DREDGED MATERIAL MANAGEMENT PROGRAM

Puget Sound Dredged Disposal Analysis
Grays Harbor/Willapa Bay Evaluation Procedures
NW Regional Sediment Evaluation Framework (WA)

BIENNIAL REPORT

Dredging Years 2012/2013

PREPARED BY THE DMMP AGENCIES

US Army Corps of Engineers®

WASHINGTON STATE DEPARTMENT OF Natural Resources

EPA United States Environmental Protection Agency

DEPARTMENT OF ECOLOGY State of Washington

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Grays Harbor/Willapa Bay Evaluation Procedures
Lower Columbia River Evaluation Framework (Washington)

BIENNIAL REPORT

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LIST OF ACRONYMS

AD	Antidegradation
ADFW	Ash-Free Dry Weight
BT	Bioaccumulation Trigger
BU	Beneficial Use
COC	Chemical of Concern
CY	Cubic Yard
DMMO	Dredged Material Management Office
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DNR	Washington Department of Natural Resources
DY	Dredging Year
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FC	Full Characterization
HPA	Hydraulic Project Approval
HPAH	High-molecular-weight PAH
LPAH	Low-molecular-weight PAH
ML	Maximum Level
MTCA	Model Toxics Control Act
MPR	Management Plan Report
MPRSA	Marine Protection, Research and Sanctuaries Act
NMFS	National Marine Fisheries Service
O&M	Operations and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PPB	Parts per Billion
PPM	Parts per Million
PPTR	Parts per Trillion
PSDDA	Puget Sound Dredged Disposal Analysis
QA/QC	Quality Assurance/Quality Control
RSET	Regional Sediment Evaluation Team
SAP	Sampling and Analysis Plan
SDM	Suitability Determination Memorandum
SEF	Sediment Evaluation Framework
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SL	Screening Level
SQS	Sediment Quality Standard
TBT	Tributyltin
TEQ	Toxic Equivalency
TOC	Total Organic Carbon
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

CHAPTER 1. INTRODUCTION AND PROJECT OVERVIEW

1.1 Introduction

The Dredged Material Management Program (DMMP) is an interagency approach to the management of dredged material in the State of Washington. The four cooperating agencies are: U.S. Army Corps of Engineers, Seattle District; U.S. Environmental Protection Agency, Region 10; Washington Department of Ecology; and Washington Department of Natural Resources. The DMMP applies dredged material evaluation guidelines to federal and permitted projects in Washington State. These guidelines were originally developed for the Puget Sound Dredged Disposal Analysis program in the 1980s, and expanded to cover Grays Harbor and Willapa Bay in 1995. The DMMP agencies modify the evaluation guidelines, as needed, through an annual review process.

In 2002, the Regional Sediment Evaluation Team (RSET) was initiated to establish dredged material evaluation guidelines that would be applicable throughout the states of Washington, Oregon and Idaho. One goal of RSET was the consolidation of the existing regional guidance manuals into one "umbrella" document, allowing consistent evaluation of dredging projects across the region. This document, called the Northwest Regional Sediment Evaluation Framework (SEF), was published in May 2009.

Integration of guidance from RSET - the larger regional program, and DMMP – the Washington-specific program – is an ongoing process. Projects in Washington State (with the exception of port projects on the north side of the Columbia River) use the DMMP User Manual for SAP preparation and data review. Elements from SEF, such as freshwater bioassays, are used for projects in Washington State on a case-by-case basis to augment the guidance found in the DMMP User Manual.

This report summarizes DMMP activities for Dredging Years (DY) 2012 and 2013. As defined by the DMMP agencies, DY12 covers the period from June 16, 2011 to June 15, 2012, and DY13 covers the period from June 16, 2012 to June 15, 2013.

1.2 Project Overview

During DY12/13 there were 46 projects for which the DMMP agencies completed some kind of action or determination. These projects are summarized in Tables 1-1 and 1-2. Many were full characterizations (FC) of a project area, intended to assess the suitability of the proposed dredged material for open-water disposal and evaluate the quality of the sediment to be exposed by dredging. Full characterizations result in a suitability determination memorandum (SDM), signed by the DMMP agencies, that summarizes the results of the FC and provides an official determination regarding suitability for open-water disposal. Other DMMP actions include volume revisions, recency extension, Tier 1 evaluations, and standalone anti-degradation evaluations.

As listed in Tables 1-1 and 1-2, 26 projects had DMMP suitability determinations or other actions completed by June 15, 2012 and are considered DY12 projects. Another 20 projects had DMMP suitability determinations or other actions completed by June 15, 2013 and are considered DY13 projects. Puget Sound project locations for DY12 and DY13 are plotted in Figures 1-1 and 1-2, respectively. Projects in Grays Harbor and Willapa Bay for both years are shown in Figure 1-3. Projects on the Columbia River for the biennium are shown in Figure 1-4.

The DMMP agencies reviewed and approved sampling and analysis plans (SAPs) for another 15 projects during DY12/13, but suitability determinations for these projects were not completed before the end of DY13. These projects are listed in Table 1-3 but are not discussed in the remainder of the report.

Chapter 2 includes tables related to project-specific ranking, sampling, testing and suitability determinations. Information regarding no-test determinations, recency extensions, frequency determinations, volume revisions and antidegradation evaluations is also presented. Chapter 3 presents an overall assessment of sampling and testing activities, including an evaluation of regulatory processing time. Chapter 4 provides details of projects that were complex in nature or where the application of best professional judgment by the agencies was necessary. Chapter 5 reviews disposal-site monitoring activities during DY12/13.

Appendices A and B include the chemical and biological evaluation guidelines respectively. Appendix C tabulates exceedances of those guidelines.

Table 1-1. DMMP Evaluation Activities Completed in DY12.

PROJECT	DMMP Action	Disposal Area/Type	Project Volume (cy)	SAP DY
Bay Center Mariculture Dock, Willapa Bay	T1	WB	<1,000	- - -
City of Chelan, Don Morse Park	SD	BU	8,000	2011
City of Renton Municipal Airport Seaplane Base	RE	PSDDA	- - -	- - -
Deer Harbor Boatworks, Orcas Island	T1	BU	114	- - -
Deschutes River Estuary Restoration (Capitol Lake)	T1	BU	500,000	- - -
Harbour Village Marina, Lake Washington	SD	PSDDA	7,427	2011
J.A. Jack and Sons	AD	PSDDA	<1,000	2012
LaFarge North America	SD	PSDDA	24,000	2010
Point Roberts Marina Sand Bypass Operation	T1	PSDDA	10,000	- - -
Port of Anacortes Cap Sante Boat Haven – M,N,O-Docks	SD	PSDDA	12,000	2012
Port of Brownsville Marina	SD	PSDDA	17,500	2012
Port of Everett Marina, Phase 1	VR	PSDDA	39,500	- - -
Port of Everett Pacific Terminal	RE	PSDDA	- - -	- - -
Port of Grays Harbor Terminal 3	SD	GH	74,000[1]	2012
Port of Tacoma Husky Terminal	SD	PSDDA	42,100	2011
Port of Willapa, Bay Center Marina Entrance Channel	SD/VR	WB	60,000	2012
Seattle Iron and Metals	SD	PSDDA	28,000	2012
US Naval Air Station Whidbey Island Fuel Pier	VR	PSDDA	35,000	- - -
US Navy Big Beef Creek Estuary Restoration	SD	PSDDA	125,000	2011
USACE Bellingham O&M (dioxin evaluation)	SS	PSDDA	139,865	2012
USACE Duwamish O&M	SD	PSDDA	127,093	2011
USACE Grays Harbor O&M	SD	GH	1,650,000	2012
USACE Keystone O&M	SD	PSDDA/BU	60,000	2011
USACE Quillayute O&M, Boat Basin	VR	CW	60,000	- - -
USACE Snohomish O&M	RD/SD/RE	PSDDA	651,571	2012
USACE Swinomish O&M	VR	PSDDA	340,000	- - -

[1]Testing assessed 67,000 cy of new dredged material, excluding ~7,000 cy of overlying material previously characterized in August 2008 SDM.

DMMP Actions
AD = Anti-degradation Determination
RD = Re-ranking Determination
RE = Recency Evaluation
SAP = Sampling and Analysis Plan Review
SD = Suitability Determination
SS = Special Study
T1 = Tier 1 Evaluation
VR = Volume Revision

Disposal Area/Type
BU = Beneficial Use
CR = Columbia River
CW = Coastal Washington
GH = Grays Harbor
PSDDA = Puget Sound Dredged Disposal Analysis
UP = Upland
WB = Willapa Bay

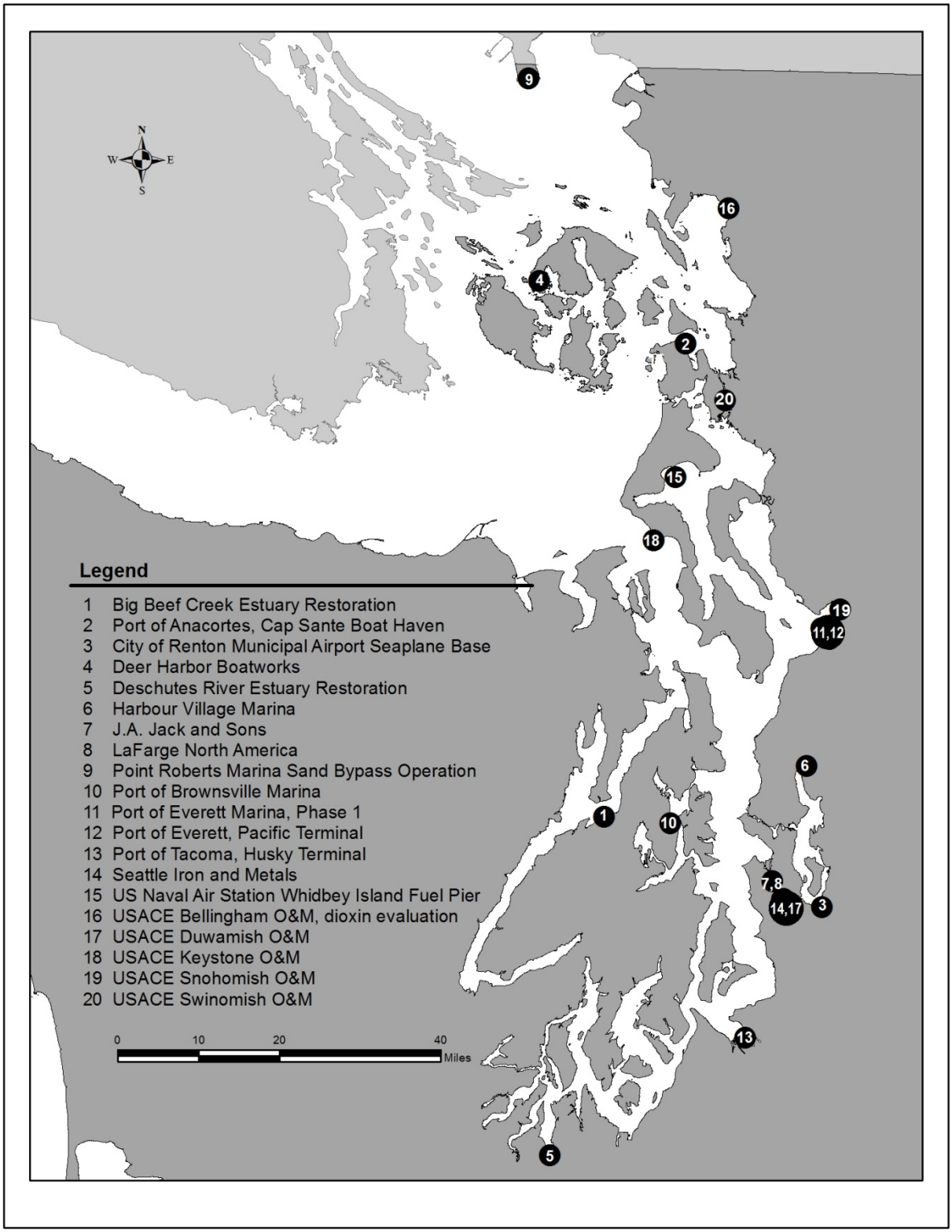

Figure 1-1. DY12 Puget Sound Project Locations

Table 1-2. DMMP Evaluation Activities Completed in DY13

PROJECT	DMMP Action	Disposal Area/Type	Project Volume (cy)	SAP DY
Bay Head Marina	SD	PSDDA	20,000	2013
Birch Bay Village Marina Entrance Channel	T1	BU	2,000	- - -
Christensen Shipyards	SD	CR	10,000	2012
City of Kenmore, Navigation Channel & Vicinity	SS	PSDDA	- - -	2013
Delta Marine Industries	RD	PSDDA	- - -	- - -
Grant County PUD, Frenchman Coulee Boat Ramp	T1	BU	950	- - -
Georgia Pacific Camas Slough	AD	UP	- - -	- - -
LD Commodities NW, Snake River	T1	BU	45	- - -
Newport Yacht Club	RE	PSDDA	- - -	- - -
Olympia Yacht Club	SD	PSDDA	16,241	2012
Port of Anacortes, Pier 2 & Curtis Wharf	SD	PSDDA	13,500	2013
Port of Clarkston, Crane Dock	SD	BU	2,050	2013
Port of Kingston Marina	SD	PSDDA	17,000	2013
Salmon Bay Marina	SD	PSDDA	11,900	2012
Simpson Lumber, Oakland Bay	AD	UP/BU	135	2013
USACE Duwamish Subsurface Investigation	SS	- - -	- - -	2013
USACE Duwamish – DMMU 15	AD	PSDDA	- - -	2013
USACE Grays Harbor Navigation Improvement Project	SD	GH	1,973,812	2012
USACE Grays Harbor Channel Realignment	T1	- - -	- - -	- - -
WSDOT SR520 Pontoon Constr., Aberdeen Log Yard	VR	GH	30,000	- - -

DMMP Actions
AD = Anti-degradation Determination
RD = Re-ranking Determination
RE = Recency Evaluation
SAP = Sampling and Analysis Plan Review
SD = Suitability Determination
SS = Special Study
T1 = Tier 1 Evaluation
VR = Volume Revision

Disposal Area/Type
BU = Beneficial Use
CR = Columbia River
CW = Coastal Washington
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PSDDA = Puget Sound Dredged Disposal Analysis
UP = Upland
WB = Willapa Bay

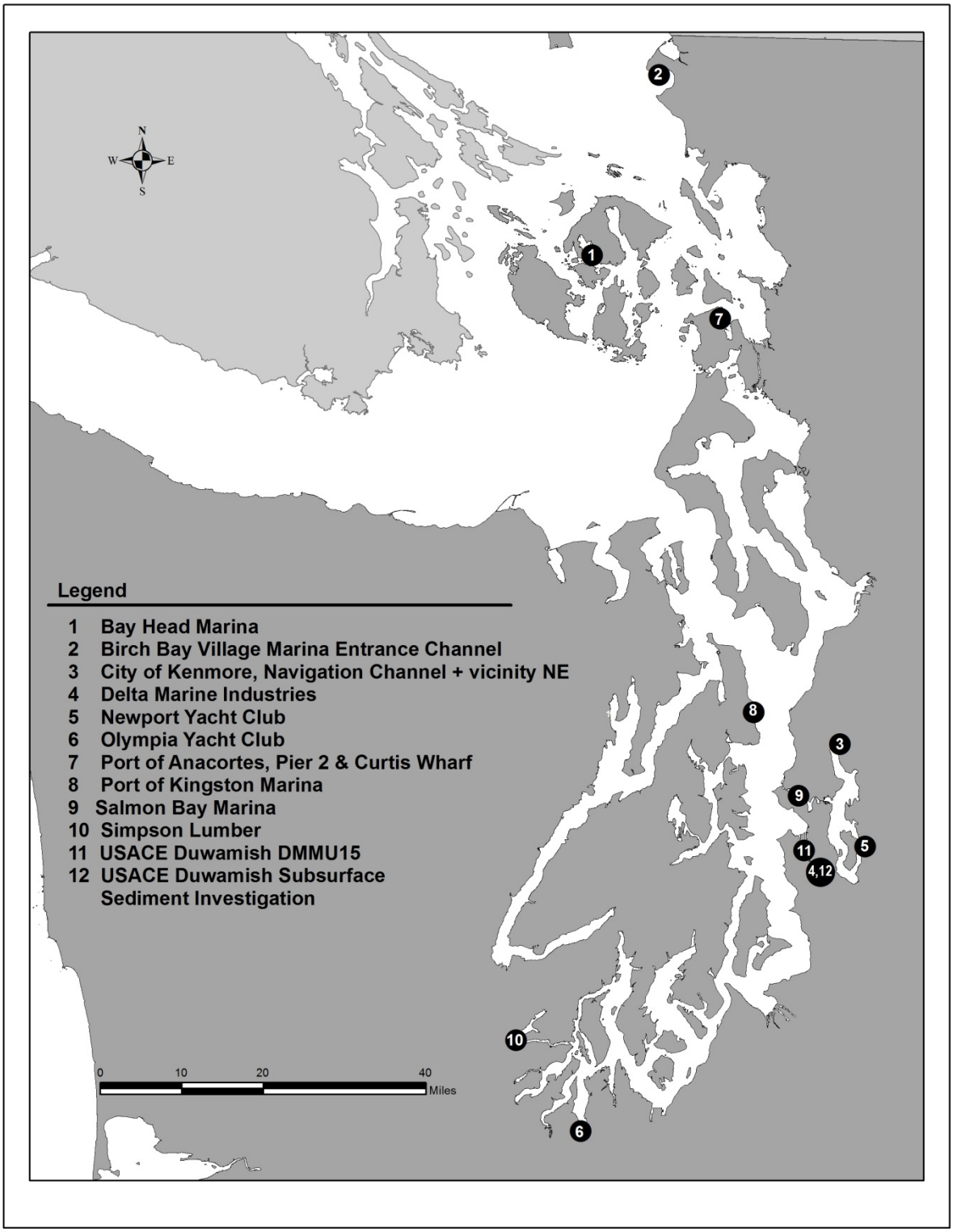


Figure 1-2. DY13 Puget Sound Project Locations

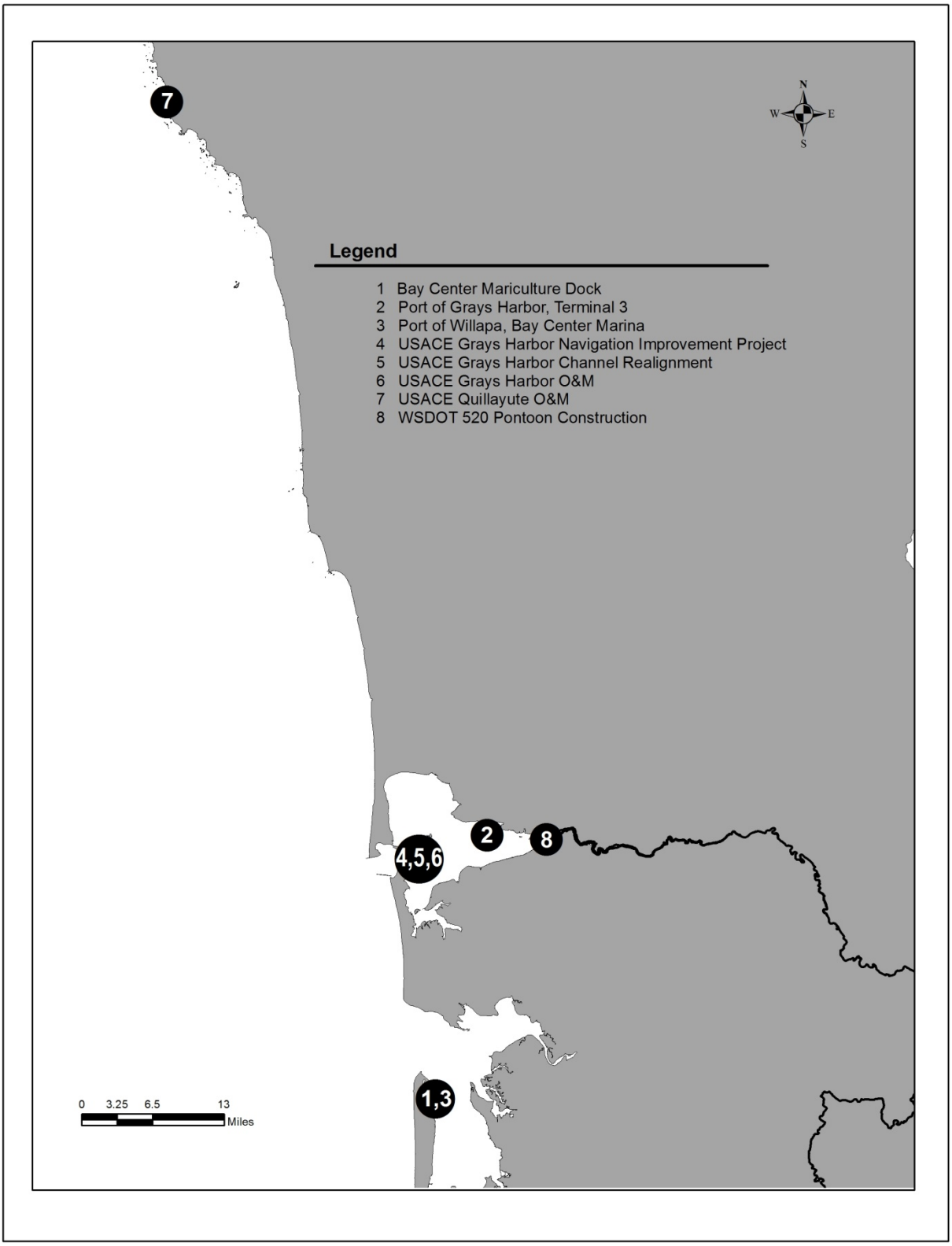


Figure 1-3. DY12/13 Coastal Project Locations

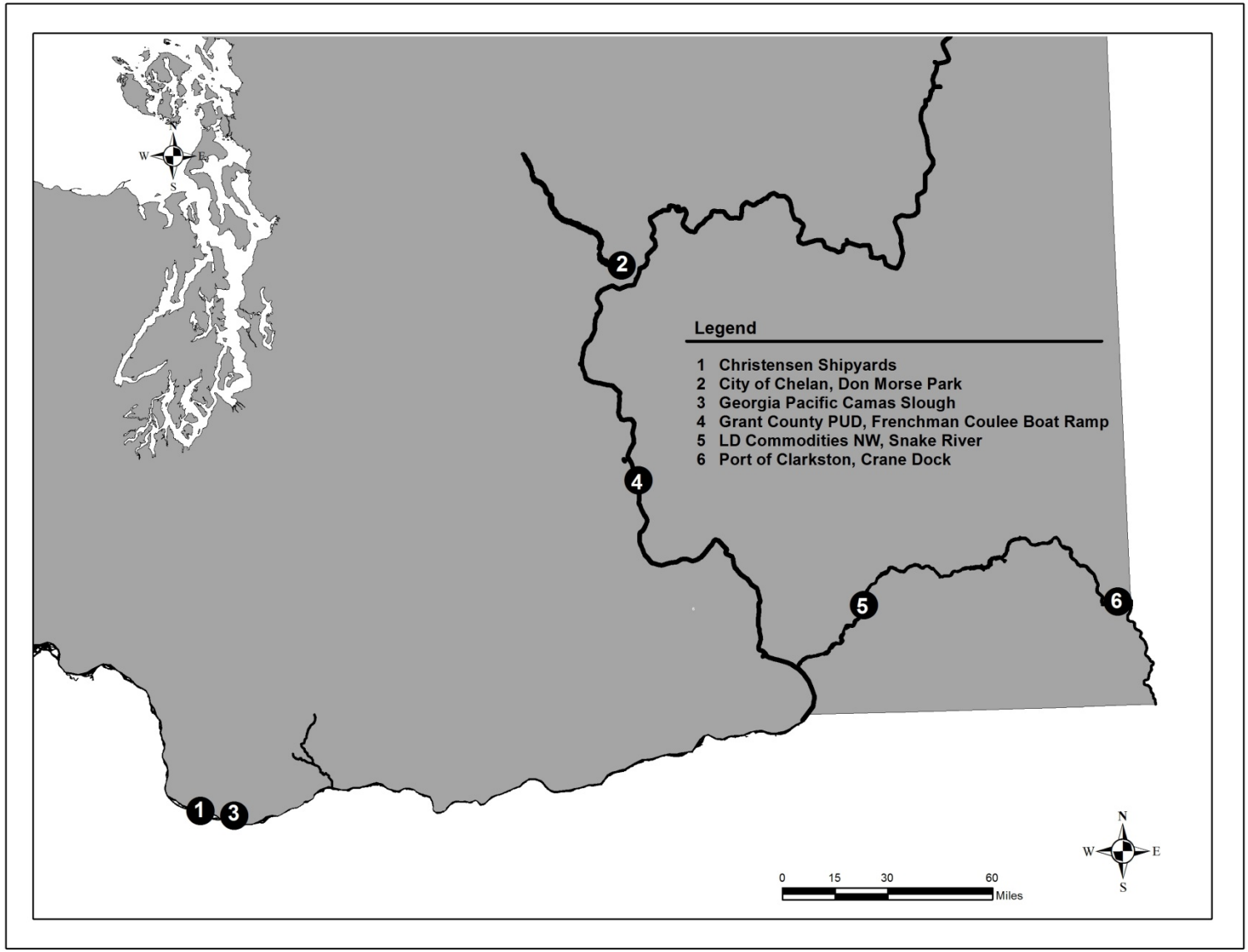


Figure 1-4. DY12/13 Columbia River and Eastern Washington Project Locations

Table 1-3. DMMP Evaluation Activities Initiated in DY12/13, but ongoing into DY14

PROJECT	DMMP Action	Project Volume (cy)	SAP Review DY	Status at end of DY13
Cape George Colony Club Marina	T1	5,000	13	Waiting for data report
City of Port Angeles Waterfront Development	NE	23,000	12	Data report submitted to Ecology DY12, no further DMMP involvement
Dunlap Towing, Budd Inlet, Olympia,	FC	4,814	12	SAP approved
Duwamish Yacht Club	FC	20,000	13	Waiting for data report
Kittitas County Boat Ramp Recreational Improvement Project	FC	12,280	13	SD in preparation
Longview Fibre Paper and Packaging	FC	316,348	13	Waiting for data report
MJB Travelift	FC	1,350	13	Sampling complete
Owl Creek (Cowlitz River)	FC	5,400,000	12	Project abandoned
Port of Olympia, Berth and Swantown	NE/AD	39,000	13	SD in preparation
Port of Seattle, T5	FC	7,490	13	Waiting for data report
Port of Tacoma, Pier 4 Reconfiguration	FC	550,000	13	Sampling in process
Silver King Resort	FC	7,300	13	SD in preparation
Snake River O&M	FC	500,000	13	SAP approved
U.S. Navy Bangor Electromagnetic Measurement Ranging System	FC	20,500	13	Waiting for data report
WSDOT Mukilteo Multimodal Project	FC	23,500	13	SAP approved

NE = Nature and Extent (MTCA)
FC = Full Characterization
AD = Anti-degradation Determination
SD = Suitability Determination

CHAPTER 2. DY12/13 PROJECTS

This chapter presents project-specific information related to the evaluation of DY12/13 projects. Sections 2.1 through 2.8 pertain only to those projects that underwent sediment testing – including full, partial, supplemental, anti-degradation, and exclusionary characterizations. Sections 2.9 through 2.11 address those projects for which Tier 1 determinations, recency extensions, or volume revisions were completed. Section 2.12 deals with special studies that involved sediment sampling and testing, but did not result in a suitability determination.

2.1 Ranking

Project ranking is based on the probability of sediments in a project area having elevated concentrations of chemicals of concern. Sampling and analysis requirements are determined, to a large extent, by the project ranking. The DMMP agencies have established ranks for geographic areas (e.g., Elliott Bay) and activities (e.g., marinas) based on historical data or the presence of active sources of contamination. Ranking guidance for Puget Sound, Grays Harbor and Willapa Bay can be found in the 2013 DMMP User Manual. Ranking guidance for projects on the Columbia River can be found in the Northwest Regional Sediment Evaluation Framework document.

Adjustment of the initial ranking is possible if the historical data at the site are adequate; if the applicant conducts a partial characterization (PC); or in special cases where additional information is available. If the PC chemistry data support a lower ranking, sampling and analysis requirements may be reduced during the full characterization (FC), commensurate with the revised ranking. Chemicals of concern may also be eliminated for analysis during the FC, based on the PC data. There were no partial characterizations completed during DY12/13.

Projects that underwent DMMP sediment sampling and testing in DY12/13 and had an adjustment to their 'initial rank' are shown in Table 2-1. The 'final rank' reflects the adjustments made by the DMMP agencies prior to sediment characterization, or – in the case of the Port of Anacortes Pier 2 project – following characterization.

The USACE Quillayute O&M Boat Basin/Marina project was initially ranked moderate. According to the guidelines for down-ranking outlined in the DMMP User Manual, a project can be down-ranked after two rounds of testing. This project was down-ranked to low based on the results of two previous rounds of testing, each demonstrating that all chemicals of concern (COCs) in the dredged material were detected or non-detected at levels lower than the SLs.

USACE Snohomish O&M was originally ranked low-moderate. After multiple rounds of testing showed the material to be suitable, the DMMP agencies re-evaluated the ranking of the Snohomish River O&M project for the DY12 characterization such that: 1) no testing of the most upstream shoal in the channel was required because it has consistently been shown to consist of gravel and cobble; 2) all the material in the upstream turning basin and shallow navigation channel between settling basins required only a confirmatory level of sampling – one sample per 20,000 cy and one analysis per 100,000 cy; and 3) the downstream settling basin was ranked low. This re-ranking of the Snohomish O&M project only applied to the DY12 characterization.

Delta Marine Industries was initially ranked high due to its location within the lower Duwamish Waterway. The DMMP agencies reviewed the results from the two previous rounds of testing (2001 and 2007) and found that the project would qualify for a low rank, if rank were based solely on the project data. However, considering the location of the project on the Duwamish River and the potential for sources of contamination in the area, the DMMP agencies determined the appropriate rank for the project was low-moderate.

The Port of Anacortes Pier 2/Curtis Wharf project was initially ranked moderate. Results of the DY13 dredged material characterization revealed high TBT in the Pier 2 area, with porewater TBT at 0.38 μg/L (BT = 0.15 μg/L). Due to the BT exceedance, future characterizations of the Port of Anacortes Pier 2 area will be ranked high.

Table 2-1. DY12/13 Project Rank Changes

PROJECT	DY	Location	Waterbody	Initial Rank	Final Rank
Delta Marine Industries	13	Seattle, WA	Duwamish River	H	LM
USACE Quillayute O&M Boat Basin/Marina	12	La Push	Quillayute River	M	L
USACE Snohomish O&M	12	Everett	Snohomish River	LM	L/C/NT
Port of Anacortes Pier 2	13	Anacortes, WA	Guemes Channel	M	H

Ranking:
NT = No Test
C = Confirmatory
L = Low
LM = Low-moderate
M = Moderate
H = High

2.2 Sampling and Analysis Plans

A sampling and analysis plan (SAP) must be prepared by the applicant and approved by the DMMP agencies before sediment samples are collected. The sampling and analysis requirements are determined by the volume of surface and subsurface dredged material and the rank. The minimum number of field samples and dredged material management units for full characterization are calculated as follows:

Table 2-2. DMMP Sampling Requirements

Project Rank	Maximum Volume Represented by a Field Sample (CY)	Heterogeneous Sediment		Homogeneous Sediment DMMUs (CY)
		Surface[1] DMMUs (CY)	Subsurface[1] DMMUs (CY)	
Low	8,000	48,000	72,000	60,000
Low-Moderate	8,000	32,000	48,000	40,000
Moderate	4,000	16,000	24,000	20,000
High	4,000	4,000	12,000	8,000

[1]"Surface" is defined as the top 4 feet of the dredge prism. "Subsurface" is defined as that portion of the dredge prism beneath the 4-ft surface layer.

The applicant presents a conceptual dredging plan in the SAP, with the dredging area divided into the requisite number of DMMUs. The number of DMMUs may need to be increased beyond the minimum to address site-specific considerations. Sampling locations are identified and a compositing plan is presented. Protocols for station positioning, decontamination, field sampling, sample compositing, chemical analysis, biological testing, QA/QC and data submittal requirements are also included. Once completed, the DMMO coordinates review and approval of the plan with the DMMP agencies. Tables 2-3 and 2-4 contain data for sampling plans approved for DY12/13 projects. Descriptions of those projects for which best professional judgment was applied are provided in Chapter 4.

Table 2-3. DY12 Projects – Approved Sampling Plans

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Subsurface Volume (cy)	Number of Sub-surface Samples	Number of Sub-surface DMMUs
City of Chelan, Don Morse Park	M	7,877	6,992	2	1	885	2	1
Harbour Village Marina	H	7,427	7,427	7	3	0	0	0
J.A. Jack & Sons	H	<1,000[1]	NA	2 (AD)	NA	NA	0	0
LaFarge North America	H	24,000	24,000	12	6	0	0	0
Owl Creek (Cowlitz River)[2]	L	5,400,000	5,400,000	16	3	0	0	0
Port of Anacortes, Cap Sante Boat Haven – M,N,O-Docks	M	12,000	12,000	3	1	0	0	0
Port of Brownsville Marina	M	17,500	17,500	7	2	0	0	0
Port of Grays Harbor Terminal 3	LM	67,000	67,000	6	2	0	0	0
Port of Tacoma Husky Terminal	M	42,100	42,100	8	4	0	0	0
Port of Willapa, Bay Center Marina	L	18,000	18,000	5	1	0	0	0
Seattle Iron and Metals	H	28,000	16,000	8	4	12,000	4	1
USACE Bellingham	M/H	139,865	139,865	11	11	0	0	0
USACE Duwamish O&M	LM/M/H	127,093	53,891	13	5	73,202	16	12
USACE Grays Harbor O&M	L	1,650,000	1,650,000	223	28	0	0	0
USACE Keystone O&M	L	60,000	60,000	8	2	0	0	0
USACE Snohomish O&M	L/C/NT	651,571	651,571	43	9	0	0	0
US Navy Big Beef Creek Estuary Restoration	LM	125,000	125,000	17	5	0	0	0

"Z-sample" analysis of 2 surrogate stations outside of the limestone spill footprint was conducted for the antidegradation evaluation; the limestone aggregate itself was not tested.

[2] After SAP approval, the ----proponent abandoned the project and no sampling was conducted.

AD = antidegradation

Table 2-4. DY13 Projects – Approved Sampling Plans

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Subsurface Volume (cy)	Number of Subsurface Samples	Number of Subsurface DMMUs
Bay Head Marina - dioxin	M	20,000	11,000	3	1	9,000	3	1
Christensen Shipyards	L	10,000	10,000	3	1	0	0	0
City of Kenmore, Navigation Channel and Nature & Extent	H	NA	NA	6	6	0	0	0
Olympia Yacht Club	H	15,579[1]	15,579	9	4[2]	0	0	0
Port of Anacortes Pier 2 & Curtis Wharf	M	13,500	9,500	5	2	4,000	5	2
Port of Clarkston, Crane Dock	LM	2,050	2,050	2	1	---	---	---
Port of Kingston Marina	M	17,000	17,000	5	2	---	---	---
Salmon Bay Marina	H	11,900	4,600	4	2	7,300	4	1
Simpson Lumber	H	135	135	1	1	---	---	---
USACE Duwamish Subsurface Investigation[3]	H	---	---	23	---	---	25	---
USACE Duwamish DMMU 15[4]	H	---	---	5	---	---	5	---
USACE Grays Harbor NIP	L/LM	1,973,812	1,973,812	233	38	0	0	0

[1]This volume was later recalculated to be 16,241 cy
[2]One DMMU was later split in into two for a total of 5 DMMUs
[3] Reconnaissance-level study of shoaled areas in the Duwamish, East and West Waterways, as well as monitoring of CAD site in West Waterway
[4]Antidegradation testing only

2.3 Sampling

Tables 2-5 and 2-6 contain data related to sampling efforts during DY12/13. Two general requirements exist with respect to core sampling: 1) samples must be taken to the depth of dredging (including overdepth and Z-samples) and 2) positioning data must be collected with a minimum precision of one-tenth of a second, latitude and longitude. In areas with high shoaling rates or that meet Section 404 or Section 103 exclusionary criteria, core samples are unnecessary. In these cases sampling of the surface sediment with a grab sampler is generally allowed.

For projects utilizing coring devices, the maximum sample depth in the tables corresponds to the maximum thickness of the dredging prism, including overdepth. Exceptions include projects in which sampling problems were encountered, such as core refusal due to compact native sediment, gravel or woody debris. There is an additional requirement to collect an archived sample from the two feet of sediment beyond the dredging prism ("Z" sample). This additional depth is not reflected in these tables.

Table 2-5. DY12 Project Sampling

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 – 2 mm	SILT .004 – .063 mm	CLAY < .004 mm			
City of Chelan, Don Morse Park	3-4	83-86	9-12	2	Hollow-stem Auger	8	7
Harbour Village Marina	0-11	27-37	50-67	2-11	Mod. California Sampler	1.5	1.1
J.A. Jack and Sons, Inc.	2-4	12-30	46-62	20-24	Piston Corer	2	2
LaFarge North America	1-9	10-32	45-61	20-27	Vibracore	8.3	5.6
Port of Anacortes, Cap Sante Boat Haven	2-18	27-28	55-71 (silt/clay)		Vibracore	10	8
Port of Brownsville Marina	3-68	23-76	7-37	0-2	Vibracore	9	1.3
Port of Grays Harbor Terminal 3	0-1	47-48	33-34	18-19	Vibracore	13.5	9.9
Port of Tacoma Husky Terminal	1-26	47-65	20-29	7-13	Vibracore	5.3	1.7
Port of Willapa, Bay Center Marina	0	25	57	18	VanVeen Grab	0.3	0.3
Seattle Iron & Metals	1-27	24-50	27-60	10-17	Vibracore	10	8
USACE Bellingham	0	2-34	34-82	15-40	Vibracore	6.4	3.4
USACE Duwamish O&M	0-7	27-87	4-62	3-12	Vibracore	14	6
USACE Grays Harbor	0-38	9-89	3-59	2-27	VanVeen Grab	0.3	0.3
USACE Keystone	10-30	67-81	1-5	2-4	VanVeen Grab	0.3	0.3
USACE Snohomish	0-6	47-97	0-42	0-11	Pneumatic Grab	0.3	0.3
US Navy Big Beef Creek Estuary	28-55	36-57	3-18	2-8	Vibracore	7.3	4.2

Table 2-6. DY13 Project Sampling

PROJECT		GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
		GRAVEL > 2 mm	SAND .063 – 2 mm	SILT .004 – .063 mm	CLAY < .004 mm			
Bay Head Marina		8-10	72-82	8-15	3	Split Spoon Auger	12.7	6.0
Christensen Shipyards		11	85	3	0	Vibracore	5.0	4.5
City of Kenmore, Navigation Channel and Nature & Extent		0-71	26-55	3-51	0-11	Power Grab	0.9	0.8
Olympia Yacht Club		5-30	68-90	3-5	0	Vibracore	12.0	6.6
Port of Anacortes	Pier 2	0-1	40-54	39-51	5-8	Hollow Stem Auger	5.5	4.7
	Curtis Wharf	28-55	34-43	3-17	2-17		5.0	4.3
Port of Clarkston, Crane Dock		37	59	4	1	Vibracore	5	3.25
Port of Kingston Marina		0-23	84-92	5-12	1-2	Vibracore	7.5	7.1
Salmon Bay Marina		2-16	33-43	24-35	18-31	Vibracore	6.4	2.9
Simpson Lumber		---	---	---	---	Hand Shovel	0.5	0.1
USACE Duwamish Subsurface Investigation		0-42	12-96	0-68	0-29	Vibracore	20.0	8.0
USACE Duwamish DMMU 15		0	33-42	47-54	11-12	Vibracore	4.5	4.1
USACE Grays Harbor Navigation Improvement Project		0-43	15-99	0-57	0-31	Vibracore	10.9	5.1

2.4 Chemical Testing

Chemical testing was conducted for fifteen full or supplemental characterizations in DY12 and eleven in DY13. A complete listing of DMMP chemical guideline exceedances for DY12/13 is included in Appendix C.

2.5 Biological Testing

Five projects required bioassay testing (Table 2-7) during DY12/13. Tiered testing was employed for the USACE Duwamish Subsurface Sediment Investigation, as well as the USACE Grays Harbor Navigation Improvement Project. Tiered testing means that bioassays are conducted only on those DMMUs having one or more exceedance of DMMP screening levels. For the rest of the projects, bioassays were conducted concurrently with chemical testing. Of the five projects with biological testing, three had one or more DMMUs that failed bioassay interpretive guidelines. Projects requiring best professional judgment in the application of the DMMP interpretive guidelines are addressed in Chapter 4.

2.6 Bioaccumulation Testing

There were no projects with bioaccumulation testing in DY12/13.

Table 2-7. DY12/13 Biological Testing Summary

PROJECT	Number of biological analyses		Number of analyses failing bioassays	Bioassay tests conducted			Control Sediment location	Reference sediment location
	tiered testing	concurrent testing		Amphipod Mortality	Sediment Larval Development	*Neanthes* 20-day Mortality & Growth		
USACE Grays Harbor O&M	0	2 (D)	0	*Ee*	*Mg*	*Na*	Yaquina Bay	Grays Harbor
USACE Duwamish O&M	0	17 (ND)	1	*Ee*	*Mg*	*Na*	Yaquina Bay	Carr Inlet
USACE Duwamish Subsurface Investigation	10 (ND)	0	3	*Ee*	*Mg*	*Na*	Yaquina Bay	Carr Inlet
USACE Grays Harbor Navigation Improvement Project	12 (D)	0	1	*Ee/Aa*	*Mg*	*Na*	Yaquina Bay	Grays Harbor
USACE Duwamish DMMU15	0	1 (SMS)	0	*Ee*	*Mg*	*Na*	Yaquina Bay	Carr Inlet

De = *Dendraster excentricus*
Ee = *Eohaustorius estuarius*
Mg = *Mytilus galloprovincialis*
Na = *Neanthes arenaceodentata*

D = Dispersive Guidelines
ND = Nondispersive Guidelines
SMS = SMS interpretive guidelines used for anti-degradation evaluation

2.7 Suitability Determinations

A suitability determination summarizes the evaluation procedures used in the characterization of project sediments, evaluates chemical and biological testing data and associated QA/QC issues, and documents the interpretation of testing results. The suitability determination is a technical memorandum, drafted by the Corps' DMMO and signed by representatives from the DMMP agencies. It documents the suitability of proposed dredged sediments for open-water disposal. The suitability determination does not, however, constitute final project approval by the agencies. Comprehensive agency comments on the overall project are provided through the regulatory public notice and review process.

Tables 2-8 and 2-9 contain information taken from the suitability determinations for each of the projects that completed their DMMP review during DY12 and DY13, respectively. For the projects receiving suitability determinations in DY12 and DY13, eleven projects included material that was found unsuitable for unconfined open-water disposal. Of the 5,084,059 cubic yards covered by 23 suitability determinations, only 155,699 cubic yards (3.1%) were found unsuitable for open-water disposal at a DMMP disposal site.

Table 2-8. DY12 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	DMMUs, chemical analyses	DMMUs, bioassay analyses	DMMUs, bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed Disposal Site/Type
City of Chelan, Don Morse Park	M	8,000	2	0	0	0	0	2	8,000	BU
Harbour Village Marina	H	7,427	3	0	0	3	7,427	0	0	UP
LaFarge North America	H	24,000	6	0	0	6	24,000	0	0	UP
Port of Anacortes, Cap Sante Boat Haven	M	12,000	1	0	0	1	12,000	0	0	UP
Port of Brownsville Marina	M	17,500	2	0	0	0	0	2	17,500	EB
Port of Grays Harbor Terminal 3	LM	67,000	2	0	0	0	0	2	67,000	PC, SJ
Port of Tacoma Husky Terminal	M	42,100	4	0	0	1.45	15,950	2.55	26,150	CB, UP
Port of Willapa, Bay Center Marina	L	60,000	1	0	0	0	0	1	18,000[1]	FL
Seattle Iron & Metals	H	28,000	5	0	0	5	28,000	0	0	UP
USACE Bellingham[2]	M/H	139,865	11	0	0	4	28,587	7	111,278	NA
USACE Duwamish O&M	LM/M/H	127,093	17	17	0	1	3,630	16	123,463	EB, UP
USACE Grays Harbor O&M	L	1,650,000	28	2	0	0	0	28	1,650,000	PC, SJ, BU
USACE Keystone	L	60,000	2	0	0	0	0	2	60,000	BU
USACE Snohomish O&M	L/C/NT	651,571	8	0	0	0	0	9	651,571	PG, BU
US Navy Big Beef Creek Estuary Restoration	LM	125,000	5	0	0	0	0	5	125,000	BU
Totals:	---	3,019,556	97	19	0	21.45	119,594	76.55	2,857,962	---

[1] Volume tested. Total volume for 10-year maintenance permit increased to 60,000 cy to accommodate future maintenance.
[2] Special study to evaluate dioxin relative to DMMP non-dispersive and dispersive site guidelines.

Table 2-9. DY13 Suitability Determinations

PROJECT		Rank	Total Volume (cy)	DMMUs, chemical analyses	DMMUs, bioassay analyses	DMMUs, bioaccum analyses	DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed Disposal Site/Type
Bay Head Marina		M	20,000	2	0	0	0	0	2	20,000	RS
Christensen Shipyards		L	10,000	1	0	0	0	0	1	10,000	CR
Olympia Yacht Club		H	16,241	5	0	0	2	6,892	3	9,349	AK, UP
Port of Anacortes	Pier 2	M	8,700	2	0	0	0.56	3,250	1.44	5,450	RS, UP
	Curtis Wharf	M	4,800	2	0	0	0	0	2	4,800	RS
Port of Clarkston, Crane Dock		LM	2,050	1	0	0	0	0	1	2,050	BU
Port of Kingston Marina		M	17,000	2	0	0	0	0	2	17,000	PG, BU
Salmon Bay Marina		H	11,900	3	0	0	2	3,563	1	8,337	EB, UP
USACE Grays Harbor NIP		L/LM	1,973,812	38	8	0	1	22,400	37	1,951,412	PC, SJ, BU, UP
Totals:		---	2,064,503	56	8	0	5.56	36,105	60.44	2,028,398	---

.

Disposal Sites
AK = Anderson-Ketron (ND)
CB = Commencement Bay (ND)
CR = Columbia River (D)
EB = Elliott Bay (ND)
PC = Point Chehalis (D)
PG = Port Gardner (ND)
RS = Rosario Strait (D)
SJ = South Jetty (D)

Disposal Type
BU = Beneficial Use (includes both aquatic and upland)
D = Dispersive
FL = Flow Lane
ND = Non-Dispersive
UP = Upland Disposal

NA = Not Applicable

2.8 Antidegradation Evaluations

Dredging operations expose new sediment to direct contact with biota and the water column. The exposed sediment must meet the State of Washington Sediment Quality Standards (SQS) or the antidegradation policy contained in the Sediment Management Standards. All DMMP suitability determinations include a section in which antidegradation is evaluated, but not all projects require special testing to support that evaluation. Projects that received DMMP suitability determinations for open-water disposal but did not require additional testing to address antidegradation are not included in this section of the biennial report. The projects included in this section met one of the following criteria: a) upland disposal was planned, so the project did not have a DMMP suitability determination; the only DMMP action was to conduct an antidegradation evaluation; b) additional testing was conducted to support the antidegradation evaluation, including analysis of surface sediment or z-samples prior to dredging, or analysis of post-dredge samples.

A 'z-sample' is a sample from the sediment layer just below the dredging overdepth and typically is collected during sampling of heterogeneous sediments. The DMMP agencies defined the two-foot interval beyond the overdepth as the z-layer at the 2010 SMARM. Additional z-samples are sometimes also collected (e.g. 2 to 3 feet below overdepth). Depending on the results from characterization of the dredged material prism, it may be necessary to analyze the z-samples to determine whether dredging the project will result in degradation of the surface sediment condition.

In some cases collection of z-samples is not possible (e.g. refusal during vibracore sampling). In other cases, where DMMUs with elevated concentrations of chemicals of concern have been removed, there may be concern that residuals from the dredging operation may leave a contaminated surface. In either case, sampling and testing of the new surface sediment after dredging may be necessary.

In DY12/13, the DMMP agencies required analysis of Z-samples or post-dredge sampling and testing for 16 projects, the details of which are included in Table 2-10. One other project slated for upland disposal was evaluated for antidegradation based on a Tier 1 analysis.

Table 2-10. DY12/13 Antidegradation Evaluations

PROJECT		DY	Rank	Type	Reason for Z-Sample Analysis, Post-Dredge Evaluation or Surface-Sediment Testing	Did the New Surface Meet SQS or Antidegradation Policy?
Bay Head Marina		13	M	Z-sample	Analyzed concurrently	Yes
City of Chelan, Don Morse Park		12	M	Z-sample	Elevated pesticides	Yes
Georgia Pacific Camas Slough		13	M	Tier 1	Upland disposal; proximal to paper mill	Yes
Harbour Village Marina		12	H	Z-samples	Elevated dioxin, PCBs	No (1-foot sand cover required)
J.A. Jack & Sons, Inc.		12	H	Z-samples	Other projects on the Duwamish River have had increasing levels of contamination with depth	No (1-foot sand cover required)
LaFarge North America		12	H	Z-samples	Elevated dioxin, PCBs	No (1-foot sand cover required)
Port of Anacortes, Cap Sante Boat Haven		12	M	Z-sample	Elevated dioxin, TBT	Yes
Port of Anacortes	Pier 2	13	M/H	Z-samples	Elevated TBT	Yes
	Curtis Wharf		M	Z-samples	Analyzed concurrently	Yes
Port of Brownsville Marina		12	M	Z-samples	Analyzed concurrently	Yes
Port of Tacoma Husky Terminal		12	M	Z-samples	Elevated dioxin	Yes
Seattle Iron & Metals		12	H	Z-samples	Elevated dioxin	No (1-foot sand cover required)
Simpson Lumber[1]		13	H	Grab sample	Elevated dioxin	Yes
USACE Bellingham O&M, Special Dioxin Study		12	M/H	Z-samples	Elevated dioxin	Yes
USACE Duwamish Subsurface Sediment Investigation		13	H	Z-samples	Analyzed concurrently	Yes/No
USACE Duwamish, DMMU 15		13	H	Z-sample	Overlying material failed bioassays	Yes
USACE Grays Harbor NIP		13	L/LM	Z-samples	Overlying material exhibited bioassay hits	Yes
US Navy Big Beef Estuary		12	L	Z-sample	Analyzed concurrently	Yes

[1]Upland disposal was planned so there was no DMMP suitability determination for open-water disposal. The only DMMP action was to conduct an antidegradation evaluation.

2.9 Tier 1 Determinations

All projects begin with a Tier 1 evaluation, which includes an analysis of existing information on the proposed dredging project, including the site history and all previously collected sediment data. Using the information collected in a Tier 1 evaluation, projects can be exempted from sediment testing under three different scenarios: 1) the small-project guidelines are met; 2) the proposed dredged material meets the Section 404 or Section 103 exclusionary criteria; or 3) upland disposal is planned and there are no issues with the sediment surface to be exposed by dredging.

The *small-project* guidelines are as follows:

Project Rank	Maximum No-Test Volume (CY)
L	8,000
LM or M	1,000

The *exclusionary criteria* are described in the regulations for the Marine Protection, Research, and Sanctuaries Act (MPRSA) (40 CFR 227.13) and Clean Water Act (40 CFR 230.60). Generally, relatively larger-grained material (e.g., sand and gravel) from high-energy environments that are geographically removed from contaminant sources meet the exclusionary criteria. The DMMP agencies apply the exclusion criteria on a case-by-case basis.

A total of 6 projects received no-test determinations in DY12/13 following Tier 1 review (Table 2-11).

Table 2-11. DY12/13 No-Test Determinations

PROJECT	DY	Total Volume (cy)	Rank	Reason for No-Test Determination	Proposed Disposal Site
Bay Center Mariculture Dock	12	<1,000	LM	Meets small-project no-test guideline	Bay Center flow-lane disposal site
Birch Bay Village Marina Entrance Channel	13	2,000	E	Meets exclusionary criteria	On-site beneficial use
Deer Harbor Boatworks	12	<200 in 10 yrs	M	Meets small-project no-test guideline	Upland beneficial use
Deschutes River Estuary Restoration (Capitol Lake)	12	500,000	N/A	Testing in 2000 resulted in no SL exceedances; sediment will remain in Capitol Lake as part of a restoration project	On-site beneficial use
Frenchman Coulee Boat Ramp	13	950	L	Meets small-project no-test guideline	On-site beneficial use
LD Commodities NW	13	45	LM	Meets small-project no-test guideline	On-site beneficial use
Point Roberts Marina Sand Bypass	12	<10,000/yr	E	Meets exclusionary criteria	On-site beneficial use
USACE Grays Harbor Channel Realignment	13	decrease in volume	L/LM	Existing data adequately represents realigned channel	Pt. Chehalis/South Jetty

Ranking:
E = Exclusionary
L = Low
LM = Low-moderate
M = Moderate
H = High

2.10 Recency Extensions

Recency guidelines apply to material that has been sampled and tested for open-water disposal but not yet dredged. Key considerations in determining whether the existing data are still representative are the recency of the information and sources of contamination in the vicinity of the project. For high-ranked projects, the recency guidelines allow characterization data to be valid for a period of 2 years. The DMMP guidelines specify a recency period of 5, 6 or 7 years for moderate, low-moderate and low-ranked projects, respectively.

When other permitting requirements prevent a project from being dredged during the recency period, extension of the recency period is considered on a case-by-case basis. When considering whether existing data continue to adequately characterize sediment from a specific project, the agencies review previous characterization data, any new data from the dredge site or vicinity, site use, and sources of contamination. Based on this review, the agencies may extend the recency determination, typically for one to two years. This extension may be allowed with no additional testing, or may require some level of confirmatory testing. Table 2-12 presents information for the five recency extensions that were allowed in DY12/13.

Table 2-12. DY12/13 Recency Extensions

PROJECT	DY	Rank	Sampling Date	Original Recency Time Limit	Recency Extension
City of Renton Seaplane Base	12	M	Nov 2006	5 years (to Nov 2011)	2 yrs, 3 mos (to Feb 2014)
Newport Yacht Club	13	M	May 2008	5 years (to May 2013)	2 years (May 2015
Port of Everett Pacific Terminal	12	H	Dec 2009	2 years (to Dec 2011)	2 months (to Feb 2012)
USACE Quillayute O&M	13	L	Oct 2010	6 years (to Oct 2016)	1 year (to Oct 2017)
USACE Snohomish O&M	12	LM	Sep 2003 (Upper) Mar 2004 (Lower)	7 years Sep 2010 (Upper) Mar 2011(Lower)	2 yrs (Upper) 1.5 yrs (Lower) (to Sep 2012)

2.11 Project Revisions

Dredging projects are dynamic by nature and shoaling continues to occur between the time of sediment characterization and the time of dredging. There may also be design changes that alter the dredging volume or footprint. When the project volume or footprint changes subsequent to full characterization, a dredging applicant may request a revision of the volume/footprint found in the suitability determination. The DMMP agencies review such requests on a case-by-case basis. Table 2-13 includes the pertinent information for the 6 project revisions approved by the DMMP agencies during DY12/13.

Table 2-13. DY12/13 Project Revisions

PROJECT	DY	Rank	Original Volume (CY)	Revised Volume (CY)	Reason for Volume Revision
Port of Everett Marina, Phase 1	2012	LM	29,000	39,500	Post-characterization sediment accretion
Port of Willapa, Bay Center Marina	2012	L	18,000	60,000	Anticipation of future maintenance dredging
US Naval Air Station Whidbey Island Fuel Pier	2012	M	25,000	35,000	Design modification
USACE Quillayute O&M	2012	L	12,000	60,000	Rank changed to low
USACE Swinomish O&M	2012	L	152,000	340,000	Post-characterization sediment accretion
WSDOT SR-520 Pontoon Construction	2013	H	25,000	30,000	Increased maintenance dredging volume

2.12 Special Studies

In DY12/13 there were three special studies conducted. These special studies were designed to answer specific questions about the status of sediment contamination in areas where future dredging is expected to occur. More specific information about the results of the special studies is provided in Chapter 4.

Table 2-14. DY12/13 Special Studies

PROJECT	DY	Rank	Number of chemistry samples	Number of bioassay samples	COC list
USACE Bellingham Dioxin	12	H	14	0	Dioxins/furans
USACE Duwamish Subsurface Sediment Investigation	13	H	72	10	DMMP, including TBT and dioxin
City of Kenmore, Navigation Channel and vicinity N&E	13	H	16	0	DMMP, including TBT and dioxin

CHAPTER 3. SUMMARY & ASSESSMENT OF DY12/13 DATA

3.1 Summary of Chemical Testing Results.

Table 3-1 and Appendix C summarize the chemical testing results from DY12/13 for dredging projects with DMMP chemical guideline exceedances. Data from the two special studies without suitability determinations – USACE Duwamish Subsurface Investigation and City of Kenmore Navigation Channel & Vicinity – are not included. There are 58 individual chemicals or groups of chemicals that are considered standard DMMP COCs. In addition to these standard COCs, TBT is often required to be analyzed. Of these 59 COCs, 25 were detected in dredged material at concentrations above DMMP screening levels. Three COCs (chlordane, TBT and DDT) had detected concentrations above the BT. A single chemical (DDT) was detected above the ML. Only six chemicals had guideline exceedances in more than one project. Benzyl alcohol was the chemical with the most SL exceedances - 19 DMMUs in four projects, with PCBs the second most frequently observed with 14 DMMUs exceeding SL in three projects. The tributyltin BT was exceeded six times in three projects. All 15 PAH SL exceedances occurred for a single project – Salmon Bay Marina.

Numerous SMS and DMMP guideline exceedances also occurred during antidegradation evaluations. The majority of these were SQS or SL exceedances; however two projects also had CSL exceedances. These included benzyl alcohol in one z-sample from Seattle Iron and Metals; and PCB and arsenic exceedances at Lafarge North America. Both projects are on the Lower Duwamish Waterway.

Fewer unresolved reporting limit problems occurred in DY12/13 when compared to past biennia. COCs for which reporting limits exceeded SLs included the chlorobenzenes; 2,4-dimethylphenol; hexachlorobutadiene; and the pesticides chlordane, heptachlor and dieldrin. In most cases reporting limit exceedances of SLs were resolved by verifying that method detection limits were under the SLs.

Dioxin Evaluation. For the evaluation of dioxins and furans for projects in DY12/13, the DMMP agencies utilized the guidelines found in Table 3-2. Testing outcomes for all projects subjected to dioxin testing can be found in Appendix C and are summarized in Table 3-3. Of the 23 projects receiving suitability determinations during the biennium, 18 included dioxin testing of dredged material.

The DMMP agencies implemented revised dioxin guidelines for Puget Sound in December 2010. Ports and other dredging proponents expressed concern about the impact the guidelines would have on dredging projects. Table 3-3 evaluates these impacts for DY12/13. Eight projects had dioxin concentrations at levels found unsuitable for open-water disposal. However, half of these projects (Harbour Village Marina; Lafarge North America; USACE Bellingham I&J Waterway; and Cap Sante Boat Haven) had average dioxin concentrations that far exceeded the former guideline of 15 pptr TEQ. These projects account for 57% of the material exceeding the revised guidelines. The remaining projects (Olympia Yacht Club; Port of Tacoma Husky Terminal; Salmon Bay Marina; and Seattle Iron & Metals) had average dioxin concentrations higher than the revised guidelines but lower than the former guideline. But two of these projects – Salmon Bay Marina and Seattle Iron & Metals – both had other significant DMMP guideline exceedances that had the potential for resulting in failed dredged material regardless of the dioxin testing results. Salmon Bay Marina included TBT above the bioaccumulation trigger and numerous PAHs above SL. Seattle Iron & Metals had SL exceedances for PCBs, chlordane, benzyl alcohol and benzoic acid.

Table 3-1. DY12/13 Chemical Testing Summary

CHEMICAL OF CONCERN	# of DMMUs D > SL	# of Projects D > SL	# of DMMUs D > BT	# of Projects D > BT	# of DMMUs D > ML	# of Projects D > ML
Arsenic	2	1				
Mercury	1	1				
Zinc	2	1				
Total LPAH	1	1				
Acenaphthene	1	1				
Fluorene	1	1				
Phenanthrene	1	1				
Anthracene	1	1				
Total HPAH	1	1				
Fluoranthene	1	1				
Pyrene	1	1				
Benzo(a)anthracene	1	1				
Chrysene	1	1				
Benzofluoranthenes	1	1				
Benzo(a)pyrene	1	1				
Indeno(1,2,3-cd)pyrene	1	1				
Dibenzo(a,h)anthracene	1	1				
Benzo(g,h,i)perylene	1	1				
Benzoic Acid	2	1				
Benzyl Alcohol	19	4				
Total Chlordane	3	2	1	1		
4-4'-DDD	2	1				
4-4'-DDE	7	2				
4-4'-DDT	6	2				
Total DDT	NA	NA	2	1	2	1
Total PCBs	14	3				
Tributyltin	NA	NA	6	3		

D = Detected, SL = Screening Level, BT = Bioaccumulation Trigger, ML = Maximum Level, NA = Not Applicable

Biological testing was not conducted due to the dioxin failures, so it is impossible to say what the volume of unsuitable material would have been for these two projects without the revised dioxin guidelines in place. The two remaining projects – Olympia Yacht Club and Port of Tacoma Husky Terminal – were the two projects that were clearly impacted by the revised dioxin guidelines. Husky Terminal had no other guidelines exceedances. Olympia Yacht Club had a mercury exceedance of SL for one DMMU, but would have had unsuitable material due to dioxin regardless of bioassay testing results. These two projects account for only 4% of the material tested for dioxin, and 18% of the material that failed the revised dioxin guidelines. For both of these projects, dioxin impacted approximately 40% of the material tested.

Table 3-2. Dioxin Guidelines Utilized to Evaluate DY12/13 Projects

(a) Puget Sound Interim Guidelines for Nondispersive Sites[1]		
Disposal Sites	Project Volume-Weighted Average	DMMU Maximum
Anderson-Ketron, Commencement Bay, Elliott Bay, Port Gardner, Bellingham Bay	4 pptr TEQ	10 pptr TEQ
(b) Puget Sound Interim Guidelines for Dispersive Sites		
Disposal Sites	DMMU Maximum	
Port Angeles, Port Townsend, Rosario Strait	4 pptr TEQ	
(c) Grays Harbor Guidelines (Derived from 1991 Risk Assessment)		
DMMU Maximum: 2,3,7,8-TCDD = 5 pptr; and TEQ = 15 pptr		
(d) Columbia River Basin[2]		
Comparison to Columbia River background stations downstream of Puget Island: 0.65 to 2.89 pptr TEQ		
(e) Upland Beneficial Use		
Model Toxics Control Act method B unrestricted land use level: 11 pptr TEQ		

[1]Case-by-case determinations may be made for exceedances of these guidelines based on material placement sequencing, presence or absence of other bioaccumulatives, and frequency of disposal-site use.
[2]There were no Columbia River Basin projects that required dioxin testing in DY12/13.

Table 3-3. Dioxin Testing Summary for DY12/13 Projects

Dioxin Evaluation Guidelines	Project ID	Volume	Total Unsuitable Volume	Unsuitable Due to Dioxin	Comments
Puget Sound Nondispersive	Harbor Village Marina	7,427	7,427	7,427	average dioxin concentration of unsuitable = 70.9 pptr TEQ PCBs > SL; no bioassays conducted
	Lafarge North America	24,000	24,000	24,000	average dioxin concentration of unsuitable = 28.0 pptr TEQ PCBs, pesticides, As, Zn > SL; no bioassays conducted
	Olympia Yacht Club	16,241	6,892	6,892	average dioxin concentration of unsuitable = 10.4 pptr TEQ Hg > SL in one DMMU; no bioassays conducted
	Port of Brownsville Marina	17,500	0	0	---
	Port of Tacoma Husky Terminal	42,100	15,950	15,950	average dioxin concentration of unsuitable = 10.3 pptr TEQ
	Salmon Bay Marina	11,900	3,563	3,563	average dioxin concentration of unsuitable = 10.1 pptr TEQ TBT > BT; PAHs > SL; no bioassays or bioaccum testing conducted
	Seattle Iron & Metals	28,000	28,000	28,000	average dioxin concentration of unsuitable = 12.4 pptr TEQ PCBs, chlordane, benzyl alcohol, benzoic acid > SL no bioassays conducted
	USACE Bellingham O&M	139,865	28,587	28,587	All unsuitable material was in I&J Waterway average dioxin concentration of unsuitable = 33.2 pptr TEQ No other COCs analyzed
	USACE Duwamish O&M	127,093	3,630	0	---
Puget Sound Dispersive	Bay Head Marina	20,000	0	0	---
	Cap Sante Boat Haven M, N, O-Dock	12,000	12,000	12,000	average dioxin concentration of unsuitable = 42.7 pptr TEQ TBT > BT; no bioaccumulation testing conducted
	Port of Anacortes Pier 2 & Curtis Wharf	13,500	3,250	0	---
	USACE Keystone O&M	60,000	0	0	---
Grays Harbor	Bay Center Marina Entrance Channel	60,000	0	0	---
	Port of Grays Harbor Terminal 3	67,000	0	0	---
	USACE Grays Harbor Navigation Improvement	1,973,812	22,400	0	---
	USACE Grays Harbor O&M	1,650,000	0	0	---
Upland Beneficial Use	Simpson Lumber	135	0	0	---

Legend: BT = bioaccumulation trigger; SL = screening level
COCs = chemicals of concern; pptr = parts per trillion; TEQ = toxic equivalents
As = arsenic; Hg = mercury; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls; TBT = tributyltin; Zn = zinc

3.2 Biological Testing

Biological testing was conducted on 29 DMMUs from 3 dredging projects in DY12/13, not including the Duwamish subsurface investigation (special study) and testing for USACE Duwamish DMMU 15 (antidegradation evaluation). Table 3-4 shows that 17 DMMUs were evaluated for nondispersive disposal and 12 were evaluated for dispersive disposal. Appendix A includes the DMMP bioassay interpretation guidelines used in these evaluations.

All bioassay testing during the biennium was conducted by the Corps of Engineers for maintenance and new-work dredging projects. During this same time period the DMMP agencies were making the transition from the dry-weight endpoint to the ash-free dry-weight (AFDW) endpoint for the *Neanthes* bioassay. The sediment larval test was also in transition, with introduction of the use of the resuspension protocol for DMMUs with highly-flocculent sediment. In order to ground-truth these alternative protocols, the Corps agreed to conduct side-by-side testing for federal projects. All side-by-side results are shown in Table 3-4 and Appendix C, with the exception of the dry-weight endpoint for the Grays Harbor Navigation Improvement Project. By the time the suitability determination was written for this project, the AFDW endpoint had already been implemented and the dry-weight data were not used.

There were no hits in either the amphipod mortality or *Neanthes* growth bioassays. Elevated ammonia during one round of amphipod testing for the Grays Harbor Navigation Improvement Project (GHNIP) resulted in the data for this round being rejected for use by the DMMP agencies. Best professional judgment needed to be applied in interpreting the side-by-side sediment larval results for GHNIP. In general, the combined mortality and abnormality exhibited with the resuspension protocol was less than that with the standard protocol, although one DMMU had results that were the reverse of this trend.

In DY12/13 there was only one performance issue with reference and control sediments. In the Grays Harbor O&M project, the reference sediment failed to meet the performance standard in the *Neanthes* growth test using the dry-weight endpoint. However, the reference sediment did meet the performance standard using the AFDW endpoint. This event illustrates a problem that has occurred periodically with the *Neanthes* test and provided support for the transition from use of the dry-weight endpoint to use of the AFDW endpoint.

Table 3-4. DY 12/13 Bioassay "Hit" Summary

BIOASSAY	Number of DMMUs Tested		Number Rejected	Number of Hits Under the "Two-Hit Rule"		Number of Hits Under the "Single-Hit Rule"	
	ND	D		ND	D	ND	D
Amphipod	17	12	4	0	0	0	0
Sediment Larval - Standard Protocol	17	12	0	7	5	1	2
Sediment Larval - Resuspension Protocol	17	12	0	5	0	1	2
Neanthes Growth – Dry-Weight Endpoint	17	0	0	0	NA	0	NA
Neanthes Growth – Ash-Free Dry-Weight Endpoint	17	12	0	0	0	0	0

ND = non-dispersive site interpretation guidelines
D = dispersive site interpretation guidelines

3.3 Bioaccumulation Testing

As indicated in Section 3.1, there were three chemicals with bioaccumulation trigger (BT) exceedances in DMMUs during the DY12/13. In the case of the Port of Anacortes Pier 2, Cap Sante Boat Haven and Salmon Bay projects, the dredging proponent accepted the fact that the material in question was unsuitable for open-water disposal and would need to be disposed upland. At the City of Chelan's Don Morse Park, the material in question was intended to be used on site for beach restoration and covered with three feet of sand and gravel. The DMMP agencies determined that the 3-foot cover would adequately isolate this material from receptors in the environment and bioaccumulation testing was not required. There were also several projects for which the bioaccumulation test-out option for dioxin could have been pursued. But dredging proponents for these projects elected not to conduct bioaccumulation testing. Hence, no bioaccumulation testing was conducted during the biennium.

3.4 Regulatory Processing

Regulatory Framework. For the majority of dredging projects, DMMP sediment sampling and testing are a part of the regulatory requirements under Section 404 of the Clean Water Act, or under Section 103 of the Marine Protection, Research and Sanctuaries Act. For those dredging projects requiring sampling and testing, the regulatory process consists of a sequence of steps that must be taken before obtaining a permit. The majority of permit actions involve 404 jurisdiction but the steps are similar for 103 actions. These steps are typically sequenced as follows:

(1) Prepare sampling and analysis plan (SAP) for characterization of proposed dredged material.

(2) Receive approval of SAP from DMMP agencies.

(3) Perform sampling and chemical/biological analysis and submit testing results.

(4) Receive suitability determination for open-water disposal from DMMP agencies.

(5) Complete application details required for issuance of public notice.

(6) Corps prepares and issues public notice.

(7) Corps transmits review comments to applicant after 30-day public comment period.

(8) Applicant provides Corps with responses to public comments.

(9) Corps completes public interest review, 404(b)(1) evaluation, NEPA documentation, ESA consultation, and HPA coordination - as necessary - and issues permit decision.

The DMMP dredged material evaluation process consists of Steps 1 through 4, which are elaborated on in the following sections.

Sampling and Analysis Plan Development. A sediment sampling and analysis plan must be developed and submitted to the DMMP agencies for review prior to commencement of field sampling. The time required for SAP development is highly variable and almost completely within control of the dredging applicant.

Sampling and Analysis Plan Approval. Once a sediment SAP has been submitted, the DMMO coordinates review with the other DMMP agencies: EPA, DNR and Ecology. Agency comments are provided to the applicant, the applicant revises the SAP to address the comments, and the revised SAP is submitted to the agencies for approval. Occasionally, more than one round of revision is needed to adequately address all agency comments. Once the SAP is finalized, an approval letter or email message is sent to the applicant. At that point, sampling and analysis may proceed. It is the goal of the DMMO to complete the review of SAPs within three weeks. During

DY12/13 the average time for SAP reviews was 11 days, and ranged from a low of 1 day to a high of 47 days. Three projects exceeded the goal of a three-week turnaround time. For those projects with more than one review cycle, the average review time was used in compiling these statistics.

Sampling and Analysis. During this phase, field sampling and chemical/biological analysis are completed following the protocols established in the approved SAP. Data are compiled and submitted in a dredged material characterization report. Sampling, testing and reporting consume a substantial portion of the DMMP process-time budget, averaging 119 days during DY 12/13. This is one of the project phases with the highest degrees of variability, with sampling, analysis and reporting taking anywhere from 49 to 317 days for projects completed within this biennium. Factors influencing the time required for this phase include 1) weather; 2) sampling difficulties; 3) laboratory capacity and turn-around time; 4) QA problems arising during chemical and biological testing; 5) data validation; and 6) report compilation time. Those projects that include bioassay or bioaccumulation testing usually are those with the longer turn-around times, although no bioaccumulation testing was accomplished during this 2 year review period, and only 5 of 23 projects required toxicity testing.

Data Review and Suitability Determination. Once a full set of validated chemical/biological testing data is submitted, the DMMO conducts a data review with the other DMMP agencies. The result of this review is the signing, by DMMP agency representatives, of a Memorandum for Record documenting the determination reached on the suitability/unsuitability of each of the dredged material management units for unconfined open-water disposal or beneficial use. The suitability determination also includes an evaluation of the sediment surface that will be exposed by dredging vis-à-vis the State of Washington's antidegradation standard. The goal of the DMMO is to complete the data review and finalize the suitability determination within three weeks of data submittal. In DY12/13, the average time required was 13 days, with review times ranging from 1 to 39 days. Occasionally, the dredged material characterization report requires revision after agency review. In those cases, the average time required for review of draft and final data reports was used in compilation of these statistics.

Total DMMP Process Time. The entire DMMP dredged material evaluation process, as depicted in Figure 3-1, includes 1) sampling and analysis plan review and approval; 2) field sampling, testing, validation and data report preparation; and 3) data review and completion of the suitability determination. The average time required for the DMMP dredged material evaluation process was 143 days (ranging from 89 to 336 days) in DY12/13, with the majority of that time taken up by sampling, testing, and data report preparation by the applicant.

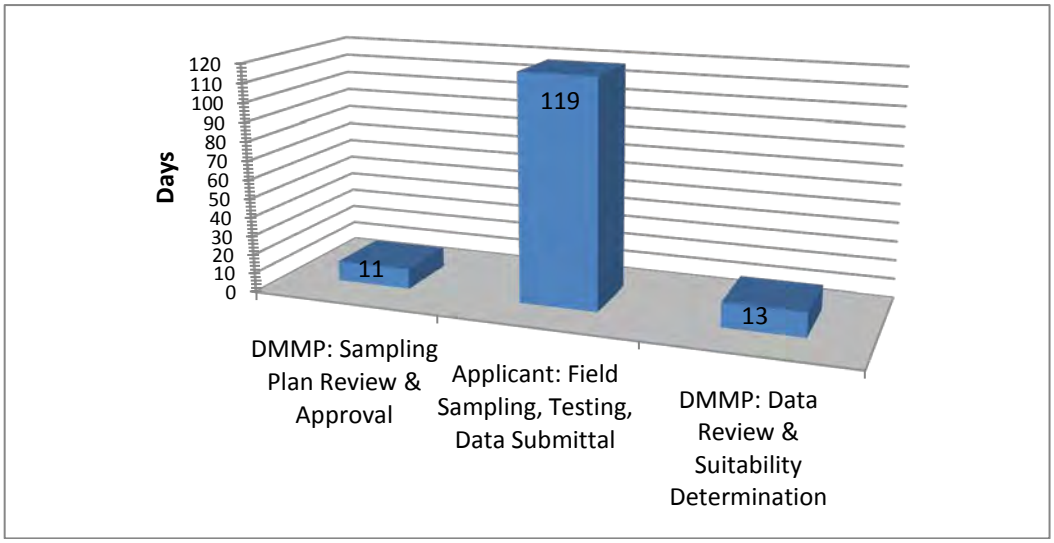


Figure 3-1. DMMP Processing Time (means for DY 12/13 projects in days)

CHAPTER 4. UNUSUAL AND/OR COMPLEX PROJECTS

The following discussion includes unusual or complex projects requiring explanation beyond the summaries provided in Chapters 1 and 2. Projects with special considerations for ranking, sampling plan development, sampling, chemical testing, biological testing, or those for which the DMMP agencies used best professional judgment are further described in this chapter.

4.1 Dredging Year 2012

City of Chelan, Don Morse Park. Sample cores were taken from two locations. The upper four feet from each sample location was composited for DMMU 1 and the lower portion of each sample was composited for DMMU 2. Z-samples were collected from each sample location and archived.

Both DMMUs were analyzed for DMMP chemicals of concern, with comparison to the 2006 interim freshwater guidelines for most chemicals of concern, and to the marine screening values for those chemicals of concern for which there are no freshwater guidelines. There were exceedances of DMMP screening levels in DMMU 1 for p,p'-DDE, p,p'-DDD and chlordane, and in DMMU 2 for p,p'-DDT, p,p'-DDE, p,p'-DDD and chlordane.

Due to the screening level exceedances, the agencies determined that z-sample analysis was required for this project. The two z-samples were composited for one analysis and analyzed for pesticides. Pesticides were undetected in the z-sample.

The exceedances of DMMP screening levels would normally trigger the requirement for bioassay testing prior to dredging and disposal. In this case, the DMMP agencies did not require bioassay testing because the applicant proposed to dredge the material in the dry and use it for fill as part of the restoration of the lakeshore. The dredged material will be isolated from the lake with at least 3 feet of pea gravel.

J.A. Jack & Sons, Inc. This project is located in a high concern area, along the Lower Duwamish Waterway (LDW), and the applicant, J.A. Jack & Sons, Inc. is proposing to conduct maintenance dredging activities at its operational berth area due to a limestone spill that occurred within the berth area. Because the limestone presented an impenetrable layer for collection of cores to assess the z-layer, two stations just outside the footprint of the limestone material were selected as surrogate stations to represent the likely sediment surface that would be exposed.

Benzyl alcohol exceeded the DMMP ML and SMS CSL guidelines in both samples. Dioxins were quantitated at 12.5 and 13.1 pptr-TEQ, so both samples were above the 10 pptr-TEQ bioaccumulation trigger. Based on the testing results the exposed surface represented by the two stations was deemed to be degraded by the DMMP agencies. The following actions were required following removal of the spilled limestone:

a. Dredge an additional two feet of material below the spilled limestone.
b. Place a one-foot clean sand cover over the dredged area.

Harbour Village Marina. Three DMMUs were evaluated for this project. PCBs exceeded the SL in all three DMMUs, with concentrations of total PCBs ranging from 196 to 277 ug/kg. The results for

dioxin/furan testing ranged from 43.2 to 92.1 pptr-TEQ. All three DMMUs were found unsuitable for open-water disposal at the Elliott Bay disposal site.

Based on the PCB and dioxin guideline exceedances, the DMMP required the analysis of all three z-samples underlying the three DMMUs. The results of the antidegradation evaluation for the three z-samples were compared to the 2007 SEF freshwater guidelines for PCBs. Two z-samples were quantitated above the SL2 (120 ug/kg), with concentrations of 126 and 237 ug/kg, and the third DMMU exceeded the SL1 (60 ppb) with a concentration of 104 ug/kg. The dioxin concentrations for two of the z-samples were above the DMMP bioaccumulation trigger of 10 pptr-TEQ.

The DMMP agencies concluded that the z-sample results for all three DMMUs were not in compliance with the antidegradation standard. The following actions were required to remedy the exposed surface after maintenance dredging was completed:

a. Dredge an additional foot of material beyond the required maintenance depth.
b. Place a one-foot clean sand cover over the exposed surface.

Seattle Iron & Metals. Five DMMUs were evaluated for this project. PCBs exceeded the SL (130 ug/kg) in all five DMMUs, with concentrations of total PCBs ranging from 181 to 241 ug/kg. The dioxin concentrations ranged from 9.96 to19.9 pptr-TEQ. On the basis of the dioxin results, all five DMMUs were found unsuitable for open-water disposal at the Elliott Bay site.

Based on the PCB and dioxin guideline exceedances, the DMMP agencies required the analysis of all z-samples. PCBs exceeded the carbon-normalized SQS (12 mg/kg oc) with concentrations ranging from 13.4 to 55.5 mg/kg oc, and all were concentrations exceeded those found in the overlying sediment. The dioxin results for the Z-samples ranged from 6.4 to19.1 pptr-TEQ, with two of the Z-samples having higher concentrations than the overlying sediments. In addition, the CSL was exceeded in one Z-sample for both benzoic acid and benzyl alcohol.

Based on the PCB and dioxin testing results, the DMMP agencies concluded that the Z-sample results were not in compliance with the antidegradation standard. The following actions were required to remedy the degraded surface after dredging is completed:

a. Dredge an additional foot of material beyond the required maintenance depth.
b. Place a one-foot clean sand cover over the exposed surface.

Lafarge North America. This project included six DMMUs. PCBs exceeded the SL in all six DMMUs, with concentrations ranging from 231 ppb to 980 ppb. Dioxin concentrations ranged from 20.2 to 48.0 pptr-TEQ, making all of the material unsuitable for open-water disposal at the Elliott Bay disposal site.

Based on the PCB and dioxin guideline exceedances, the DMMP agencies required the analysis of all z-samples. The PCB concentrations exceeded the SQS (12 mg/kg oc) in five of these samples, ranging in concentration from 20.0 to 95.0 mg/kg oc. In addition, the concentration for four of these samples exceeded the concentrations in the overlying material. The dredging proponent failed to test the z-samples for dioxin.

Based on the PCB results and the absence of dioxin testing, the DMMP agencies concluded that the Z-sample results for all six DMMUs were not in compliance with the antidegradation standard. The following actions were required to remedy the degraded surface after dredging is completed:

a. Dredge an additional foot of material beyond the required maintenance depth.
b. Place a one-foot clean sand cover over the exposed surface.

USACE Bellingham O&M Dioxin Special Study (DY12). A special study was initiated to evaluate dioxin concentrations within Squalicum Creek Waterway and I&J Street Waterway relative to open-water disposal alternatives. In I&J Waterway, the dioxin results ranged from 22.6 to 43.5 pptr-TEQ within the dredge prism, and from 5.7 to 29.4 pptr-TEQ in underlying Z-samples. Within Squalicum Creek Waterway, the dioxin results ranged from 2.0 to 5.1 pptr-TEQ within the dredge prism, and from 0.94 to 6.5 pptr-TEQ in underlying Z-samples.

The dioxin data collected within I&J Street Waterway were all above the 10 pptr-TEQ upper limit, and indicate that none of the potential dredged material within this waterway is suitable for unconfined-open-water disposal.

The dioxin data collected within Squalicum Creek Waterway were all below 10 pptr-TEQ. Most were also below the DMMP site management objective of 4 pptr-TEQ – the exceptions were two DMMUs at the north end head of Squalicum Waterway. Therefore, all the material except for the DMMUs at the north end of the waterway would meet the dispersive site guidelines relative to dioxin. With regard to nondispersive disposal, there is sufficient material that could be mixed with the material from the north end of Squalicum waterway to meet the 4 pptr-TEQ volume-weighted-average.

Port of Anacortes, Cap Sante Boat Haven. One DMMU, consisting of 12,000 cy, was evaluated for open-water disposal using sampling and testing requirements for a moderate-ranked project. Dioxin and TBT both exceeded the bioaccumulation trigger, with concentrations of 42.7 pptr-TEQ and 0.25 µg/L respectively. The applicant elected not to perform bioaccumulation testing. Therefore, all the proposed dredged material was determined to be unsuitable for unconfined-open-water disposal. Based on the elevated dioxin and TBT testing results, this project will require testing as a high-ranked project for future DMMP characterizations.

USACE Snohomish. The Snohomish navigation channel is divided into five parts, with separate characteristics, per federal authorization. The DMMP agencies modified the ranking for this characterization based on past results as summarized in the table below.

Summary of channel segments, DMMP rank and sampling scheme.

	Location and Station	Authorized Depth + Overdepth	Est. Dredge Volume (cy)	Min. # of Grab Samples	# of Analyses	Comments
DMMU 1	Shallow Nav. Channel 46+00 to 55+00	8 + 2	12,484	0	0	Tier 1 suitability (no testing required)
DMMU 2	Upstream Settling Basin 67+88 to 75+10	30 + 2	400,504	5	1	Confirmatory sampling
DMMU 3	Upstream Settling Basin 75+10 to 78+90	30 + 2		5	1	
DMMU 4	Upstream Settling Basin 78+90 to 82+95	30 + 2		5	1	
DMMU 5	Upstream Settling Basin 82+95 to 88+29	30 + 2		5	1	
DMMU 6	Shallow Nav. Channel 88+00 to 333+50	8 + 2	89,321	4	1	Existing shoals, confirmatory sampling
DMMU 7	Downstream Settling Basin 333+50 to 338+34	20 + 2	149,261	8	1	Settling basin
DMMU 8	Downstream Settling Basin 338+34 to 344+12	20 + 2		8	1	Settling basin
DMMU 9	Downstream Settling Basin, Deep-draft Channel & Transition 344+12 to 375+00	15 + 2		3	1	Downstream end of settling basin, shoal downstream of settling basin
Total characterized volume (cy)			651,571			

Results of previous years' testing have demonstrated consistent patterns of grain size and low levels of contaminants throughout the channel. This information was used to modify the testing requirements for this low-ranked area as follows:

1. The most upstream shoal in the channel is consistently characterized as gravel and cobble. The DMMP agencies used a Tier 1 evaluation (review of site history and data) to conclude that no additional testing was necessary to determine whether this material is suitable for open-water disposal and/or beneficial use.
2. All material in the upstream turning basin and shallow navigation channel between settling basins has consistently been found to be primarily coarse sediments with no history of contamination. A confirmatory level of sampling, designated as approximately one sample per 20,000 cy and one analysis per 100,000 cy, was considered sufficient for characterizing these portions of the project.

3. Although no SL exceedances have previously been observed in the downstream settling basin, the standard level of testing for a low-ranked area is retained because of the fine-grained and organic nature of the sediments that settle out there. For homogenous sediments in a low-ranked area, DMMP calls for one grab sample for each 8,000 cy and one laboratory analysis for each 60,000 cy.

Chemical analysis of the DMMUs shown in the above table resulted in a single COC – benzyl alcohol – being detected at levels above the SL in DMMUs 7, 8, and 9, all from the downstream settling basin. Benzyl alcohol and several other semi-volatiles were analyzed by EPA Method 8270D using both a full scan and SIM methodology using the same sample extract. The laboratory used the SIM methodology to lower reporting limits on these analytes. No QA/QC problems appeared to exist in the benzyl alcohol data.

In most cases of exceedances of even a single detected or undetected COC, bioassays are used to determine whether the exceedances cause observable toxicity in benthic organisms. In this case, the DMMP agencies determined that bioassay testing was not necessary and instead used several lines of evidence to determine that all material was suitable for open-water disposal. These included:

- Several of the grab samples collected in the downstream settling basin included a lens of sulfide-stained plant and wood material. The sulfide-stained layer was covered by a thin 1- to 3-inch-thick layer of sandy silt or silty sand. The overall depth of the deposits could not be determined from the grab sampling but the sulfide-stained layer appeared to extend deeper than 20 cm below the sediment surface. In addition, some of the samples without discrete layers of plant material had trace amounts of wood and plant material in discrete pockets or distributed throughout the sample. Plant and woody material are known natural sources of benzyl alcohol.
- Anthropogenic sources of benzyl alcohol include pharmaceuticals, soap, perfume and flavoring products. However, anthropogenic sources to the Snohomish River have not changed appreciably since previous characterizations. Also, if the benzyl alcohol was from an anthropogenic source, it would most likely be found along with exceedances, or at least detections, of other compounds. There were very low detections of PAHs in the downstream turning basin but those were orders of magnitude below the SL and consistent with past data.
- The Portland District, USACE also used best professional judgment in a similar circumstance in the Umpqua River basin (Abney 2006). In this case as well, this was an isolated exceedance in an area removed from other sources.

Based on the above analysis, the DMMP recommends that the downstream settling basin be sampled with vertical core samples throughout the depth of the dredge prism in future sediment characterizations. This approach could potentially alter the portion of organic material in the analyzed sample and provide a more representative sample of the dredge prism.

City of Renton Municipal Airport Seaplane Base. In addition to the recency extension documented in Table 2-12, the City of Renton proposed minor modifications to the dredge prism covered by their 2007 DMMP suitability determination. The proposed dredge depth was changed from +7 feet to +8 feet (Corps of Engineers Lake Washington Datum). The footprint was also modified - shifted to the west and expanded to the south to include the area occupied by the floating docks. These modifications did not alter the total project volume, which remained at 16,000 cubic yards. The DMMP agencies reviewed the proposed depth and footprint changes and determined that the sampling and testing completed in 2006 still adequately represented the modified project.

Port of Everett Marina. The original volume of 29,000 cubic yards (DMMU 1) was based on bathymetry conducted in 2008. Prior to the commencement of dredging in December 2011 a predredge survey was performed. It was determined that significant additional accretion of sediment had occurred in the intervening time. The greatest amount of infilling occurred on the west and north sides of DMMU 1. The infill material likely consisted of clean sediment from the Snohomish River.

The Port of Everett submitted a request on January 13, 2012 for a volume increase to 39,500 cy for DMMU 1. Based on the sedimentation pattern; the likelihood that the recently accreted material came straight from the Snohomish River; and past testing of sediment in the Snohomish River navigation channel, the DMMP agencies determined that there was little likelihood that the quality of the newly-accreted sediment was an issue. Therefore, the agencies agreed that the requested volume increase was permissible without additional sampling and testing.

Port of Tacoma Husky Terminal. Dioxins in the dredging-prism material were analyzed in two rounds. In the first round of dioxin testing, composited samples representing DMMUs 1 through 4 were tested, resulting in concentrations ranging from 2.78 to 10.99 parts per trillion (pptr) toxicity equivalents (TEQ, with undetects = ½ estimated detection limit). The Port of Tacoma independently initiated a second round of testing to determine the dioxin concentrations in the individual cores making up DMMUs 1, 2 and 3. The range of concentrations for these cores was 1.21 to 8.02 pptr.

With regard to dioxin, the DMMP agencies established new interim disposal guidelines in December 2010 (DMMP, 2010). The new interim guidelines are as follows for non-dispersive sites:

DMMUs with dioxin concentrations below 10 pptr TEQ will be allowed for open-water disposal as long as the volume-weighted average concentration of dioxins in material from the entire dredging project does not exceed the Disposal Site Management Objective of 4 pptr TEQ.

The guidelines also provide flexibility for non-dispersive disposal on a project-specific basis:

Case-by-case decisions to allow disposal of material not meeting the screening levels may be made by the DMMP Agencies based on the overall goal of meeting the Non-dispersive Disposal Site Management Objective. Case-by-case considerations will include the following: (a) material placement sequencing; (b) consideration of the possible cumulative effects of other bioaccumulative compounds within the project sediments; and (c) the frequency of disposal site use.

In the case of Husky Terminal, there were no other bioaccumulative compounds detected above DMMP screening levels and Commencement Bay is a frequently-used disposal site, thereby providing more latitude in making a case-by-case determination. The DMMP agencies evaluated the data from both rounds of testing and provided the Port of Tacoma options for moving forward with the project, including the sequenced dredging and disposal of the entire 42,100 cubic yards of material at the Commencement Bay site, followed by post-disposal monitoring to determine whether the site management objective of 4 pptr had been met. The Port opted not to conduct post-disposal monitoring, but to pursue a mixed-disposal option instead, in which some of the material would be taken to the Commencement Bay site, with the rest of the material disposed upland.

The Port of Tacoma indicated that "Parcel 14", near the head of the Blair Waterway, would be used for the upland disposal component of the project. The DMMP agencies communicated their preference to the Port that the VWA of material taken to the Commencement Bay site be reduced to 4.0 pptr or less if Parcel 14 had adequate capacity for unsuitable material and the upland disposal cost was reasonably low. The Port of Tacoma agreed to this proposal and accepted the following sequence of dredging and disposal at the Commencement Bay site:

Accepted sequence of dredging for open-water disposal

Dredging Order	Dredging Unit	Dioxin/furan TEQ (ng/kg)	Volume (cy)
1	HT-03-01	8.02	*3,200*
2	HT-02-02	4.76	7,100
3	HT-03-02	4.51	7,050
4	DMMU 4	2.78	1,700
5	HT-02-01	1.21	7,100
	VWA:	4.00	26,150

In order to meet the 4.0 pptr target, only a portion of the material from HT-03-01 could be disposed in open water. The maximum volume that could be dredged from HT-03-01 and taken to the Commencement Bay site was 3,200 cubic yards, which is approximately 45% of the total material in that unit. The rest of the material was to be disposed at Parcel 14:

Material for upland disposal

Dredging Unit	Dioxin/furan TEQ (ng/kg)	Volume (cy)
DMMU 1	10.99	12,100
HT-03-01	8.02	*3,850*
VWA:	10.27	15,950

The actual volumes dredged were considerably lower than those shown in the preceding tables. This was due to the conservative assumptions made about under-pier sloughing. A total of 3,480 cubic yards were taken to the Commencement Bay site and 1,357 cubic yards were taken to Parcel 14. The significant change in volumes also affected the final volume-weighted average for dioxin in the material disposed in open-water. The VWA for material taken to the Commencement Bay site was 4.75 pptr, while the VWA for material placed at the upland site was 9.40 pptr. Given the disposal sequencing that was required at the Commencement Bay site, the relatively minor exceedance of the site management objective, the high cost of monitoring and lack of available funds, no post-disposal monitoring was conducted at the site to determine whether the site management objective had been met. Lessons learned from this project will be used in future projects involving case-by-case decision-making.

US Naval Air Station Whidbey Island Fuel Pier Replacement. Subsequent to the 20 May 2011 suitability determination, the Navy made revisions to the project design. The modified design included minor changes in the footprint of the project, plus a 60-foot extension on the west end of the project. The design depth was also subject to change. The original design depth was -20 feet MLLW (plus 1-foot of overdredge depth), but the Navy wanted to include a bid option for an additional two feet of dredging for a

revised design depth of -22 feet (plus 1-foot of overdepth). To cover this contingency the Navy requested a volume increase from 25,000 cy to a maximum of 35,000 cy.

The DMMP agencies reviewed the design modifications vis-à-vis the data collected for the original suitability determination and concluded that additional sampling and testing would not be required for the following reasons:

- The sampling stations used in the 2011 DMMP characterization fell within the footprint of the modified project and provide adequate spatial representation of the modified project.

- There were no DMMP SL exceedances in the 2011 DMMP characterization and most chemicals of concern were undetected at low reporting limits. There was no reason to believe that the additional material included in the modified dredge prism contained chemicals of concern at toxic concentrations.

- Stiff inorganic clay (i.e. native material) was encountered at stations DMMP-1, 2, 3 and 4. This prevented z-samples from being collected at DMMP-1, 2 and 3; only a 0.6 ft z-sample could be collected at DMMP-4. The z-samples collected at DMMP-5 and 6 were silty sand, but these two sampling locations were the farthest removed from the fuel pier. Therefore, most of the deeper material in the modified -22-foot project is native material.

- In a moderate-ranked area, surface material requires one sample for each 4,000 cubic yards and one dredged material management unit (DMMU) for each 16,000 cubic yards. There were a total of nine samples and three DMMUs, which were nominally enough to cover 36,000 cubic yards and 48,000 cubic yards respectively. This was adequate to cover the maximum proposed volume of 35,000 cubic yards.

- While the revised dredging boundaries included the sideslopes on either end of the sheetpile wall at the face of the fuel pier, the volume to be dredged from these sideslopes was estimated to be only 358 cy, approximately 1 percent of the total volume. The sheetpile wall will be in place prior to dredging, thereby preventing underpier material from sloughing into the area being dredged.

4.2 Dredging Year 2013

Bay Head Marina. A sediment characterization report was sent to the DMMP agencies on June 27, 2012 documenting the results of sampling and analysis that were conducted in the marina without prior coordination with the DMMP agencies and without an approved SAP. After reviewing the sediment characterization report, the DMMP agencies determined that dioxin/furan analysis would be required in order to dispose of the material at the dispersive Rosario Strait disposal site. There was no properly archived sediment available for the dioxin analysis, so additional sampling was necessary. A SAP for the additional sampling and dioxin analysis was prepared, approved by the DMMP agencies and followed.

Port of Anacortes, Pier 2. A single DMMU was sampled and tested at Pier 2. TBT was quantitated at 0.38 µg/L, exceeding the BT of 0.15 ug/L. The applicant proposed breaking the DMMU into three subareas, corresponding to the three samples that were composited for the original analysis. TBT testing was conducted on archived material from the three subareas. The TBT concentration for two of the subareas exceeded the BT, with concentrations of 4.9 and 0.45 ug/L. The applicant elected not to perform

bioaccumulation testing on the subareas exceeding the BT, so these two subareas were determined to be unsuitable for open-water disposal. The third subarea was found to be suitable for open-water disposal.

Olympia Yacht Club. There were a number of issues related to the sampling and documentation for this project that required application of best professional judgment by the DMMP agencies. Following are the most important of these issues and the resolution arrived at by the agencies:

- One station (SC-4) was placed incorrectly in the field, with the sample taken just outside the dredging footprint. The DMMP agencies determined that this error did not impact the representativeness of the sample because it was located on a mudflat that appeared to be consistent in nature. The dioxin data supported this determination.

- In a second case (SC-5), the contractor determined that the recorded sample coordinates were in error and provided approximate coordinates for that station. The agencies determined that the evidence provided for the corrected location was convincing. Also, SC-5 was located within a DMMU subunit that was found unsuitable for open-water disposal. So the precise location of SC-5 was not critical for decision-making. Had it been at the recorded location, the decision for this subunit would not have changed.

- Real-time tidal correction of the measured mudline elevations was performed in the field, but upon later examination these tide-corrected measurements were found to be unreliable. To address this issue, the contractor returned to the site and did numerous spot checks of the bathymetry data. On the basis of these spot checks, the contractor decided to use the hydrographic survey data to derive estimated mudline elevations at the sampling stations. The DMMP agencies accepted this solution to the problem.

- As a result of the problems encountered during sampling, approximately 0.8 ft and 0.5 ft of sediment from what should have been the z-sample stratum at stations SC-8 and SC-9 were included in the composite representing DMMU 4. There was evidence from the z-sample composite for dioxin that this deeper material was cleaner than the shallower material. Therefore, including cleaner material in the DMMU 4 composite would have decreased the concentration of chemicals of concern in this laboratory sample. The potential effects of this dilution were evaluated by applying a worst-case correction factor to the chemical concentrations found in DMMU 4. Application of the correction factor did not elevate any chemicals of concern above the DMMP screening levels, so this sampling error was determined not to have impacted the representativeness of the analytical results.

Salmon Bay Marina. This project was complicated by the site bathymetry, with mudline elevations dropping off steeply on the northeast side of the dredge prism. It was further complicated by difficulties in vibracoring due to the presence of stiff native material at shallow depths. Numerous attempts were made at the target sampling stations, with only limited success in retrieving subsurface samples.

The analytical data indicated that the native material was uncontaminated, while the soft, black layer of silt that had accumulated over the entire project area was moderately contaminated. The DMMP agencies worked with the contractor to reconfigure the dredging project, with the top 1.5 feet of material being found unsuitable for open-water disposal and the underlying native material being found suitable. An additional 1-foot vertical buffer is to be included when separating suitable for unsuitable during dredging, meaning that the top 2.5 feet of material will need to be taken to an upland disposal site.

USACE Grays Harbor Navigation Improvement Project. This project presented numerous challenges mainly due to problems encountered during biological testing and conflicting results for chemistry and bioassays:

- Unexpectedly high clay content was found in DMMUs CP32 and CP33. The initial amphipod tests were inadvertently run with a species – *Eohaustorius estuarius* – that is known to be sensitive to clay content. CP32 and CP33 both scored hits under the single-hit rule. The amphipod bioassay was rerun, using *Eohaustorius estuarius* and *Ampelisca abdita* in a side-by-side test. In the retest there were no hits for either species. The DMMP agencies used a weight-of-evidence approach for CP33 and found this DMMU suitable for open-water disposal. The evidence was less clear for CP32 and the agencies required this DMMU to be resampled and tested to provide more definitive evidence.

- DMMU CO7 scored hits under the single-hit rule in the larval test using both the standard and resuspension protocols. In order to reduce the volume requiring upland disposal, the Corps of Engineers split the DMMU into two subunits, resampled it along with CP32 and conducted additional testing.

- In the second round of amphipod testing of CO7 and CP32, ammonia concentrations were present at toxic concentrations. The amphipod results were rejected as a result. Both subunits of CO7 passed the other two bioassays and there were no SL exceedances. The second round of sampling was more intensive than in the first round, thus providing a better spatial and volumetric representation of the dredged material in these DMMUs. Therefore, the DMMP agencies weighted the results from Round 2 more heavily than the results from Round 1. Based on a weight-of-evidence approach, both subunits of CO7 were found suitable for open-water disposal. CP32 was more complicated. Subunit CP32a exhibited toxicity in the larval test that could not be explained by any single nontreatment effect. Therefore, the DMMP agencies found this subunit unsuitable for open-water disposal. Subunit CP32b only scored a hit under the 2-hit rule in the standard larval test in Round 2 and was found suitable for open-water disposal.

Simpson Lumber. Analysis of dioxin in surface debris from this project was required by the DMMP agencies, even though upland disposal was planned for the 135 cy of proposed dredged material, due to the extremely high levels of dioxins found though Oakland Bay sediments. The material proposed for dredging consisted of a large amount of woody debris; so a sample was collected and sieved at the laboratory into a >0.5 inch fraction and a <0.5 inch fraction. Dioxin in both sample fractions was below the MTCA method B criterion for dioxin of 11 pptr TEQ. Thus, the project passed anti-degradation and no additional analyses were required.

City of Kenmore, Navigation Channel and Vicinity. Testing was conducted as part of a characterization effort supported by the City of Kenmore and Department of Ecology to assess sediment quality in the northeastern portion of Lake Washington in and near the City of Kenmore. One objective of this effort was to provide information from the federal navigation channel to support a funding request for maintenance dredging by the Corps of Engineers.

Six grab samples were collected within the Kenmore Navigation Channel. The DMMP marine SL was exceeded for benzyl alcohol at five of the six stations, and the ML was exceeded for benzoic acid at two of the stations. Under a full DMMP characterization, exceedances of SL or ML would require biological

toxicity testing to complete the suitability determination. With respect to the freshwater guidelines assessment, the 2006 SL1 was exceeded in the channel for bis(2-ethylhexyl)phthalate at four stations and the SL2 was exceeded at two stations. Zinc exceeded SL1 at two of the six stations and phenol exceeded the SL1 at a single station. Dioxin concentrations ranged from 1.5 to 8.4 pptr -TEQ. Therefore, all six stations were quantified below the bioaccumulation trigger (10 pptr-TEQ), but only two of the six stations were quantified below the site management objective of 4 pptr-TEQ. These data suggest that dioxin concentrations may pose an impediment to open-water disposal.

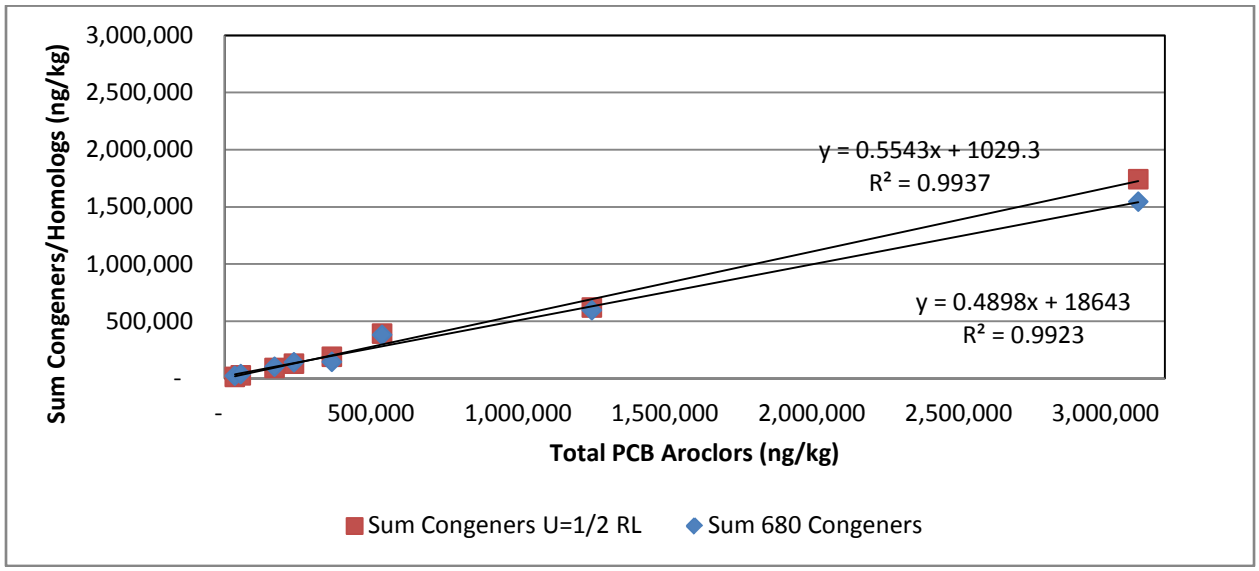
USACE Duwamish Subsurface Sediment Investigation. This project was designed to gather information about the level of contamination in subsurface sediments throughout the Lower Duwamish Waterway, East Waterway, and West Waterway in order to facilitate planning for future dredging. In addition, monitoring of the CAD site in West Waterway was conducted, and a special study comparing PCB methods was also conducted. Vibracores were taken from 1 location in East Waterway (EW), 4 locations in West Waterway (WW) and 18 locations in the Lower Duwamish Waterway (LDW). All of these locations were chosen to represent areas that had shoaled above the authorized depth of the navigation channel, and therefore might be subject to dredging in the future.

Results of the analyses are documented in *Data Report: Lower Duwamish Waterway, East Waterway, and West Waterway Subsurface Sediment Characterization* (HDR, 2013). All standard DMMP COCs were analyzed, as well as porewater TBT and dioxin. Briefly, results from the LDW demonstrated widespread contamination above DMMP screening levels for multiple COCs, including mercury, PCBs, benzyl alcohol and dioxin. Extremely high levels of PAHs, PCBs, and dioxin were found at several locations within the northern-most section of the LDW. The single core collected from East Waterway was below DMMP screening levels for all COCs, including dioxin. In the West Waterway, most of the samples were below DMMP screening levels, with the exception of the surface interval from WW02, which had elevated PCBs and dioxin.

Monitoring of the WW CAD site followed previous monitoring events; the most recent of which occurred in 1995. Cores were taken from three locations within the CAD site, and at each location core samples were collected from within the contaminated material and from within the sand cap layer. The sand cap layer was positively identified at all three locations, although the thickness of the sand layer varied considerably. The amount of sedimentation above the sand layer was greater than previously found, as would be expected in a depositional environment. Metals and PCBs were measured in four intervals from each core location. Overall, the highest concentrations were found within the contaminated material, with lesser concentrations in the sand cap layers, demonstrating that the CAD is still functioning as designed.

Ten samples were chosen for a detailed PCB methods study. These ten samples were analyzed for total PCBs by three methods: PCB Aroclors by Method 8080, PCB homologues by Method 680, and PCB congeners by Method 1668. Results of the homologue method 680 showed poor correlation with results of the other methods; this was later determined to be due to sulfur interference. All the samples were re-extracted with a sulfur clean-up step, and the results of this second analysis showed a high degree of correlation with the results of methods 8080 and 1668 - see the figure below. Consistent with results found in other studies, total PCB values calculated by method 680 or 1668, are approximately 50% less than total PCBs by method 8080.

Regression of 1) sum of congeners (U=1/2 RL) vs. total Aroclors and 2) sum of homologues vs. total Aroclors



CHAPTER 5. DISPOSAL SITE USE AND MONITORING

5.1 Disposal Activity and Site Use

The DMMP program manages designated open-water disposal sites in Puget Sound and coastal Washington (Grays Harbor and Willapa Bay). For those projects placing dredged material at these sites, the Washington State Department of Natural Resources (DNR) issues site-use authorizations prior to placement. These authorizations are issued for sediments that are:

- suitable for unconfined open-water disposal as determined by the Dredged Material Management Program (DMMP) evaluation process, and
- associated with dredging projects that have received all other required regulatory permits (e.g., Clean Water Act 401/404 permits).

Other disposal options for open-water disposal include flow-lane disposal (used primarily in the lower Columbia River) or beneficial use.

5.1.1 Dredging Year 2012 (June 16, 2011 through June 15, 2012)

During DY12, four Puget Sound non-dispersive sites received material from six separate projects (Table 5-1 and Table 5-2). Only one small project (180 cy from Skyline Marina in Anacortes) placed material at a Puget Sound dispersive site (Rosario Strait). The dispersive sites in Grays Harbor received almost 2 million cy from maintenance dredging of both the federal navigation channel and Port of Grays Harbor terminals.

Over 288,000 cy of material were placed at beneficial use sites in Puget Sound and Grays Harbor, or approximately 12% of total open-water disposal.

Table 5-1. Dredging Year 2012 Disposal Site Use Summary

Disposal Site	Jurisdiction	# of Projects	Total Volume (cy)
Anderson/Ketron Island	Puget Sound	1	10,579
Commencement Bay	Puget Sound	1	3,480
Elliott Bay	Puget Sound	2	165,700
Port Gardner	Puget Sound	2	34,143
Rosario Strait	Puget Sound	1	180
Keystone Harbor BU	Puget Sound	1	34,920
Point Chehalis	Grays Harbor	4	1,606,641
South Jetty	Grays Harbor	1	320,985
Half Moon Bay BU	Grays Harbor	1	111,205
South Beach BU	Grays Harbor	1	142,313
Total Puget Sound sites	Puget Sound Keystone BU	7 1	214,082 34,920
Total GH/WB sites	Grays Harbor sites Grays Harbor BU Willapa Bay sites	4 1 0	1,927,626 253,518 0
Total upland sites	All	4	53,516
Grand Total	All Sites	15	2,483,662

Table 5-2. Summary of Disposal Activity by Project and Site, DY12

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	# Off Site	Disposal Dates
AK	Zittel's Marina	American Construction	CS	10,579	9	0	12/21/11 – 1/14/12
CB	Port of Tacoma, Husky Terminal	Orion Marine Construction	CS	3,480	3	0	1/26/12 – 2/13/12
UD	Port of Tacoma, Husky Terminal	Orion Marine Construction	CS	1,357	N/A	N/A	---
EB	USACE Seattle Harbor/Duwamish	Kiewit Construction	CS	152,349	38	0	0/17/11 – 2/22/12
EB	KC/WDOT – South Park Bridge	Kiewit-Massman	CS	13,351	16	0	9/17/11 – 2/22/12
UD	KC/WDOT – South Park Bridge	Kiewit-Massman	CS	3,459	N/A	N/A	---
PG	Port of Everett, Pacific Terminal	Manson Construction	CS	2,990	5	0	1/23/12 – 1/31/12
PG	Port of Everett, Everett Marina	Pacific Pile & Marine LP	CS	31,153	62	0	12/27/11 – 2/20/12
UD	Hat Island Marina	Redside Construction	CS	1,200	N/A	N/A	---
UD	Port of Bellingham Gate 3	Dutra Construction	CS	47,500	N/A	N/A	---
RS	City of Anacortes, Skyline Marina	Waterfront Construction	CS	180	4	0	3/7/11 – 3/14/12
BN (BU)	USACE Keystone Harbor	American Construction	CS	34,920	N/A	N/A	11/30/11 – 1/20/12
PC	Port of Grays Harbor, Terminal 2	American Construction	CS	51,240	14	0	1/24/12 – 2/3/12
PC	Port of Grays Harbor, Terminal 3	American Construction	CS	69,337	28	0	1/28/12 – 2/6/12
PC	Port of Grays Harbor, Terminal 4	American Construction	CS	4,350	2	0	1/24/12 – 2/3/12
PC	USACE Grays Harbor, Inner Harbor	American Construction	CS	562,191	157	0	11/18/11 – 2/14/12
SJ	USACE Grays Harbor, Inner Harbor	American Construction	CS	268,563	87	0	11/18/11 – 2/14/12
PC	USACE Grays Harbor, Outer Harbor	Essayons	HD	744,743	70	0	5/2/11 – 5/18/11
SB (BU)	USACE Grays Harbor, Outer Harbor	Essayons	HD	142,313	14	0	5/2/11 – 5/18/11
PC	USACE Grays Harbor, Outer Harbor	Yaquina	HD	174,780	190	0	4/19/11 – 5/19/11
SJ	USACE Grays Harbor, Outer Harbor	Yaquina	HD	52,422	57	0	4/19/11 – 5/19/11
HMB (BU)	USACE Grays Harbor, Outer Harbor	Yaquina	HD	111,205	121	0	4/19/11 – 5/19/11

Puget Sound Disposal Sites
AK = Anderson/Ketron Island
CB = Commencement Bay
EB = Elliott Bay
PG = Port Gardner
RS = Rosario Strait
BN (BU) = Beach Nourishment – beneficial use

UD = Upland Disposal

Grays Harbor/Willapa Bay Disposal Sites
PC = Point Chehalis (GH)
SJ = South Jetty (GH)
HMB (BU) = Half Moon Bay beneficial use (GH)
SB (BU) = South Beach beneficial use (GH)

Dredge Types
CS = Clamshell Dredge
HD = Hopper Dredge

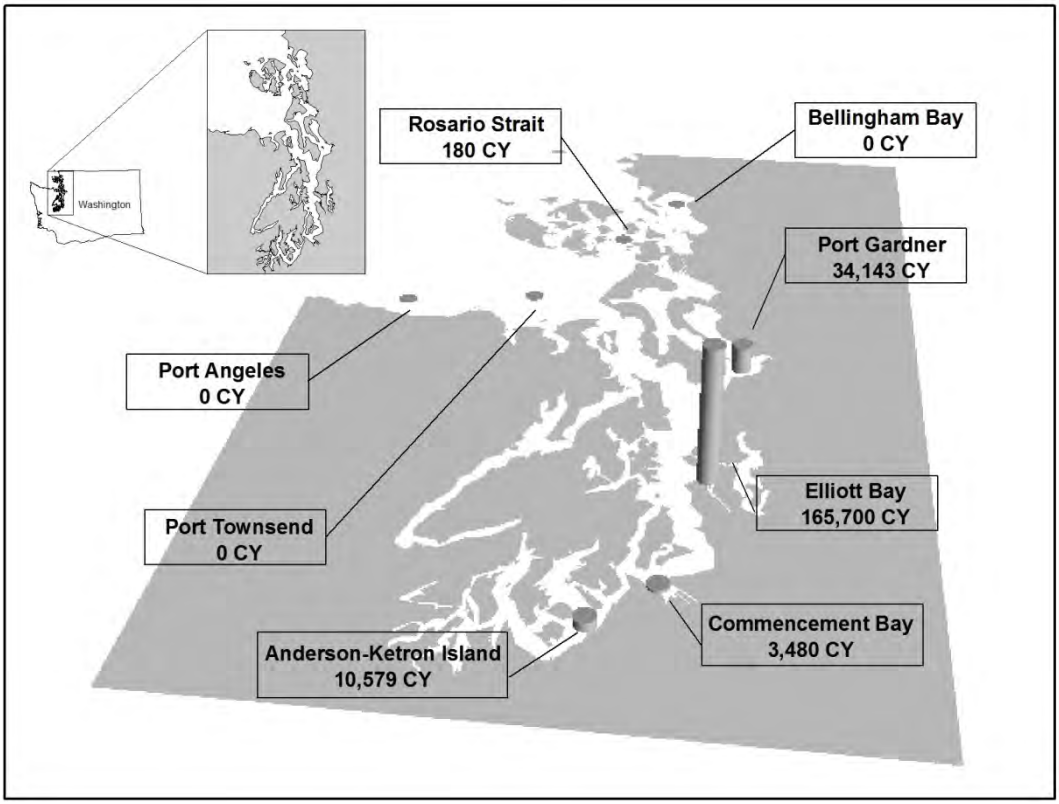


Figure 5-1. DY12 disposal volumes in Puget Sound

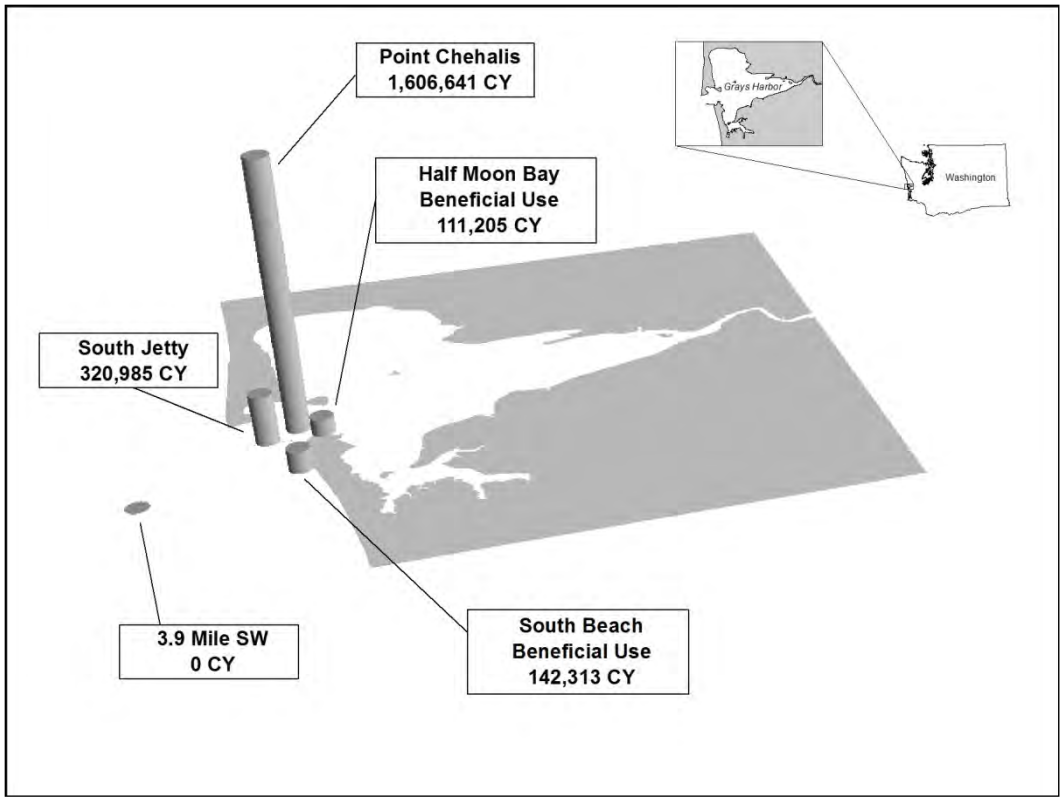


Figure 5-2. DY12 disposal volumes in Grays Harbor

5.1.2 Dredging Year 2013 (June 16, 2012 through June 15, 2013)

During DY13, three Puget Sound non-dispersive sites received material from five separate projects (Table 5-3 and Table 5-4). The only Puget Sound dispersive site to receive material was Rosario Strait, which was also the highest-use site during DY13.

The dispersive sites in Grays Harbor received over one million cy from maintenance dredging of the federal navigation channel. An additional 676,000 cy from the same project were placed at beneficial use sites in Grays Harbor. One barge-load of material on its way to the Point Chehalis site was accidentally disposed in the navigation channel due to operator error (Table 5-4).

Statewide, there was high use of clean material for beneficial uses: 38% of all DY13 dredged material went to inwater, nearshore or upland beneficial uses.

Table 5-3. Dredging Year 2013 Disposal Site Use Summary

Disposal Site	Jurisdiction	# of Projects	Total Volume (cy)
Commencement Bay	Puget Sound	1	1,673
Elliott Bay	Puget Sound	3	15,266
Port Gardner	Puget Sound	1	104,199
Everett – Jetty Island BU	Puget Sound	1	87,017
Everett – Upland BU Site "O"	Puget Sound	1	92,489
Rosario Strait	Puget Sound	1	144,206
PSR BU	Puget Sound/CERCLA	1	40,000
Point Chehalis	Grays Harbor	3	1,190,142
Half Moon Bay BU	Grays Harbor	1	86,147
South Beach BU	Grays Harbor	1	589,954
Other Upland Sites	All	1	4,640
Total Puget Sound sites	PSDDA sites Jetty Island BU PSR/CERCLA BU	6 1 1	265,344 87,017 40,000
Total GH/WB sites	Grays Harbor sites Grays Harbor BU Willapa Bay sites	3 1 0	1,190,142 676,101 0
Total upland sites	All	2	97,129
Grand Total	All Sites	11	2,355,733

Table 5-4. Summary of Disposal Activity by Project and Site, DY13

Site	Proponent/Project	Dredger	Dredge Type	Disposal Volume (cy)	# Barge Loads	# Off Site	Disposal Dates
CB	Murphy's Landing (Owner Assoc.)	Orion Marine Contractors	CS	1,673	1	0	9/28/12
EB	Bellingham Cold Storage	Pacific Pile and Marine	CS	6,516	12	0	8/9/12 – 8/24/12
EB	KC/WSDOT South Park Bridge	Kiewit-Massman	CS	3,496	7	0	8/24/12 – 10/8/12
EB	Delta Marine Maintenance Dredging	Kiewit Infrastructure West	CS	5254	6	0	2/2/13 – 2/11/13
PG	Port of Everett/USACE Snohomish	American Construction	CS	104,199	74	0	1/22/13 – 2/13/13
RS	USACE, Swinomish	American Construction	CS	144,206	137	0	9/21/12 – 1/15/13
PSR (BU)	USACE, Swinomish	American Construction	CS	40,000	26	0	10/19/12 – 11/08/12
Site "O" (UD/BU)	USACE, Snohomish	Portable Hydraulic Dredging	HYD	92,489	N/A	N/A	10/16/12 – 11/14/12
JI (BU)	USACE, Snohomish	Portable Hydraulic Dredging	HYD	87,017	N/A	N/A	11/15/12 – 12/19/12
UD	USACE, Duwamish	Kiewit	CS	4,640	N/A	N/A	1/28/13 – 2/17/13
PC	Port of Grays Harbor, Terminal 2	American Construction	CS	78,270	28	0	11/29/12 – 1/31/13
PC	WSDOT 520 Bridge Pontoon Const.	Kiewit-General	CS	19,629	17	0	4/12/13 – 4/20/13
PC	USACE, Grays Harbor, Inner Harbor	American Construction	CS	860,391	312	1	5/11/12 – 1/29/13
PC	USACE, Grays Harbor, Outer Harbor	Essayons	HD	129,528	27	0	4/1/13 – 4/21/13
PC	USACE, Grays Harbor, Outer Harbor	Yaquina	HD	102,324	115	0	4/6/13 – 5/2/13
SB (BU)	USACE, Grays Harbor, Outer Harbor	Essayons	HD	477,732	94	0	4/1/13 – 4/21/13
SB (BU)	USACE, Grays Harbor, Outer Harbor	Yaquina	HD	112,222	122	0	4/6/13 – 5/2/13
HMB (BU)	USACE, Grays Harbor, Outer Harbor	Yaquina	HD	86,147	90	0	4/6/13 – 5/2/13

Puget Sound Disposal Sites
AK = Anderson/Ketron Island
CB = Commencement Bay
EB = Elliott Bay
PG = Port Gardner;
RS = Rosario Strait
PSR (BU) = cap material for PSR CERCLA site (beneficial use)
Site "O" = upland material storage site, Everett
JI (BU) = Jetty Island beach nourishment, Everett (beneficial use)

UD = Upland Disposal

Grays Harbor/Willapa Bay Disposal Sites
PC = Point Chehalis (GH)
HMB (BU) = Half Moon Bay beneficial use (GH)
SB (BU) = South Beach beneficial use (GH)

Dredge Types
CS = Clamshell Dredge
HYD = Hydraulic Dredge (pipeline)
HD = Hopper Dredge

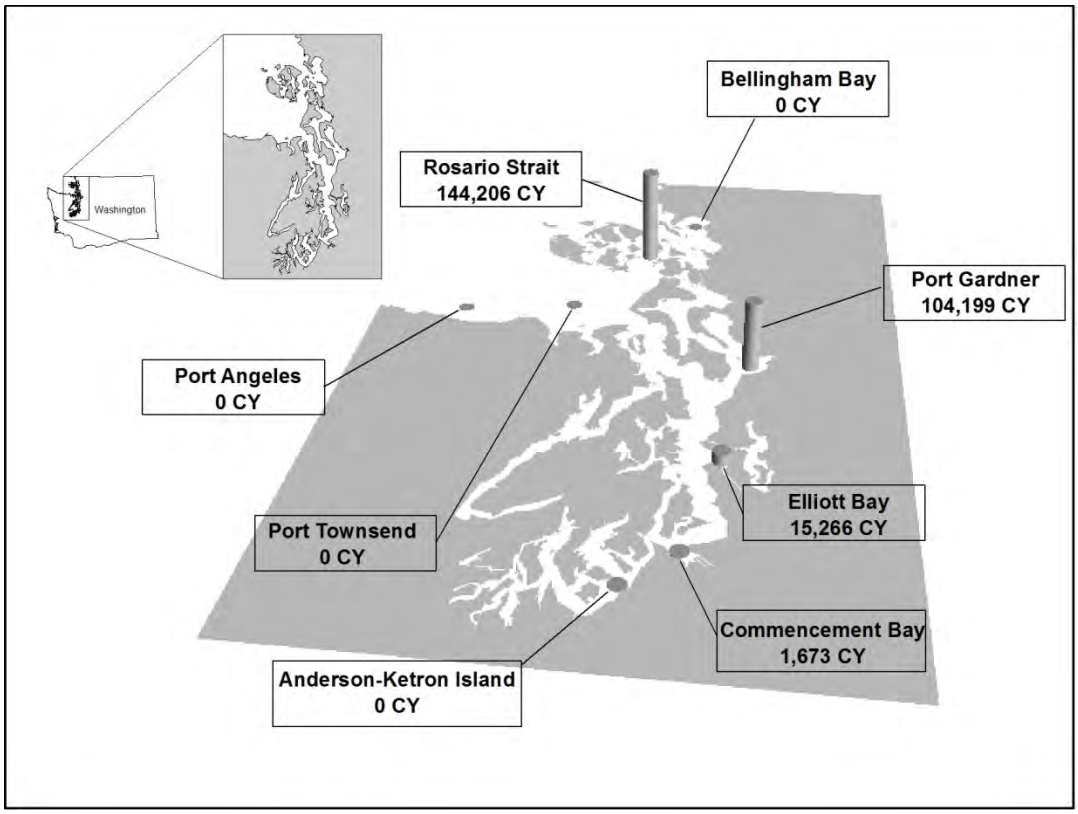


Figure 5-3. DY13 disposal volumes in Puget Sound

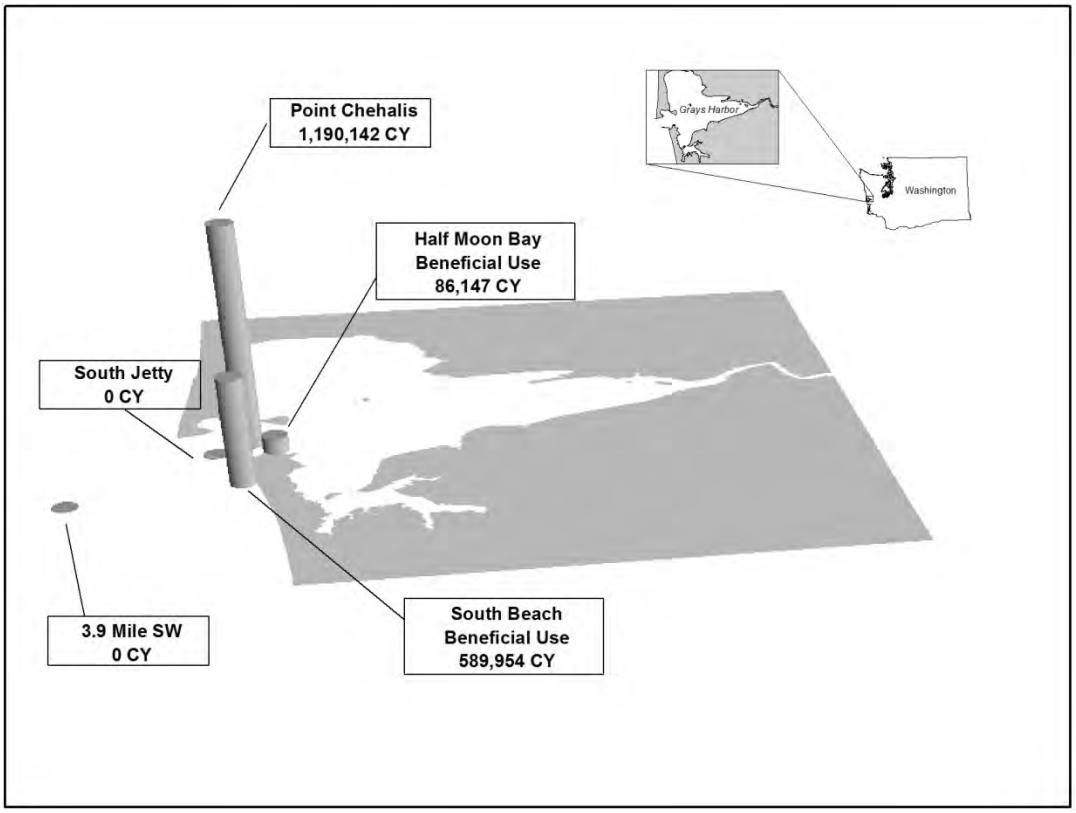


Figure 5-4. DY13 disposal volumes in Grays Harbor

5.2 Post-Disposal Site Monitoring (2012 – 2013)

During this biennium, placement at the Commencement Bay site was quite low compared to average annual disposal. The Bellingham Bay site was the only non-dispersive site with no disposal at all during dredging years 2012-2013. Of the three dispersive sites in Puget Sound only Rosario Strait was used (Table 5-6).

There were no monitoring events conducted during the 2012-2013 biennium. However, disposal at the Elliott Bay site passed the 500 kcy "soft trigger" (DMMP 2002) for monitoring during DY13. Partial monitoring of the Elliott Bay site - as well as SPI and multibeam bathymetric surveys of both the Commencement Bay and Elliott Bay sites - was conducted in early DY14 and will be summarized in the DY14-15 biennial report.

Table 5-5. Cumulative Disposal Volumes at the end of DY13 Relative to Soft Triggers

Site: (Monitoring Soft Triggers)	A/K (300 kcy)	CB (500 kcy)	EB (500 kcy)	PG (500 kcy)	BB (300 kcy)
Last Monitoring date(s)	Partial 2005 SS 2007/2008 (dioxin)	Full 2007 SS 2007 (dioxin)	Partial 2002 SS 2005 SS 2007 (dioxin)	Tiered-Full 2010	Partial 1993 SS 2007 (dioxin)
Cumulative volume since last monitoring event	118,296	~~432,786~~	603,121	182,538	46,000
Cumulative volume since SS (dioxin)	10,579	432,786	486,475	NA	0
DY14 Monitoring	none	SPI/MBS	Partial, including SPI/MBS	none	none

A/K = Anderson/Ketron
EB = Elliott Bay
BB = Bellingham Bay
CB = Commencement Bay
PG = Port Gardner
SS = Special Study
SPI = sediment profile imaging
MBS = multibeam bathymetric survey

5.3 Cumulative DMMP Disposal Site Use and Monitoring History

The cumulative dredged material volumes disposed at each Puget Sound and Grays Harbor/Willapa Bay site since program implementation are depicted in Figure 5-5 and Figure 5-6 and listed in Table 5-6. Twenty-five-year summaries for the Puget Sound sites show that site capacities used in the FEIS appear to be sufficient to last at least 40 more years.

The PSDDA Management Plan Reports (MPR 1998, 1989) recognized that intensive post-disposal monitoring surveys would be required early in the program to gather data on the adequacy of the evaluation procedures to meet the site management objectives. None of the monitoring events to date have detected adverse impacts at any of the non-dispersive sites. In accordance with the management plan, the DMMP agencies reduced the frequency and scope of monitoring based on past documented compliance with the

site management objectives. The DMMP agencies increased the disposal volume soft trigger from 150,000 cy to 300,000 cy in 1996, and subsequently raised it from 300,000 cy to 500,000 cy at the Commencement Bay site, Elliott Bay site, and the Port Gardner site following the 2002 SMARM. The volume trigger was left at 300,000 cy for the two less-frequently used non-dispersive sites (Bellingham Bay and Ketron/Anderson Island). The monitoring triggers are considered soft triggers, and may be relaxed at the discretion of the DMMP agencies based on best professional judgment.

Table 5-8 summarizes the completed DMMP disposal site monitoring surveys at the Puget Sound non-dispersive and dispersive sites. To date, the DMMP agencies have conducted multiple post-disposal monitoring surveys at non-dispersive sites, four post-disposal bathymetric surveys at the Rosario Strait dispersive site, and four bathymetric surveys at the Commencement Bay site. Monitoring has also involved side-scan surveys at the Bellingham Bay and Elliott Bay sites to evaluate debris disposal concerns onsite. Additionally, multiple special studies have been conducted, including the 2006-2007 dioxin sediment and tissue evaluation at the Puget Sound non-dispersive sites, and the 2008 dioxin special study at the Anderson/Ketron Island site to reassess dioxin sediment concentrations following the off-site disposal of one barge load of material.

Based on Puget Sound site monitoring conducted to date (including physical mapping, on- and off-site sediment chemistry, sediment toxicity, off-site infaunal bioaccumulation, and off-site benthic community structure analysis), dredged material disposal has not caused adverse impacts at or adjacent to any of the non-dispersive sites. DMMP evaluation procedures have consistently met the site management objectives, and appear to be adequately protecting the disposal site environments and surrounding areas.

The overall goals of the DMMP site monitoring program are to ensure that the DMMP-prescribed disposal site conditions are maintained and to verify that DMMP dredged material evaluation procedures adequately protect the aquatic environment. Monitoring surveys provide positive feedback to verify the adequacy of the DMMP dredged material management process. The Sediment Management Annual Review Meetings provide a forum to report on these post-disposal survey findings conducted during any given dredging year, and to make management plan adjustments if needed.

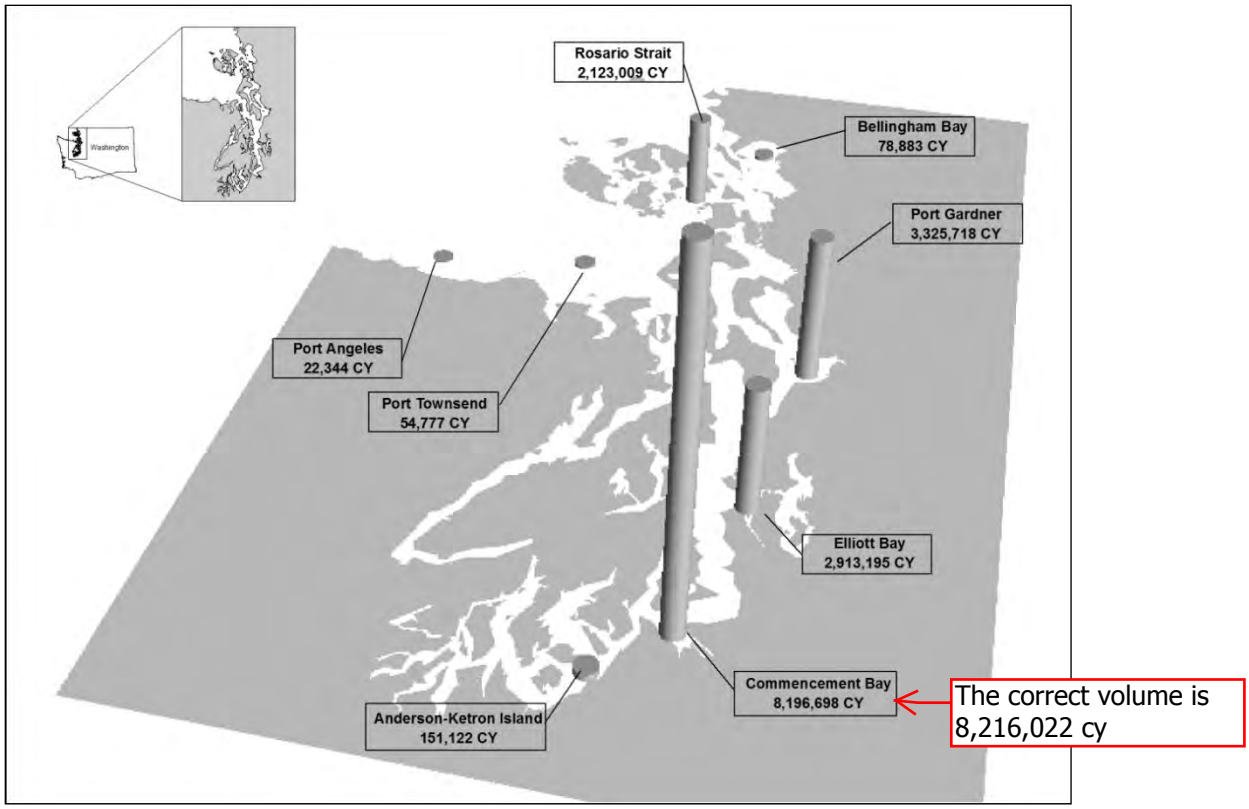


Figure 5-5. DMMP cumulative disposal volumes in Puget Sound 1989 – 2013

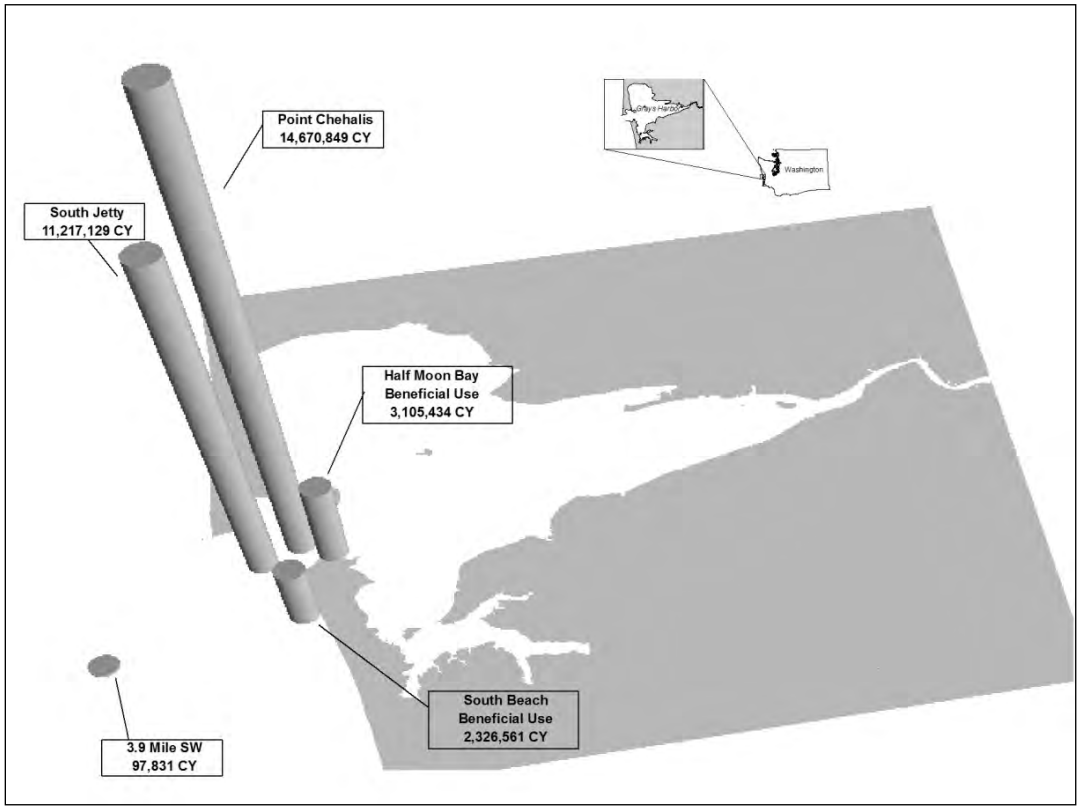


Figure 5-6. DMMP cumulative disposal volumes in Grays Harbor 1996 – 2013

Table 5-6. Cumulative Site-Use Summary

Disposal Site	Dredging Years Used	Volume Disposed 2012 - 2013	Cumulative Volumes Disposed (cy)	Average Annual Disposal Volume (cy)
PUGET SOUND (Central)	1989 - 2013			
Port Gardner (ND)	90, 91, 93, 94, 95, 96, 97, 02, 06, 07, 08, 09, 10, 11, 12, 13	138,342	3,325,718	138,572
Elliott Bay (ND)	90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	180,966	2,913,195	121,383
Commencement Bay (ND)	89, 91, 95, 96, 98, 99, 00, 01, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	5,153	~~8,196,698~~	341,529
PUGET SOUND (North / South)	1990 – 2013			
Bellingham Bay (ND)	93, 96, 98	0	78,883	3,430
Anderson/Ketron (ND)	93, 95, 04, 05, 07, 08, 12	10,579	151,122	6,571
Rosario Strait (D)	91, 92, 93, 94, 95, 96, 98, 99, 02, 03, 04, 05, 06, 07, 09, 11, 12, 13	144,386	2,123,009	92,305
Port Townsend (D)	93, 98, 99, 07, 09, 10	0	54,777	2,382
Port Angeles (D)	96	0	22,344	971
PUGET SOUND (Total)		479,426	16,865,746	707,142
GRAYS HARBOR	1996 – 2013			
Point Chehalis (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	2,796,783	14,670,849	815,047
South Jetty (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 09, 11, 12	320,985	11,217,129	623,174
Half Moon Bay (BU)	96, 97, 98, 99, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13	197,352	3,105,434	172,524
(2001-2013) South Beach (BU)	01, 02, 04, 05, 06, 09, 10, 11, 12, 13	732,267	2,326,561	178,966
3.9 Mile Ocean (D)[1]	03, 04	0	97,831	5,435
GRAYS HARBOR (Total)		4,047,387	31,417,804	1,795,146
WILLAPA BAY	1996 – 2013			
Cape Shoalwater (D)	00, 03	0	251,095	13,950
Goose Point (D)	99, 03, 06	0	205,977	11,443
(2010-2013) Tokepoint (FLD)	10, 11	0	55,000	13,750
QUILLAYUTE	2008 – 2013			
Site A, Site 2A (BU)	08, 10	0	119,184	19,864
WILLAPA & QULLAYUTE (Total)		0	631,256	70,140
Totals (all sites)		4,526,813	48,914,806	2,541,347

ND = nondispersive; D = dispersive; BU = beneficial use; FLD = flow lane disposal

Table 5-7. Puget Sound Nondispersive Sites: Cumulative Disposal Volumes vs. Site Capacity

Disposal Site	Range of Years Open	# of Years Open	Cumulative Volume (cy)	Average Annual Volume (cy/yr)	Site Capacity[1] (cy)	Percent of Site Capacity	Est. Time to Reach Site Capacity[2] (Years)
Port Gardner	1989-2013	25	3,325,718	133,029	9,000,000	37.0	42.7
Elliott Bay	1989-2013	25	2,913,195	116,528	9,000,000	32.4	52.2
Bellingham Bay[3]	1990-2013	24	78,883	3,287	9,000,000	0.9	>100
Commencement Bay	1989-2013	25	~~8,196,698~~	327,868	23,000,000[4]	35.6	45.2
Anderson/Ketron	1990-2013	24	151,122	6,297	9,000,000	1.7	>100

[1] Site capacity estimated in Phase I and II Disposal Site Selection Technical Appendices for non-dispersive sites is approximately 9,000,000 cubic yards.

[2] Estimated Time to Reach Site Capacity = (Site Capacity – Cumulative Volume)/average annual disposal volume.

[3] The Bellingham Bay disposal site has not been used since 1998; it is currently deactivated and not available for disposal pending renewal of the shoreline permit.

[4] The capacity of the Commencement Bay site was increased from 9 to 23 million cubic yards following finalization of a 2010 NEPA/SEPA Supplemental Environmental Impact Statement.

Table 5-8. Puget Sound Disposal Site Monitoring History

Year	Disposal Site	Type of Survey
1988	Port Gardner, Elliott Bay, Commencement Bay	Initial Baseline Surveys: Full
1989	Bellingham Bay, Anderson/Ketron Island	Initial Baseline surveys: Full
1990	Bellingham Bay	Dungeness Crab Density Study
1990	Port Gardner	Full
1990	Elliott Bay	Partial
1991	Rosario Strait	Bathymetric Survey
1991	Port Gardner, Bellingham Bay	Special Study: new PG benchmark station Special Study: tissue chemistry protocol PG/BB
1992	Elliott Bay	Full
1993	Bellingham Bay	Partial, Side Scan Sonar Survey
1994	Port Gardner	Tiered-Full
1994	Rosario Strait	Bathymetric Survey
1995	Elliott Bay	Side Scan Sonar Survey (debris evaluation)
1995	Commencement Bay	Tiered-Full (new baseline)
1996	Commencement Bay	Tiered-Partial
1998	Commencement Bay	SPI Survey
1999	Rosario Strait	Bathymetric Survey
2000	Elliott Bay	Full, special PCB Congener Study, 45-day bioaccumulation
2001	Commencement Bay	Full + Bathymetric Survey
2002	Elliott Bay	Tiered-Full, BCOC special study
2003	Commencement Bay	Tiered-Full
2004	Commencement Bay	Tiered-Partial + Bathymetric Survey
2005	Commencement Bay	SPI Survey + Special Phenol Study
2005	Anderson/Ketron Island	Full (new baseline)
2005	Elliott Bay	Special Onsite Chemistry Study
2006	Port Gardner	Full, Dioxin Baseline
2006	Commencement Bay	Mulitbeam bathymetric survey (MBS)
2007	Commencement Bay, Bellingham Bay, Elliott Bay,	Full + MBS @ CB site, dioxin baseline at all 3 sites
2008	Anderson/Ketron Island	Dioxin/furan post-disposal special survey (offsite disposal evaluation): OSV Bold Survey
2009	Rosario Strait	Multibeam Bathymetric Survey
2010	Port Gardner	Tiered-Full
2010	Puget Sound Dispersive Sites	Fate & Transport Study

SPI = Sediment Profile Imagery Survey
BCOC = bioaccumulative chemicals of concern
Partial = Answers 1st 2 Monitoring Questions (hypotheses 1-4)
Full = Answers all 3 Monitoring Questions (hypotheses 1-6)

PG = Port Gardner
BB = Bellingham Bay
S = Sediment
T = Tissue

5.4 Endangered Species Act (ESA) Consultation

The Corps, in coordination with the DMMP agencies, consults with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) (together referred to as "the services") under Section 7 of the Endangered Species Act (ESA) on a regular basis. All designated DMMP disposal sites are covered under this regular coordination so that placement of dredged material in designated disposal sites does not need to be coordinated individually for each project. The most recent consultation began with submittal of a Biological Evaluation (BE) to the services in August 2010 for continued use of the Puget Sound Dredged Disposal Analysis (PSDDA) disposal sites. This process was not completed until DY12, with a concurrence letter from NMFS for non-rockfish species, dated November 29, 2011.

The reason for the long coordination process was the new listing (in 2010) of three species of Puget Sound rockfish under the ESA. NMFS determined that disposal under the DMMP program was "likely to adversely affect" the three species: canary rockfish (*Sebastes pinniger)*, yellow-eye rockfish (*S. ruberrimus*) and bocaccio (*S. paucispinis*). The NMFS Biological Opinion (BiOp) concluded: "the proposed action **is not likely to jeopardize** the continued existence of the Puget Sound/Georgia Basin Distinct Population Segments of yelloweye rockfish, canary rockfish, and bocaccio. However, the BiOp concluded that the disposal could impact larval fish and estimated the extent of "take" for the three species at nondispersive sites as:

- 88,092 yelloweye rockfish larvae
- 37,519 canary rockfish larvae
- 781 bocaccio rockfish larvae

The BiOp recommended as one of the EFH conservation recommendations that the Corps/DMMP agencies "conduct or support comprehensive ichthyoplankton surveys near each of the PSDDA program dispersive and non-dispersive sites within the Puget Sound/Georgia Basin." In response to this recommendation the DMMP agencies worked cooperatively with NMFS on an EPA-funded comprehensive study to broadly assess the ecological health of Puget Sound's pelagic food web. As part of this study monthly ichthyoplankton surveys were conducted at six of the eight disposal sites between April 2010 and February 2012.

In analyzing the data from this study, Greene and Godersky (2012) found rockfish ichthyoplankton in the surface waters of all the Puget Sound disposal sites. Larval rockfish appeared to occur in two peaks, one in early spring and one in late summer. Only one of the listed species (bocaccio) can be readily identified visually at early larval stages, and none of the larval rockfish identified during the study were identified as bocaccio. Genetic analysis will be pursued in 2014 to determine whether any of the rockfish collected were yelloweye or canary rockfish.

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APPENDICES

Dredging Years 2012/2013

APPENDIX A - DY12/13 GUIDELINE VALUES

		Marine - DMMP			Freshwater			Marine - SMS	
CHEMICAL NAME	Units	SL	BT	ML	SL1	SL2	Units	SQS	CSL
METALS									
Antimony	mg/kg	150	---	200	---	---	mg/kg	---	---
Arsenic	mg/kg	57	507.1	700	20	51	mg/kg	57	93
Cadmium	mg/kg	5.1	11.3	14	1.1	1.5	mg/kg	5.1	6.7
Chromium	mg/kg	260	260	---	95	100	mg/kg	260	270
Copper	mg/kg	390	1,027	1,300	80	830	mg/kg	390	390
Lead	mg/kg	450	975	1,200	340	430	mg/kg	450	530
Mercury	mg/kg	0.41	1.5	2.3	0.28	0.75	mg/kg	0.41	0.59
Nickel	mg/kg	---	---	---	60	70	---	---	---
Selenium	mg/kg	---	3	---	---	---	---	---	---
Silver	mg/kg	6.1	6.1	8.4	2.0	2.5	mg/kg	6.1	6.1
Zinc	mg/kg	410	2,783	3,800	130	400	mg/kg	410	960
ORGANOMETALLICS									
TBT ion (porewater)	ug/L	---	0.15	---	---	---	---	---	---
TBT ion (bulk)	ug/kg	---	73	---	75	75	---	---	---
LPAH									
Naphthalene	ug/kg	2,100	---	2,400	500	1,300	mg/kg OC	99	170
Acenaphthene	ug/kg	500	---	2,000	1,100	1,300	mg/kg OC	16	57
Acenaphthylene	ug/kg	560	---	1,300	470	640	mg/kg OC	66	66
Fluorene	ug/kg	540	---	3,600	1,000	3,000	mg/kg OC	23	79
Phenanthrene	ug/kg	1,500	---	21,000	6,100	7,600	mg/kg OC	100	480
Anthracene	ug/kg	960	---	13,000	1,200	1,600	mg/kg OC	220	1,200
2-Methylnaphthalene[1]	ug/kg	670	---	1,900	470	560	mg/kg OC	38	64
Total LPAHs	ug/kg	5,200	---	29,000	6,600	9,200	mg/kg OC	370	780
HPAH									
Fluoranthene	ug/kg	1,700	4,600	30,000	11,000	15,000	mg/kg OC	160	1,200
Pyrene	ug/kg	2,600	11,980	16,000	8,800	16,000	mg/kg OC	1,000	1,400
Benzo(a)anthracene	ug/kg	1,300	---	5,100	4,300	5,800	mg/kg OC	110	270
Benzofluoranthenes (sum of b,j,k)	ug/kg	3,200	---	9,900	600	4,000	mg/kg OC	230	450
Chrysene	ug/kg	1,400	---	21,000	5,900	6,400	mg/kg OC	110	460
Benzo(a)pyrene	ug/kg	1,600	---	3,600	3,300	4,800	mg/kg OC	99	210
Indeno(1,2,3-c,d)pyrene	ug/kg	600	---	4,400	4,100	5,300	mg/kg OC	34	88
Dibenzo(a,h)anthracene	ug/kg	230	---	1,900	800	840	mg/kg OC	12	33
Benzo(g,h,i)perylene	ug/kg	670	---	3,200	4,000	5,200	mg/kg OC	34	78
Total HPAHs	ug/kg	12,000	---	69,000	31,000	55,000	mg/kg OC	960	5,300
CHLORINATED HYDROCARBONS									
1,2,4-Trichlorobenzene	ug/kg	31	---	64	---	---	mg/kg OC	0.81	1.8
1,2-Dichlorobenzene	ug/kg	35	---	110	---	---	mg/kg OC	2.3	2.3
1,4-Dichlorobenzene	ug/kg	110	---	120	---	---	mg/kg OC	3.1	9
Hexachlorobenzene (HCB)	ug/kg	22	168	230	---	---	mg/kg OC	0.38	2.3
PHTHALATES									
Bis(2-ethylhexyl) phthalate	ug/kg	1,300	---	8,300	220	320	mg/kg OC	47	78
Butylbenzyl phthalate	ug/kg	63	---	970	260	370	mg/kg OC	4.9	64
Di-n-butyl phthalate	ug/kg	1,400	---	5,100	---	---	mg/kg OC	220	1,700
Di-n-octyl phthalate	ug/kg	6,200	---	6,200	26	45	mg/kg OC	58	4,500
Diethyl phthalate	ug/kg	200	---	1,200	---	---	mg/kg OC	61	110
Dimethyl phthalate	ug/kg	71	---	1,400	46	440	mg/kg OC	53	53

CHEMICAL NAME	Units	SL	BT	ML	SL1	SL2	Units	SQS	CSL
PHENOLS									
2-Methylphenol	ug/kg	63	---	77	---	---	ug/kg	63	63
4-Methylphenol	ug/kg	670	---	3,600	---	---	ug/kg	670	670
2,4-Dimethylphenol	ug/kg	29	---	210	---	---	ug/kg	29	29
Pentachlorophenol	ug/kg	400	504	690	---	---	ug/kg	360	690
Phenol	ug/kg	420	---	1,200	---	---	ug/kg	420	1,200
MISCELLANEOUS EXTRACTABLES									
Benzyl alcohol	ug/kg	57	---	870	---	---	ug/kg	57	73
Benzoic acid	ug/kg	650	---	760	---	---	ug/kg	650	650
Dibenzofuran	ug/kg	540	---	1,700	400	440	ug/kg	1.5	58
Hexachlorobutadiene	ug/kg	11	---	270	---	---	ug/kg	3.9	6.2
N-Nitrosodiphenylamine	ug/kg	28	---	130	---	---	ug/kg	11	11
PESTICIDES AND PCBs									
4-4'-DDD	ug/kg	16	---	---	---	---	---	---	---
4-4'-DDE	ug/kg	9	---	---	---	---	---	---	---
4-4'-DDT	ug/kg	12	---	---	---	---	---	---	---
Total DDT[2]	ug/kg	---	50	69	---	---	---	---	---
Aldrin	ug/kg	9.5	---	---	---	---	---	---	---
Total Chlordane[3]	ug/kg	2.8	37	---	---	---	---	---	---
Dieldrin	ug/kg	1.9	---	1,700	---	---	---	---	---
Heptachlor	ug/kg	1.5	---	270	---	---	---	---	---
Total PCBs (Aroclors)	ug/kg	130	---	3,100	60	120	---	---	---
Total PCBs (Aroclors)	mg/kg OC	---	38	---	---	---	mg/kg OC	12	65
DIOXINS/FURANS									
TEQ (Puget Sound)	ng/kg	4[4]	10	---	---	---	---	---	---
TEQ (Grays Harbor)	ng/kg	---	15	---	---	---	---	---	---

[1]2-Methylnaphthalene is not included in the summation for total LPAH.

[2]Total DDT is the sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT.

[3]Total Chlordane is the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane.

[4]Project volume-weighted average

APPENDIX B - BIOASSAY PERFORMANCE STANDARDS AND EVALUATION GUIDELINES

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs. M_R SS (p=.05) and		$M_T - M_C > 20\%$ and M_T vs. M_R SS (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$	$N_R \div N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SS (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SS (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C \leq 10\%$ and $MIG_C \geq 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SS (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SS (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

Subscripts: R = reference sediment, C = negative control, T = test sediment

M = mortality
N = normal larvae
I = initial count
MIG = mean individual growth rate (mg/individual/day)
SS = statistically significant
NOCN = no other conditions necessary
N/A = not applicable

Appendix C: DY 12/13 Evaluation Guideline Exceedances

PROJECT:	Bay Center Marina	Cap Sante Boat Haven		Don Morse Park Marina			Harbor Village Marina						JA Jack and Sons		Lafarge No					
DMMU ID:	C1	C1	C1-Z	DMMU 1	DMMU 2	Z-sample	DMMU 1	DMMU 1-Z	DMMU 2	DMMU 2-Z	DMMU 3	DMMU 3-Z	S1Z	S2Z	C1	C1-Z	C2	C2-Z	C3	C3-Z
Assessment Rank:	L	M	M	M	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																				
Arsenic						-														
Mercury						-														
Zinc						-														
LPAH (ug/kg)																				
Acenaphthene						-														
Fluorene						-														
Phenanthrene						-														
Anthracene						-														
Total LPAH						-														
HPAH (ug/kg)																				
Fluoranthene						-														
Pyrene						-														
Benzo(a)anthracene						-														
Chrysene						-														
Total Benzofluoranthenes						-														
Benzo(a)pyrene						-														
Indeno(1,2,3-cd)pyrene						-														
Dibenzo(a,h)anthracene						-														
Benzo(g,h,i)perylene						-														
Total HPAH						-														
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)						-										3.7 U[SQS]		1.3 U[SQS]		1.3 U[SQS]
1,2-Dichlorobenzene (carbon-normalized)						-										3.7 U[SQS]				
1,4-Dichlorobenzene (carbon-normalized)						-										3.7 U[SQS]				
PHENOLS (ug/kg)																				
2,4-Dimethylphenol						-														
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol						-							160	220						
Benzoic Acid						-														
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD				41 E	56 E															47 J
4,4'-DDE				19 E	38 E															47 J
4,4'-DDT					13														14 J	41 J
Total DDT				77.6 J	107 J															
Total Chlordane				62 J	17 J										3.9 U				8.1 U	4.3 U
Dieldrin					2 U										2 U		2 U		2 U	2.0 U
Heptachlor			1.9 U																1.6 U	7.0 U
Total PCBs							277	126[FW2]	196	104[FW1]	237	237[FW2]			520		231	490	247	1520
Total PCBs (carbon-normalized)																		32.7[SQS]		95[CSL]
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)		0.25																		
Tributyltin (ug/kg bulk)																				
Dioxins/Furans (pptr TEQ; u=1/2 DL)	1.4	42.7	1.57	---	---	---	92.1	64.3	77.3	0.9	43.2	11.1	12.5	13.1	26.2	---	20.2	---	24.8	---
BIOASSAYS																				
Amphipod (marine)																				
Larval (marine) - standard protocol																				
Larval (marine) - resuspension protocol																				
Neanthes Growth Rate (marine) - dry-weight endpoint																				
Neanthes Growth Rate (marine) - AFDW endpoint																				
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:																				
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	PASS	FAIL[C]	PASS[AD]	PASS[NR]	PASS[NR]	PASS[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[AD]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]
VOLUME (CY):	60,000	12,000	NA	4,000	4,000	NA	2,461	NA	2,023	NA	2,943	NA	NA	NA	4,000	NA	4,000	NA	4,000	NA

[C] this DMMU is to be excavated at low tide, translocated and covered with 3 feet of sand and pea gravel as part of a restoration project

Appendix C: DY 12/13 Evaluation Guideline Exceedances

PROJECT:	rth America						Port of Brownsville Marina		Port of Grays Harbor Terminal 3		Port of Tacoma Husky Terminal									
DMMU ID:	C4	C4-Z	C5	C5-Z	C6	C6-Z	DMMU 1	DMMU 2	C1	C2	HT-01-CS	HT-01-01	HT-01-01-Z	HT-01-02	HT-01-02-Z	HT-02-CS	HT-02-01	HT-02-02	HT-02-02-Z	HT-03-CS
Assessment Rank:	H	H	H	H	H	H	M	M	LM	LM	M	M	M	M	M	M	M	M	M	M
METALS (mg/kg)																				
Arsenic		65[SQS]	162	68[SQS]	71	136[CSL]														
Mercury																				
Zinc			539			491[SQS]														
LPAH (ug/kg)																				
Acenaphthene																				
Fluorene																				
Phenanthrene																				
Anthracene																				
Total LPAH																				
HPAH (ug/kg)																				
Fluoranthene																				
Pyrene																				
Benzo(a)anthracene																				
Chrysene																				
Total Benzofluoranthenes																				
Benzo(a)pyrene																				
Indeno(1,2,3-cd)pyrene																				
Dibenzo(a,h)anthracene																				
Benzo(g,h,i)perylene																				
Total HPAH																				
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)		1.4 U[SQS]		2.2 U[SQS]		1.3 U[SQS]														
1,2-Dichlorobenzene (carbon-normalized)																				
1,4-Dichlorobenzene (carbon-normalized)																				
PHENOLS (ug/kg)																				
2,4-Dimethylphenol																				
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol																				
Benzoic Acid																				
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD	23 J	35 J	28 J	20 J	34	28 J														
4,4'-DDE	23 J	35 J	28 J	20 J	34	28 J														
4,4'-DDT	21 J		23 J			23 J														
Total DDT																				
Total Chlordane	3.6 U	3.0 U	3.6 U		3.9 U	3.6 U														
Dieldrin	2 U	2.0 U	2 U	2.0 U	3 U	2.0 U														
Heptachlor	2 U	3.3 U		2.6 U	4.4 U	1.9 U														
Total PCBs	303	820	379	285	980	304														
Total PCBs (carbon-normalized)		59.4[SQS]		32.5[SQS]		20.0[SQS]														
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)							---	---												
Tributyltin (ug/kg bulk)																				
Dioxins/Furans (pptr TEQ; u=1/2 DL)	25.1	---	23.6	---	48.0	---	2.24	0.93	6.60	6.69	10.99[VWA]	5.93	0.05	5.83	3.26	4.12	1.21	4.76	0.21	6.13
BIOASSAYS																				
Amphipod (marine)																				
Larval (marine) - standard protocol																				
Larval (marine) - resuspension protocol																				
Neanthes Growth Rate (marine) - dry-weight endpoint																				
Neanthes Growth Rate (marine) - AFDW endpoint																				
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:																				
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	PASS	PASS	PASS	PASS	FAIL[C]	NA	PASS[AD]	NA	PASS[AD]	NA	PASS[VWA]	PASS[VWA]	PASS[AD]	NA
VOLUME (CY):	4,000	NA	4,000	NA	4,000	NA	13,000	4,500	33,400	33,600	12,100	NA	NA	NA	NA	NA	7,100	7,100	NA	NA

[c] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:							Seattle Iron and Metals													
DMMU ID:	HT-03-01	HT-03-01	HT-03-01-Z	HT-03-02	HT-03-02-Z	HT-04-CS	C1	C1-Z	C2	C2-Z	C3	C3-Z	C4	C4-Z	C5	I-1	I-1-Z	I-3	I-3-Z	I-5
Assessment Rank:	M	M	M	M	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																				
Arsenic																-	-	-	-	-
Mercury																-	-	-	-	-
Zinc																-	-	-	-	-
LPAH (ug/kg)																				
Acenaphthene																-	-	-	-	-
Fluorene																-	-	-	-	-
Phenanthrene																-	-	-	-	-
Anthracene																-	-	-	-	-
Total LPAH																-	-	-	-	-
HPAH (ug/kg)																				
Fluoranthene																-	-	-	-	-
Pyrene																-	-	-	-	-
Benzo(a)anthracene																-	-	-	-	-
Chrysene																-	-	-	-	-
Total Benzofluoranthenes																-	-	-	-	-
Benzo(a)pyrene																-	-	-	-	-
Indeno(1,2,3-cd)pyrene																-	-	-	-	-
Dibenzo(a,h)anthracene																-	-	-	-	-
Benzo(g,h,i)perylene																-	-	-	-	-
Total HPAH																-	-	-	-	-
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)																-	-	-	-	-
1,2-Dichlorobenzene (carbon-normalized)																-	-	-	-	-
1,4-Dichlorobenzene (carbon-normalized)																-	-	-	-	-
PHENOLS (ug/kg)																				
2,4-Dimethylphenol																-	-	-	-	-
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol							120		100	92[CSL]	110		77			-	-	-	-	-
Benzoic Acid							880			780						-	-	-	-	-
Hexachlorobutadiene																-	-	-	-	-
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD																-	-	-	-	-
4,4'-DDE																-	-	-	-	-
4,4'-DDT																-	-	-	-	-
Total DDT																-	-	-	-	-
Total Chlordane								12 J	22.8		5.6 U	7.7 U				-	-	-	-	-
Dieldrin																-	-	-	-	-
Heptachlor																-	-	-	-	-
Total PCBs							212	550 J	241	194	219	400	186	338	181	-	-	-	-	-
Total PCBs (carbon-normalized)								55.5 J[SQS]		13.4[SQS]		18.8[SQS]		18.7[SQS]		-	-	-	-	-
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)																-	-	-	-	-
Tributyltin (ug/kg bulk)																-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	8.02[VWA]	8.02	0.22	4.51	0.1	2.78	16.9	14	14.2	6.36	9.96[VWA]	18.8	10.8	19.1	10[VWA]	38.0	29.4	28.6	5.7	43.5
BIOASSAYS																				
Amphipod (marine)																				
Larval (marine) - standard protocol																				
Larval (marine) - resuspension protocol																				
Neanthes Growth Rate (marine) - dry-weight endpoint																				
Neanthes Growth Rate (marine) - AFDW endpoint																				
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:																				
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	FAIL[C]	PASS[VWA]	PASS[AD]	PASS[VWA]	PASS[AD]	PASS[VWA]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL[AD]	FAIL[C]	FAIL	ND	FAIL	ND	FAIL
VOLUME (CY):	3,850	3,200	NA	7,050	NA	1,700	4,000	NA	4,000	NA	4,000	NA	4,000	NA	12,000	8,178	NA	8,333	NA	8,796

[C] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:	USACE Bellingham - I&J and Squalicum Waterways - dioxin evaluation																			
DMMU ID:	I-5-Z	I-7	S-1	S-1-Z	S-2	S-3	S-4	S-5	S-6	S-7	S-7-Z	S-8-Z	S-9-Z	S-11-Z	S-12-Z	S-13-Z	S-15-Z	DMMU 1	DMMU 2	DMMU 3
Assessment Rank:	H	H	H	M	M	M	M	M	M	M	M	M	M	M	M	M	M	LM	M	M
METALS (mg/kg)																				
Arsenic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Zinc	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
LPAH (ug/kg)																				
Acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total LPAH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
HPAH (ug/kg)																				
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Benzo(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total Benzofluoranthenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Dibenzo(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total HPAH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1,2-Dichlorobenzene (carbon-normalized)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1,4-Dichlorobenzene (carbon-normalized)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
PHENOLS (ug/kg)																				
2,4-Dimethylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-			
Benzoic Acid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Hexachlorobutadiene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4,4'-DDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4,4'-DDT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total DDT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total Chlordane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Dieldrin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Heptachlor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total PCBs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Total PCBs (carbon-normalized)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin (ug/kg bulk)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	25.5	22.6	5.0	6.5	5.1	2.8	2.44	2.10	2.02	2.37	3.75	2.25	3.00	1.85	3.68	0.94	6.29	0.86 J	0.70 J	-
BIOASSAYS																				
Amphipod (marine)																		NH	NH	NH
Larval (marine) - standard protocol																		NH	NH	NH
Larval (marine) - resuspension protocol																		NH	NH	NH
Neanthes Growth Rate (marine) - dry-weight endpoint																		NH	NH	NH
Neanthes Growth Rate (marine) - AFDW endpoint																		NH	NH	NH
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:																		PASS	PASS	PASS
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	ND	FAIL	PASS[VWA]	ND	PASS[VWA]	PASS	PASS	PASS	PASS	PASS	ND	ND	ND	ND	ND	ND	ND	PASS	PASS	PASS
VOLUME (CY):	NA	3,280	12,234	NA	5,313	9,364	14,008	17,698	35,491	17,170	NA	NA	NA	NA	NA	NA	NA	14,834	14,346	15,851

[c] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:	USACE Duwamish O&M																			
DMMU ID:	DMMU 4	DMMU 5	DMMU 6	DMMU 7	DMMU 8	DMMU 9	DMMU 10	DMMU 11	DMMU 12	DMMU 13	DMMU 14	DMMU 15	DMMU 16	DMMU 17	XR-C1	XR-C2	XR-C3	XR-C4	XR-C5	XR-C6
Assessment Rank:	M	M	M	M	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L
METALS (mg/kg)																				
Arsenic																				
Mercury																				
Zinc																				
LPAH (ug/kg)																				
Acenaphthene																				
Fluorene																				
Phenanthrene																				
Anthracene																				
Total LPAH																				
HPAH (ug/kg)																				
Fluoranthene																				
Pyrene																				
Benzo(a)anthracene																				
Chrysene																				
Total Benzofluoranthenes																				
Benzo(a)pyrene																				
Indeno(1,2,3-cd)pyrene																				
Dibenzo(a,h)anthracene																				
Benzo(g,h,i)perylene																				
Total HPAH																				
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)																				
1,2-Dichlorobenzene (carbon-normalized)																				
1,4-Dichlorobenzene (carbon-normalized)																				
PHENOLS (ug/kg)																				
2,4-Dimethylphenol																				
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol	60	82	200	86	140	140	91	72	66					68						
Benzoic Acid																				
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD																				
4,4'-DDE																				
4,4'-DDT																				
Total DDT																				
Total Chlordane																				
Dieldrin																				
Heptachlor																				
Total PCBs																				
Total PCBs (carbon-normalized)																				
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin (ug/kg bulk)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	0.84 J	-	-	1.73 J	-	-	-	-	-	-	-	-	-	-	0.95	0.80	1.53	1.06	1.36	3.64
BIOASSAYS																				
Amphipod (marine)	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH						
Larval (marine) - standard protocol	NH	2H	2H	2H	NH	NH	NH	2H	NH	NH	2H	1H	2H	2H						
Larval (marine) - resuspension protocol	NH	2H	2H	2H	NH	NH	2H	NH	NH	NH	NH	1H	2H	NH						
Neanthes Growth Rate (marine) - dry-weight endpoint	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH						
Neanthes Growth Rate (marine) - AFDW endpoint	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH						
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS						
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	11,072	10,016	12,327	10,975	4,744	4,116	3,320	3,433	3,624	3,498	3,695	3,630	3,839	3,773	60,000	60,000	60,000	60,000	60,000	60,000

[c] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:	USACE Grays Harbor O&M																			
DMMU ID:	NC-C7	NC-C8	NC-C9	NC-C10	NC-C11	HO-C12	HO-C13	HO-C14	HO-C15	HO-C16	HO-C17	CP-C18	CP-C19	CP-C20	AB-C21	AB-C22	AB-C23	SA-C24	SA-C25	SA-C26
Assessment Rank:	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
METALS (mg/kg)																				
Arsenic																				
Mercury																				
Zinc																				
LPAH (ug/kg)																				
Acenaphthene																				
Fluorene																				
Phenanthrene																				
Anthracene																				
Total LPAH																				
HPAH (ug/kg)																				
Fluoranthene																				
Pyrene																				
Benzo(a)anthracene																				
Chrysene																				
Total Benzofluoranthenes																				
Benzo(a)pyrene																				
Indeno(1,2,3-cd)pyrene																				
Dibenzo(a,h)anthracene																				
Benzo(g,h,i)perylene																				
Total HPAH																				
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)																				
1,2-Dichlorobenzene (carbon-normalized)																				
1,4-Dichlorobenzene (carbon-normalized)																				
PHENOLS (ug/kg)																				
2,4-Dimethylphenol																				
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol																				
Benzoic Acid																				
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD																				
4,4'-DDE																				
4,4'-DDT																				
Total DDT																				
Total Chlordane																				
Dieldrin																				
Heptachlor																				
Total PCBs																				
Total PCBs (carbon-normalized)																				
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin (ug/kg bulk)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	0.68	3.57	2.87	4.50	2.40	1.57	3.61	4.24	3.22	11.83	3.86	6.34	10.48	10.60	7.23	1.58	0.84	1.37	1.35	7.76
BIOASSAYS																				
Amphipod (marine)				NH											NH					
Larval (marine) - standard protocol				NH											NH					
Larval (marine) - resuspension protocol				NH											NH					
Neanthes Growth Rate (marine) - dry-weight endpoint																				
Neanthes Growth Rate (marine) - AFDW endpoint				NH											NH					
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:				PASS											PASS					
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000

[c] this DMMU is to be excavated at low tide, translocated and cov

Appendix C: DY 12/13 Evaluation Guideline Exceedances

PROJECT:			USACE Keystone O&M		USACE Snohomish O&M								US Navy Big Beef Creek Estuary Restoration						Bayhead Mari	
DMMU ID:	SA-C27	SA-C28	DMMU 1	DMMU 2	DMMU 2	DMMU 3	DMMU 4	DMMU 5	DMMU 6	DMMU 7	DMMU 8	DMMU 9	C1	C2	C2-Z	C3	C4	C5	surface	subsurface
Assessment Rank:	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M
METALS (mg/kg)																				
Arsenic																				
Mercury																				
Zinc																				
LPAH (ug/kg)																				
Acenaphthene																				
Fluorene																				
Phenanthrene																				
Anthracene																				
Total LPAH																				
HPAH (ug/kg)																				
Fluoranthene																				
Pyrene																				
Benzo(a)anthracene																				
Chrysene																				
Total Benzofluoranthenes																				
Benzo(a)pyrene																				
Indeno(1,2,3-cd)pyrene																				
Dibenzo(a,h)anthracene																				
Benzo(g,h,i)perylene																				
Total HPAH																				
CHLORINATED HYDROCARBONS (ug/kg)																				
1,2,4-Trichlorobenzene (carbon-normalized)																				
1,2-Dichlorobenzene (carbon-normalized)																				
1,4-Dichlorobenzene (carbon-normalized)																				
PHENOLS (ug/kg)																				
2,4-Dimethylphenol																				
MISCELLANEOUS EXTRACTABLES (ug/kg)																				
Benzyl Alcohol										59	200	160								
Benzoic Acid																				
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)																				
4,4'-DDD																				
4,4'-DDE																				
4,4'-DDT																				
Total DDT																				
Total Chlordane																				
Dieldrin																				
Heptachlor																				
Total PCBs																				
Total PCBs (carbon-normalized)																				
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Tributyltin (ug/kg bulk)	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Dioxins/Furans (pptr TEQ; u=1/2 DL)	1.21	1.26	0.91	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	composite = 0.09	
BIOASSAYS																				
Amphipod (marine)																				
Larval (marine) - standard protocol																				
Larval (marine) - resuspension protocol																				
Neanthes Growth Rate (marine) - dry-weight endpoint																				
Neanthes Growth Rate (marine) - AFDW endpoint																				
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:																				
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS[AD]	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	60,000	60,000	30,000	30,000	100,126	100,126	100,126	100,126	89,321	49,753	49,754	49,754	30,000	30,000	NA	30,000	27,000	8,000	9,000	11,000

[c] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:	ha	Christensen Shipyard	Olympia Yacht Club																
DMMU ID:	Z-sample	C1	DMMU 1	DMMU 2	DMMU 3	DMMU 4	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7	SC-8	SC-9	Z-composite	P2-1-A-Comp	P2-1A	P2-2A
Assessment Rank:	M	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	M	M
METALS (mg/kg)																			
Arsenic							-	-	-	-	-	-	-	-	-	-			
Mercury					0.505		-	-	-	-	-	-	-	-	-	-			
Zinc							-	-	-	-	-	-	-	-	-	-			
LPAH (ug/kg)																			
Acenaphthene							-	-	-	-	-	-	-	-	-	-			
Fluorene							-	-	-	-	-	-	-	-	-	-			
Phenanthrene							-	-	-	-	-	-	-	-	-	-			
Anthracene							-	-	-	-	-	-	-	-	-	-			
Total LPAH							-	-	-	-	-	-	-	-	-	-			
HPAH (ug/kg)																			
Fluoranthene							-	-	-	-	-	-	-	-	-	-			
Pyrene							-	-	-	-	-	-	-	-	-	-			
Benzo(a)anthracene							-	-	-	-	-	-	-	-	-	-			
Chrysene							-	-	-	-	-	-	-	-	-	-			
Total Benzofluoranthenes							-	-	-	-	-	-	-	-	-	-			
Benzo(a)pyrene							-	-	-	-	-	-	-	-	-	-			
Indeno(1,2,3-cd)pyrene							-	-	-	-	-	-	-	-	-	-			
Dibenzo(a,h)anthracene							-	-	-	-	-	-	-	-	-	-			
Benzo(g,h,i)perylene							-	-	-	-	-	-	-	-	-	-			
Total HPAH							-	-	-	-	-	-	-	-	-	-			
CHLORINATED HYDROCARBONS (ug/kg)																			
1,2,4-Trichlorobenzene (carbon-normalized)							-	-	-	-	-	-	-	-	-	-			
1,2-Dichlorobenzene (carbon-normalized)							-	-	-	-	-	-	-	-	-	-			
1,4-Dichlorobenzene (carbon-normalized)							-	-	-	-	-	-	-	-	-	-			
PHENOLS (ug/kg)																			
2,4-Dimethylphenol		31 U					-	-	-	-	-	-	-	-	-	-			
MISCELLANEOUS EXTRACTABLES (ug/kg)																			
Benzyl Alcohol							-	-	-	-	-	-	-	-	-	-			
Benzoic Acid							-	-	-	-	-	-	-	-	-	-			
Hexachlorobutadiene		15 U					-	-	-	-	-	-	-	-	-	-			
PESTICIDES AND PCBs (ug/kg)																			
4,4'-DDD							-	-	-	-	-	-	-	-	-	-			
4,4'-DDE							-	-	-	-	-	-	-	-	-	-			
4,4'-DDT							-	-	-	-	-	-	-	-	-	-			
Total DDT							-	-	-	-	-	-	-	-	-	-			
Total Chlordane							-	-	-	-	-	-	-	-	-	-			
Dieldrin							-	-	-	-	-	-	-	-	-	-			
Heptachlor							-	-	-	-	-	-	-	-	-	-			
Total PCBs							-	-	-	-	-	-	-	-	-	-			
Total PCBs (carbon-normalized)							-	-	-	-	-	-	-	-	-	-			
OTHER CHEMICALS OF CONCERN																			
Tributyltin (ug/l porewater)							-	-	-	-	-	-	-	-	-	-	0.38	4.9	0.45
Tributyltin (ug/kg bulk)							-	-	-	-	-	-	-	-	-	-		280	91
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	0.43	-	-	-	-	9.62	1.86	0.25	0.23	14.82[VWA]	3.44	10.86[VWA]	5.75	5.81	0.14	0.15	-	-
BIOASSAYS																			
Amphipod (marine)																			
Larval (marine) - standard protocol																			
Larval (marine) - resuspension protocol																			
Neanthes Growth Rate (marine) - dry-weight endpoint																			
Neanthes Growth Rate (marine) - AFDW endpoint																			
Chironomus (freshwater)																			
Hyalella (freshwater)																			
Bioassay Result:																			
BIOACCUMULATION																			
Bioaccumulation result (P/F)																			
OVERALL PASS/FAIL:	PASS[AD]	PASS	PASS	SPLIT	FAIL[C]	PASS	PASS[VWA]	PASS[VWA]	PASS[VWA]	PASS[VWA]	FAIL[C]	FAIL[C]	FAIL[C]	PASS[VW]	PASS[VW]	PASS[AD]	NA	FAIL[C]	FAIL[C]
VOLUME (CY):	NA	10,000	NA	NA	3,974	NA	367	1,799	1,799	1,496	2,918	NA	NA	1,944	1,944	NA	NA	1,625	1,625

[c] this DMMU is to be excavated at low tide, translocated and cov

Appendix C: DY 12/13 Evaluation Guideline Exceedances

PROJECT:	Port of Anacortes Pier 2 and Curtis Wharf						**Port of Clarkston Crane Dock**	Port of Kingston Marina		Salmon Bay Marina					Simpson Lumber			USACE D DMMU
DMMU ID:	P2-3A	P2-1-B-Comp	P2-1-Z-Comp	CW-1-A-Comp	CW-1-B-Comp	CW-1-Z-Comp	CCD-1	DMMU 1	DMMU 2	C1	C2	C3	C2-B-Bottom	C2-C-Bottom	whole	>0.5 inch	<0.5 inch	surface
Assessment Rank:	M	M	M	M	M	M	LM	M	M	H	H	H	H	H	H	H	H	H
METALS (mg/kg)																		
Arsenic															-	-	-	-
Mercury															-	-	-	-
Zinc															-	-	-	-
LPAH (ug/kg)																		-
Acenaphthene										1300 J					-	-	-	-
Fluorene										1600 J					-	-	-	-
Phenanthrene										5300 J					-	-	-	-
Anthracene										2700 J					-	-	-	-
Total LPAH										11640 J					-	-	-	-
HPAH (ug/kg)																		
Fluoranthene										7900 J					-	-	-	-
Pyrene										6700 J					-	-	-	-
Benzo(a)anthracene										3800 J					-	-	-	-
Chrysene										3400 J					-	-	-	
Total Benzofluoranthenes										4800					-	-	-	-
Benzo(a)pyrene										2500 J					-	-	-	
Indeno(1,2,3-cd)pyrene										930 J					-	-	-	-
Dibenzo(a,h)anthracene										350 J					-	-	-	-
Benzo(g,h,i)perylene										960 J					-	-	-	-
Total HPAH										31340 J					-	-	-	
CHLORINATED HYDROCARBONS (ug/kg)																		-
1,2,4-Trichlorobenzene (carbon-normalized)															-	-	-	-
1,2-Dichlorobenzene (carbon-normalized)															-	-	-	-
1,4-Dichlorobenzene (carbon-normalized)															-	-	-	-
PHENOLS (ug/kg)																		-
2,4-Dimethylphenol															-	-	-	-
MISCELLANEOUS EXTRACTABLES (ug/kg)																		-
Benzyl Alcohol															-	-	-	-
Benzoic Acid															-	-	-	-
Hexachlorobutadiene															-	-	-	
PESTICIDES AND PCBs (ug/kg)																		-
4,4'-DDD															-	-	-	-
4,4'-DDE															-	-	-	-
4,4'-DDT															-	-	-	-
Total DDT															-	-	-	-
Total Chlordane															-	-	-	-
Dieldrin															-	-	-	-
Heptachlor															-	-	-	-
Total PCBs															-	-	-	-
Total PCBs (carbon-normalized)															-	-	-	-
OTHER CHEMICALS OF CONCERN																		
Tributyltin (ug/l porewater)	0.02							-	-	0.76	0.46				-	-	-	-
Tributyltin (ug/kg bulk)	10							-	-						-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	0.08	0.09	0.16	0.09	0.1	-	-	-	16.7	3.4	0.16	0.95	0.2	9.42	5.92	9.88	-
BIOASSAYS																		
Amphipod (marine)																		NH
Larval (marine) - standard protocol																		2H
Larval (marine) - resuspension protocol																		1H
Neanthes Growth Rate (marine) - dry-weight endpoint																		NH
Neanthes Growth Rate (marine) - AFDW endpoint																		NH
Chironomus (freshwater)																		
Hyalella (freshwater)																		
Bioassay Result:																		
BIOACCUMULATION																		
Bioaccumulation result (P/F)																		
OVERALL PASS/FAIL:	PASS	PASS	PASS[AD]	PASS	PASS	PASS[AD]	PASS	PASS	PASS	FAIL[C]	FAIL[C]	PASS	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	PASS[AD]	NA
VOLUME (CY):	2,550	2,900	NA	3,700	1,100	NA	2,050	3,500	13,500	1,782	1,781	8,337	NA	NA	NA	NA	NA	NA

[c] this DMMU is to be excavated at low tide, translocated and cov

PROJECT:	uwamish 15 O&M																			
DMMU ID:	z-sample	SR1	SR3	SR4	CO5	CO6	CO7	CO7a-P	CO7a-Z	CO7b-P	CO7b-Z	CO8	CO9	CO10	CO11	CO12	CO13	CO/NC14	NC15	NC16
Assessment Rank:	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
METALS (mg/kg)																				
Arsenic	-																			
Mercury	-																			
Zinc	-																			
LPAH (ug/kg)	-																			
Acenaphthene	-																			
Fluorene	-																			
Phenanthrene	-																			
Anthracene	-																			
Total LPAH	-																			
HPAH (ug/kg)																				
Fluoranthene	-																			
Pyrene	-																			
Benzo(a)anthracene	-																			
Chrysene																				
Total Benzofluoranthenes	-																			
Benzo(a)pyrene																				
Indeno(1,2,3-cd)pyrene	-																			
Dibenzo(a,h)anthracene	-																			
Benzo(g,h,i)perylene	-																			
Total HPAH																				
CHLORINATED HYDROCARBONS (ug/kg)	-																			
1,2,4-Trichlorobenzene (carbon-normalized)	-																			
1,2-Dichlorobenzene (carbon-normalized)	-																			
1,4-Dichlorobenzene (carbon-normalized)	-																			
PHENOLS (ug/kg)	-																			
2,4-Dimethylphenol	-																			
MISCELLANEOUS EXTRACTABLES (ug/kg)	-																			
Benzyl Alcohol	-																			
Benzoic Acid	-																			
Hexachlorobutadiene																				
PESTICIDES AND PCBs (ug/kg)	-																			
4,4'-DDD	-																			
4,4'-DDE	-																			
4,4'-DDT	-																			
Total DDT	-																			
Total Chlordane	-						3.4 U													
Dieldrin	-																			
Heptachlor	-																			
Total PCBs	-																			
Total PCBs (carbon-normalized)	-																			
OTHER CHEMICALS OF CONCERN																				
Tributyltin (ug/l porewater)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin (ug/kg bulk)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dioxins/Furans (pptr TEQ; u=1/2 DL)	-	0.3	0.4	1.0	2.0	1.8	2.5	-	-	-	-	1.0	1.8	2.4	2.5	2.6	2.9	4.6	3.2	5.0
BIOASSAYS																				
Amphipod (marine)	NH	NH	NH	NH			NH	R	R	R	R									
Larval (marine) - standard protocol	NH	NH	NH	1H			1H	2H	NH	2H	2H									
Larval (marine) - resuspension protocol	2H	NH	NH	NH			1H	NH	NH	NH	NH									
Neanthes Growth Rate (marine) - dry-weight endpoint	NH																			
Neanthes Growth Rate (marine) - AFDW endpoint	NH	NH	NH	NH			NH	NH	NH	NH	NH									
Chironomus (freshwater)																				
Hyalella (freshwater)																				
Bioassay Result:								PASS	PASS[AD]	PASS	PASS[AD]									
BIOACCUMULATION																				
Bioaccumulation result (P/F)																				
OVERALL PASS/FAIL:	PASS[AD]	PASS	PASS	PASS[WE]	PASS	PASS	SPLIT	PASS	PASS[AD]	PASS	PASS[AD]	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME (CY):	NA	72,002	72,003	72,003	65,163	64,162	63,150	31,593	NA	31,557	NA	62,143	61,124	60,128	59,106	58,089	57,093	56,063	55,073	54,045

[c] this DMMU is to be excavated at low tide, translocated and cov

APPENDIX C - LEGEND

S	=	reported concentration exceeds the marine screening level
S^{FW1}	=	reported concentration exceeds the freshwater screening level 1
S^{FW2}	=	reported concentration exceeds the freshwater screening level 2
S^{SQS}	=	reported concentration exceeds the marine sediment quality standard
B	=	reported concentration exceeds the bioaccumulation trigger (and SL, if it exists for that COC)
M	=	reported concentration exceeds maximum level
M^{CSL}	=	reported concentration exceeds marine cleanup screening level
BM	=	reported concentration exceeds bioaccumulation trigger and maximum level
D^{VWA}	=	reported dioxin concentration drives the volume-weighted average above the site management objective of 4.0 pptr TEQ
U	=	detection limit exceeds either screening level, bioaccumulation trigger, or maximum level
J	=	estimate
NA	=	not applicable
ND	=	not determined
NH	=	no hit
R	=	rejected due to elevated ammonia concentrations
2H	=	a hit under the two-hit interpretation guideline
1H	=	a hit under the one-hit interpretation guideline
$1H^{NH3}$	=	a hit under the one-hit interpretation guideline; toxicity attributed to elevated ammonia concentrations
PASS	=	test sediment passes DMMP guidelines for open-water unconfined disposal
$PASS^{AD}$	=	test sediment meets the antidegradation guideline
$PASS^{VWA}$	=	test sediment passes DMMP dioxin guidelines for open-water unconfined disposal based on project volume-weighted average
$PASS^{WE}$	=	test sediment passes DMMP guidelines for open-water unconfined disposal based on weight of evidence
$PASS^{RR}$	=	test sediment passes DMMP guidelines for beneficial use based on implementation of risk reduction measures
FAIL	=	test sediment fails DMMP guidelines for open-water unconfined disposal
$FAIL^{AD}$	=	test sediment fails to meet the antidegradation guidelines
$FAIL^{C}$	=	DMMU found unsuitable for open-water disposal in the absence of biological testing data
SPLIT	=	DMMU split into smaller subunits and retested