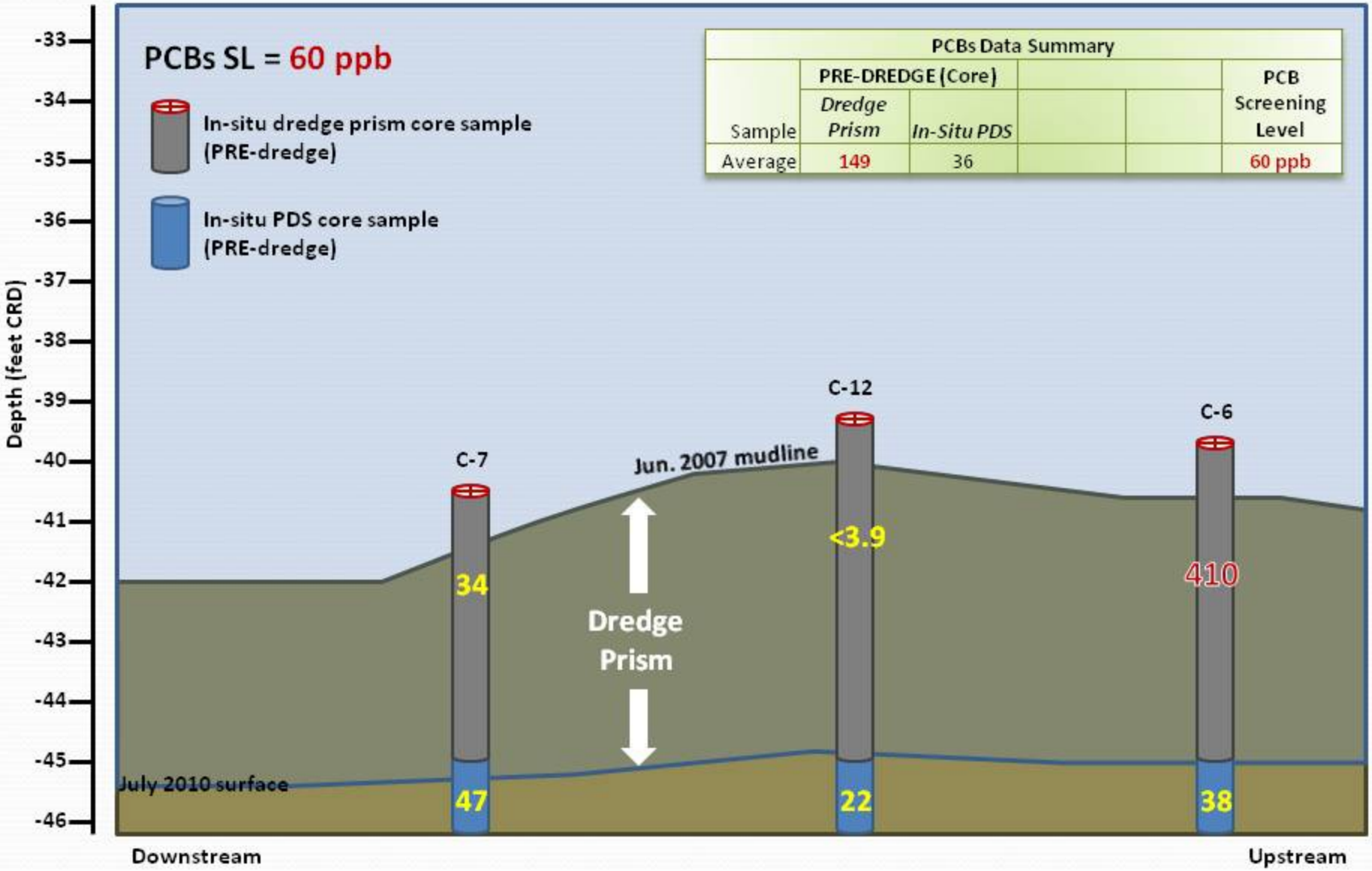
Zinc Concentrations					
	PRE-DREDGE (Core)		POST-DREDGE (Grab)		Zinc Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*	*July 2010*		
Average	156	153	127		130 ppm

ZINC: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge; 2010 & 2011 post-dredge



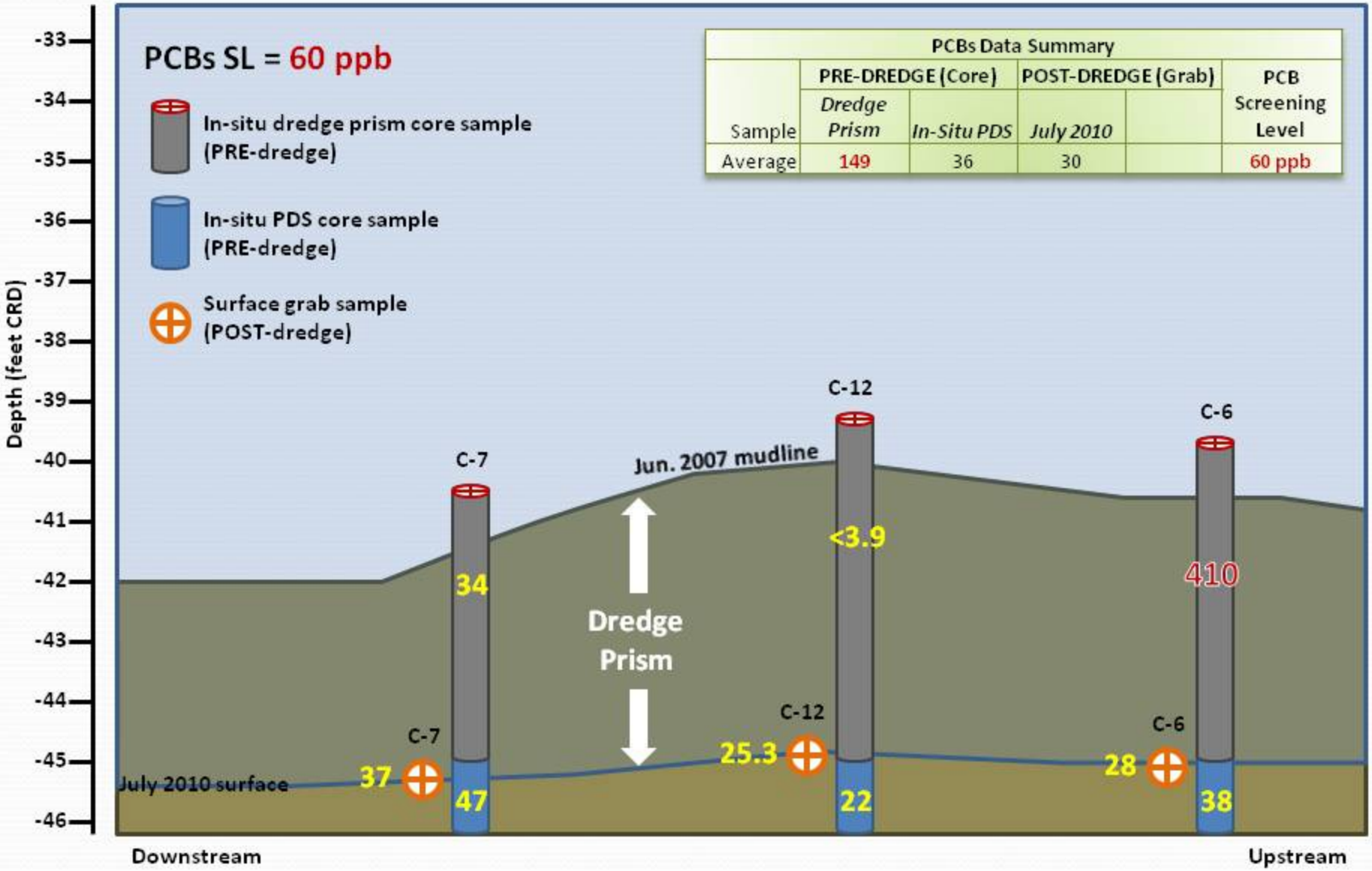
Zinc Concentrations					
	PRE-DREDGE (Core)		POST-DREDGE (Grab)		Zinc Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*	*July 2010*	*Aug. 2011*	
Average	156	153	127	124	130 ppm

PCBs: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge



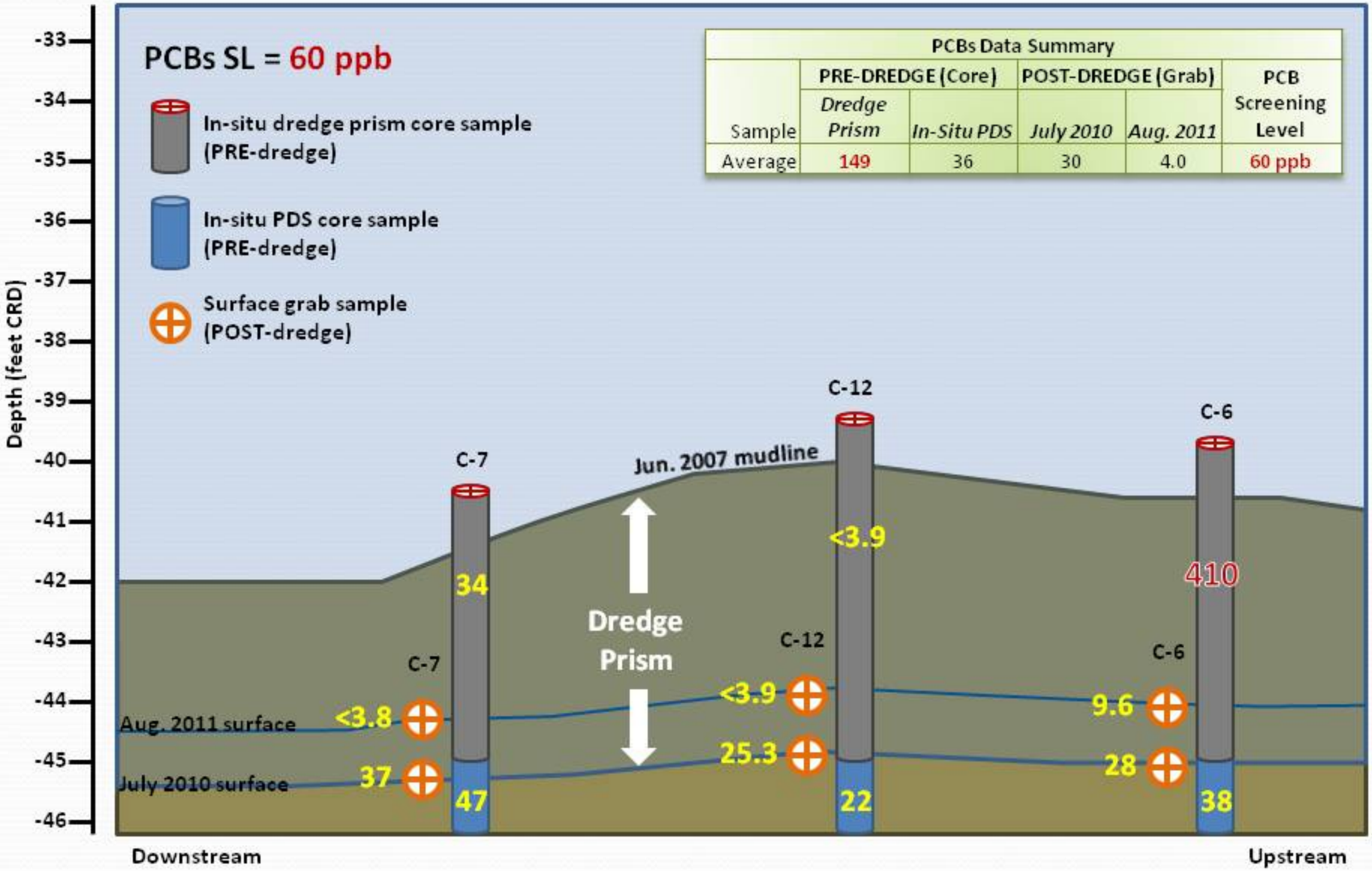
PCBs Data Summary					
	PRE-DREDGE (Core)				PCB Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*			
Average	149	36			60 ppb

PCBs: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge; 2010 post-dredge



PCBs Data Summary					
	PRE-DREDGE (Core)		POST-DREDGE (Grab)		PCB Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*	*July 2010*		
Average	149	36	30		60 ppb

PCBs: PORT OF PORTLAND, TERMINAL 5 – 2008 pre-dredge; 2010 & 2011 post-dredge



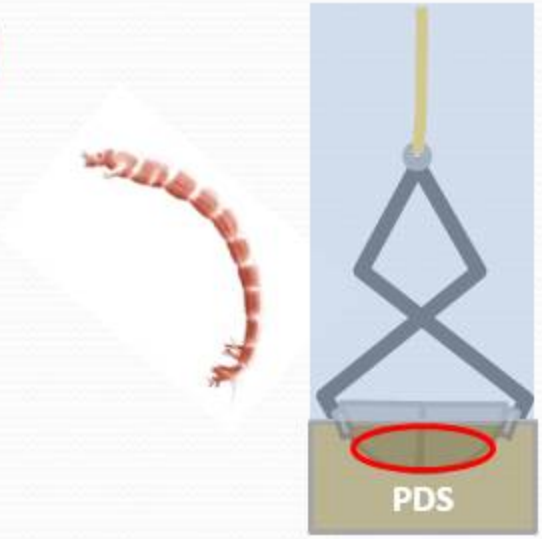
PCBs Data Summary					
	PRE-DREDGE (Core)		POST-DREDGE (Grab)		PCB Screening Level
Sample	*Dredge Prism*	*In-Situ PDS*	*July 2010*	*Aug. 2011*	
Average	149	36	30	4.0	60 ppb

What might account for differences between in-situ cores and PDS grabs?

- Fallback is a reality
- Mixing happens: physical mixing during dredging natural river processes, marine traffic
- Side slope sloughing
- Known rates of deposition: 4" to 6" year accumulation

Regulatory requirements for the PDS

(based on pre-dredge core sampling)



BEFORE DREDGING

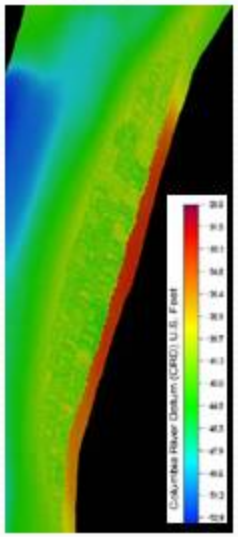
- Bioassays on pre-dredge core samples
- Benthic invertebrate study

AFTER DREDGING

- PDS sediment sampling
- Monitored natural recovery
  - Additional sediment sampling
  - Bathymetric surveys
  - Additional benthic invertebrate studies

OR

OVERDREDGE and cover with sand



Conclusions

- The in-situ PDS core sample generally over-predicted the post-dredge condition
- Depending on site conditions and patterns of contamination, the in-situ PDS sample may under-predict the post-dredge condition
- When available, consider historic information and knowledge of site conditions to help predict PDS chemistry and potentially reduce sampling burden:

$$C_{PDS} = f[c_{\text{in-situ core}}, c_{\text{DP(mixed\&fallback)}}, c_{\text{side slope}}, c_{\text{deposition}}]$$

Conclusions

Agencies and the regulated community should use these findings to inform risk-based regulatory decision making for dredging projects in the Portland Harbor

Future Work

Examine additional paired in-situ core and PDS grab samples to improve risk-based decision making in the Portland Harbor

Questions?

US Army Corps of Engineers
Portland District

PORT OF PORTLAND
Possibility. In every direction.

DEPARTMENT OF ECOLOGY
State of Washington

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10

PAH Sediment Screening for the Protection of Fish: A Draft Framework

Lyndal Johnson
NOAA Fisheries
RSET Annual Meeting
October 17, 2012

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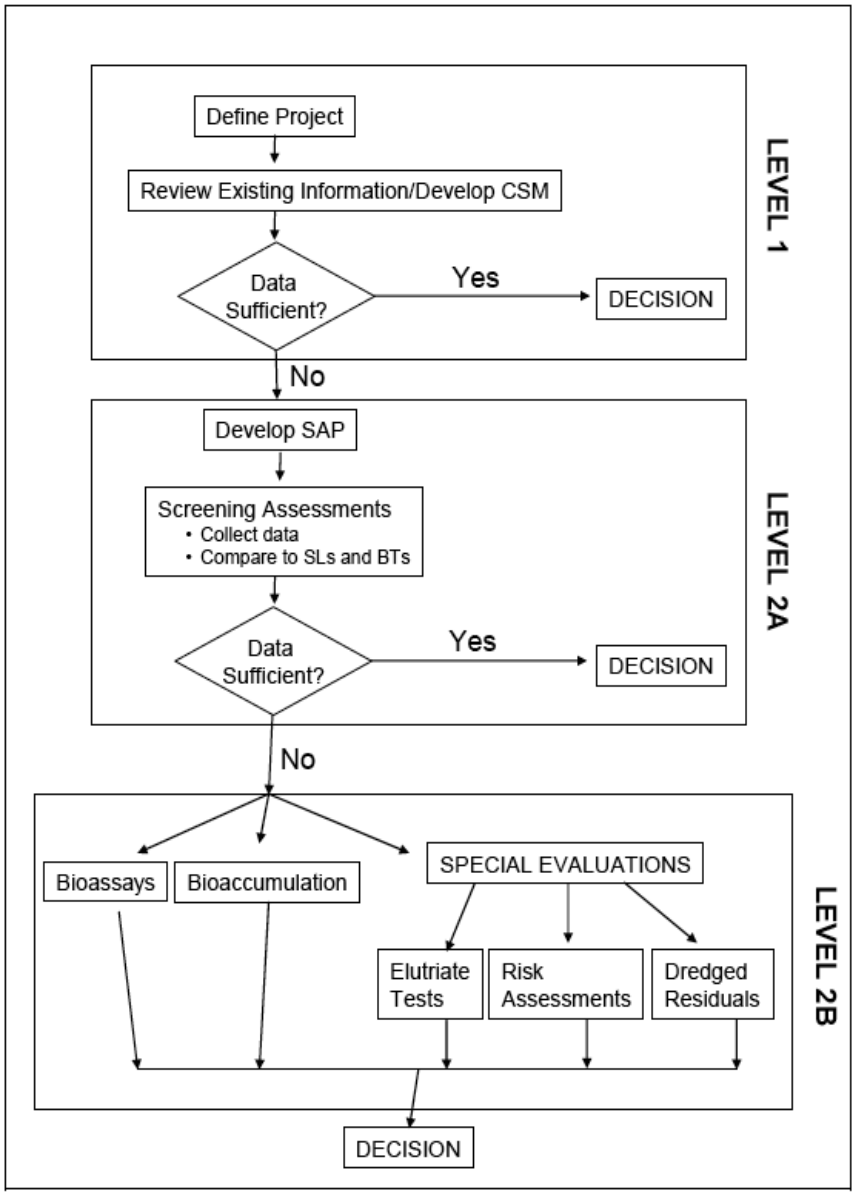
Figure 4-1. Sediment Evaluation Framework



SLs = screening levels; BTs = bioaccumulation triggers

Sediment Evaluation Framework (SEF 2009)

Protection of:

- Benthic organisms (SLs)
- Fish (TRVs/SLs)
- Wildlife (TTLs/BTs)
- Human Health (TTLs/BTs)

Fish TRVs for bioaccumulative contaminants

- TRV approach has been applied for some major classes of contaminants, e.g.
  - PCBs for salmon (Meador et al. 2002)
  - DDTs for fish (Beckvar et al. 2005)
  - Methyl mercury for fish (Beckvar et al. 2005)
- Some limitations
  - Translating to sediment value – site specific BSAFs
  - Many contaminants of concern for which TRVs haven't been developed
- But at least a viable approach
- Revised criteria based on human health concerns would also protect fish

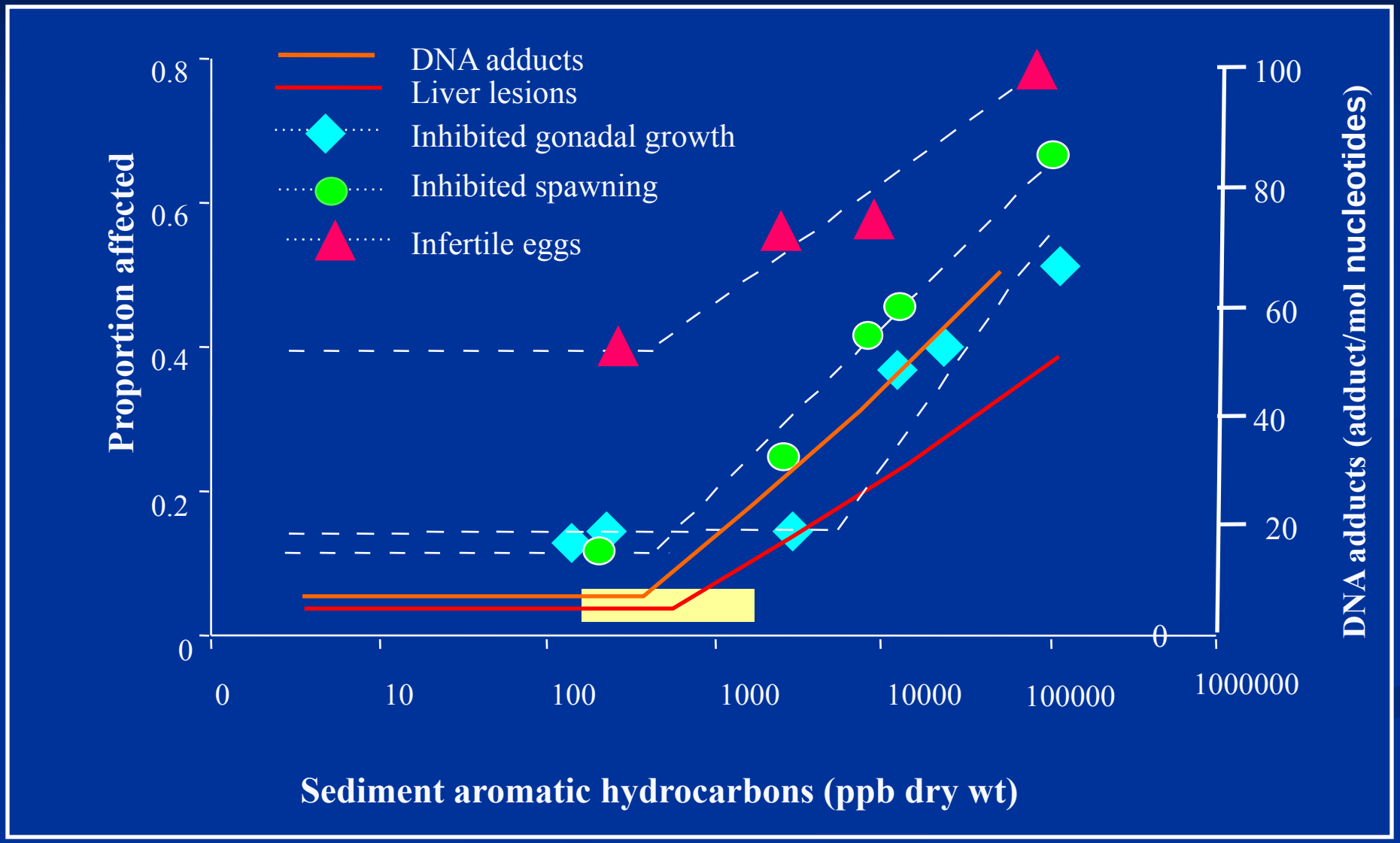
PAH SLs & TRVs for fish: Problems and limitations

- Current SLs are based on synoptic field data combining chemistry with invertebrate bioassay and/or benthic data
- May be protective of fish prey base, but not direct effects on fish
- TRV approach proposed as alternative for protection of fish for bioaccumulative compounds
- Fish metabolize PAHs, so TRV won’t work; something different needed

Exposure Pathway/Assessment

- Direct correlation of sediment PAH levels with biological effects
- Alternatives to TRVs
  - Metabolites of PAHs in bile of fish
  - Dietary effects thresholds

English sole injury vs. sediment PAH concentrations

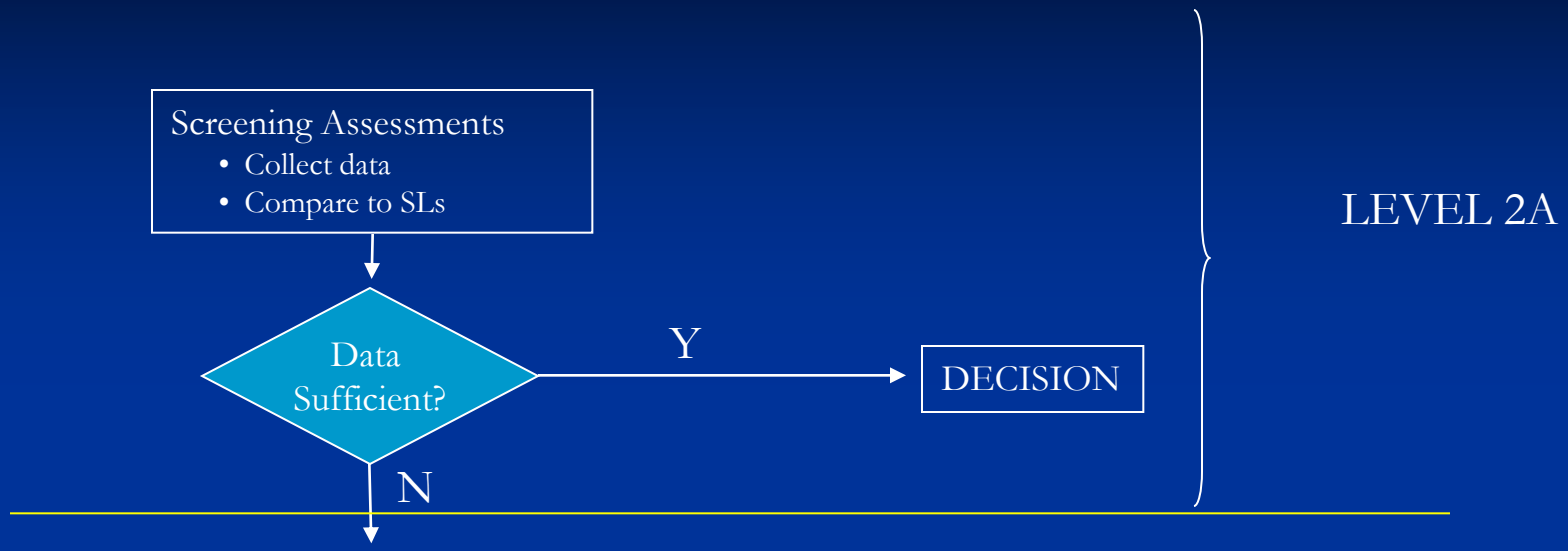


Sediment PAH concentration vs. biological effects in English sole

Biological Effect

PAH (ppb dry wt)	**Liver Lesions** (%)	**Gonad Dev** (%)	**Inhib. spawn** (%)	**Infertile eggs** (% eggs)	**DNA damage** (nmol adducts per mol bases)	**Reduced Growth** (%change in wt per day)
50	0	15	12	38	5	1.1-1.2
100	0	15	12	38	5	--
1000	9	15	17	42	25	--
2000	18	15	25	48	36	--
3000	24	15	30	51	43	0.05-0.10
5000	31	18	35	55	51	--
10000	40	27	43	61	63	--
100000	71	58	69	80	100	--

SEF Sediment Evaluation Framework



NWFSC Recommendation for this screening level:

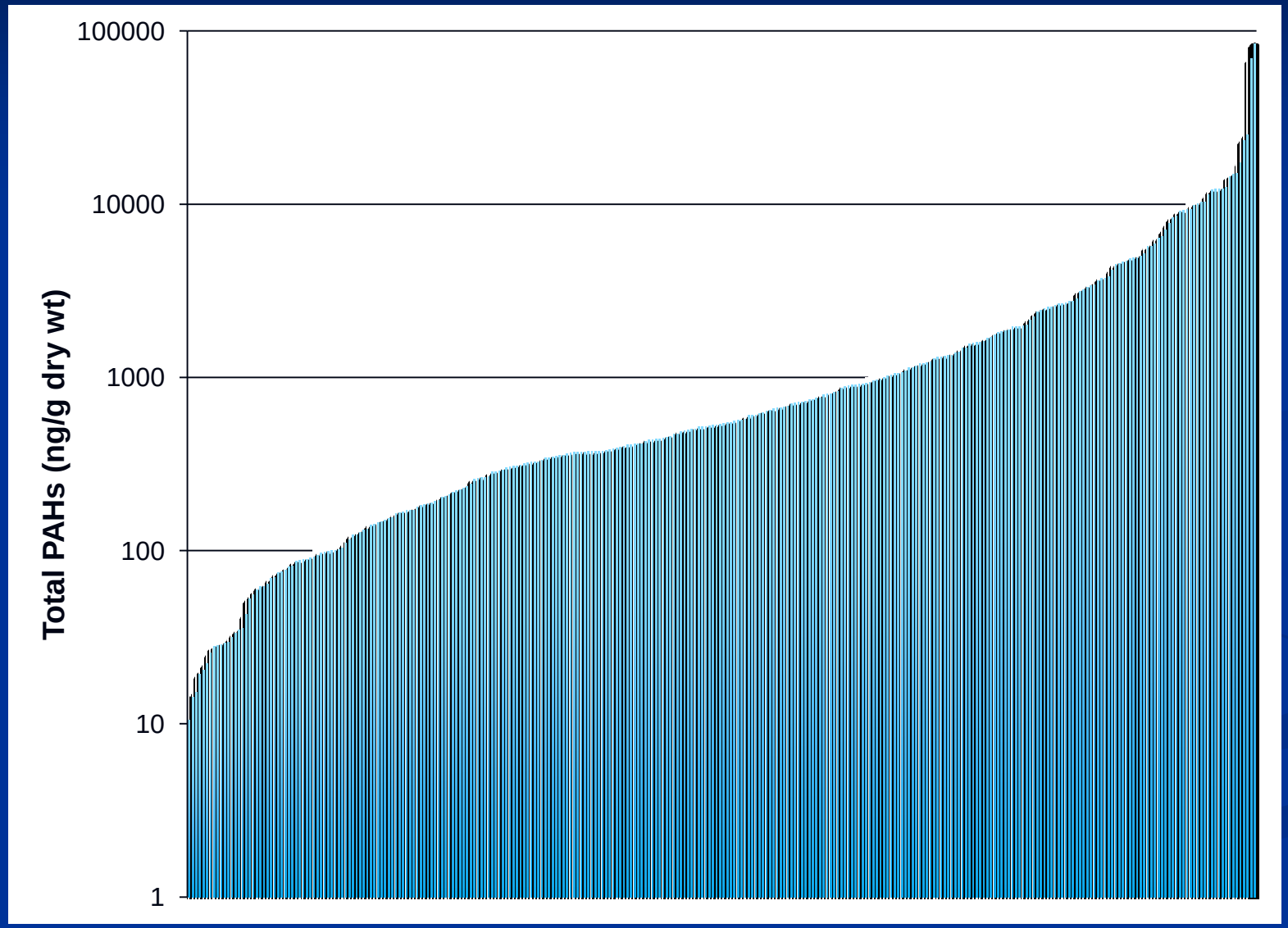
Modified SL for fish based on

Direct correlation of sediment PAH levels with biological effects

--injury endpoints in benthic fish

Recommended Screening Level: 2000 ng/g dry wt total PAH

Distribution of PAH Concentrations in Puget Sound Sediments



21% > 2000 ppb

11% < 5000 ppb

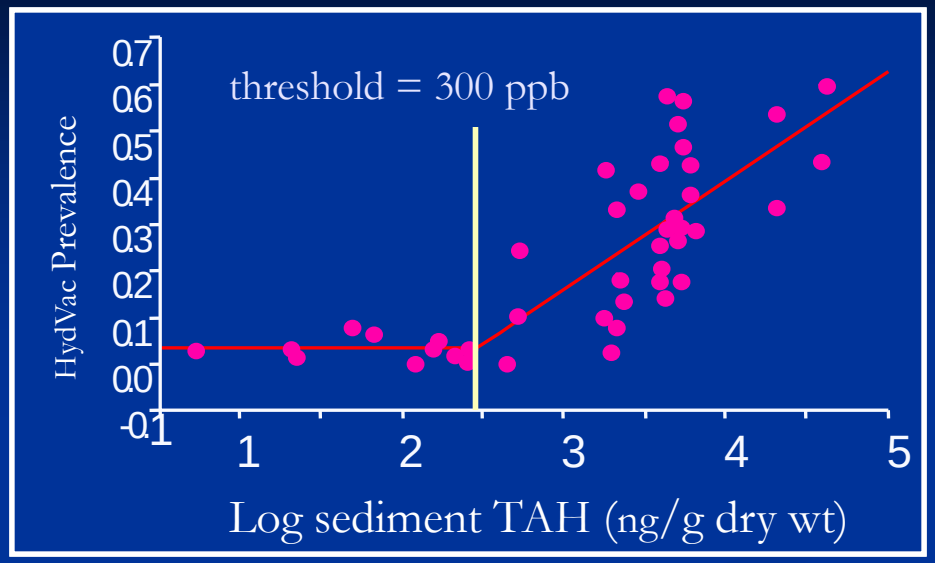
5% < 10,000 ppb

PSAMP data
300 stations
from 1997-1999

Liver Lesions In Other Species

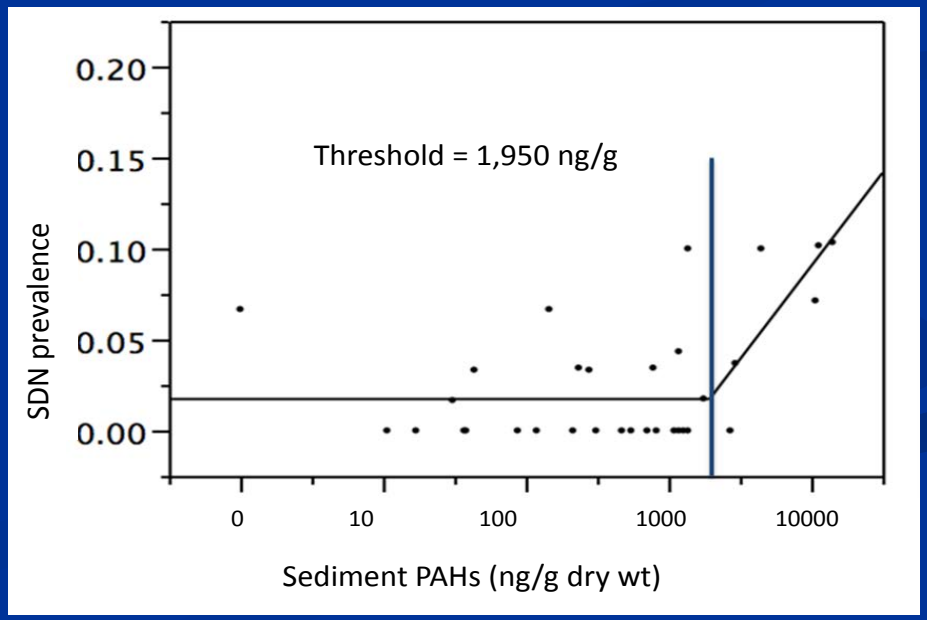
Winter flounder

Threshold for degenerative lesions
300 ppb total PAHs



Starry flounder

Threshold for degenerative lesions
1950 ppb Total PAHs

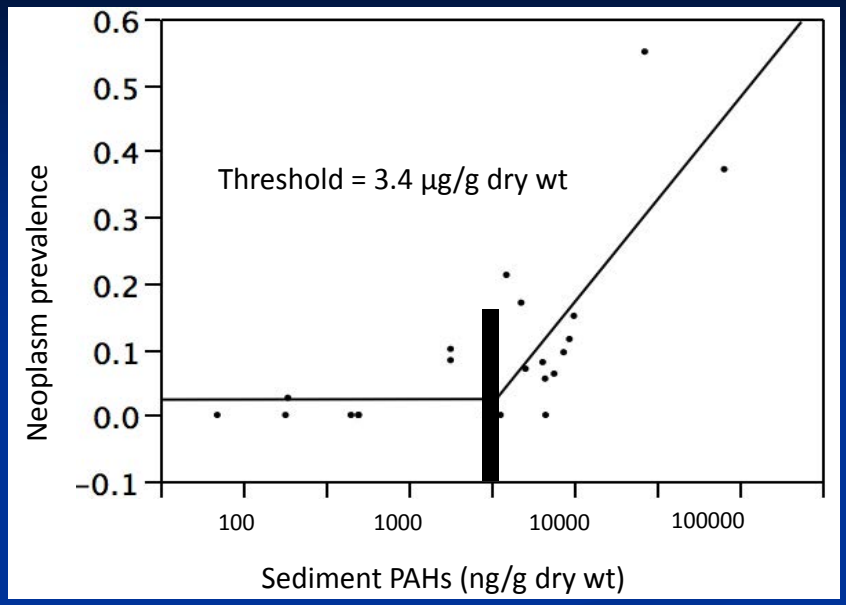


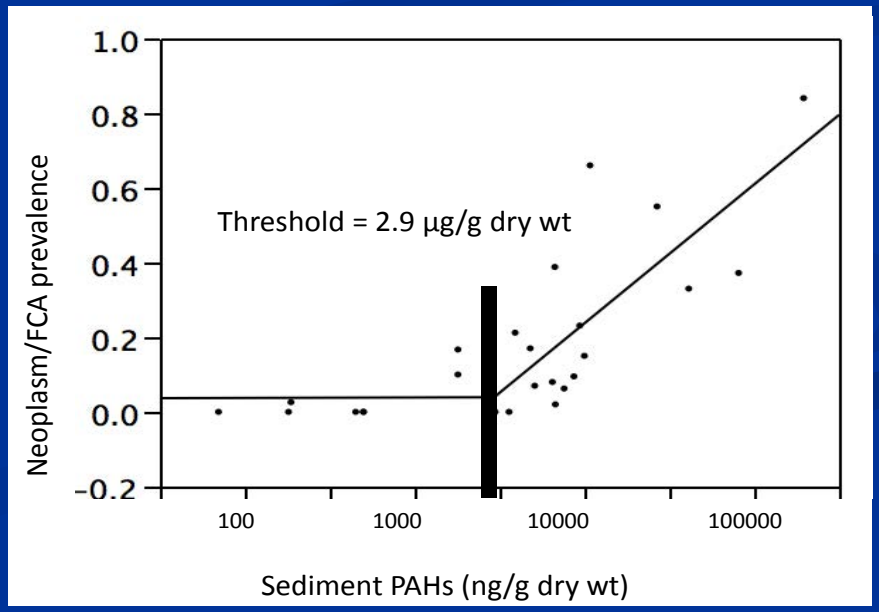
Liver Lesions in Other Species

Brown Bullhead

Threshold for neoplasms
3400 ppb Total PAHs

Threshold for FCA and neoplasms
2900 ppb total PAHs

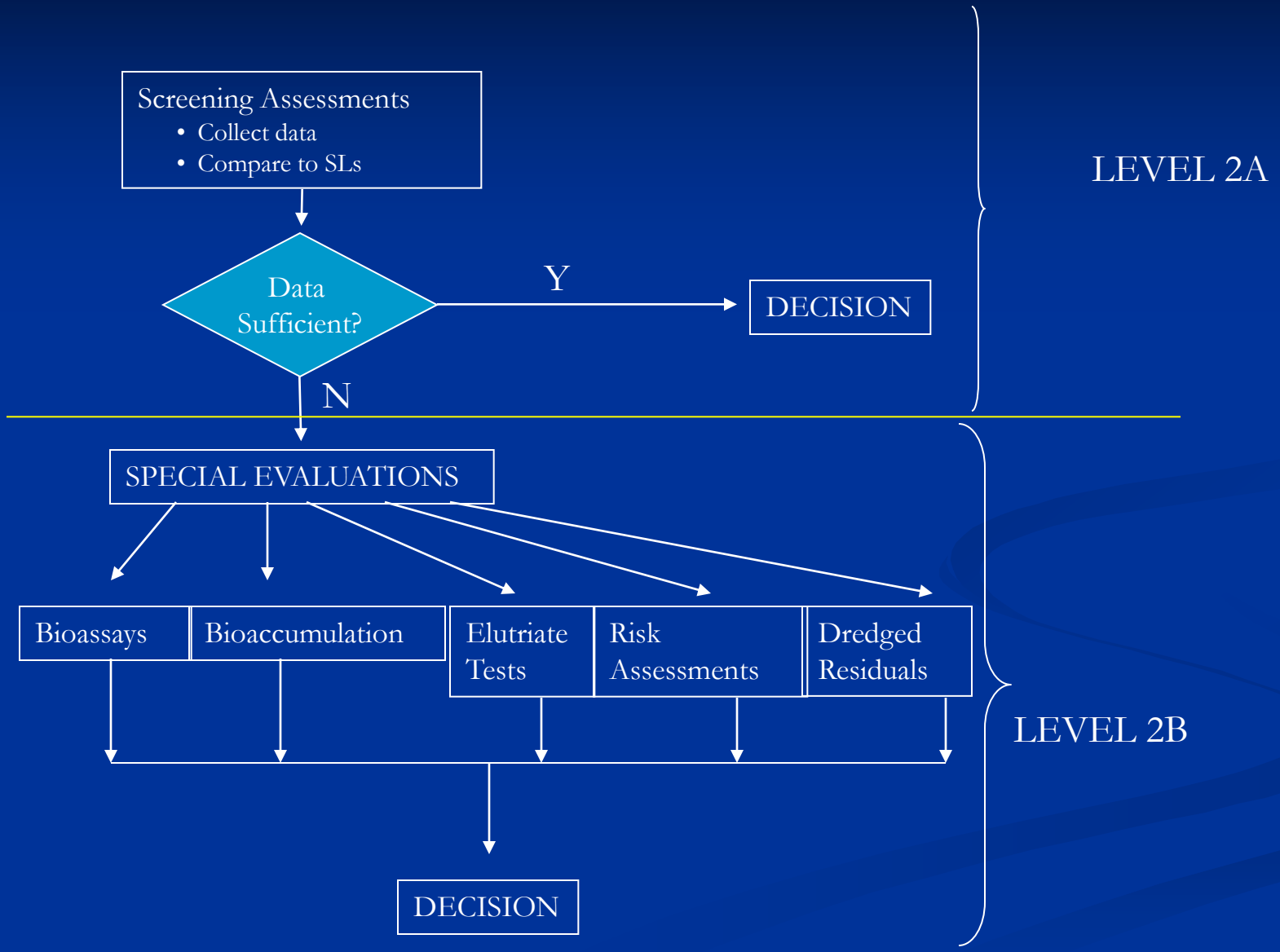




Additional Studies of PAH concentration in sediments vs. biological effects

Species	Compound	Endpoint	Concentration	Reference
Pink salmon eggs	PAHs in weathered oil	Embryo mortality	2.8 ug/g dry wt	Murphy et al. 1999
Pink salmon embryos	PAHs in weathered oil	Embryo mortality	3.8-4.6 ug/g dry wt	Heinz et al. 1999
Senegalese sole	PAHs in sediment	Degenerative liver lesions	1.1 ug/g dry wt	Costa et al. 2009
Turbot	PAHs in sediment	Reduced growth; lipid depletion	2-3 ug/g dry wt	Kerambrum et al. 2012
White perch	PAHs in sediment	Altered stress response	3-4 ug/g dry wt	Hontela et al. 1995
Mummichog	PAHs in sediment (BaP only)	EROD activity in the intestine	3.5 ug/g dry wt	Couillard et al. 2009

SEF Sediment Evaluation Framework



Exposure Pathway/Assessment

- Alternatives to TRVs
  - Dietary effects thresholds
  - Metabolites of PAHs in bile of fish

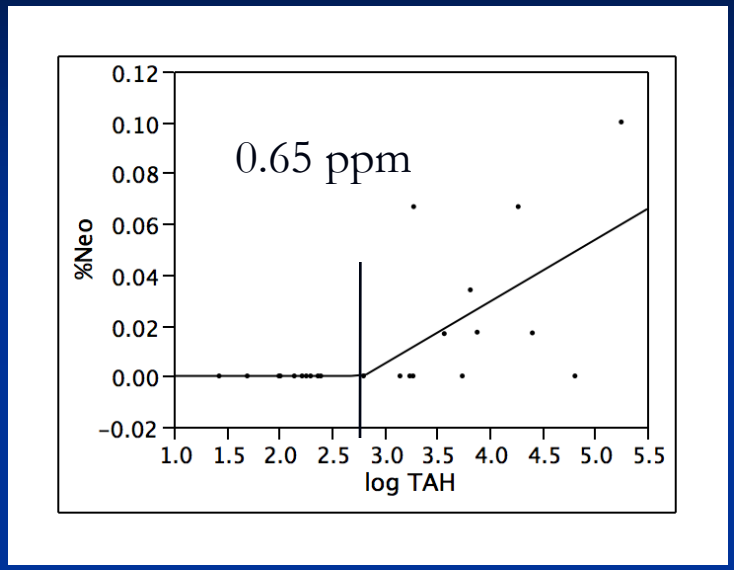
Might be used to derive sediment guidelines to support SLs; or used for Level 2B testing

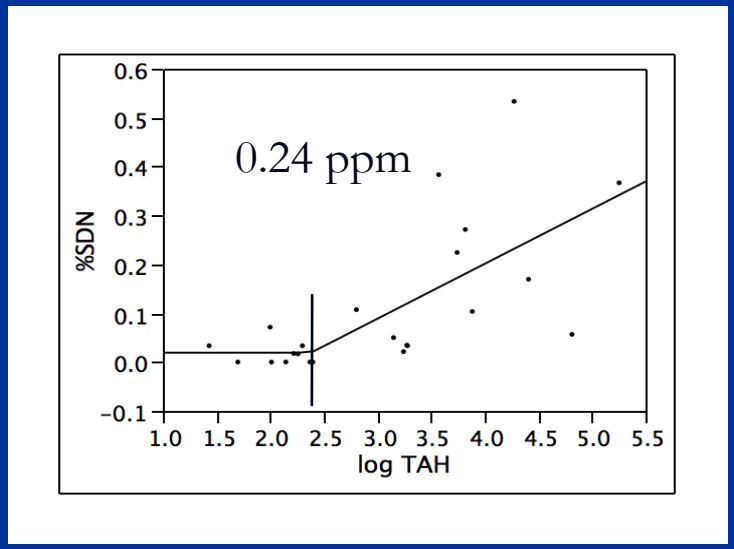
Dietary PAH concentrations vs. biological effects

Species	Endpoint	Dose (ppm fish wt/day)	Concentration in food (ug/g ww)	Reference
English sole	Reduced growth rate	0.12	2.3	Rice et al. 2000
Pink salmon	Reduced growth rate	0.14	0.9*	Carls et al. 1996
Rainbow trout	Decreased disease resistance	0.66	6.2	Bravo et al. 2011
Chinook salmon	Increased growth variability	0.7	4.4*	Meador et al. 2006
Chinook salmon	Changes in enzymes related to lipid metabolism	2.3	14*	Meador et al. 2006
Chinook salmon	Changes in lipid content	6.1	38*	Meador et al. 2006
Chinook salmon	Reduced weight	18	112*	Meador et al. 2006

*Assumes a feeding rate for salmon species of 16% body wet per day

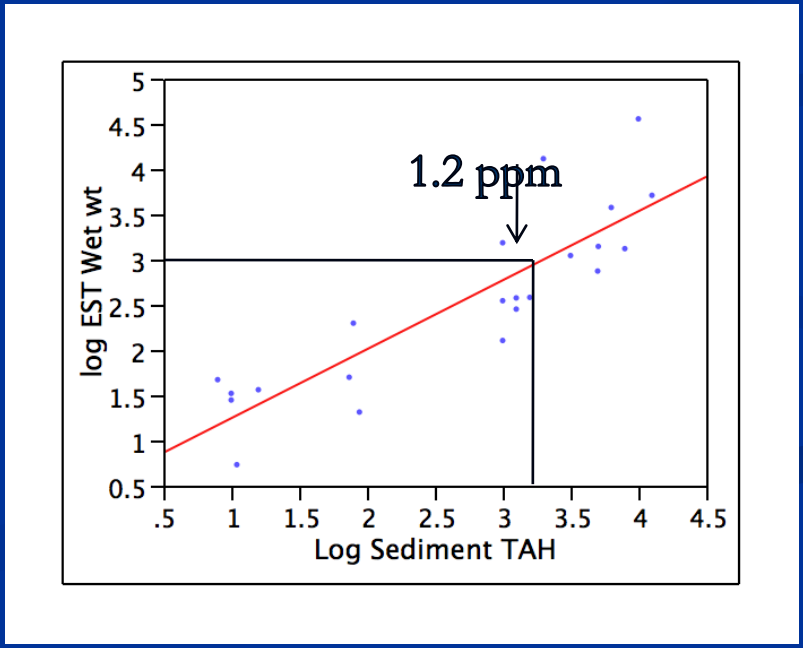
PAHs in sole stomach contents vs. lesions



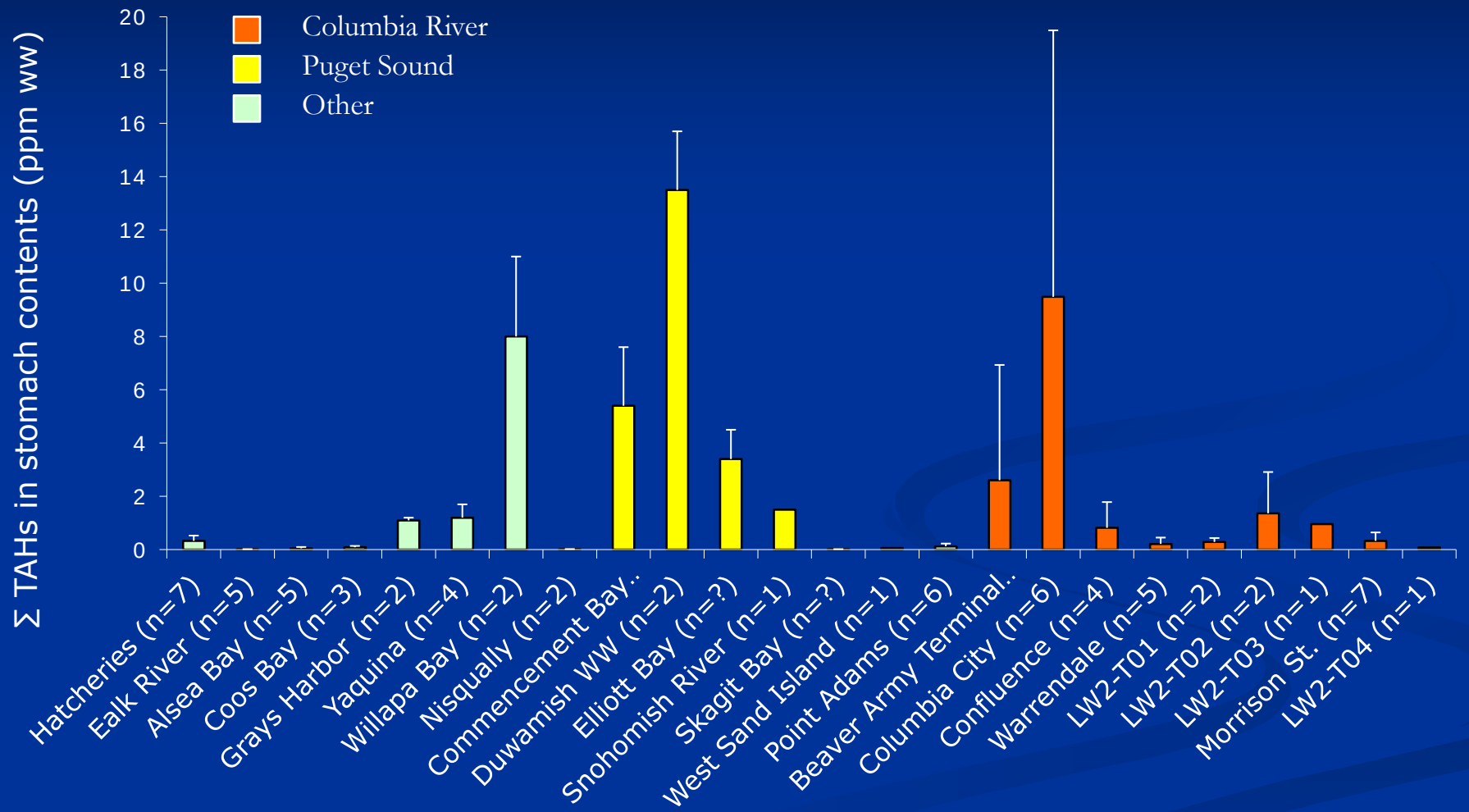


Threshold values of 0.2-0.6 ppm for total PAHs in stomach contents

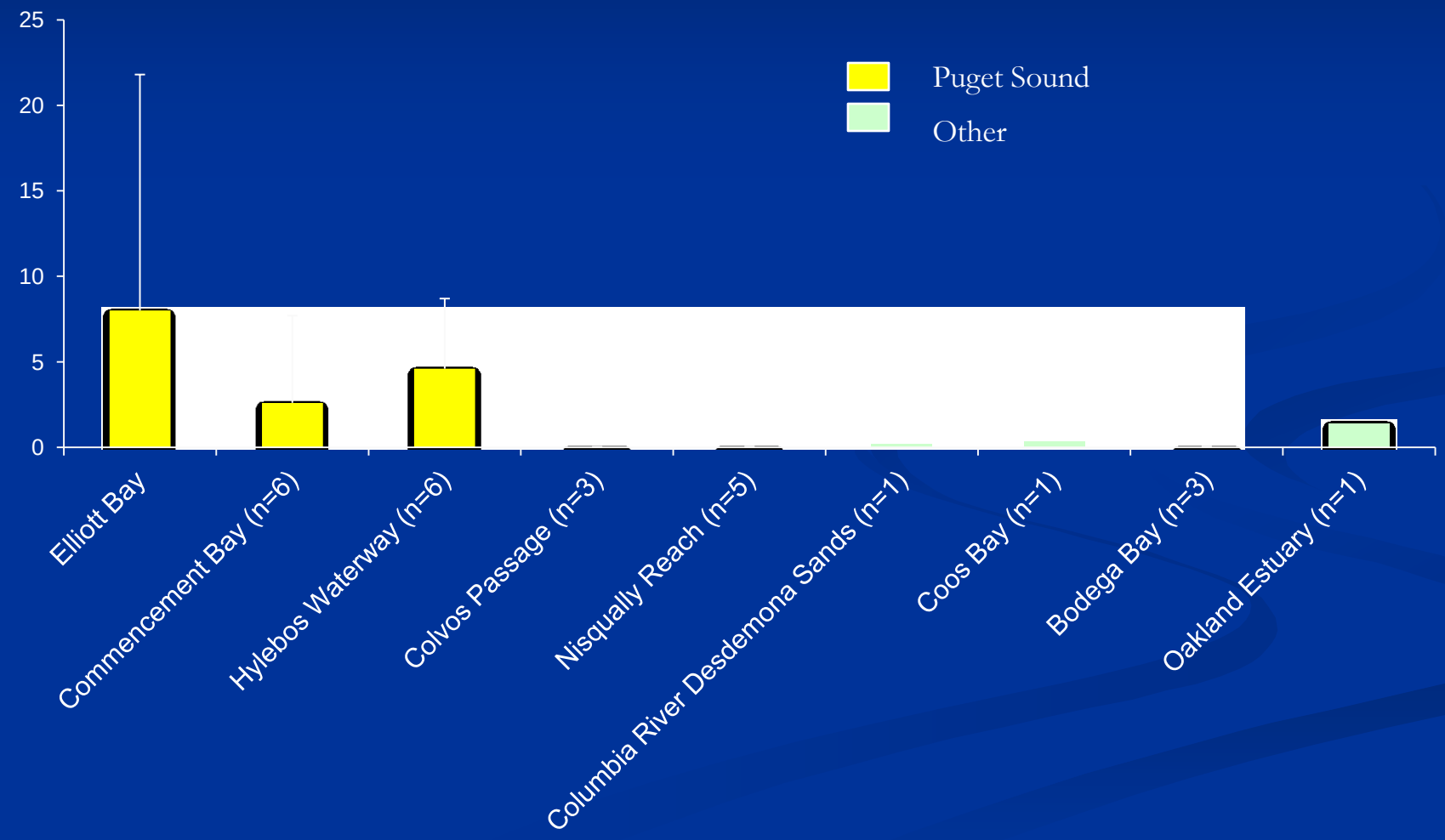
Estimated English sole stomach content TAHs at sediment TAH of 2 ppm = 1.2 ppm ww



PAHs in salmon stomach contents (ppm wet wt)



PAHs in English sole stomach contents (ppm wet wt)

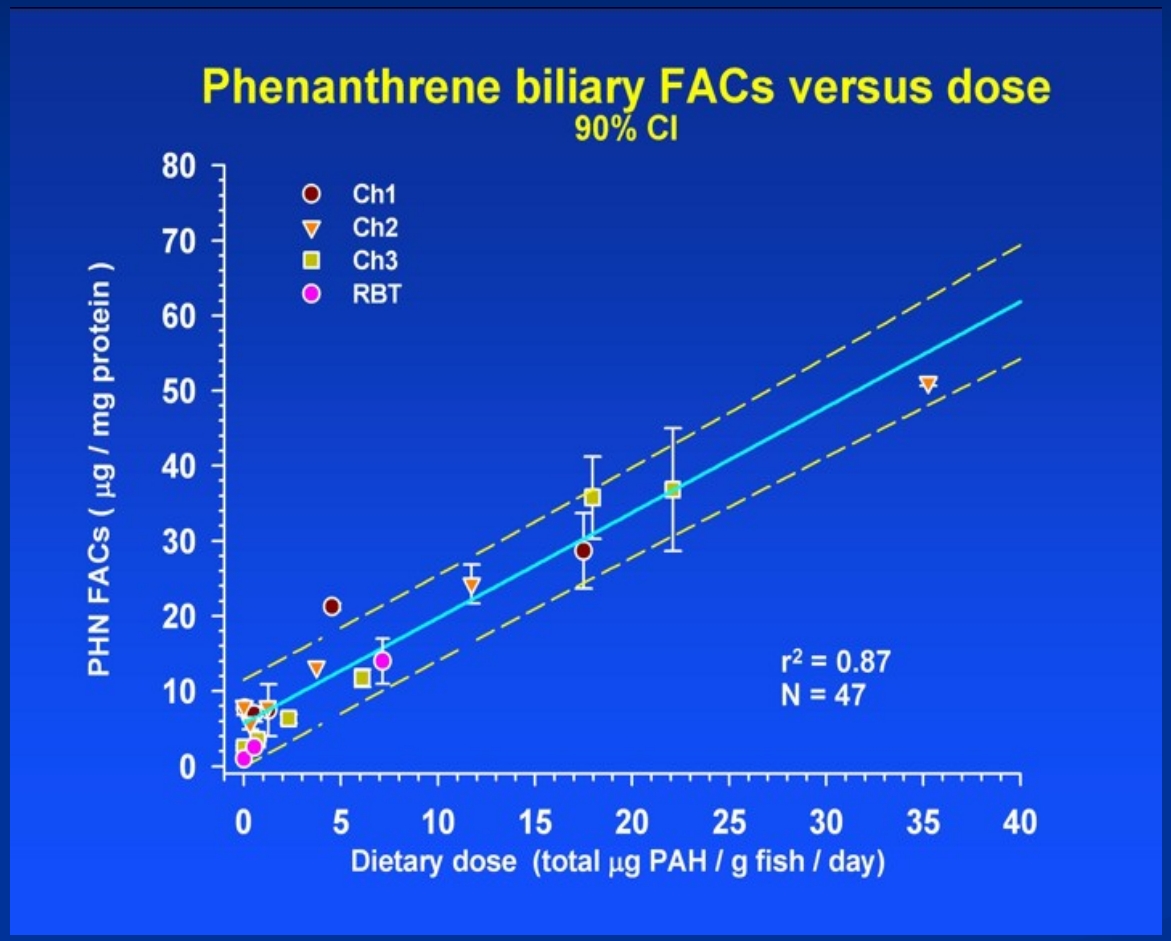


Exposure Pathway/Assessment

- Alternatives to TRVs
  - Dietary effects threholds
  - Metabolites of PAHs in bile of fish

Might be used to derive sediment guidelines to support SLs; or used for Level 2B testing

Salmonid bile metabolites vs. PAHs in diet



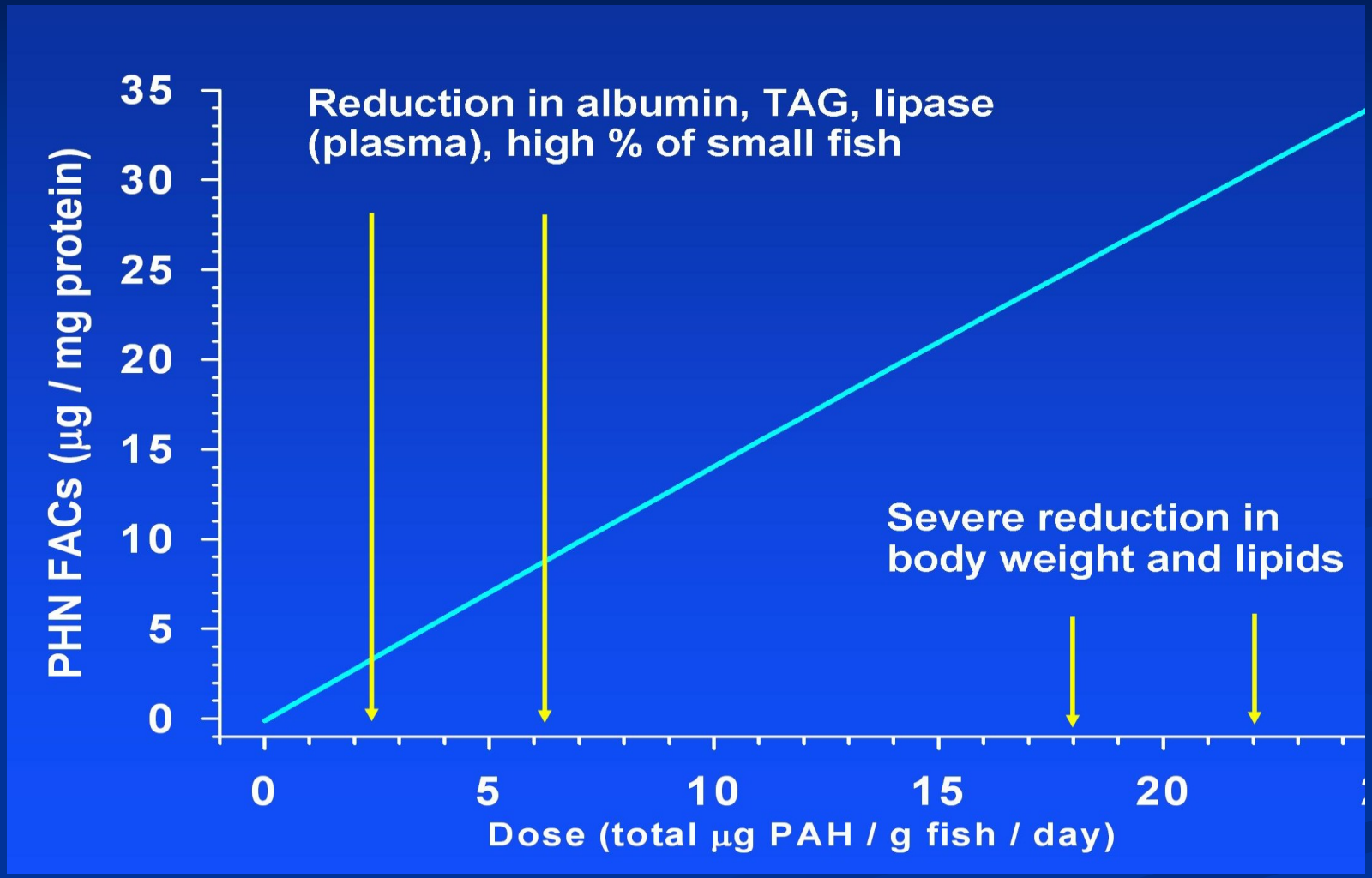
Adapted from Meador et al. 2008

Strong correlation between bile metabolites and dietary dose

Dietary PAH concentrations of 2-6 ug/g fish/day correspond to bile metabolite levels of 8-13 ug PHN-FACs/mg bile protein or 3-8 ug/mg at lower 90% CI

Dietary dose of 18-22 ug/g fish/day correspond to PHN FACs of 31-36 ug/mg bile protein or 25-31 ug/mg at lower 90% CI

Dose, PHN FACs and Toxicity



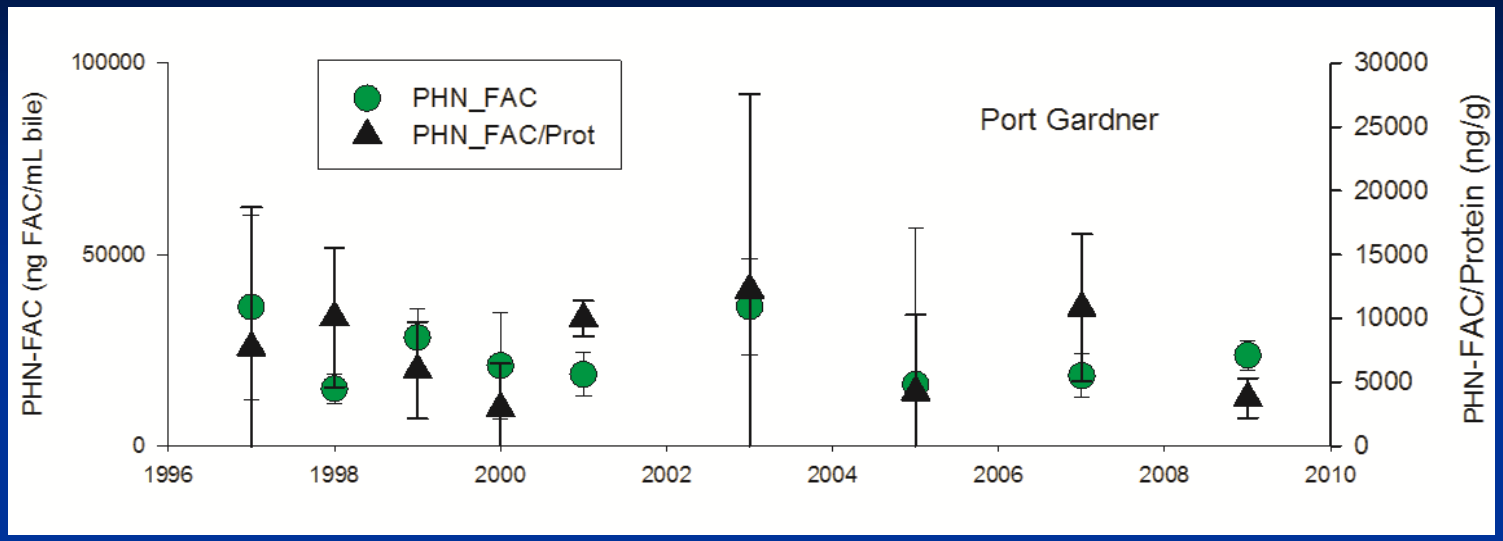
Adapted from Meador et al. 2008

PAH metabolites in bile vs. biological effects

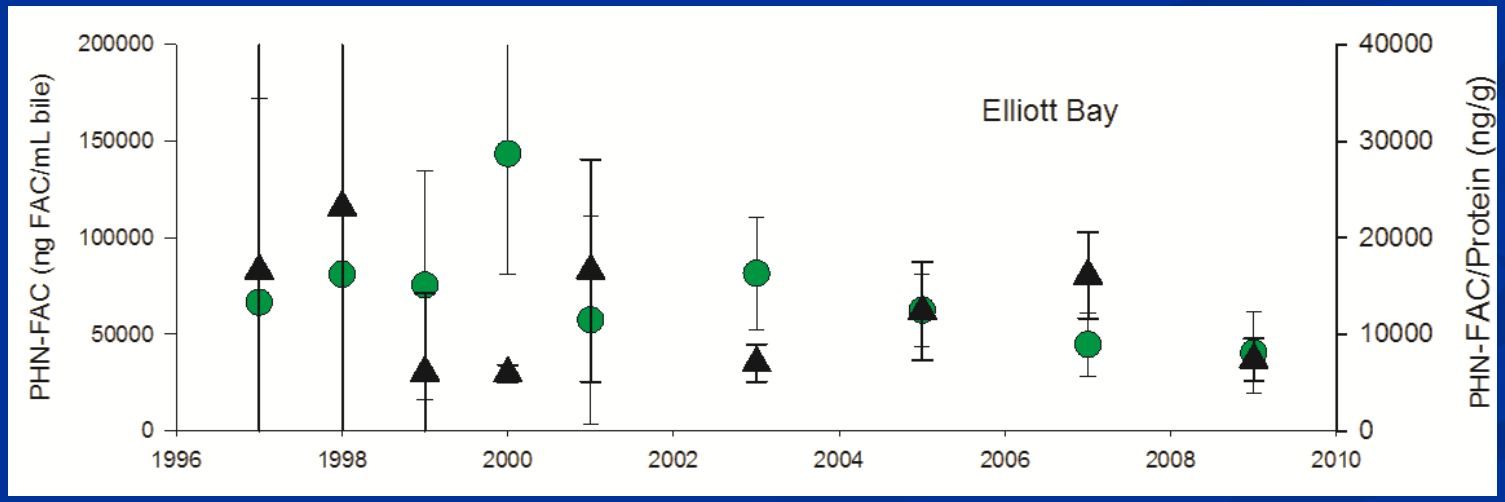
Species	Endpoint	Dose (ppm fish wt/day)	Bile metabolites FACs-PHN (ug/mg bile protein)	Reference
English sole	Increased liver lesion risk	-	5-10[a]	J. West, WDFW, pers. comm
English sole	Reduced growth rate	0.12	4.7[b]	Rice et al. 2000,
Pink salmon	Reduced growth rate	0.14	4.8[b]	Carls et al. 1996
Rainbow trout	Decreased disease resistance	0.66	5.5[b]	Bravo et al. 2011
Chinook salmon	Increased growth variability	0.7	3.5[a]	Meador et al. 2006
Dolly varden trout	Reduced reproductive hormones	-	5[a]	Meador et al. 2006
Chinook salmon	Changes in enzymes related to lipid metabolism	2.3	6.3[a]	Meador et al. 2006
Chinook salmon	Changes in lipid content	6.1	12[a]	Meador et al. 2006
Chinook salmon	Reduced weight	18	36[a]	Meador et al. 2006

[a]measured value, [b]estimated from equation in Meador et al. 2008

Bile metabolite concentrations in English sole

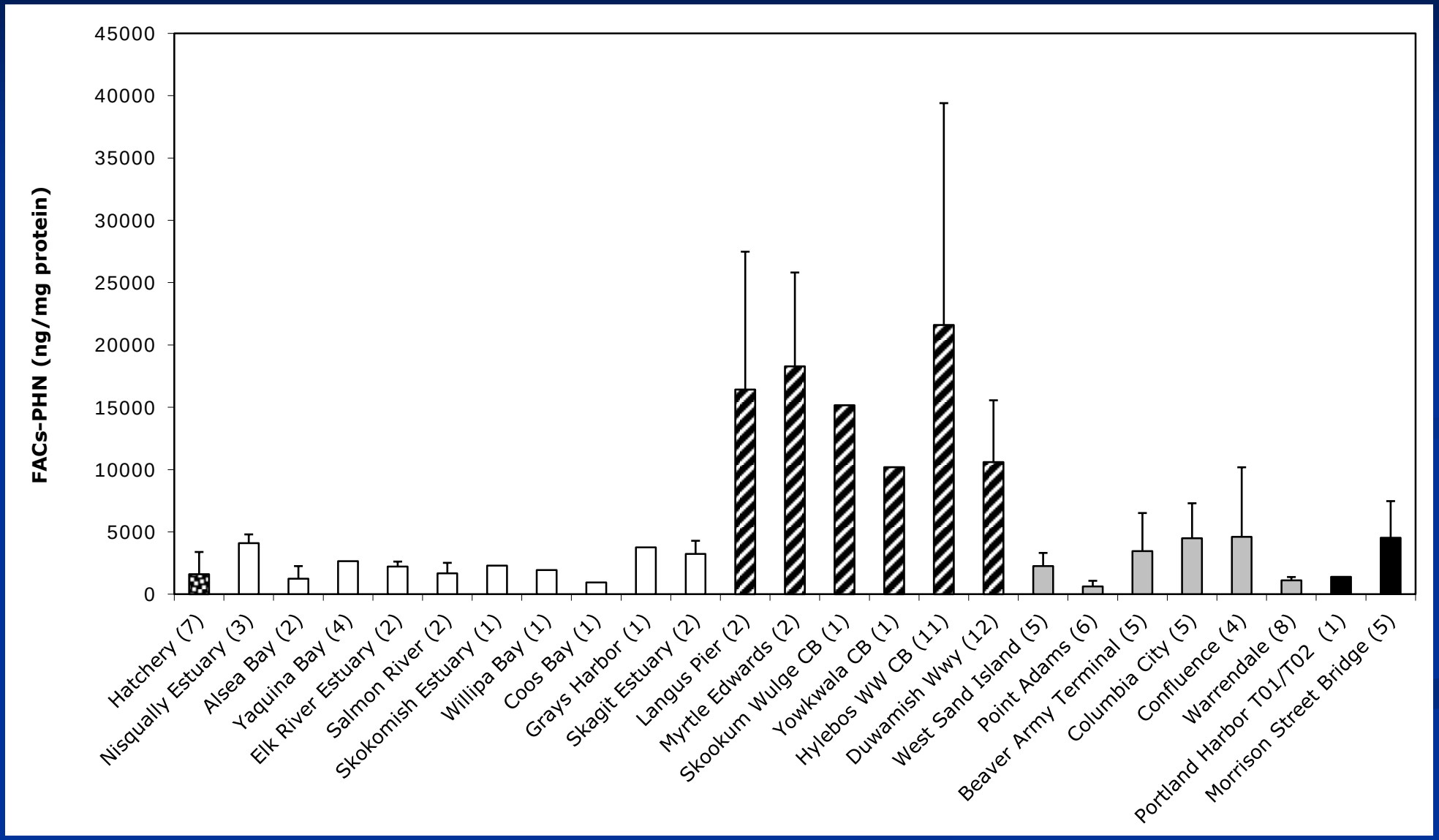


Lesion risk 2x baseline

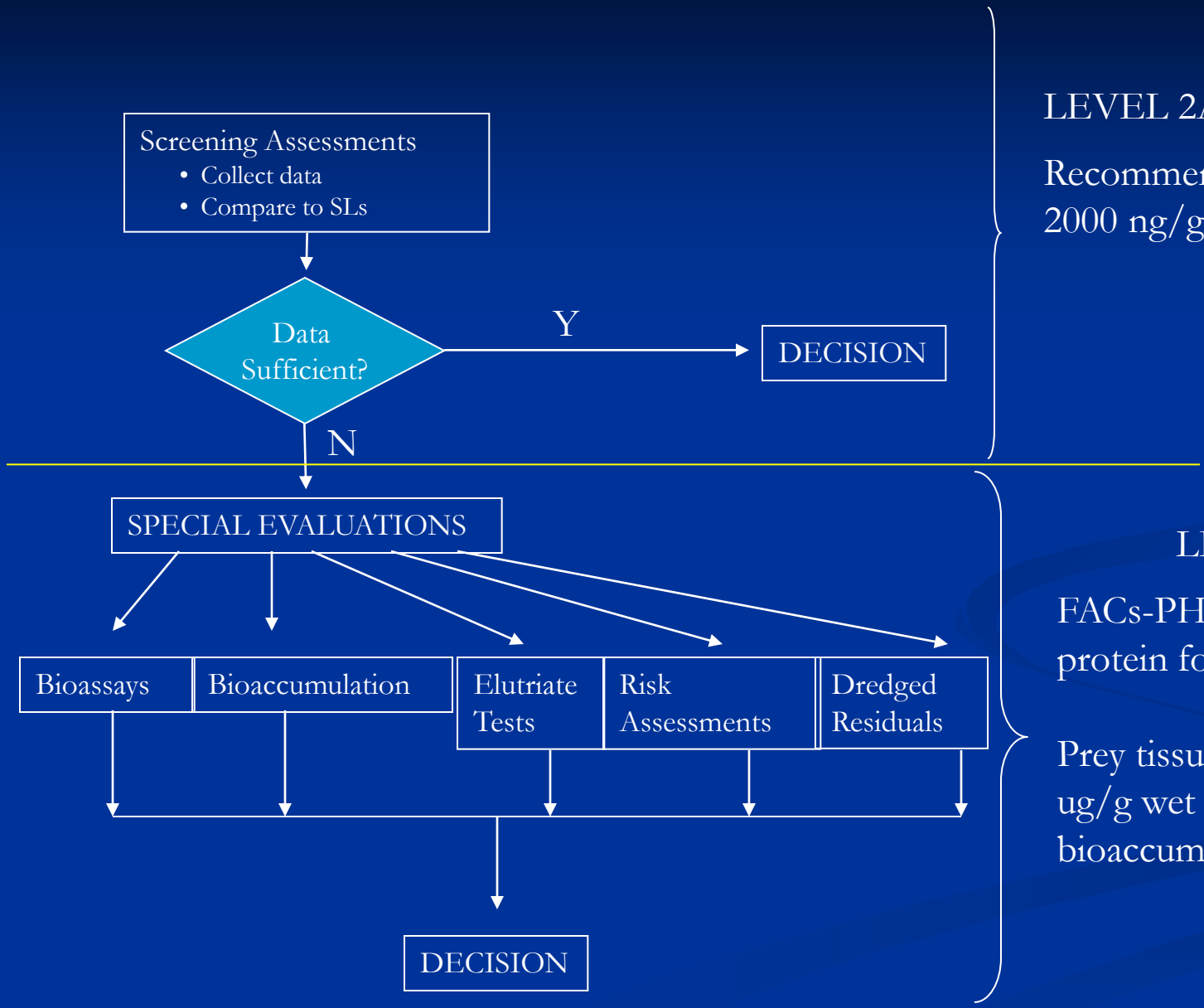


Lesion risk 4-6 x baseline

Bile metabolite concentrations in juvenile salmon



RSET Sediment Evaluation Framework



LEVEL 2A

Recommended SL1:
2000 ng/g dry wt total PAH

LEVEL 2B

FACs-PHN guideline of ~3 ug/mg protein for use in field assessments

Prey tissue concentrations of ~1-2 ug/g wet wt total PAHs for in bioaccumulation testing

RSET Sediment Evaluation Framework

SPECIAL EVALUATIONS

Bioassays

Currently no bioassay for fish

Bioaccumulation

Compare PAH accumulation in prey species with dietary guideline; may need to add additional test species for salmon

Elutriate Tests

LC_{50} tests available for several marine and freshwater fish; may not be sufficient for listed species?

Bile metabolite levels?

Risk Assessments

Field assessment of exposure and risk in species of concern

Bile metabolite levels

Stomach contents PAHs

Surrogate species

Dredged Residuals

Compare PAH concentrations in exposed surface with 2000 ng/g dry wt guideline

Follow up with field assessment of exposure if SL guideline exceeded

Biological Testing Subcommittee White Paper addresses some issues related to bioassays and bioaccumulation testing for the protection of fish; revisit this issue for new information?

Next Steps?

- Complete white paper outlining suggested screening guidelines and evaluation framework
- Internal NOAA review of white paper
- Present to white paper to RSET
- Come to consensus on how to apply and incorporate into the SEF

Regional Sediment Reference Material (SRM)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

What is the Regional SRM?

- QA/QC tool -- a known sediment reference material concurrently analyzed with environmental samples
- Targets regionally important COCs -- dioxins & PCBs
- Independent, stand alone material from local waters, not directly linked to a specific location, with COCs at levels close to screening levels
- Developed by DMMP work group working with EPA OEA via the QATS contractor (Shaw Environmental, Las Vegas)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

Field Sampling

- Targeted dioxin 4-10 ng/kg TEQ dry weight; Aroclors 70-130 ug/kg dry weight
- Used double Van Veen to sample Budd Inlet, T-117, and Carr Inlet – 27 5-gal buckets
- Overnight shipped to QATS lab, Las Vegas
- Field sampling report July 2011 – includes QAPP and all sampling specifics

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

T-117 typical sample (09/23/2010)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

Field sieving T-117 (09/23/2010)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

Carr Inlet – weighing bucket (09/27/2010)

United States Environmental Protection Agency

Department of Ecology

WASHINGTON STATE DEPARTMENT OF Natural Resources

SRM Processing

- Target location sediments were air dried, sieved using 60 mesh sieve (<250 um) per ASTM E-11, and homogenized separately
- Initial range finding chemical analyses (Aroclors and Dioxins/Furans, Grain Size, TOC) were conducted
- Our intention was to combine and homogenize the samples to create 100 kg of final SRM
- T-117 selected

United States Environmental Protection Agency

Department of Ecology

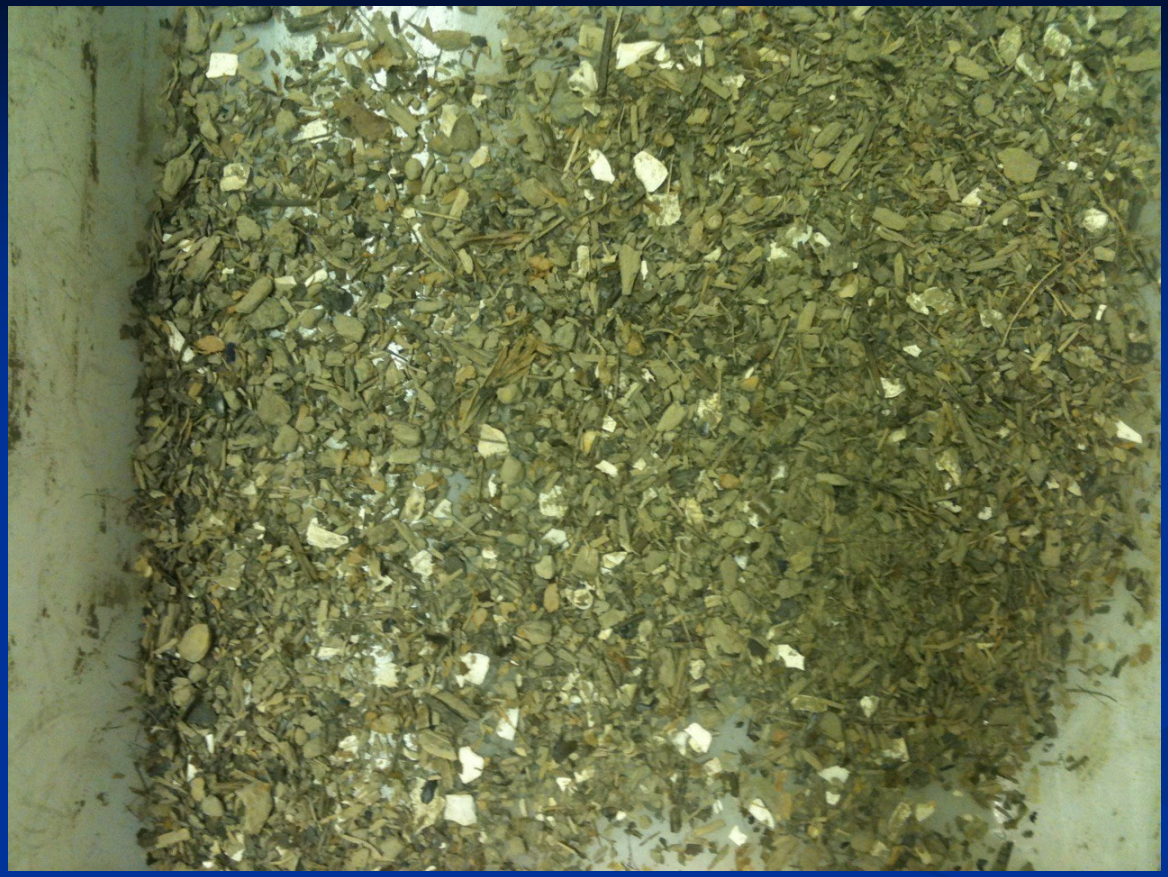
Washington State Department of Natural Resources

T-117 air drying (9/30/2010)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources



T-117 sample retained on 20 mesh sieve (>850 um) 10/19/2010

United States Environmental Protection Agency

Department of Ecology

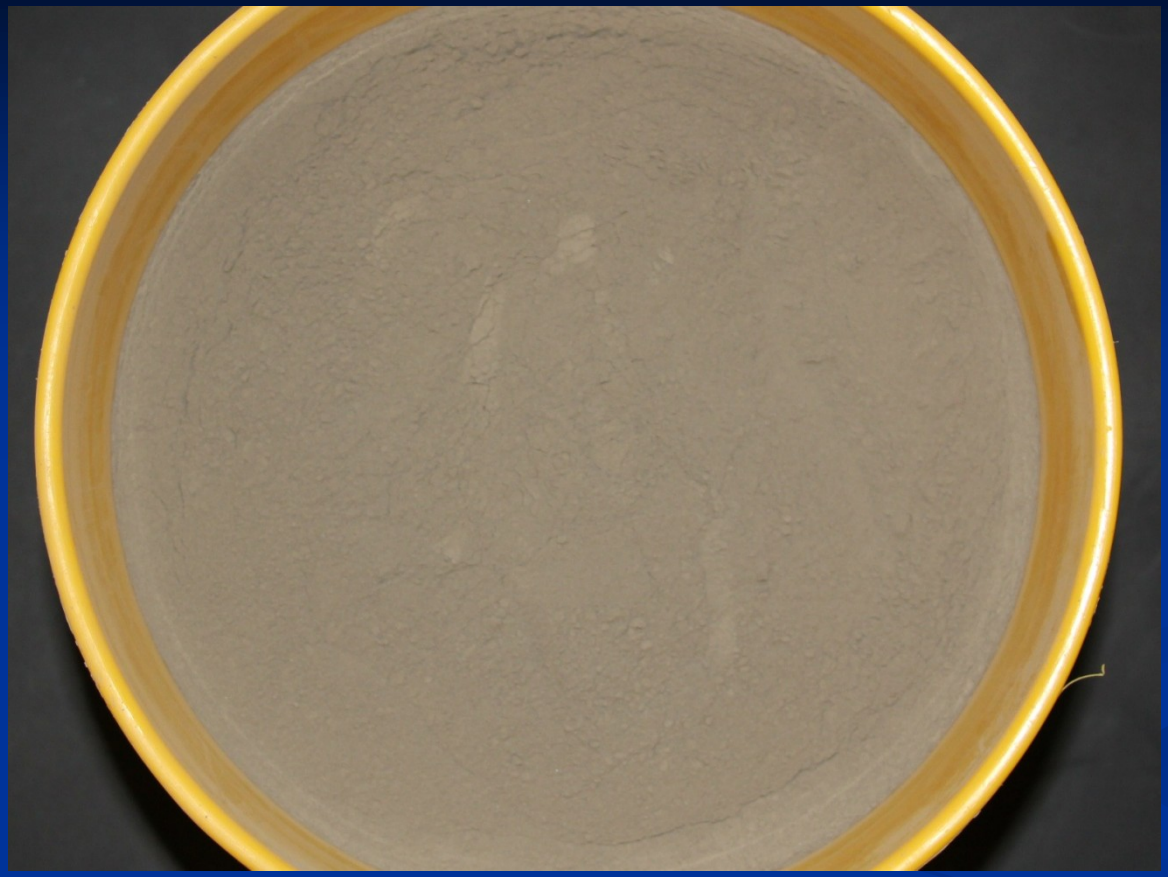
Washington State Department of Natural Resources

T-117 dry V-blender process (10/19/2010)

United States Environmental Protection Agency

Department of Ecology

WASHINGTON STATE DEPARTMENT OF Natural Resources



T-117 bulk with 60 mesh sieve (<250 um)

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

Bottles with EPA QA program labels

United States Environmental Protection Agency

Department of Ecology

Washington State Department of Natural Resources

Acceptance Limits

- Guidance values are based on round robin data, implications associated with meeting or not is case by case depending on goals of a program/project
- For upcoming dredging year 2013, the DMMP will review results on a case by case basis and will consider the values advisory

United States Environmental Protection Agency

Department of Ecology

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Aroclors

- 12 lab round robin (including commercial and CLP labs)
- Acceptance limit for Aroclor 1260 set at the 95% confidence interval:
  - Warning low 41 ug/kg
  - Warning high 180 ug/kg
  - Average concentration 108 ug/kg

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CDD/CDF

- 10 lab round robin (including commercial and CLP labs)
- Acceptance limit of +- 50% action low and action high set for each congener
- Using the action low and high the TEQ = 2.73 to 8.2 ng/kg dry weight (average concentrations TEQ = 5.47 ng/kg dry weight)

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Analyte	CAS No.	Ave. Conc. ng/kg	Action Low (-50%)	Action High (+50%)
1,2,3,4,6,7,8-HpCDD	35822-46-9	90.6	45.3	136
1,2,3,4,6,7,8-HpCDF	67562-39-4	18.7	9.36	28.1
1,2,3,4,7,8,9-HpCDF	55673-89-7	1.63	0.815	2.44
1,2,3,4,7,8-HxCDD	39227-28-6	1.59	0.797	2.39
1,2,3,4,7,8-HxCDF	70648-26-9	3.02	1.51	4.53
1,2,3,6,7,8-HxCDD	67653-85-7	3.88	1.94	5.82
1,2,3,6,7,8-HxCDF	57117-44-9	1.09	0.545	1.64
1,2,3,7,8,9-HxCDD	19408-74-3	3.04	1.52	4.55
1,2,3,7,8,9-HxCDF	72918-21-9	0.511	0.255	0.77
1,2,3,7,8-PeCDD	40321-76-4	1.08	0.542	1.63
1,2,3,7,8-PeCDF	57117-41-6	1.23	0.613	1.84
2,3,4,6,7,8-HxCDF	60851-34-5	1.83	0.917	2.75
2,3,4,7,8-PeCDF	57117-31-4	1.07	0.533	1.60
2,3,7,8-TCDD	1746-01-6	1.05	0.525	1.57
2,3,7,8-TCDF	51207-31-9	1.11	0.557	1.67
OCDD	3268-87-9	811	406	1217
OCDF	39001-02-0	58.4	29.2	87.6

SRM Distribution

- Guidance for distribution and reporting now final – www.nws.usace.army.mil
- Agency contacts / authorized requesters: Corps DMMO, Ecology -- Laura Inouye & Tom Gries, EPA -- Justine Barton / Erika Hoffman / Donald Brown
- Puget Sound SRM Request Form – via requesters to Donald Brown, SRM manager

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SRM Distribution (con't)

- SRM will arrive with handling and storage instructions, data reporting requirements, chain of custody, etc.
- All information relative to the SRM, including associated QA data, should be sent to original agency requester – who will see it is submitted to Donald Brown (and Shaw Environmental)

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Long-term Management

- Shaw Environmental will store and maintain SRM, incl. stability testing and database to track reported results over time
- Shaw Environmental will use reported data to recalculate acceptance limits – likely after approx. 30 new data points received

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Next steps:

- CB congener data and acceptance limits (imminent!)
- SRM production documentation report, by 14 November
- Revisit guidance for distribution and reporting, and provide update at 2013 SMARM

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Sediment Management Standards Rule Revisions

RSET Annual meeting

2012

SMS Rule Revisions - Topics for Today

- **Purpose**: Why are the rule revisions necessary?
- **Scope**: What are the rule revisions?
- **Schedule:** What is Ecology's schedule for adoption?
- **Information**: Additional materials
- **Questions:** Contact information

Overview

- The SMS rule has six sections and Ecology is proposing changes to:
  - Part II – Definitions
  - Part V – Sediment Cleanup Standards

- Proposed changes to Part V include adding to the current two-tiered cleanup standards decision framework:
  - Human health protection and background concentrations.
  - Chemical and biological criteria for freshwater sediments.

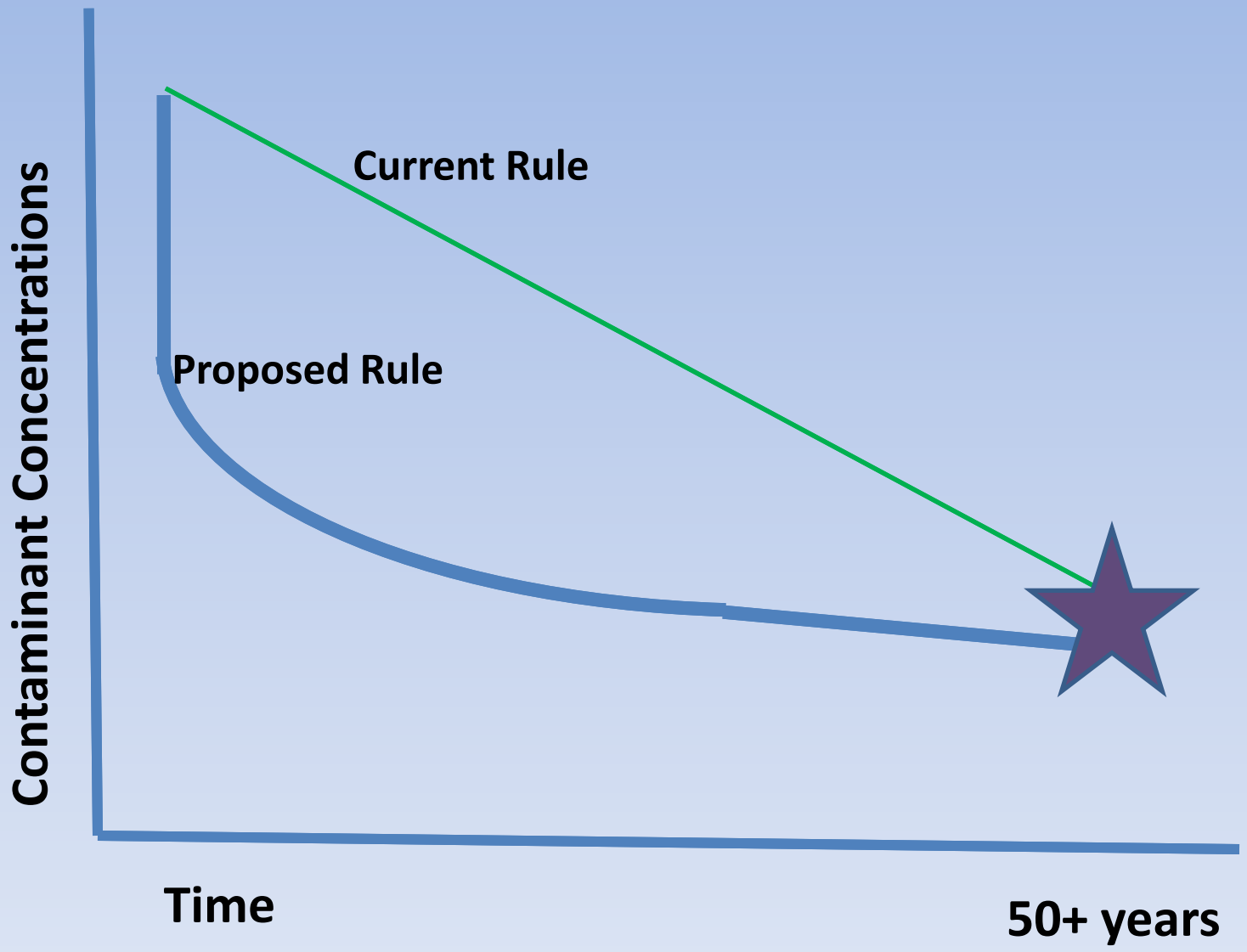
- Part IV has the two-tiered decision framework for source control.
  - Ecology is <u>not</u> proposing changes to Part IV (Source Control).
  - Part V changes will impact source control requirements.

Why do we need to revise the SMS rule?

- Rules should be:
  - Protective.
  - Legally defensible.
  - **Implementable.**

- Lack of clarity in the SMS rule on how to address bioaccumulative chemicals and freshwater sediment cleanup leads to:
  - Unpredictable and inconsistent cleanup decisions.
  - Cleanup delays and increased costs.
  - Technically infeasible decisions.

Intent of SMS Rule Revisions



Considerable public input led to the proposed SMS revisions

- **2008 – 2009:** Ecology conducted **early scoping** to identify issues.
- **2009 – 2010**: Ecology published **issue papers** to get public feedback.
- **2010 – 2011: Three Advisory committees**:
  - Sediment Cleanup Advisory Committee
  - MTCA/SMS Advisory Group
  - Sediment Workgroup
- **2011**: **Preliminary draft rule language** provided to advisory committees for review and comment.

What are the rule revisions?

- Address specifically how to establish cleanup standards for bioaccumulative chemicals.
    - Human health risks and assessment.
    - Background concentrations.
    - Integrate SMS and MTCA requirements.
- Adopt numeric chemical and biological freshwater benthic criteria.
- Clarify requirements for cleanup and controlling sources of contamination.

SMS Section 500 - Expectations

- Updated to clarify cleanup process and decision making framework.
- Addresses recontamination of cleanup sites and resolving liability.
- Clarifies the expectations around source control and protecting cleanups from recontamination.
- Resolving liability for cleanups including establishing cleanup standards, reasonable restoration time frames, and recontamination.
- Clarifies ability to conduct cleanup of discrete units within a site and resolving liability for those unit cleanups.

Sediment Cleanup Standards: SMS Sections -560 through -564

Upper Tier:
Cleanup Screening Level

↑

Cleanup Standard/Level:
Set as close as practicable to Sediment Cleanup Objective based on technical possibility, adverse environmental impacts

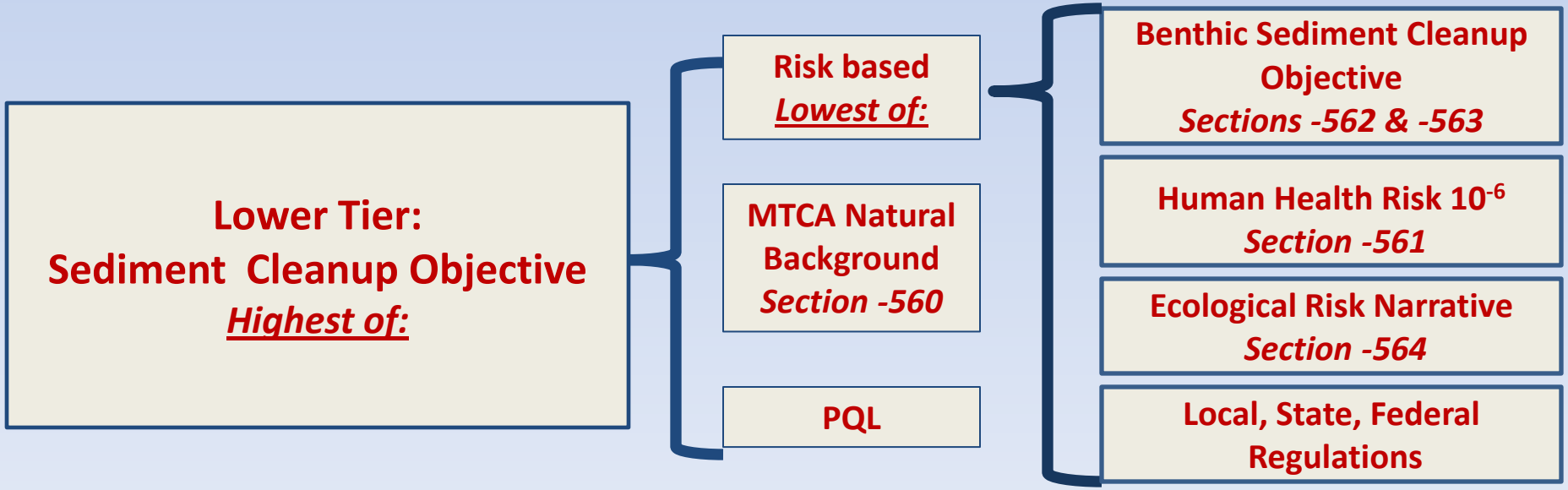
↓

Lower Tier:
Sediment Cleanup Objective

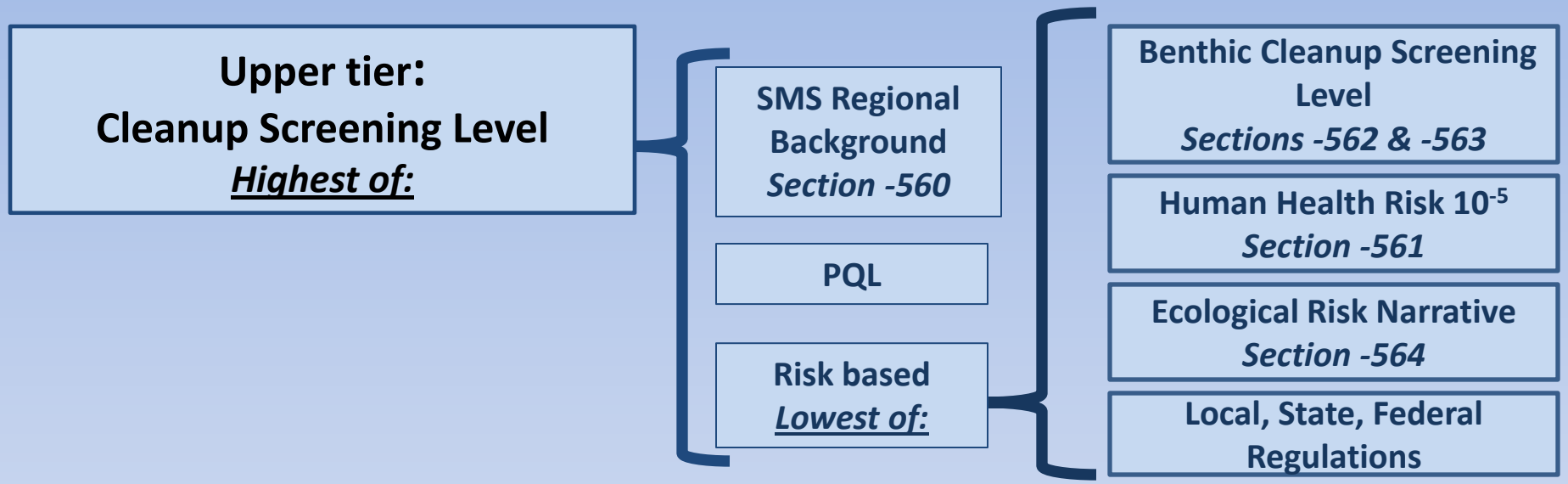
- Cleanup standards established using two-tiered decision framework.
- Site-specific cleanup standards set as close as practicable to the lower tier:
  - **Current rule** – practicability based on technical feasibility, cost and net environmental impacts.
  - **Proposed rule** – practicability based on technical possibility and adverse environmental impacts.
- Defining upper and lower tiers:
  - **Current rule** – largely based on benthic toxicity.
  - **Proposed rule** – benthic toxicity, human health risks, background, analytical limits

Sediment Cleanup Standards – Lower Tier SMS Sections -560 through -564

- The lower tier integrates two sets of existing rule requirements:
  - Current SMS rule requirements based on benthic protection ("no adverse effects").
  - Current MTCA rule requirements for establishing Method B cleanup standards.
- These two rules also define the baseline conditions considered in the support economic and environmental analyses.



Sediment Cleanup Standards – Upper Tier SMS Sections -560 through -564



- Upper tier integrates the existing SMS rule w/ new requirements:
  - Current SMS benthic criteria ("minor adverse effects") with
  - Human health risk levels and regional background.
- The upper tier defines the maximum for a cleanup standard and initial identification of cleanup sites.

Sediment Cleanup Standards
SMS Section -561 – Protection of Human Health

- Target Risk Levels:
  - Lower tier: 10^{-6} risk for individual chemicals; HQ = 1
  - Upper tier: 10^{-5} total site risk; HI = 1
- Reasonable Maximum Exposure:
  - Site specific fish consumption rate.
  - Risk assessment based on tribal exposure.
- Toxicological Parameters: Use EPA toxicity values.
- Tissue testing: Allow tissue chemistry results to:
  - Screen chemicals of concern during RI/FS process.
  - Evaluate compliance with the sediment cleanup standard.

Sediment Cleanup Standards
SMS Section -563 – Freshwater Sediment Benthic Criteria

- **Current SMS rule:**
  - Two tier narrative standard (“no adverse effects” & “minor adverse effects”) implemented on a case-by-case basis.
- **Proposed SMS rule:**
  - Biological criteria based on protecting benthic community.
    - Seven acute and chronic sediment bioassays
    - Interpretation criteria for “no adverse effects” & “minor adverse effects”
  - Chemical criteria based on protecting benthic community.
  - Biological test results override chemical testing results.
  - Cleanup proponents may propose use of alternate methods.

Other Changes to Part V

- **Section 510/530:** Incorporated freshwater standards and human health/background revisions into site identification.
- **Section 550: Remedial Investigation/Feasibility Process** Updated to reflect MTCA requirements, clarified the process, reorganized information into one section.
- **Section -570: Remedy Selection:**
  - Updated to reflect MTCA requirements.
  - Use of permanent solutions.
  - Reorganized into one section.
- **Sediment Recovery Zones Section -590:** Updated to incorporate attainment of the sediment cleanup standard, and clarify recovery time frames.

Source Control Requirements

- Ecology is **not** proposing changes to Part IV (source control for NPDES permitted dischargers).
- Changes to sediment cleanup standards (Part V) will impact implementation of Part IV and MTCA upland cleanup actions.
  - PLPs must control their sources to prevent recontamination above cleanup standard (new requirement).
  - Dischargers must control sources in order to prevent creation of new cleanup sites (current requirement impacted by Part V revisions).
  - Soil and ground water cleanup standards must prevent sediment contamination above the sediment cleanup standards (current requirement impacted by Part V revisions).

SMS Rule Revisions Timeline

- **September 26**, 2012 – **October 4**, 2012: Public hearings.
- **October 29**, 2012: Public comment period ends.
- **October** 2012 through **December** 2012:
  - Review public comments
  - Revise proposed rule language
  - Revise preliminary cost benefit analysis
  - Revise draft environmental impact statement
- **January 2013**: Rule adoption (this is our goal)
- **Summer 2013**: Rule effective date
- **Summer 2013**: Finalized guidance to support the revised rule

Submit Comments by October 29, 2012

- **E-mail** your comments: RuleUpdate@ecy.wa.gov
- **Fax** your comments to: (360) 407-7154
- **Mail** your comments to:

  Department of Ecology
  Toxics Cleanup Program
  Adrienne Dorrah
  PO Box 47600
  Olympia, WA 98504-7600

SMS Rule Revisions
Materials

- Useful website links:
  - Proposed rule language
  - Draft Environmental Impact Statement
  - Draft Small Business Economic Impact Statement
  - Draft Cost Benefit Analysis/Least Burdensome Alternatives Analysis
  - Draft sediment cleanup guidance
- Frequently Asked Questions
- Focus Sheet
- Diagram of the SMS two tier decision framework

Guidance Development for Rule Revisions Updating Sediment Cleanup Users Manual II

- Current Sampling Analysis Plan Appendix information.
- Assessing human health risk.
- Implementing freshwater sediment standards.
- Establishing natural and regional background.
- Screening CoCs (tissue and sediment chemistry)
- Evaluating compliance at a cleanup site.
- Establishing practical quantitation limits at a cleanup site.
- Draft available as of September 5, 2012.

Contacts for the SMS Rule Revisions

- **SMS rule language** and general rule questions or comments:
  - Chance Asher, SMS rule technical lead
    - (360) 407-6914 chance.asher@ecy.wa.gov

- **SMS freshwater sediment standards**:
  - Russ McMillan, Freshwater standards technical lead
    - (360) 407-7536 russ.mcmillan@ecy.wa.gov

- **Fish consumption rates**:
  - Martha Hankins, Policy Unit supervisor
    - (360) 407- 6864 martha.hankins@ecy.wa.gov

Questions?

Regional Superfund Update (Puget Sound)

Shawn Blocker
Cleanup Program
USEPA Region 10

Mr. Blocker gave an oral presentation with a paper copy map as a visual aid. Please refer to the 2012 RSET meeting notes for the Puget Sound Superfund update.

Dredging BMPs: Examples from Navigation Dredging at Contaminated Sites

Tom Wang and Clay Patmont

October 17, 2012

Overview

- Contaminant release during dredging
- BMP drivers
- Types of MPs
- Lessons learned

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Hylebos, Middle, and Thea Foss Waterway Hydraulic/Mechanical Dredging and Nearshore Fill Disposal: 2002 - 2005

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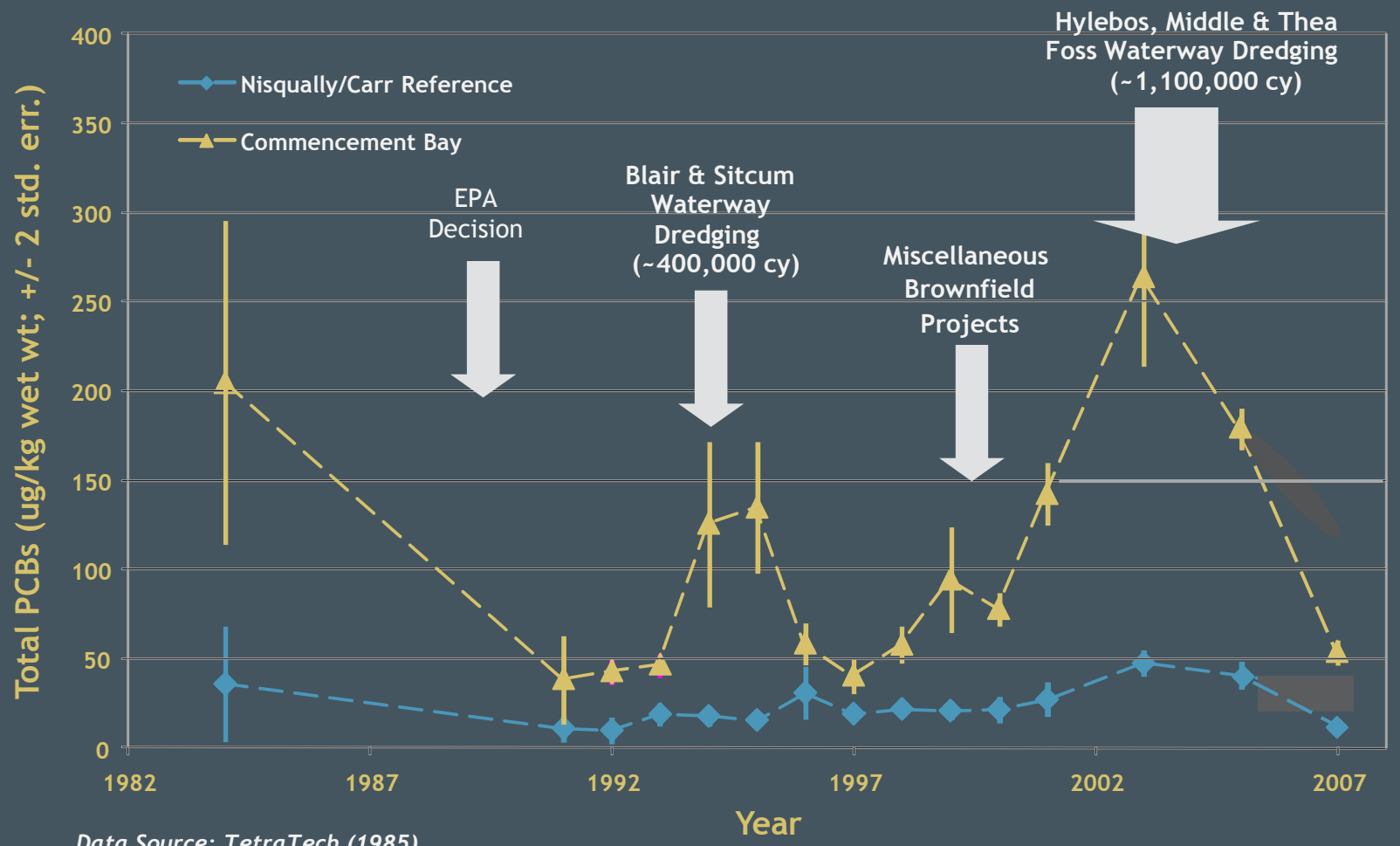
Dredging Increased Commencement Bay Fish Tissue PCB Concentrations



Data Source: TetraTech (1985), West and O'Neill (2007) & WDFW (2010)

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Duwamish River Mechanical Dredging and Off-Site Landfill Disposal: 2003 - 2005

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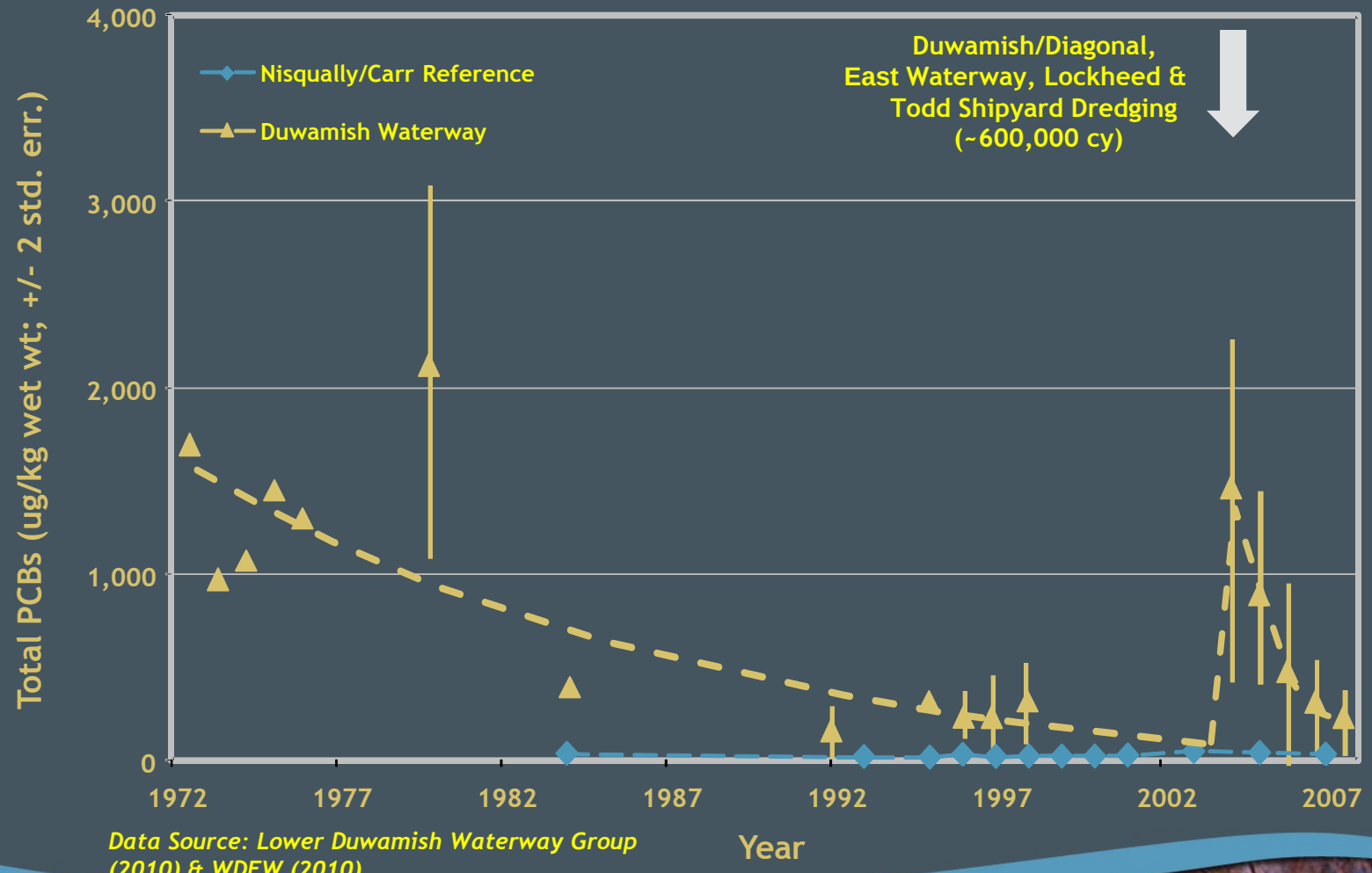
Dredging Increased Duwamish River Fish Tissue PCB Concentrations



Data Source: Lower Duwamish Waterway Group (2010) & WDFW (2010)

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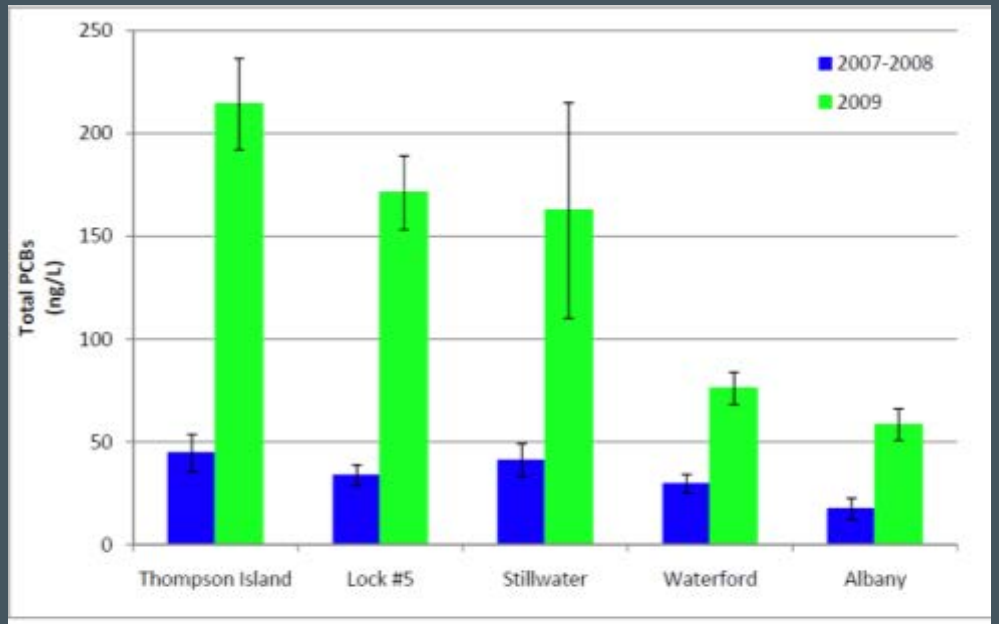

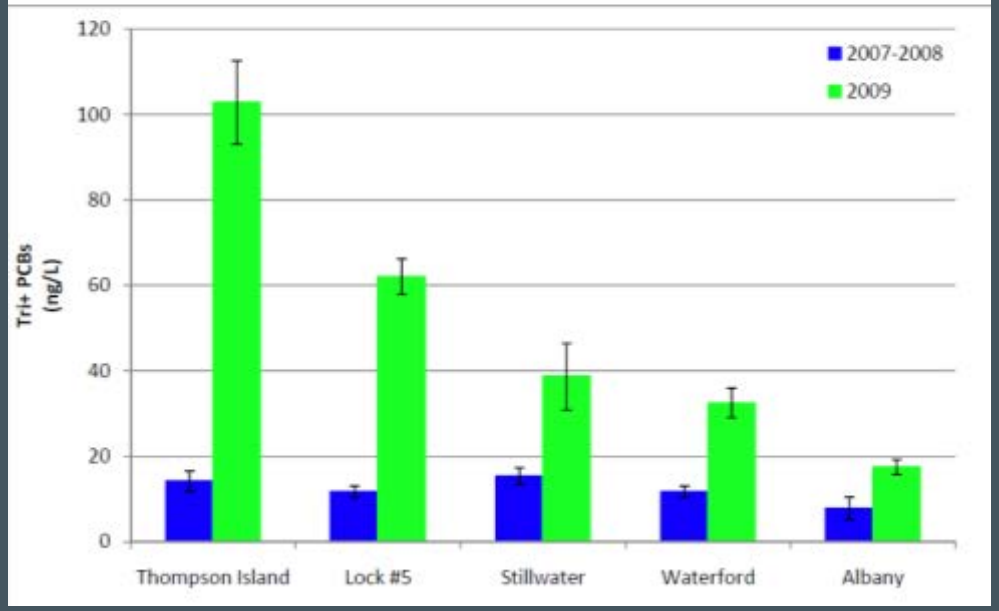

Data Source: Anchor QEA and Arcadis (2010)

Hudson River PCB Dredging Releases

- 2009 dredging sent ~3 percent of dredged mass downstream
- Controls largely ineffective and caused other problems

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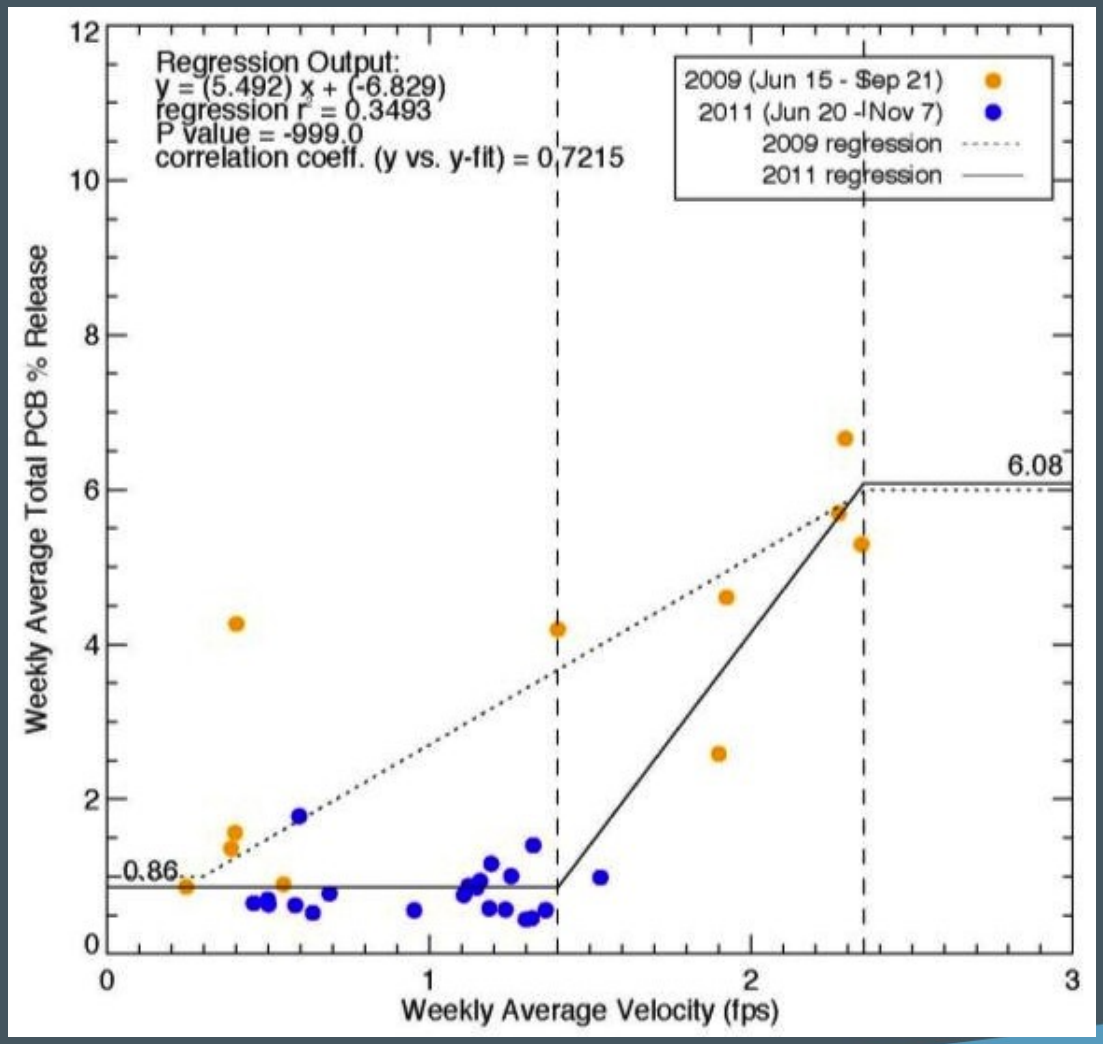
Percent Release at First Far-Field Station vs. Dredge Area Velocity: Hudson River



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Dredging Release Case Studies*

Project	Environmental Dredging Activity	BMPs	Source of Release Estimate	Contaminant Mass Released	Primary Reference
1995 Grasse River	3,000 cy hydraulic	Operation BMPs/ silt curtains	Caged fish monitoring	Fish tissue concentrations increased 5x to 50x	NAS Panel Presentation. November 8, 1999
1999-2000 Fox River	82,000 cy hydraulic	Operation BMPs/ silt curtains	Water quality monitoring	Average 2% (~30% dissolved)	Steuer, J.J. 2000
2004 Duwamish/ Diagonal	70,000 cy mechanical	Operation BMPs	Fate/transport and food web modeling to simulate measured fish tissue PCBs	Midpoint 3% (range: 1 to 6%)	Stern. J. H. 2007
2005 Grasse River	25,000 cy hydraulic	Operation BMPs/ silt curtains	Water quality monitoring	Average 3% (>50% dissolved)	Connolly J.P., Quadrini J.D., and McShea L.J. 2007
2005 Lower Passaic River	4,000 cy mechanical	Operation BMPs/ rinse tank	Water quality monitoring	Average 3 to 4% (range: 1 to 6%)	Lower Passaic River Restoration Project Team. 2009
2009 Hudson River	280,000 cy mechanical	Operation BMPs/ silt curtains	Water quality monitoring	Average 3 to 4% (~80% dissolved)	Anchor QEA and Arcadis. 2010
2011 Hudson River	360,000 cy mechanical	Operation BMPs	Water quality monitoring	Average 1% (~80% dissolved)	GE and Anchor QEA . Unpublished data. 2012

**** Note: preliminary data summaries; subject to revision***

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ERDC/EL TR-08-29

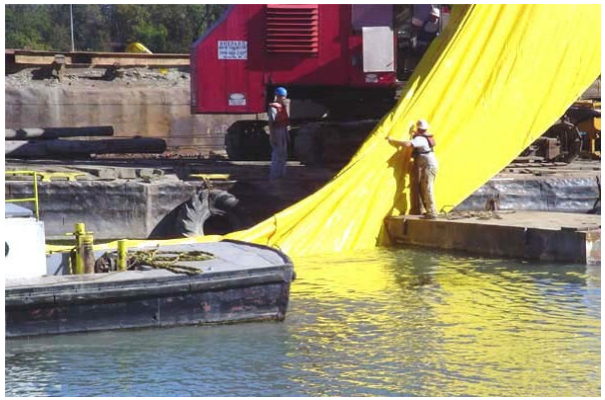
Environmental Laboratory

US Army Corps of Engineers®
Engineer Research and Development Center

Technical Guidelines for Environmental Dredging of Contaminated Sediments

Michael R. Palermo, Paul R. Schroeder, Trudy J. Estes, and Norman R. Francingues

September 2008



Approved for public release; distribution is unlimited.

PIANC
'Setting the course'

Report n° 100 - 2009

Dredging Management Practices for the Environment

A Structured Selection Approach

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BMP Drivers

- Sediment resuspension
  - Residuals and recontamination
  - Water quality
  - Impacts to benthic environment or fish
- Quality of Life
  - Air and odor
  - Noise
  - Lighting
  - Aesthetics

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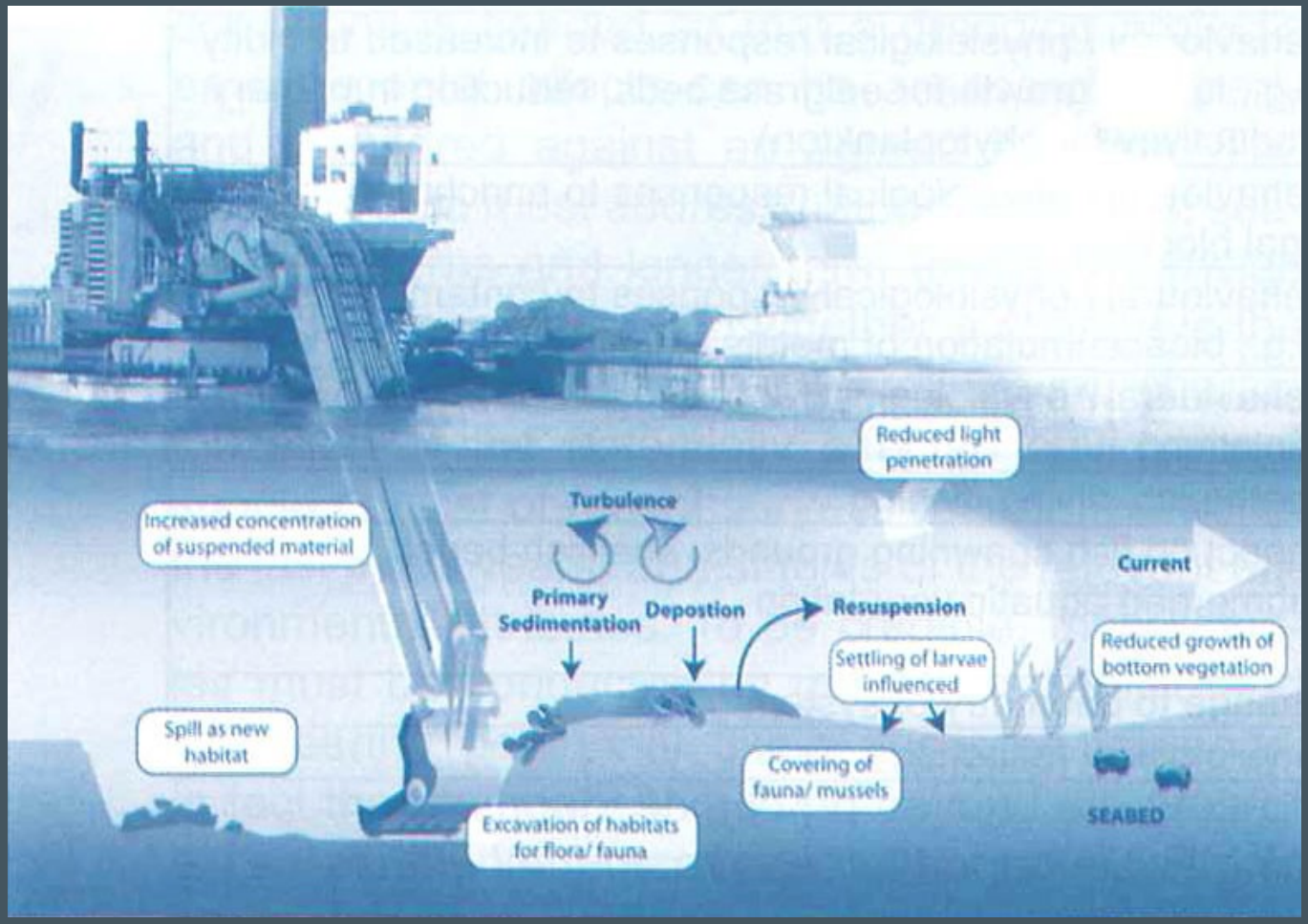
Resuspension Considerations

- Resuspension is affected by many factors:
  - Site conditions (e.g., currents, subsurface condition, bathymetry)
  - Sediment physical characteristics (e.g., grain size, in situ density, cohesiveness)
  - Presence of debris and obstructions
  - Operational factors (e.g., operator skill, equipment selection, production rates)
  - External influences (e.g., vessel propwash)
- TSS vs. Turbidity relationship is highly variable
  - Water quality monitoring can be ineffective indicator of residuals concern

Resuspension Considerations: Dredging



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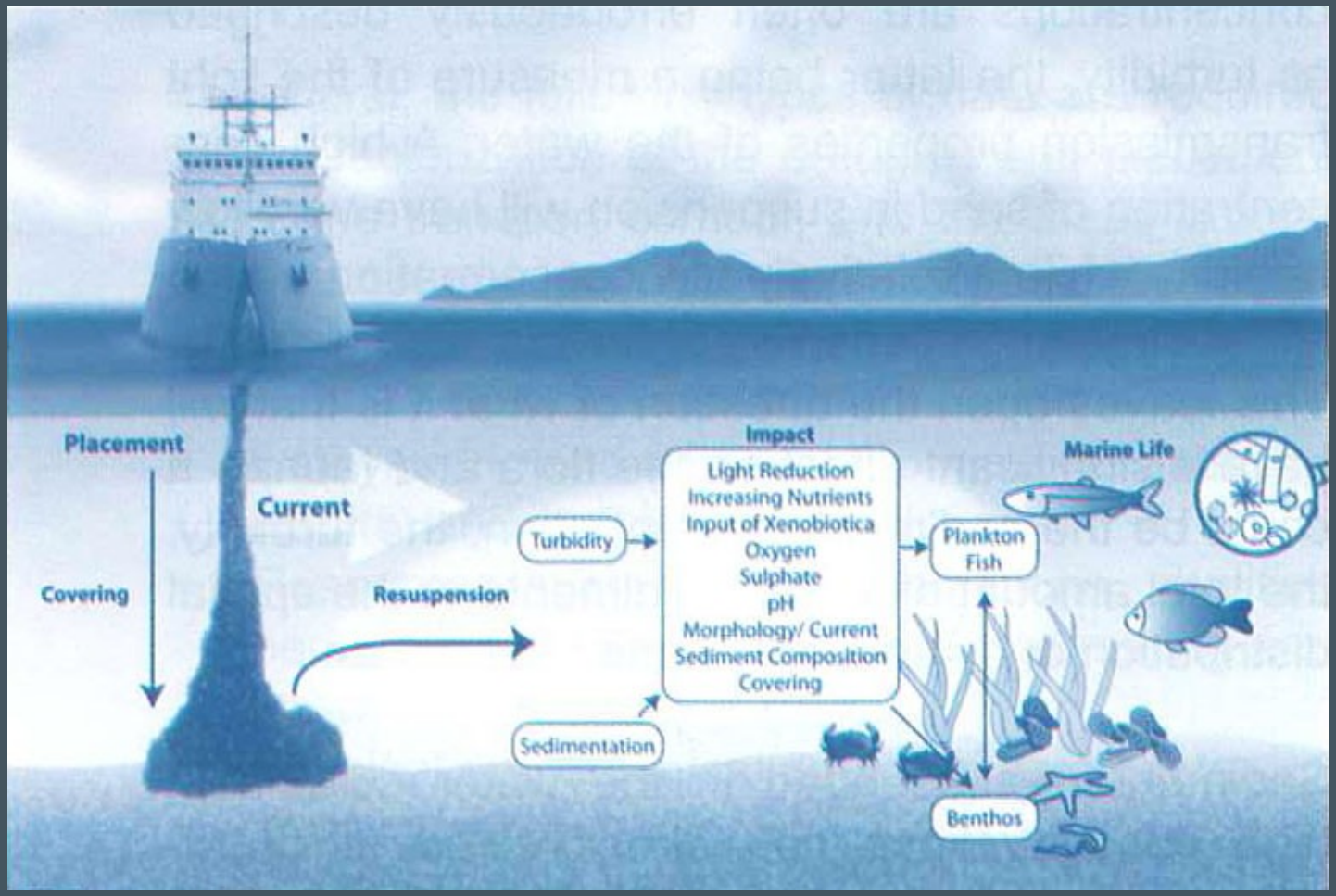
Resuspension Considerations: Placement/Capping



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Resuspension Considerations: Bucket and Barge Spillage

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Resuspension Considerations: Propwash

Los Angeles River Estuary Confined Aquatic Disposal

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Resuspension Considerations

- Assess short-term impacts in context of ambient conditions

Example Reference:
Literature Review of Effects of Resuspended Sediments Due to Dredging Operations. Prepared for Los Angeles Contaminated Sediments Task Force, Los Angeles, CA. Anchor Environmental (2003)

Norman Francingues, Jr., Control Measures 3 R's and Monitoring Presentation

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Residuals Terminology

- ***Undisturbed residuals*** - consolidated or intact contaminated sediments found at the post-dredging sediment surface uncovered by dredging but not fully removed

- ***Generated residuals*** - contaminated post-dredging disturbed surface sediments dislodged or suspended by the dredging operation and subsequently redeposited

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4Rs Literature

ERDC/EL TR-08-4

US Army Corps of Engineers®
Engineer Research and Development Center

Dredging Operations and Environmental Research Program

The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk

Todd S. Bridges, Stephen Ells, Donald Hayes, David Mount, Steven C. Nadeau, Michael R. Palermo, Clay Patmont, and Paul Schroeder

January 2008

Approved for public release; distribution is unlimited.

Integrated Environmental Assessment and Management — Volume 6, Number 4—pp. 619–630
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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††*

Enviro

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Types of BMPs

- Design strategies
- Resuspension controls
  - Operational controls
  - Specialized equipment to reduce loading
  - Containment options to limit spread
- Construction management approach
- Environmental monitoring

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Design Strategies

- Plan for residuals management early in process
- Integrate residuals management strategy and contingency actions with investigation, remedial design, and monitoring plans
- Strategize on using performance vs. method specifications (or combination)
- Develop contracting strategy
- Consider performing constructability and value engineering reviews

Resuspension Controls

- Operational controls
- Specialized equipment to reduce loading
- Containment options to prevent spreading

Grasse River Pilot Study (GAC)

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Resuspension Controls

- Dredging operational controls
  - Require experienced dredge operator
  - Real Time Kinematic (RTK) positioning
  - Lowering production rate reduces loading
  - Work during specific tides (ebb/flood vs slack)
  - Conduct debris removal prior to dredging
  - Adaptively adjust dredge plant operations
    - Mechanical (bucket cycle modifications)
    - Hydraulic (cut depth and swing speed)
  - Minimize propwash impacts where practical
  - Anchoring restrictions
  - Do work in the “dry” at low tide

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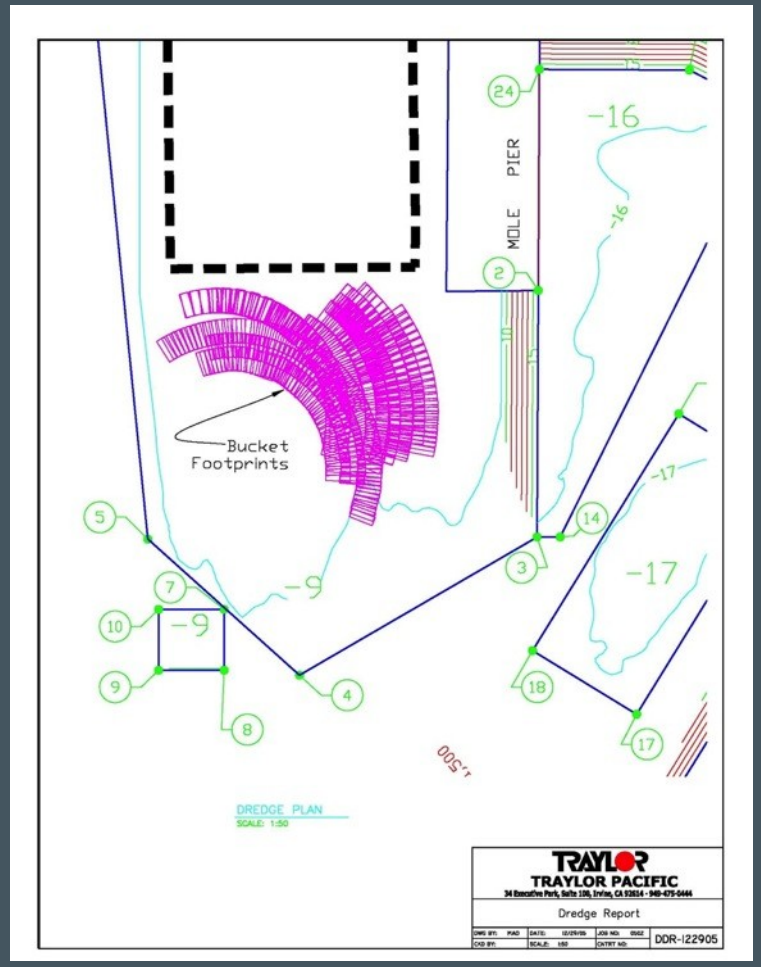
Dredging Operational Controls
RTK Positioning



Campbell Shipyard Remediation

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Dredging Operational Controls
RTK Positioning

Denny Way CSO Remediation

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Dredging Operational Controls
Debris Removal Prior to Dredging

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Resuspension Controls

- Offloading operational controls
  - Spill plate
  - Spanning barge
  - Contained landside facility
  - Temporary capping of upland stormdrains

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Offloading Operational Controls

Alcoa Vancouver Cleanup

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Offloading Operational Controls

East Waterway Removal Action

ANCHOR QEA

Offloading Operational Controls

Todd Shipyard Remediation

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Resuspension Controls

- Transport operational controls
  - Barge transport
    - Specify no barge overflow or effluent release
    - Balanced loading of barges and specify minimum freeboard
    - Marine surveyor certification of transport vessel sea-worthiness
    - Limit transport during acceptable sea-state
  - Upland transport using lined trucks or containers
    - Truck wheelwash
  - Hydraulic transport using double walled pipeline

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Transport Operational Controls

Campbell Shipyard Remediation

ANCHOR QEA

Transport Operational Controls

Port of Olympia Pilot Dredging

ANCHOR QEA

Transport Operational Controls

Fox River Cleanup

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Resuspension Controls

- Placement/capping operational controls
  - Require experienced dredge operator
  - RTK positioning
  - Controlled placement methods
    - Controlled barge discharge
    - Bucket placement (above water)
    - Tremie tube
    - Hopper or pipeline discharge
    - Hydraulic spray
    - Conveyor (telebelt) placement
  - Diffuser to reduce energy of placed materials
  - Do work in the “dry” at low tide

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Placement/Capping Operational Controls: Barge Placement

Port Hueneme (U.S. Army Corps of Engineers, U.S. Navy)

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Placement/Capping Operational Controls: Bucket Placement

Georgia Pacific Log Pond Capping

ANCHOR QEA

Placement/Capping Operational Controls: Tremie and Conveyor

ANCHOR QEA

Placement/Capping Operational Controls: Hydraulic Spray

Eagle Harbor Thin Layer Capping

ANCHOR QEA

Placement/Capping Operational Controls: Telebelt Conveyor

Todd Shipyard Underpier Capping

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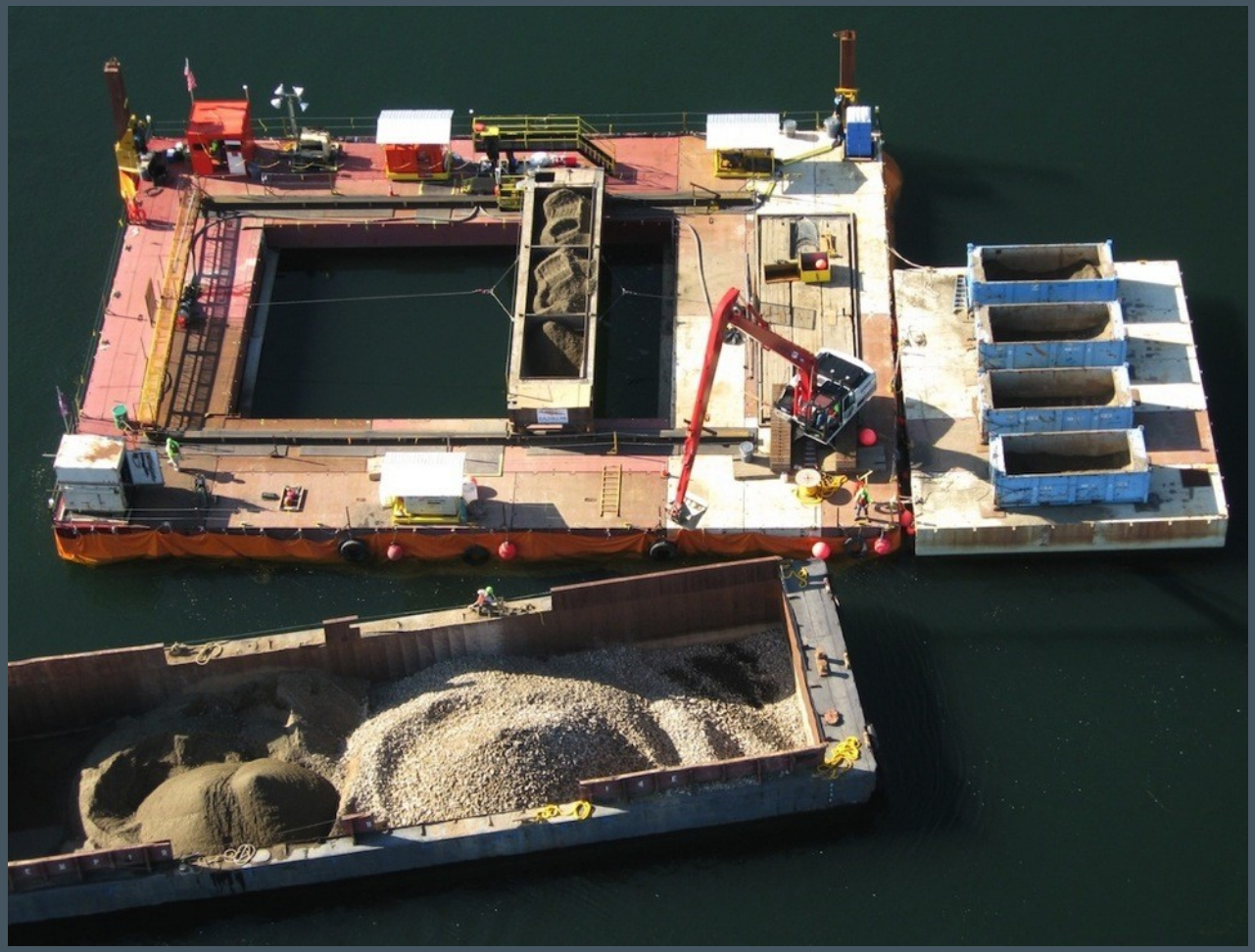
Placement/Capping Operational Controls: Customized Equipment



Grasse River Capping

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Placement/Capping Operational Controls Diffuser

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Specialized Equipment: Closed Bucket Overview

- Combination of covers, exterior pulleys and sealed joints
- Intent is to reduce loss of sediment from bucket
- Typically used with special operational constraints when attempting to minimize resuspended sediments
- Not designed for digging; typically restricted to dredging loose, unconsolidated material

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Specialized Equipment: Closed vs. Conventional Buckets

- Effectiveness at reducing resuspended sediment impacts
  - Closed buckets can be more effective than conventional buckets if used in appropriate site conditions
  - Prior projects using closed buckets have mixed results in reducing resuspension
- Typically lower dredging production rates
- Unit costs directly related to production rate

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Specialized Equipment: Closed Bucket Effective Conditions

- Dredge material has a very loose consistency. SPT blow counts less than or equal to approximately 5 blows per foot
- Dredge material has low percentage of cohesive material, such as clay
- Dredge site has minimal debris
- Dredge site has consistent material type throughout the dredge prism
- Ideally, assess feasibility using SPT results

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Closed Bucket

Port or Portland Terminal 4 Remediation

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Closed Bucket

ANCHOR QEA

Closed Bucket

ANCHOR QEA

Horizontal Profile Grab Bucket

Bean Dredging, Dredge Bonacavair

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Resuspension Controls

- Containment options to limit spread
  - Silt curtain
  - Cofferdam
  - Caisson

Grasse River Cleanup

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Resuspension Controls: Silt Curtain Overview

- Typically defined as a temporary flexible barrier deployed in water to prevent the spread of suspended sediment and turbidity
- Many variations exist but standard curtain does not control dissolved contaminants
- ERDC TN-DOER-E21 provides guidance
- Silt curtains may be an effective resuspension control but only if they are designed specifically for the site conditions and are frequently maintained

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Resuspension Controls: Silt Curtain Overview

- Silt curtains often have limited effectiveness (e.g., most systems can not extend the full water column depth, maintenance is neglected) and have significant impacts on construction activities
- Site conditions need to be fully understood in order to properly design and maintain a silt curtain system (tides, currents, debris)
- Careful consideration is needed before adding silt curtains as an MP

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Silt Curtains

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Silt Curtains

Oil boom deployment (near field) and silt curtains (far field)

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Cofferdam

Housatonic Cleanup

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Caisson Dredging and Backfill

Rock Bay, Barclay Point Remediation

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Dewatered Caisson Interior

Rock Bay, Barclay Point Remediation

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Construction Management Approach

- Consider using adaptive management approach during construction
  - Can prevent problems from escalating into claims
  - Need to carefully consider how to direct contractor without providing basis for claims
  - Requires intensive construction management (CM) support and staffing
- Site conditions, project complexity and uncertainty will drive the need for adaptive management

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Environmental Monitoring

- Monitoring to provide timely results during construction is critical component to adaptive management approach
  - Water quality as indicator of resuspension
  - Placement accuracy and thickness for capping
  - Disposal site monitoring
    - Tracking capacity
    - Loss of contaminants
  - QOL parameters
    - Air/odor
    - Noise
    - Light

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Lessons Learned

- Identify site specific risk drivers that may require adopting BMPs
- Project approach should not treat BMPs as a set of independent engineering design criteria. It's important to address BMPs holistically and in an integrated fashion
- BMP approach should consider impacts to production, schedule and cost, and balance against environmental risks
- Residuals will occur, so plan for residuals early in the project process

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Lessons Learned

- Integrate residuals management strategy and contingency actions with investigation, engineering design and monitoring design
- It is important to consider the following when establishing BMPs:
  - Performance vs. method specifications
  - Contracting strategy
  - QOL concerns
  - Adaptive management approach
    - Construction management
    - Environmental monitoring

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Questions?

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