DREDGED MATERIAL MANAGEMENT PROGRAM

Puget Sound Dredged Disposal Analysis
Grays Harbor/Willapa Bay Evaluation Procedures
Lower Columbia River Evaluation Framework (Washington)

BIENNIAL REPORT

Dredging Years 2004/2005

PREPARED BY THE DMMP AGENCIES

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AET	Apparent Effects Threshold
BT	Bioaccumulation Trigger
COC	Chemical of Concern
CWA	Clean Water Act
CY	Cubic Yard
DAIS	Dredged Analysis Information System
DL	Detection Limit
DMMO	Dredged Material Management Office
DMMU	Dredged Material Management Unit
DNR	Washington Department of Natural Resources
DY	Dredging Year
EPA	Environmental Protection Agency
EPTA	Evaluation Procedures Technical Appendix
FC	Full Characterization
GIS	Geographic Information System
HPA	Hydraulic Project Approval
HPAH	High-molecular-weight PAH
LPAH	Low-molecular-weight PAH
ML	Maximum Level
MPR	Management Plan Report
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PAH	Polynuclear Aromatic Hydrocarbon
PC	Partial Characterization
PCBs	Polychlorinated Biphenyls
PPB	Parts per Billion
PPM	Parts per Million
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PSNS	Puget Sound Naval Shipyard
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SDM	Suitability Determination
SMARM	Sediment Management Annual Review Meeting
SMS	Sediment Management Standards
SL	Screening Level
TOC	Total Organic Carbon
USACE	US Army Corps of Engineers
UCOWD	Unconfined Open Water Disposal
WDFW	Washington Department of Fish and Wildlife

CHAPTER 1 - INTRODUCTION

The Dredged Material Management Program (DMMP) represents an interagency approach to the management of dredged material in the State of Washington. Three separate, but closely related, dredged material programs exist under the DMMP: the Puget Sound Dredged Disposal Analysis (PSDDA), Grays Harbor and Willapa Bay, and the Lower Columbia River programs. The four cooperating agencies ("agencies") are: U.S. Army Corps of Engineers, Seattle District (Corps); U.S. Environmental Protection Agency, Region 10 (EPA); Washington Department of Ecology (Ecology); and Washington Department of Natural Resources (DNR). This chapter summarizes Dredged Material Management Program (DMMP) activities for Dredging Years 2004 and 2005.

The DMMP applies dredging evaluation guidelines to federal and permitted projects in Washington State, including Lake Washington, Puget Sound, Grays Harbor and Willapa Bay, and the Lower Columbia River. A dredging year includes all projects evaluated between June 16 of a given year and June 15 of the following year (DY04 = June 16, 2003 - June 15, 2004; DY05 = June 16, 2004 - June 15, 2005). Tables related to project-specific ranking, sampling, testing, and suitability determinations are presented in Chapter 2. Chapter 3 presents an overall assessment of sampling and testing activities and data, and details unusual circumstances or the application of best professional judgment by the agencies. Chapter 4 summarizes details of complex or unusual projects where Best-Professional-Judgment (BPJ) was exercised by the DMMP agencies.

During DY04/05 there were 39 projects that completed the DMMP process (Tables 1-1a and 1-1b). Most projects were full characterizations (FC) of a project area intended to assess suitability of the proposed dredged material for open water disposal. The typical completion action by the DMMP is a suitability determination memorandum (SDM) that summarizes the results of the FC and provides an official determination on suitability for open water disposal. Other DMMP actions include volume revisions (when the project volume changes subsequent to characterization), frequency or recency extension determinations, and beneficial use sediment quality determinations.

Of the projects listed in Tables 1-1a and 1-1b, 15 had DMMP actions completed by June 15, 2004 and are considered DY04 projects. 24 projects had DMMP actions completed by June 15, 2005 and are considered DY05 projects. Puget Sound locations for DY04 projects are depicted in Figure 1-1a and DY05 are plotted in Figure 1-1b. Projects located in Grays Harbor and Willapa Bay during DY04/05 are shown in Figure 1-1c. Any project that has resulted in an SDM or other completion action after June 15, 2005 is considered a DY 2006 project and is not considered in this report.

Table 1a. DY04 DMMP Evaluation Activities. These include all projects that concluded with an action by the DMMP between 6/15/03-6/14/04.

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	Ranking Determination DY	SAP Review DY	Suitability Determination DY
Port of Seattle East Waterway Recency Characterization	RC	PSDDA	12,030	H	DY03	DY04 (6/03)
Port of Seattle Subsurface Suitable T-18 & East Waterway (Stage II)	RE	PSDDA	175,260	H	NA	DY04 (RE: 8/05)
Glacier Northwest, Duwamish	RE	PSDDA	NA	H	NA	DY04 (RE: 2/05)
Lehigh Northwest Inc. (Cadman site)	FC	PSDDA	9,000	H	DY04	DY04 (4/04)
USACE- Duwamish O&M (Stations 254-257+35)	AR	PSDDA	NA	H → LM	NA	DY04 (9/03)
USACE- Duwamish O&M Turning Basin	FC	PSDDA	66,000	LM	DY04	DY04 (9/03)
Port of Skagit County La Conner Marina	AR	PSDDA	NA	M → L	NA	DY04 (7/03)
Anchor Cove Marina, Anacortes	FC	PSDDA	22,440	M	DY04	DY04 (5/04)
USACE Lower Snohomish River Settling Basin & Navigation Channel O&M	FC	PSDDA	271,210	LM	DY04	DY04 (1/04)
Port of Bellingham Padden Creek	RE	PSDDA	6,800 → 400	H	NA	DY04 (RE: 6/05)
Puget Sound Naval Shipyard	RE/BU	PSDDA	24,254	H	NA	DY04 (RE: 10/04)
Port of Edmonds, Marina	AR	PSDDA	NA	H → M	NA	DY04 (2/04)
Port of Tacoma Blair Waterway Bridge Reach Widening	FC	PSDDA	265,000	M	DY04	DY04 (2/04)
Basin and Channel Property Owners Association, Hood Canal	FC/BU	PSDDA	1,200	LM	DY04	DY04 (3/04)
Nahcotta Boat Basin O&M	FC	GH/WB	145,000	M	DY04	DY04 (2/04)

DMMP Actions
FC = Full Characterization
RE = Recency Extension
RC = Recency Characterization
BU = Beneficial Use
AR = Area Rerank
VR = Volume Revision
PDM = Post Dredge Monitoring (surface sediment quality)

Disposal Jurisdictions
GH/WB = Grays Harbor/Willapa Bay
PSDDA = Puget Sound Dredged Disposal Analysis
PSDDA/SMS = PSDDA/Sediment Management Standards
CR = Columbia River

NA = not applicable

Table 1-1b. DY05 DMMP Evaluation Activities. These include all projects that concluded with an action by the DMMP between 6/15/04-6/14/05.

PROJECT	DMMP Action	Disposal Jurisdiction	Project Volume (cy)	Ranking Determination DY	SAP Review DY	Suitability Determination DY
USACE / Port of Olympia, Olympia Harbor O&M	RE	PSDDA	624,000	LM	NA	DY05 (5/05)
Day Island Yacht Club, Tacoma Narrows	FC	PSDDA	23,000	M	DY05	DY05 (4/05)
Port of Tacoma Blair Bridge Reach Widening BU	BU	PSDDA	265,000	M	NA	DY05 (8/04)
Port of Tacoma Blair Inner Reach Cutback & Turning Basin Expansion	FC	PSDDA	2,600,000	LM / L	DY04	DY05 (11/04)
Port of Tacoma Blair Waterway SW Corner Cutback	FC	PSDDA	105,000	M	DY05	DY05 (12/04)
Manke Lumber Company Supplemental	FC	PSDDA	23,000	H	DY05	DY05 (12/04)
Manke Lumber Company, Supplemental Addendum & Volume Revision	FC/VR	PSDDA	31,500	H	DY05	DY05 (1/05)
Port of Silverdale Waterfront Park Boat Ramp & Marina, Dyes Inlet	FC	PSDDA	3,950	M	DY05	DY05 (5/05)
Brightwater Marine Outfall Alignment Corridor	FC	PSDDA	5,300	M	DY04	DY05 (11/04)
Lakeside Industries Sand & Gravel Spill	PDM	PSDDA/SMS	NA	H	DY04	DY05 (1/05)
Port of Seattle Fishermen's Terminal	FC	PSDDA	47,793	H	DY05	DY05 (4/05)
Seattle Parks Department – South Lake Union Project	PDM	PSDDA/SMS	NA	H	NA	DY05 (5/05)
Port of Seattle Terminal 46	FC	PSDDA	27,000	H	DY04	DY05 (6/04)
Port of Seattle T-103 Barge Berth	PDM	PSDDA/SMS	NA	H	NA	DY05 (4/05)
Port of Everett Marina 14th Street Dredging	FC	PSDDA	4,000	M	DY05	DY05 (3/05)
USACE Upper Snohomish River Settling Basin & Upstream Navigation Chan.	FC/BU	PSDDA	200,000	LM	DY04	DY05 (7/04)
Bridgehaven Community Club Marina Entrance Channel, Hood Canal	BU	PSDDA	7,000	LM	NA	DY05 (2/05)
USACE Keystone Ferry Terminal (Lake Crockett) O&M	BU	PSDDA	40,000	L	NA	DY05 (5/05)
Curtis Wharf, Anacortes	RE	PSDDA	45,000	M	NA	DY05 (RE: 3/05)
Port of Bellingham Harris Avenue Shipyard MTCA Cleanup	FC	PSDDA	15,432	H	DY04	DY05 (7/04)
Tidewater Cove	FC	CR	246,000	M	DY05	DY05
USACE Grays Harbor O&M	FC	GHWB	1,860,000	L	DY04	DY05 (3/05)
Dakota Creek, Anacortes	FC	PSDDA	12,000	M	DY05	DY06 (9/05)[1]
USACE Quillayute Boat Basin O&M	FC	GH/WB	28,500	M	DY05	DY05 (3/05)

[1] The supplemental sampling and testing for dioxin was conducted in DY05, but due to project delays the suitability determination was not concluded until DY06.

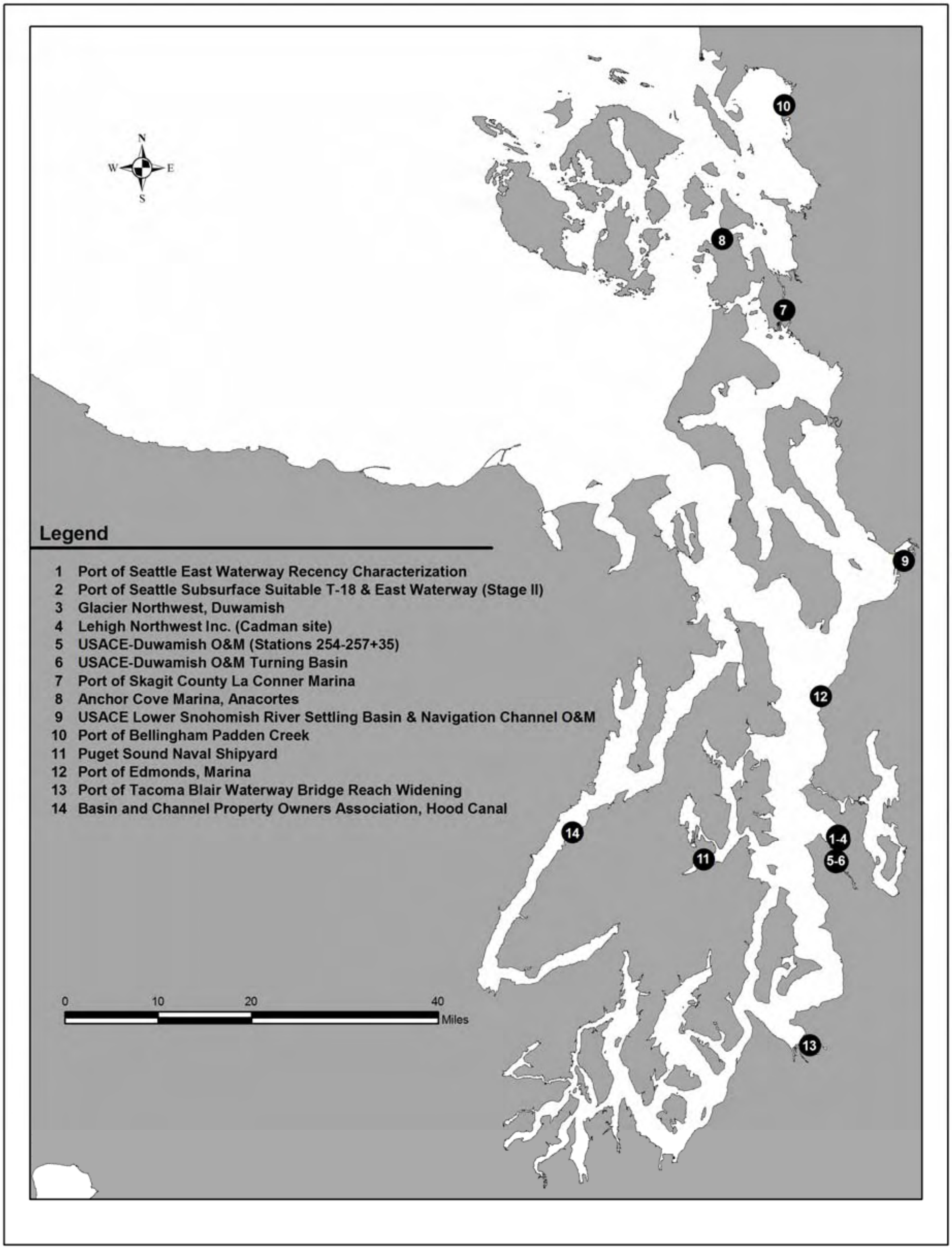

Figure 1-0-1a. Location of dredging projects in Puget Sound during DY04.

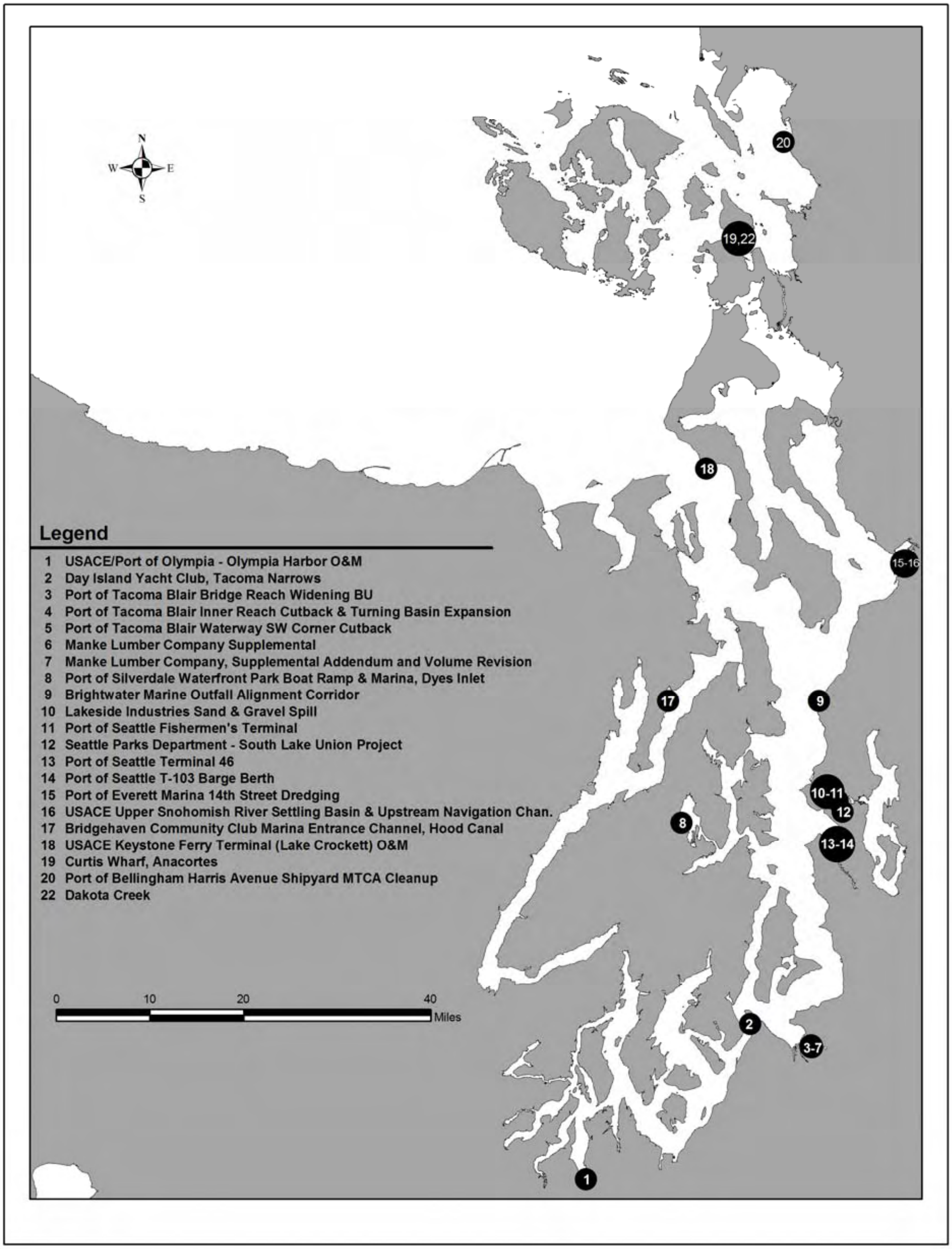

Figure 1-1b. Location of dredging projects in Puget Sound during DY05.

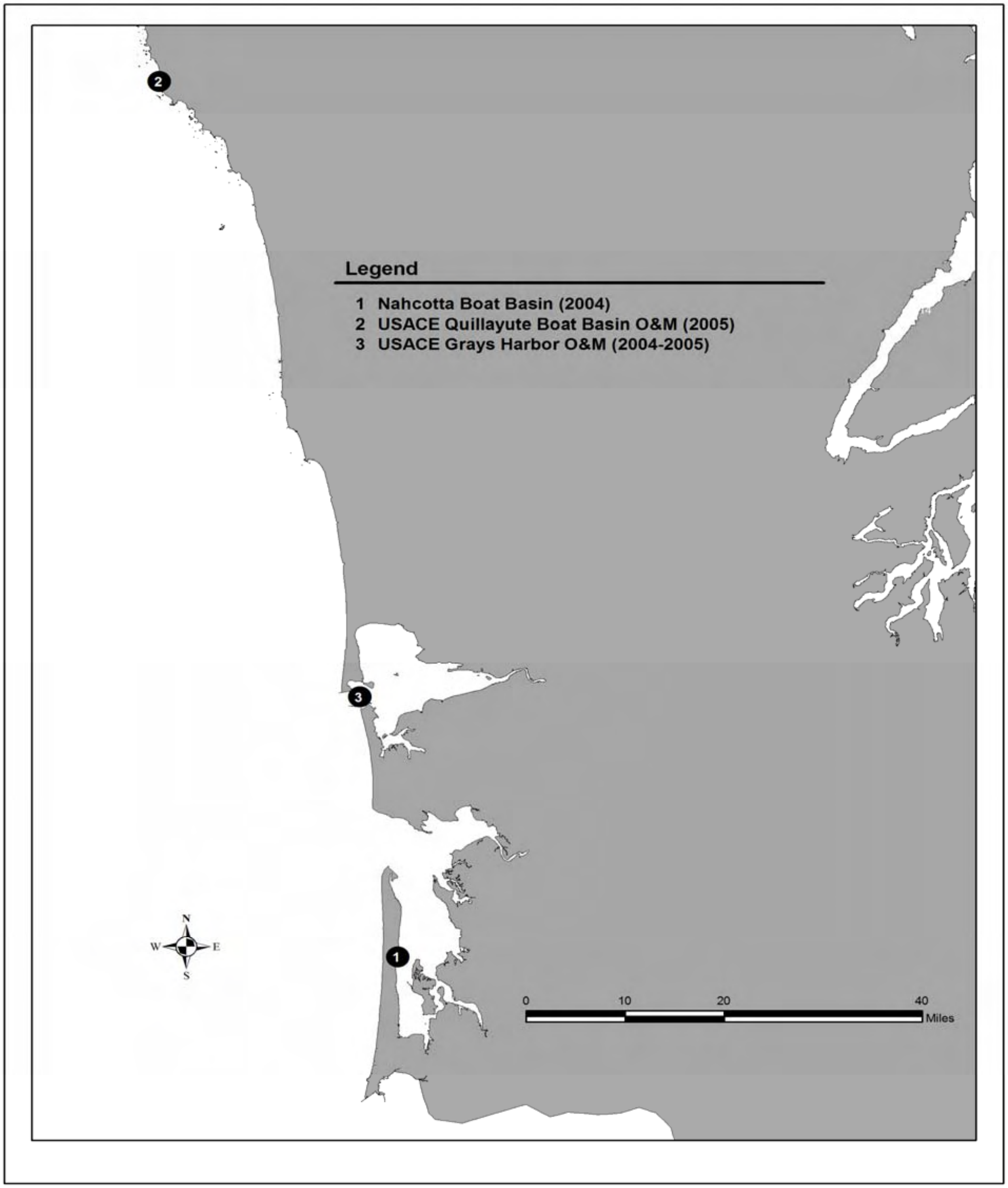

Figure 1-1c. Location of dredging projects in Grays Harbor, Willapa Bay and Coastal Washington during DY04/05.

CHAPTER 2 - DY04/05 PROJECTS

2.1 RANKING

Each jurisdiction under the DMMP has specific guidance that explains requirements for evaluating dredged material for open-water disposal. Sampling and analysis requirements under the PSDDA program are fully explained in the 1988 Phase I Evaluation Procedures Technical Appendix (EPTA) and the DMMP Users Manual. Sampling and analysis requirements in Grays Harbor and Willapa Bay are also explained in the DMMP Users Manual. Sampling and analysis requirements for projects occurring within the Columbia River are found in the November 1998 Dredged Material Evaluation Framework – Lower Columbia River Management Area.[2] The DMMP Users Manual and the Dredged Material Evaluation Framework can be accessed via the Internet from the Corp's Dredged Material Management Office home page, at http://www.nws.usace.army.mil (click on "Civil Works" and then click on "Dredge Material Management"). The Dredged Material Evaluation Framework is being revised as part of the Regional Sediment Evaluation Team efforts. A review draft of a revised regional sediment evaluation framework was released for public comment in September 2005.

Under the jurisdictional specific guidelines summarized above, the initial appraisal of a proposed dredging project requires a careful examination of all existing sediment quality data within the dredging area. An initial area ranking is based on a "reason to believe" that chemicals of concern may or may not be present in the project area. The agencies have established ranks for general areas within each jurisdiction (e.g., Elliott Bay/PSDDA) and activities (e.g., marinas) based on historical data or awareness of active sources of contamination. In the absence of project-specific data, representatives of the agencies apply an initial ranking based on guidance contained in the jurisdictional specific documents (DMMP Users Manual, Chapter 4).

All three jurisdictional areas allow for a reconsideration of the initial ranking if the historical data at the site are adequate, or if the applicant conducts a partial characterization (PC) as described within each Users Manual to survey sediments in the project area for specific chemicals of concern. 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 requirements. Chemicals of concern may also be eliminated for analysis during the FC, based on the PC data. Tables 2-1a and 2-1b contain the initial and full characterization rankings of all DY04/05 projects. The "initial rank" was taken from the respective jurisdictional guidance rankings that were in effect at the time of project initiation. The "full characterization" rank was the rank actually used in the full characterization of project sediments.

Two of the fourteen DY04 full characterizations (La Conner Marina and USACE Duwamish O&M Stations 254-257+35) and none of the twenty-two DY05 FCs had rankings adjusted based on presentation of additional data. In the both cases, the ranking was adjusted downward. It should be noted that the DMMP does not track projects that have had downranking requests denied based on insufficient "reason to believe" or inadequate data supporting the request.

[2] Henceforth referred to as the Dredged Material Evaluation Framework

Table 2-1a. DY04 Project Rankings.

PROJECT	Disposal Jurisdiction	Location	Water body	Initial Rank	Final Rank
Port of Seattle East Waterway Recency Guideline	PSDDA	Seattle	Duwamish Waterway	H	H
Port of Skagit County, La Conner Marina	PSDDA	Skagit County	Puget Sound	M	L
Port of Bellingham, Padden Creek	PSDDA	Bellingham	Bellingham Bay	H	H
USACE Duwamish O&M (Stations 254-257+35)	PSDDA	Seattle	Duwamish Waterway	H	LM
Port of Seattle Subsurface Suitable T-18 & East Waterway (Stage II)	PSDDA	Seattle	Duwamish Waterway	H	H
Puget Sound Naval Shipyard	PSDDA		Sinclair Inlet	H	H
Port of Edmonds, Marina	PSDDA	Edmonds	Puget Sound	H	M
Port of Tacoma Blair Waterway Bridge Reach Widening	PSDDA	Tacoma	Commencement Bay	M	M
Nahcotta Boat Basin O&M	GH/WB		Willapa Bay	M	M
Basin and Channel Property Owners Association, BU	PSDDA	Tahoka	Hood Canal	LM	LM
Lehigh Northwest Inc.	PSDDA			H	H
Glacier Northwest	PSDDA	Seattle	Duwamish River	H	H
Anchor Cove Marina	PSDDA	Anacortes	Puget Sound	M	M
USACE Lower Snohomish River	PSDDA	Everett	Snohomish river	LM	LM

L = Low
LM = Low/Moderate
M = Moderate
H = High

Table 2-1b. DY05 Project Rankings.

PROJECT	Disposal Jurisdiction	Location	Water body	Initial Rank	Final Rank
Port of Seattle Terminal 46	PSDDA	Seattle	Duwamish River	H	H
Port of Bellingham Harris Avenue Shipyard MTCA Cleanup	PSDDA	Bellingham	Bellingham Bay	H	H
Port of Tacoma Blair Bridge Reach Widening BU	PSDDA	Tacoma	Commencement Bay	M	M
Port of Tacoma Blair Inner Reach Cutback & Turning Basin Expansion	PSDDA	Tacoma	Commencement Bay	LM/L	LM/L
Brightwater Marine Outfall Alignment Corridor	PSDDA	Edmonds	Point Wells, Puget Sound	M	M
Curtis Wharf	PSDDA	Anacortes		M	M
USACE Upper Snohomish River	PSDDA	Everett	Snohomish River	LM	LM
Bridgehaven Community Club Marina Entrance Channel	PSDDA	Tahuya	Hood Canal	LM	LM
Manke Lumber Company	PSDDA	Tacoma	Hylebos Waterway, CB	H	H
Port of Everett Marina 14th Street Dredging	PSDDA	Everett	Snohomish River	M	M
Lakeside Industries	PSDDA	Lake Washington Ship Canal	Salmon Bay	H	H
USACE Quillayute Boat Basin	GH/WB	La Push, WA	NW Washington Coast	M	M
Day Island Yacht Club	PSDDA	Tacoma Narrows	Day Island Waterway	M	M
Port of Seattle Fishermen's Terminal	PSDDA	Lake Washington Ship Canal	Salmon Bay	H	H
Port of Seattle – Terminal 103	PSDDA	Seattle	Duwamish Waterway	H	H
USACE Keystone Ferry Terminal	PSDDA	Whidbey Island	Admiralty Bay	L	L
Port of Silverdale Waterfront Park Boat Ramp/Marina	PSDDA	Kitsap County	Dyes Inlet	M	M
Seattle Parks Department – south Lake Union Project	PSDDA	Seattle	Lake Union	H	H
USACE / Port of Olympia , Olympia Harbor O&M	PSDDA	Olympia	Lower Budd Inlet	LM	LM
USACE Grays Harbor O&M	GH/WB	Grays Harbor	Grays Harbor Chehalis River	L	L
Tidewater Cove	CR	Columbia River	Columbia River	M	M
Dakota Creek	PSDDA	Anacortes	Dakota Creek	M	M

2.2 SAMPLING AND ANALYSIS PLANS

Approved sampling and analysis plans (SAPs) are required before applicants collect sediment samples for either a PC or FC. The applicant or dredging consultant receives guidance in SAP development[3] based on the ranking that has been assigned to the proposed project. A conceptual dredging plan and representative sampling plan are established in close coordination with the Corps of Engineers Dredged Material Management Office (DMMO). Protocols for station positioning, decontamination, field sampling, sample compositing, chemical analysis, biological testing, QA/QC and data submittal are all included in the sampling and analysis plan. Once completed, DMMO coordinates review and approval of the plan with the DMMP agencies.

Tables 2-2a and 2-2b contain data related to sampling plans approved for DY04/05 projects. Application of jurisdictionally specific sampling and analysis requirements resulted in the number of field samples and dredged material management units (DMMUs) formulated for each of the projects. Descriptions of those projects for which no testing was required, or for which best professional judgment was applied, are discussed in the project descriptions in Chapter 4.

2.3 SAMPLING

Tables 2-3a and 2-3b contain data related to sampling efforts during DY04/05. Two general requirements existing within all three jurisdictions are to sample to the depth of dredging (including overdepth)[4], and to provide positioning data to a minimum precision of one-tenth of a second, latitude and longitude. A variety of positioning techniques were used to provide the required precision. Great emphasis is placed on positioning in order to provide high-quality data. Precise positioning is important to provide repeatability in sampling and to provide data that can be utilized in a geographical information system (GIS).

For the majority of the projects listed in the tables, the maximum sediment depths correspond to both the actual length of the deepest boring as well as to the maximum depth of the dredging prism, including overdepth. In high-ranked areas there is an additional requirement to provide an archived sample from the one-foot of sediment beyond the dredging prism ("Z" sample). This additional depth is not reflected in the table.

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[3] Templates for large project and small project sampling and analysis plan development are contained on the Seattle District Dredged Material Management Office homepage at the following address: http://www.nws.usace.army.mil/.

[4] This requirement is less stringent in Grays Harbor/Willapa Bay in areas with high shoaling rates, which have been previously characterized to the limits of the dredging prism, and for areas generally meeting either Section 404 or Section 103 exclusionary criteria. In these cases sampling of the surface layer with a vanVeen grab is generally allowed.

Table 2-2a. DY04 Projects - Approved Sampling Plans. Includes information from any SAP submitted that resulted in a DMMP action in DY04. SAPs were not necessarily reviewed in DY04.

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
USACE Lower Snohomish R. Settling Basin & Navigation O&M	LM	271,210	271,210	36	9	0[5]	0[3]	0[3]
Port of Seattle East Waterway Recency Characterization	H	12,030	12,030	15	3	0	0	0
Lehigh Northwest Inc. (Cadman Site)	H	9,000	6,000	4	2	3,000	3	1
USACE Duwamish Turning Basin O&M	LM	66,000	66,000	5	5	0[3]	0[3]	0[3]
Anchor Cove Marina, Anacortes	M	22,440	22,440	6	2	0	0	0
Port of Tacoma Blair Waterway Bridge Reach Widening	M	265,000	9,900	4	2	255,100	28	8
Basin and Channel Property Owners Association, BU	LM	1,200	1,200	4	1	0	0	0
Nahcotta Boat Basin	M	145,000	145,000	17	4	0	0	0

[5] The material within the Settling Basin and Navigation Channel is considered relatively homogeneous based on past testing and dredging frequency history, and therefore, no distinction between surface and subsurface samples/DMMUs was made for testing purposes.

Table 2-2b. DY05 Projects - Approved Sampling Plans. Includes information from any SAP submitted that resulted in a DMMP action in DY05. SAPs were not necessarily reviewed in DY05.

PROJECT	Rank	Total Volume (cy)	Surface Volume (cy)	Number of Surface Samples	Number of Surface DMMUs	Sub-Surface Volume (cy)	Number of Sub-surface Samples	Number of Sub-surface DMMUs
Day Island Yacht Club	M	23,000	23,000	6	2	0	0	0
Port of Tacoma Blair Inner Reach Cutback & Turning Basin Expansion	LM/L	2,600,000	126,500	14	5	248,318[6]	36	12
Port of Tacoma Blair Waterway SW Corner Cutback	M	105,000	11,900	2	1	13,600[7]	2	2
Manke Lumber Company, Supplemental Characterization	H	31,500	23,000	10	10	0	0	0
Port of Silverdale	M	3,950	3,950	6	1	0	0	0
Brightwater Marine Outfall Alignment Corridor	M	5,300	5,300	3	3	0	0	0
Port of Seattle Fishermen's Terminal	H	47,793	32,709	24	12	0	0	0
Port of Seattle Terminal 46	H	27,000	27,000	12	6	0	0	0
Port of Everett Marina 14th Street	M	4,000	4,000	3	1	0	0	0
USACE Upper Snohomish River Settling Basin & Navigation Channel	LM	200,000	200,000	21	12	0	0	0
Port of Bellingham Harris Avenue Shipyard MTCA Cleanup	H	15,432	15,432	12	6	0	0	0
USACE Quillayute Boat Basin O&M	M	28,500	28,500	9	2	0	0	0
Lakeside Industries Post Dredged Sediment Surface Quality	H	NA	NA	1	1	0	0	0
USACE Grays Harbor O&M	L	1,860,000	683,000[8]	75	11	0	0	0
Tidewater Cove	M	12,000	12,000	3	2	0	0	0
Dakota Creek	M	273,000	273,000	4	4	273,000	0	0

[6] The remaining 2,225,182 cy of subsurface material was below the native contact sediment layer and was excluded from testing.
[7] The remaining 77,500 cy of subsurface material was below the native contact sediment layer and was excluded from testing
[8] As per the Grays Harbor/Willapa Bay Testing Manual 1/3 of the Federal O&M project will be tested every 2 years.

TABLE 2-3a. DY04 Project Sampling. Grain sizes given are averages from all samples for a given project.

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 - 2mm	SILT .004 - .063 mm	CLAY < .004 mm			
USACE Lower Snohomish R. Settling Basin & Navigation O&M	0.1 - 1.1	48.3 - 81.3	12.7 - 41.8	5 - 9	Vibracore	11.9	7.1
Port of Seattle East Waterway Recency Characterization	0 - 0.1	25.3 – 33.7	47.1 – 55.2	11.1 – 26.9	Vibracore	5.9	5.6
Lehigh Northwest Inc. (Cadman Site)	25.7 -45.1	29.8 – 38.1	16.5 – 26.1	4.5 – 10.1	Impact Corer	7.1	4.6
USACE Duwamish Turning Basin O&M	0.2 – 3.4	52.7 – 90.5	4.6 – 34.7	1.8 – 10.9	Vibracore	13	7.8
Anchor Cove Marina, Anacortes	0.6 – 12.4	41.2 – 48.9	25.2 – 39.2	13.5 – 18.9	Gravity Corer	8.2	5.1
Port of Tacoma Blair Waterway Bridge Reach Widening	0.7 – 50.2	45.6 – 92.6	2.7 – 9.5	0.8 – 3.1	Hollow-stem Auger Drilling Rig	~32	~4
Basin and Channel Property Owners Association, BU	5.5	93.3	0.8	0.4	Grab sampler	10 cm	10 cm
Nahcotta Boat Basin	0.3 – 4.4	3.2 – 19.0	47.7 – 58.7	30.9 – 36.1	Gravity Corer	4	4

TABLE 2-3b. DY05 Project Sampling. Grain sizes given are averages from all samples for a given project.

PROJECT	GRAIN SIZE PERCENTAGES				SAMPLING EQUIPMENT	MAX. SAMPLE DEPTH (FT)	MEAN SAMPLE DEPTH (FT)
	GRAVEL > 2 mm	SAND .063 - 2mm	SILT .004 - .063mm	CLAY < .004 mm			
Day Island Yacht Club	21.9 – 22.1	58.2 – 58.7	13.3 – 13.6	5.7 – 6.5	Vibracore	10.5	5.6
Port of Tacoma Blair Inner-Reach Cutback & Turning Basin Expansion	0 – 30.9	5.9 – 90.9	6.7 – 70.9	1.4 – 28.0	Upland Drill Rig	18	~4
Manke Lumber Company Supplemental Characteriz.	10.0 – 18.7	37.2 – 44.4	23.0 – 34.2	13.7 – 15.7	Vibracore	7.9	5.4
Port of Silverdale	0.3 – 4.7	86.6 – 93.1	3.4 – 5.4	3.2 – 3.3	4" diameter Clam gun hand core	2.5	2.1
Brightwater Marine Outfall Alignment Corridor	0.3 – 0.8	95.0 – 98.2	0.7 – 1.3	2.7 – 3.0	van Veen Grab	10"	10"
Port of Seattle Fishermen's Terminal	0.7 – 9.1	6.5 – 59.3	22.3 -57.8	16.2 – 40.1	Vibracore	7.1	1.7
Port of Seattle Terminal 46	0.01 – 32.2	44.5 – 77.8	8.1 – 33.1	5.9 – 13.7	Vibracore Diver Cores	9	4.1
Port of Everett Marina 14th Street	2.4	39.2	47.7	10.6	Push Corer	4	3.7
USACE Upper Snohomish River Settling Basin & Navigation Channel	0.5 – 8.49	71.3 – 97.1	0.4 – 21.7	0.6 – 6.2	Vibracore	11.5	5.9
Port of Bellingham Harris Avenue Shipyard MTCA Cleanup	7.8 – 56.7	31.0 – 70.5	2.8 – 10.4	3.4 – 11.1	Vibracore	4	3.2
USACE Quillayute Boat Basin O&M	0.05 – 0.46	44.6 – 56.0	36.9 – 47.9	5.6 – 6.6	Vibracore	6.5	4.9
Lakeside Industries Post dredge sediment surface characterization	38.0	55.2	6.2	0.6	Van Veen Grab	10 cm	10 cm
USACE Grays Harbor O&M	0 -49.5	209 – 95.5	1.1 – 70.7	0.7 – 14.4	Van Veen Grab	10 cm	10 cm
Tidewater Cove	0.29 – 7.88	8.5 – 94.0	0.02 -59.5	0.01 – 32.9	Vibracore	13.2	11.3
Dakota Creek	0 – 14.1	27.5 -79.6	14.5 – 35	4.4 – 31.9	Vibracore	3	2.5

2.4 CHEMICAL TESTING

Chemical testing was conducted for 7 full characterizations in DY04 and 13 projects in DY05. In DY04 one project characterization was limited to analysis for grain size only. In DY05 one project was limited to grain size analysis; another project was subject to dioxin testing to supplement the full characterization that was conducted earlier; and a third project required post-construction dredging characterization of the newly exposed surface to verify compliance with Washington State Department of Ecology's antidegradation policy. During DY04, the DMMP agencies revaluated recency extension request from 5 applicants, subsequently granting extensions to four while requiring confirmation testing on one project. During DY05, two projects requested and were granted recency extensions. The DMMP agencies reevaluated 2 projects in DY04 and four projects in DY05 for Beneficial Uses considerations. During DY05, three projects were evaluated by the DMMP for post-construction dredging compliance with the Washington State anti-degradation policy. One of these post-construction characterizations completed testing (Lakeside Industries), and two are currently undergoing testing that is not yet complete.

In general, the QA/QC for projects undergoing chemical testing was acceptable by the DMMP agencies for regulatory decision-making. A complete listing of DMMP sediment guideline value exceedances for DY04/05 is included in Appendix C.

2.5 BIOLOGICAL TESTING

A total of five projects required acute bioassay testing (Table 2-4) during the biennium. Two of these projects underwent biological testing in DY04. Three projects underwent biological testing in DY05. Of the DY04 projects one elected to do tiered testing, while the second conducted concurrent testing, performing biological tests on only those DMMUs that had exceedances of SLs. All three DY05 projects utilized concurrent testing

DMMP regulatory use of the saline Microtox® test has been suspended since DY94 for regulatory decision-making. This suspension remains in force pending commitment of agency resources to effectively evaluate the continued use of this test, or a suitable replacement test, within each dredging/disposal jurisdiction.

Table 2-4. DY04 and DY05 Bioassay Testing Summary. Summary of bioassay tests performed for DY04/05 projects.

PROJECT	DY	Number of DMMUs undergoing biological analyses		Number of DMMUs failing bioassays	Bioassay tests conducted			Control sediment location	Reference sediment location
		tiered testing	concurrent testing		Amphipod	Sediment Larval	*Neanthes* 20-day Growth		
Port of Seattle East Waterway	04		3	3	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Carr Inlet
Lehigh NW Inc. (Cadman Site)	04	3		1	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Carr Inlet
Manke Lumber Company – Sup.	05		10	4	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Carr Inlet
Port of Seattle Fishermen's Terminal	05		7	2	*Ee*	*Mg*	*Na*	Yaquina Bay, OR	Lake Washington[9]
USACE Grays Harbor O&M	05		2		*Ee*	*Cg*	*Na*	Yaquina Bay, OR	Grays Harbor GHS7

Cg = *Crassostrea gigas*
Ee = *Eohaustorius estuarius*
Mg = *Mytilus galloprovincialis*
Na = *Neanthes arenaceodentata*

2.6 BIOACCUMULATION TESTING

No bioaccumulation testing was conducted during DY04 or DY05. The Port of Seattle Terminal 46 project had 3 bioaccumulation trigger exceedances, but due to timing constraints they opted to not undergo the required bioaccumulation testing. Therefore, these three DMMUs were determined by DMMP to be unsuitable for unconfined open water disposal based on BPJ.

2.7 SUITABILITY DETERMINATIONS

A suitability determination outlines the evaluation procedures used in the characterization of project sediments, summarizes chemical and biological testing data and associated QA/QC issues, and documents the interpretation of testing results. The suitability determination is a technical consensus memorandum, drafted by the Corps' DMMO and signed by DMMP representatives from the Corps of Engineers, Environmental Protection Agency, Department of Ecology and Department of Natural Resources. The suitability determination documents the suitability of proposed dredged sediments for open-water disposal at either one of the eight PSDDA sites, or two estuarine and one ocean sites in both Grays Harbor and Willapa Bay, or at appropriate in water sites in the Columbia River. It does not, however, constitute final project approval by the agencies.

[9] The reference sediment failed to meet performance requirements for the bivalve sediment larval test, and the DMMP used BPJ to render a determination on suitability/unsuitability for UCOWD.

Comprehensive agency comments on the overall project are provided through the regulatory public notice and review process.

Tables 2-5a and 2-5b contain information taken from the suitability determinations or other completion actions for each of the projects that completed their DMMP review during DY02 and DY03, respectively.

For the projects receiving suitability determinations in DY04, only 1.8 percent of the total volume tested was found unsuitable for unconfined-open-water disposal under relevant DMMP evaluation guidelines. For DY05, only 0.5% of the total volume was found unsuitable for unconfined open-water disposal. The amount of unsuitable material varied considerably by project and location, with considerable portions of unsuitable material coming from the high-use areas in both Seattle and Tacoma.

Table 2-5a. DY04 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	No. of chemical analyses	No. of bioassay analyses	No. of bioaccum analyses	No. of DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
USACE Lower Snohomish River	LM	271,210	9	0	0	0	0	9	271,210	Port Gardner
Port of Seattle East Waterway	H	12,030	3	3	0	3	12,030	0	0	Upland Confined
Lehigh NW Inc. (Cadman Site)	H	9,000	3	1	0	1	3,000	2	6,000	Elliott Bay
USACE Duwamish Turning Basin O&M	LM	66,000	5	0	0	0	0	5	66,000	Elliott Bay, PSR Capping
Anchor Cove Marina	M	22,440	2	0	0	0	0	2	22,440	Rosario Strait
Port of Tacoma, Blair Waterway Bridge Reach Widening	M	265,000	10	0	0	0	0	10	265,000	Commencement Bay
Basin and Channel Properties Assoc., BU	LM	1,200	1[10]	0	0	0	0	1	1,200	NA (Beach Nourishment)
Nahcotta Boat Basin	M	145,000	4	0	0	0	0	4	145,000	Goose Point, Willapa Bay
Totals:		791,880	37	4	0	4	15,030	33	776,850	

[10] Sediment Analysis limited to grain size with no chemical analyses conducted

Table 2-5b. DY05 Suitability Determinations

PROJECT	Rank	Total Volume (cy)	No. of chemical analyses	No. of bioassay analyses	No. of bioaccum analyses	No. of DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
Day Island Yacht Club	M	23,000	2	0	0	0	0	2	23,000	Commencement Bay
Port of Tacoma, Blair Inner Reach Cutback	LM/L	2,600,000	17	0	0	0	0	17	2,600,000	Commencement Bay
Port of Tacoma, Blair SW Corner Cutback	M	105,000	2	0	0	0	0	2	105,000	Commencement Bay
Manke Lumber Company, Supplemental	H	31,500[11]	10	10	0	4	6,200	6	20,400	Commencement Bay
Port of Silverdale	M	3,950	1	0	0	0	0	1	3,950	Elliott Bay
Brightwater Marine Outfall Corridor	M	5,300	3	0	0	0	0	3	5,300	Elliott Bay, Port Gardner
Port of Seattle Fishermen's Terminal	H	47,793[12]	12	7	0	2	8,559	6	24,150	Elliott Bay
Port of Seattle Terminal 46	H	27,000	6	0	0	3[13]	13,692	3	11,300	Elliott Bay
Port of Everett Marina 14th Street	M	4,000	1	0	0	0	0	1	4,000	Port Gardner
USACE Upper Snohomish River O&M	LM	200,000	12	0	0	0	0	12	200,000	Port Gardner, BU
Port of Bellingham Harris Ave. Shipyard	H	15,432	6	0	0	0	0	6	15,432	Bellingham Bay, BU
USACE Quillayute Boat Basin O&M	M	28,500	2	0	0	0	0	2	28,500	Upland

[11] The net difference between the initial volume and the cumulative total volume (suitable + unsuitable) = 4,900 cy and reflects the differences in the pre-characterization/post-characterization survey estimates regarding total volume.
[12] Volume reduced to 32,709 cy after testing initiated, after applicant withdrew the 15,084 cy within Area 2 of project area (4 DMMUs) from further DMMP consideration.
[13] Bioaccumulation Triggers exceeded, and multiple SL exceedances. Applicant elected not to perform required biological testing, including bioaccumulation testing, and DMMUs determined to be unsuitable using BPJ.

PROJECT	Rank	Total Volume (cy)	No. of chemical analyses	No. of bioassay analyses	No. of bioaccum analyses	No. of DMMUs Failing	Volume Failing (cy)	DMMUs Passing	Volume Passing (cy)	Proposed DMMP Disposal Site
Lakeside Industries PDMA	H	NA	1	0	0	1		NA	0	NA
Tidewater Cove	M	12,000	2	0	0	0	0	2	12,000	Upland/Columbia River
Dakota Creek Supplemental Dioxin Testing	M	273,000	4	0	0		(16,000)[14]	4	230,000	Rosario Strait
USACE Grays Harbor O&M	L	1,860,000	11	2	0	0	0	11	1,860,000	SJ, CH, SB,HMB[15]
Totals:		5,224,475	90	19	0	8	28,451	78	5,143,032	

[14] Initial characterization and SDM completed in DY 2001, material previously found unsuitable based on BPJ as applicant elected not to conduct required bioassay testing.
[15] SJ = South Jetty, CH = Chehalis, SB = South Beach beneficial use, HMB = Half Moon Bay beneficial use site

CHAPTER 3 - SUMMARY AND ASSESSMENT OF DY04/05 DATA

3.1 SUMMARY OF CHEMICAL TESTING RESULTS

Table 3-1 and Appendix C summarize the chemical testing results from DY 2004 and DY 2005. A total of 22 of the 58 DMMP COCs had screening levels exceeded for at least one project. These included both detected exceedances (22 COCs) and detection limit exceedances (2 COCs). Five COCs had detected concentrations above the BT; none were undetected above the BT. Two chemicals were detected above the ML, whereas none were undetected above the ML. Table 3-2 highlights those chemicals that had detected concentrations exceeding SL, BT and ML most often. Also included are those chemicals for which the detection limit exceeded the SL, BT, or ML.

From Table 3-2 it can be seen that the chemicals most often detected above SL and BT included lead, mercury, TBT, Fluoranthene, and total PCBs. Only mercury, TBT, fluoranthene, pyrene, and PCBs were quantitated above BT in one or more projects. The chemicals for which detection limits were exceed where Total DDT and Dieldrin. Detection limit exceedances were generally inconsequential, because other detected SL exceedances generally triggered biological testing. There were no instances where detection limit exceedances of SLs triggered biological testing without co-occurring exceedances of at list one other detected chemical over SL (Appendix C). Concurrent biological testing was conducted for four projects including Port of Seattle East Waterway, Manke Lumber Company – Supplemental, Port of Seattle Fishermen's Terminal and Grays Harbor O&M.

During the two-year period covered by this report six projects were evaluated for beneficial uses disposal alternatives. A portion of the federal maintenance dredged material (315,000 cy) from the Upper Snohomish River was evaluated as suitable and used as capping material to remediate contaminated sediments at the Pacific Sound Resources CERCLA site in Elliott Bay. As part of the maintenance dredge of the USACE Keystone Ferry Terminal Lake Crockett Navigation Channel approximately 40,000 cy of dredged material from the project area was evaluated for beach renourishment, necessary to replenish sand normally deposited by littoral drift. A third project, the Bridgehaven Community Club Marina, was evaluated for beneficial use of approximately 2000 cy of dredged material to renourish the adjacent beach in Hood Canal. A fourth project proposed to provide material from a maintenance dredge in Basin and Channel Property Owners Association for beneficial use. 1200 cy of dredged sand and gravel from an existing access channel south of the confluence of Rendsland Creek and Hood Canal near Tahuya was evaluated for nourishment of an adjacent upper intertidal area. In the fifth project, the Port of Tacoma Blair Bridge Reach Widening, approximately 265,000 cy were evaluated for beneficial use. The sixth project, the Puget Sound Naval Shipyard, 24,254 cy were deemed suitable for use as capping material at the Pit-CAD site.

Table 3-1. DY04/05 Chemical Testing Summary. Total projects = 24; total # of DMMU = 126.

CHEMICAL OF CONCERN	# of DMMU D > SL	# of Projects D > SL	# of DMMU D > BT	# of Projects D > BT	# of DMMU D > ML	# of Projects D > ML	# of DMMU U > SL	# of Projects U > SL	# of DMMU U > BT	# of Projects U > BT	# of DMMU U > ML	# of Projects U > ML
METALS & ORGANOMETALS												
Arsenic	1	1										
Lead [1]	2	1			1	1						
Mercury	13	4	3	2	1	1						
Zinc [1]	3	2										
TBT ion (porewater) [2]	9	2	9	2								
LPAH												
Acenaphthene [1]	1	1										
Fluorene [1]	1	1										
Phenanthrene [1]	1	1										
Total LPAHs [1]	1	1										
HPAH												
Fluoranthene	2	2	1	1								
Pyrene [1]	2	2	1	1								
Benzo(a)anthracene [1]	1	1										
Benzofluoranthenes (b+k)	1	1										
Benzo(a)pyrene	1	1										
Indeno(1,2,3-c,d)pyrene	1	1										
Benzo(g,h,i)perylene	1	1										
Total HPAHs [1]	2	2										
CHLORINATED HYDROCARBONS												
1, 4-Dichlorobenzene	1	1			1	1						
PHENOLS												
2,4-Dimethylphenol [1]	1	1										
MISCELANEOUS EXTRACTABLES												
Benzyl alcohol [1]	2	1										
PESTICIDES AND PCBs												
Total DDT							3	2				
Dieldrin [2]							3	1				
Total PCBs	8	3	1	1								

D = Detected U = Undetected SL = Screening Level BT = Bioaccumulation Trigger ML = Maximum Level
[1] = No BT exists [2] = No ML exists [3] = No BT or ML exists

Table 3-2. DY 04/05 DMMP Guideline Value Exceedances.

CHEMICAL OF CONCERN	Detected Chemicals exceeding SL in at least 3 Projects	Detected Chemicals exceeding BT in one Project	Detected Chemicals exceeding ML in one Project	Chemicals exceeding SL Detection Limits in at least 2 Projects	Chemicals exceeding BT Detection Limits in one Project	Chemicals exceeding ML Detection Limits in one Project
Mercury	X	X	X			
Lead			X			
TBT (porewater)		X				
Fluoranthene		X				
Pyrene		X				
1,4-Dichlorobenzene			X			
Total DDT				X		
Total PCBs	X	X				

3.2 BIOLOGICAL TESTING.

Biological testing was conducted on 5 of the 24 projects undergoing chemical testing during DY04/05. Table 3-3 shows the number of times each of the three bioassays was conducted and the number of hits recorded for each bioassay for non-dispersive and dispersive site disposal. The table shows that all three bioassays in the test suite recorded hits, with the sediment larval bioassay registering the most hits (2H + 1H) in 12 out of 24 bioassays (50%). The number of total hits recorded for the amphipod bioassay was 4 hits (17%). The *Neanthes* growth bioassay recorded only two one-hit responses (8%) out of the 24 DMMUs evaluated, with one hit resulting from the following quality control issues: worms smaller than those specified in the DMMP guidelines were used, and the results of the positive control were very low, barely within laboratory guidelines and worm growth in the reference sediments was much higher than in the control sediment. A retest was conducted and the sample sediment was within DMMP criteria. Most of the hits recorded were for the nondispersive site evaluations, the exception being the *Neanthes* hits noted for the two analyses utilizing the dispersive site guidelines.

Table 3-3. DY 04/05 Bioassay "Hit" Summary.

BIOASSAY	Number of DMMUs Tested		Number of Hits Under the "Two-Hit Rule"		Number of Hits Under the "Single-Hit Rule"		Total Hits (2H + 1H)
	ND	D	ND	D	ND	D	
Amphipod	22	2	0	0	4	0	4
Sediment Larval	22	2	5	0	7	0	12
Neanthes Growth	22	2	0	0	0	2*	2*

ND = non-dispersive site interpretation guidelines
D = dispersive site interpretation guidelines
* = also includes one QA/QC failure

3.3 BIOACCUMULATION TESTING

No bioaccumulation testing was conducted during the 2004 and 2005 dredging years covered by this report.

3.4 COST ANALYSIS

- **Total Costs.** Total sampling and testing costs are generally related to the size of the project and the rank. Larger projects have lower unit costs than smaller projects due to economy of scale. Area rank influences costs by requiring higher numbers of analyses (DMMU) for higher ranked projects. Figure 3-1 shows the relationship of average total cost per cubic yard to the total volume tested for all DMMP projects submitting data from DY90 to DY05. The regression of these two variables resulted in a significant ($p<0.001$) correlation and regression equation noted in Figure 3-1, which can be used to estimate testing cost given the project size.

- **Testing Costs.** Chemical testing costs are generally the most straightforward and readily discernible costs. Analytical laboratories performing DMMP analyses will provide quotes on unit costs. Average unit chemical testing costs (including QA/QC) for the past ten years are depicted in Figure 3-2 as a function of the number of analyses for the standard suite of chemicals and for the cost for the standard suite plus special chemicals such as dioxin and tributyltin. The scatter plot depicted shows that as the number of analyses increases beyond three the unit costs drop sharply and steadily decrease for the most part to a low of around $1,200 to $1,500 per analysis. Projects with one or two analyses are especially costly, as the QA/QC costs cannot be distributed over several samples.

Evaluating bioassay costs shows that the unit costs generally relate well to the total number of analyses, as shown in Figure 3-3. There is a tremendous range in unit costs for projects with only one analysis, whereas the variability in unit costs drops sharply with additional analyses.

Bioaccumulation testing is infrequently accomplished and a few examples are provided here to illustrate the actual costs for two dredging projects. For the USACE/Port of Seattle East Waterway Stage II dredging project, 25 bioaccumulation tests were conducted to evaluate TBT, PCBs, Fluoranthene, and total DDT. The average bioaccumulation testing cost was $17,953/DMMU for this project. A second example was the USACE Olympia Harbor Characterization Project, which conducted two bioaccumulation tests for TBT, and averaged $18,663/DMMU for each test.

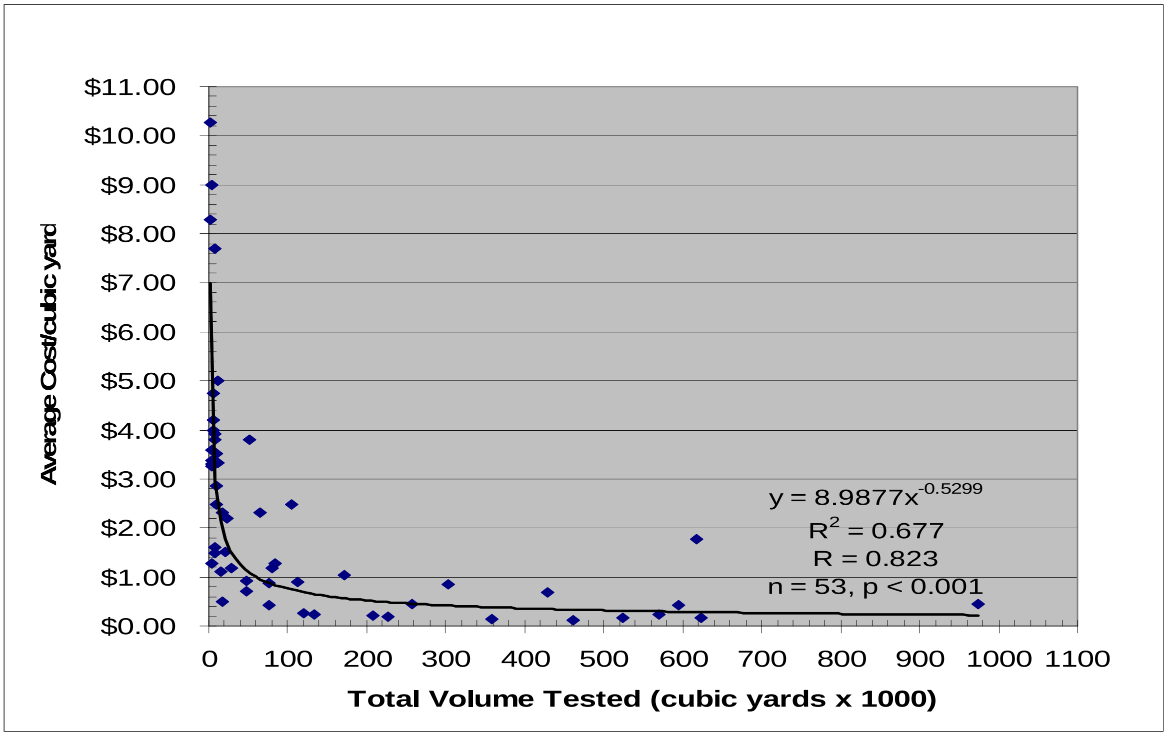


Figure 3-1. Project Size (Volume) versus Unit Testing Cost

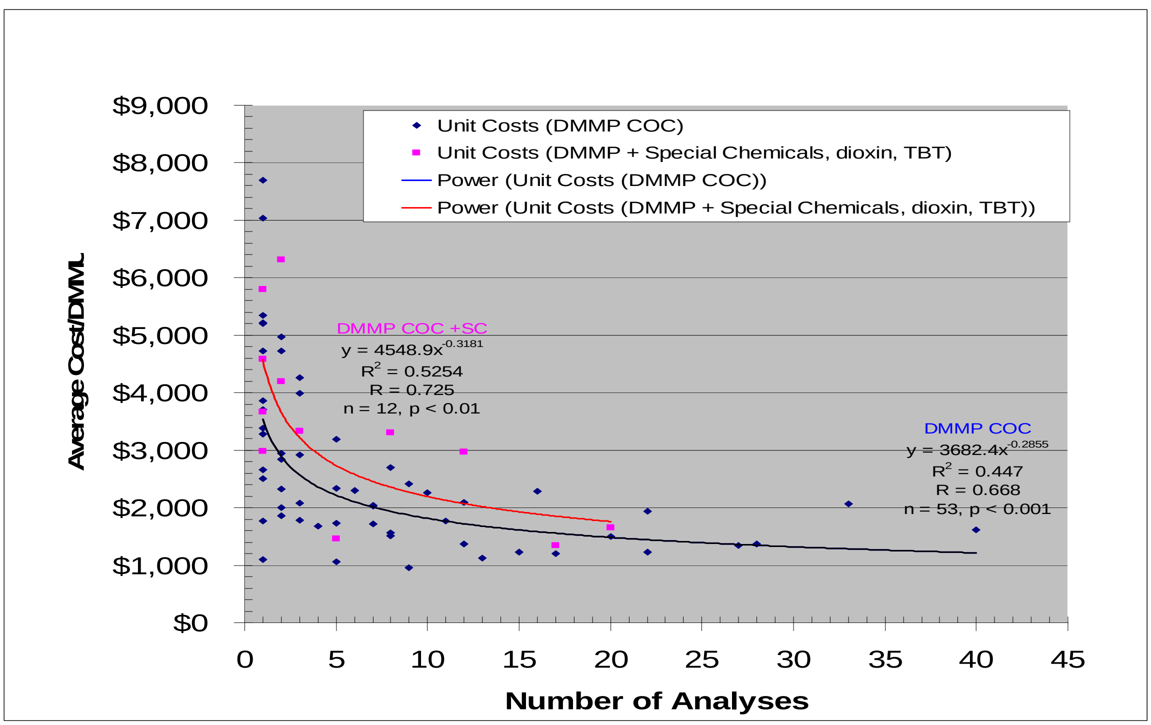


Figure 3-2. Chemical Testing Unit Costs

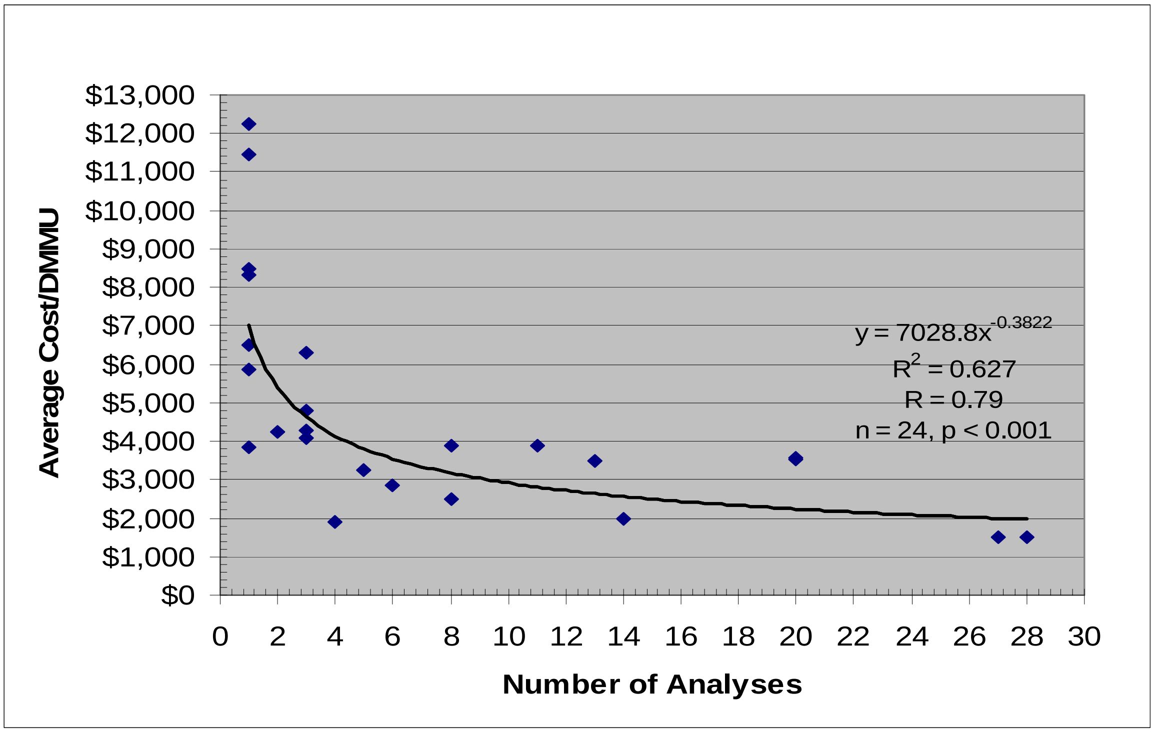


Figure 3-3. Bioassay Suite Unit Testing Costs

3.5 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 are as follows:

1. Prepare and submit application for permit.
2. Prepare sampling and analysis plan (SAP) for characterization of proposed dredged material.
3. Receive approval of SAP from DMMP agencies.
4. Perform sampling and chemical/biological analysis and submit testing results.
5. Receive suitability determination for open-water disposal from DMMP agencies.
6. Complete application details required for issuance of public notice.
7. Corps prepares and issues public notice.
8. Corps transmits review comments to applicant after 30-day public comment period.

9. Applicant provides Corps with responses to public comments.

10. Corps completes public interest review, 404(b)1 evaluation, NEPA documentation and issues permit decision.

The average time requirements for steps 3 through 5 are included in Figure 3-4, which was constructed using data from processing activities occurring in DY04/05

Permit Preparation and Submittal. An application (JARPA, or Joint Aquatic Resources Permit Application) for a Corps of Engineers Section 10/404 permit for dredging and dredged material disposal is usually submitted before any DMMP processing takes place. An application number and Regulatory Branch Project Manager are assigned when an application is submitted and the Dredged Material Management Office begins review of information relevant to the proposed dredging. Permit preparation is part of the regulatory process, but completely within the control of the permit applicant, so is not included in the analysis of processing time.

1. 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. In many cases a permit application is submitted at the same time as a draft SAP, while in other cases a permit application is submitted long before development of a SAP begins.

2. 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. An approval letter, which includes DMMP agency comments and recommends modifications to the SAP, is then sent to the applicant. Once the applicant, via telephone, letter or e-mail, has accepted these comments and modifications sampling and analysis may proceed. It is the goal of the DMMO to complete the review of SAPs within three weeks. During DY 04/05 the average time from the submittal of the final SAP for a project to SAP approval was 24 days, which exceeded the target review time by 3 days, due to staff resource constraints.

3. 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 hard copy report. A Corps contractor enters these data into the Dredged Analysis Information System. Sampling, testing and reporting consume a substantial portion of the DMMP Process time budget, averaging 138 days during DY 04/05. This is one of the project phases with the highest degrees of variability, with sampling and analysis taking anywhere from 53 to 383 days during this 2 year time period. Factors influencing the time required for this phase include weather, sampling difficulties, laboratory capacity and turn-around, QA problems arising during chemical and biological testing, and report compilation time. Those projects that included bioassays had longer turn-around times.

4. Data Review. Once a full set of chemical/biological testing data is submitted along with the sampling report, 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 defined in the approved SAP. The goal of the DMMO is to complete this review within three weeks of data submittal, though several projects during this biennium required a much longer review time that skewed the average up to over two months. In DY04/05, the average time required was 34 days. In many cases, this review was much shorter; time needed during this biennium ranged from 1 day to 140 days, with most projects in the middle of that range. The longest reviews usually involve complications such as a change in dredge volume or especially large or complex data sets. The average target of 21 days was exceeded by 13 days due in part to resource constraints and staff turnover.

5. Complete Permit Application. Once the suitability determination has been signed, the DMMO submits a copy to the Corps Regulatory Branch project manager who then prepares to issue a public notice. However, if project details have not been fully developed by this time, or if project plans are modified subsequent to the suitability determination, new drawings or other information may be required of the applicant prior to the preparation of the public notice. In other cases, the applicant may not have yet obtained a shoreline development permit and a decision may be made to wait to go out to public notice until the local shoreline jurisdiction has issued a permit.

6. Prepare and Issue Public Notice. By regulation, the Regulatory Branch must issue a public notice within fifteen days of the completion of the permit application.

7. Public Comment Period and Transmittal of Review Comments. A DMMP project typically undergoes a 30-day public comment period. Comments received during this period are collated by the Corps Regulatory project manager and are transmitted to the applicant for response.

8. Applicant Responds to Review Comments. The permit applicant is responsible for providing written responses to public review comments to the Corps before the Regulatory Branch project manager can complete a public interest review.

9. Corps Completes Public Interest Review and Makes Permit Decision. The public interest review, including a Section 404(b)(1) alternatives analysis and NEPA evaluation, is completed and documented after the permit applicant provides responses to review comments. The Corps project manager prepares a permit decision upon completion of the public interest review.

   This stage of the process may be very time consuming. Dredging and DMMP processing are often only part of complex projects. Other elements may be involved, such as wetland fills, eelgrass bed impacts or Endangered Species Act issues. The addition of several species to the list of threatened and endangered species in Western Washington has led to a substantial backlog in permit review and approval.

To improve regulatory response time, the Department of Ecology recommends that applicants seek a hydraulic project approval (HPA) from the Department of Fish and Wildlife, and resolve other problems as early as possible in the permit process.

DMMP Processing Time. The entire DMMP dredged material evaluation process, as depicted in Figure 3-4, includes final sampling and analysis plan review and approval, field sampling and analysis, data review and completion of the suitability determination. The average time required for the DMMP dredged material evaluation process was 199 days (ranging from 98 to 405 days) in DY04/05, with the majority of that time taken up by sampling, testing, and data report preparation by the applicant, which was entirely controlled by the Applicant/contractors. The SAP review and Data Review and Suitability Determination timelines have increased over the last several years due to resource constraints.

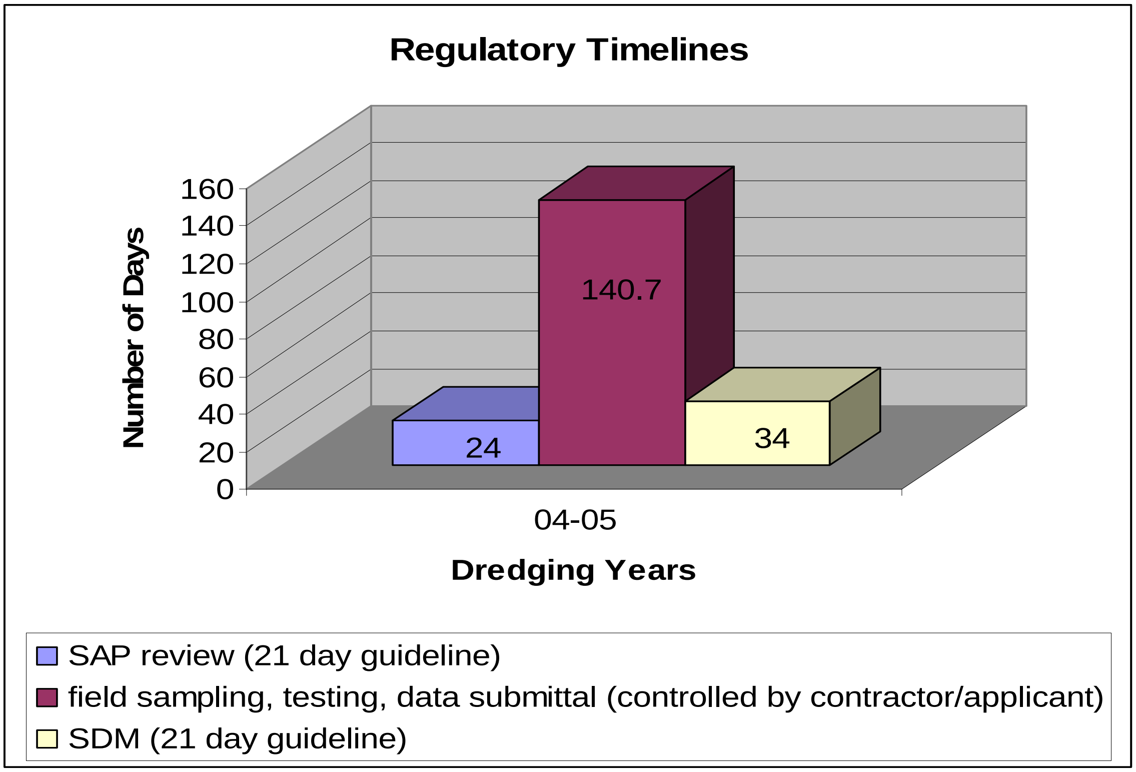


Figure 3-4. DMMP Processing Time (means for DY 04/05 Projects in days)

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 for ranking, sampling plan development, chemical testing, biological testing, or those for which the DMMP agencies used Best-Professional-Judgment (BPJ).

4.1. DREDGING YEAR 2004

4.1.1. Port of Seattle East Waterway Recency Characterization

Materials testing in East Waterway discussed here was ranked high for initial testing and recency evaluation. The materials discussed here were initially found suitable during the East Waterway, Terminal 18 sampling effort conducted during March 1996 (March 17, 1997 Suitability Determination). The results of the retesting of three DMMUs are discussed here.

Chemical analysis of the three DMMUs indicated that mercury was quantitated over the SL in 2 of 3 DMMUs analyzed, whereas PCBs were quantitated over the SL in all 3 DMMUs, and over the BT in one DMMU. Dieldrin exceeded the screening level, but was undetected in all three DMMUs, and DDT was undetected over the screening level in two of three DMMUs. All three DMMUs tested underwent concurrent bioassay toxicity testing and the results of these analyses are summarized below.

Standard bioassay testing was conducted on the three DMMUs within the 56 day biological holding time. Appendix B summarizes the solid phase bioassay Quality Control (QC) performance guidelines and also summarizes the solid phase bioassay interpretative guidelines for nondispersive sites, which were used to evaluate the bioassay data presented below. Table 4-1 summarizes the batch specific bioassay toxicity testing outcomes for the 3 DMMUs tested. Three reference samples were collected from Carr Inlet to block for grain size effects, but only one was utilized in the bioassay interpretation (e.g., CR-23). In general, all negative control and reference sediments met the DMMP performance limits for each of the three bioassay tests to assess toxicity. These bioassay results are discussed below for each of the bioassay tests.

1. Amphipod Bioassay (*Eohaustorius estuarius*). All three DMMUs showed single-hit responses for the amphipod bioassay. Interstitial total ammonia concentrations measured at the initiation of the test on day 0 were greater than 30 mg/l for two of the three DMMU tested (e.g., COMP-9 = 40 mg/l; COMP-11 = 50 mg/l). However, the applicant did not run an Ammonia LC50 to validate the sensitivity of *Eohaustorius* to Ammonia concentrations observed in the sediments, as required by the DMMP. Although it is likely that ammonia may have contributed to some of the toxicity observed, the significance of this observation remains unsubstantiated without direct toxicity information.
2. Bivalve Larval Bioassay (*Mytilus galloprovincialis*). The results of the larval bivalve test showed that two of the three DMMUs tested showed relatively low normalized combined percent mortality and abnormality (NCMA), but DMMU COMP-11 demonstrated a single-hit response relative to the reference sediment.
3. *Neanthes* 20-day Growth Bioassay (*Neanthes arenaceodentata*). The results of the *Neanthes* growth bioassay (Table 4-1) showed generally low mortality in tested sediments,

and no toxicity relative to the DMMP interpretive guidelines for mean individual growth for all three DMMUs.

4. **DMMP Bioassay Summary Determination.** Overall interpretation of the bioassay testing responses indicates that all three East Waterway recency DMMUs failed the DMMP unconfined-open-water disposal bioassay guidelines.

Table 4-1. Bioassay testing interpretation summary.

Sample ID	Amphipod		Bivalve Larvae		*Neanthes* Growth		Overall
	Mortality (%)	% over reference	NCMA (%)	% over reference	Growth (mg/day/worm)/ (% Survival)	% of reference	DMMU Pass/Fail
Control	0		0		1.29 / 100	104	
CR-23 (ref.)	19		11		1.24 /100		
COMP-9	77	58 (SH)	25.7	14.7	1.14 / 100	92	Fail
COMP-10	52	33 (SH)	20.3	9.3	1.27 / 100	102	Fail
COMP-11	80	61 (SH)	49.7	38.7 (SH)	1.06 /100	85	Fail
Ref. Tox. Test NAS WL	LC50/ $CdCl_2$ 2.32 mg/l		EC50/Cu 9.69 ug/l 8.46-13.6 ug/l		LC50/ $CdCl_2$ 10.2 mg/l 4.26-11.0 mg/l		

NCMA = normalized combined percent mortality and abnormality
SH = single hit failure response relative to reference (DMMP guidelines)
NAS WL = Northwest Aquatic Sciences warning limits

4.1.2. Port of Seattle East Waterway Recency Extension for Subsurface Material

The subset of DMMP characterized subsurface material which was subject to recency extension consideration were previously characterized and found suitable through the two separate sampling efforts, and were dredged material management units (DMMUs) identified in the CERCLA Phase I Removal Action Area. The first one consisted of 95,340 cy of subsurface suitable material identified within the Port of Seattle Terminal 18 Project (SDM dated March 17, 1997). The second project consisted of an additional 79,920 cy of subsurface suitable material characterized within the Corps of Engineers/Port of Seattle East Waterway Stage II Channel Deepening Project (SDM dated November 2, 1999).

Recency expired for the four subsurface suitable Terminal 18 DMMUs in March 1998 and for the thirteen subsurface suitable Stage II DMMUs in August 2000.

The subsurface DMMUs are physically isolated from potential sources of contamination and therefore, the physical and chemical characteristics of these sediments have not likely changed since they were characterized.

The testing summary for the seventeen subsurface DMMUs showed that there were few DMMUs with any chemical exceedances of screening level and no bioaccumulation trigger or maximum level exceedances. All seventeen DMMUs underwent concurrent bioassays testing, and the results confirmed that all DMMUs passed the nondispersive disposal site testing guidelines. All DMMUs were found suitable for unconfined-open-water disposal at the Elliott Bay disposal site.

Based on the discussion above the DMMP agencies concluded, based on BPJ, that extending the recency expiration date for these data to August 2005 was warranted based on the facts presented.

4.1.3. Puget Sound Naval Shipyard Turning Basin Material Recency Extension and Beneficial Uses Determination

The following summary provided a recency extension determination by the Dredged Material Management Program (DMMP) Agencies' (U.S. Army Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) on 24,254 cubic yards of dredged material from the Turning Basin for use as capping material on impacted State Owned Aquatic Lands (SOAL) within OU-B at the CERCLA Pit-CAD site in Sinclair Inlet. This recency extension determination augments the final 21 March 2000 SDM and August 2001 Supplemental SDM, which previously evaluated the suitability of 160,120 cy of the turning basin material for beneficial use capping material around the Pit-CAD site, as an alternative to disposal at the Elliott Bay disposal site.

This evaluation focuses on eleven DMMUs within the previously characterized Turning Basin footprint. This material was characterized during 1999, and all eleven DMMUs were found to be suitable for unconfined open-water disposal, and these data were re-evaluated in 2001 relative to the SMS guidelines for potential beneficial use placement alternatives at the Pit-CAD site. The 2001 data re-evaluation noted that the 40 DMMUs were suitable as capping material at the Pit-CAD site. The recency date expired for the eleven remaining DMMUs on October 2001.

A review of the 1999 chemical testing results for the eleven remaining DMMUs identified for potential beneficial reuse as capping material are briefly summarized as follows: Ten of eleven DMMUs had no chemical SL exceedances, whereas the remaining DMMU (S4) had detected exceedances of the mercury SL and SMS SQS, and CSL, and was quantitated at 0.733 ppm-dry weight . No other chemical exceedances were noted for this DMMU. All eleven DMMUs were subject to bioassay testing and those results are summarized below.

A summary of the 1999 DMMP bioassay testing conducted on the eleven DMMUs are briefly discussed below. In summary, the DMMP agencies using weight of evidence and BPJ concluded that the amphipod testing results indicated that two DMMUs had two-hit responses from *Eohaustorius estuarius*, whereas the remaining 9 DMMUs had no-hit responses from the amphipod, *Ampelisca abdita* bioassay. Seven DMMUs exhibited bivalve larval bioassay two-hit responses, whereas four DMMUs had no-hit responses. All eleven DMMUs exhibited no-hit responses for the *Neanthes* 20-day growth bioassay. In conclusion, all eleven DMMUs passed the nondispersive disposal site interpretation guidelines for bioassays.

Interpretation of the bioassay testing results relative to SMS guidelines results in the following outcomes. All eleven DMMUs were below the *Neanthes* SQS guidelines, and nine out of eleven were below the Amphipod (*Ampelisca abdita*) SQS guidelines, whereas two DMMUs, exceeded the SQS interpretation guidelines (*Eohaustorius estuarius*), but did not exceed the CSL interpretation guidelines. Eight of eleven DMMUs were below the bivalve larval SQS guidelines, whereas the remaining three DMMUs exceeded the bivalve larval bioassay SQS guidelines, but did not exceed the CSL guidelines. None of the DMMUs had more than one SQS hit, and there were a sum total of five DMMUs with SQS bioassay exceedances.

There have been no documented "changed" conditions such as accidental spills or new discharges in the vicinity of the Turning Basins. The surface material characterized within the Turning basin composited material from the sediment surface down to four feet in depth relative to the mudline. Portions of ten of eleven DMMUs discussed herein have been dredged and therefore partially removed leaving predominantly the underlying 2 feet of material, except one DMMU. Therefore, the sediment quality of the fraction remaining is not really known, but is considered suitable by the DMMP in consideration of the generally low chemical-of-concern concentrations in the sediments, and based on best-professional-judgment. There is no reason-to-believe that the suitability of the sediments previously evaluated has changed since the previous characterization. The DMMP agencies accepted all the data discussed herein as sufficient using BPJ to extend the recency determination date from October 2001 to October 2004.

Based on the SMS evaluation of the previous testing results and the CSL exceedance of Hg in one DMMU coupled with the SQS bioassay exceedance, the DMMP agencies do not recommend the use of the 2,455 cy of material from this DMMU for proposed remediation on SOAL. The remaining 21,799 cubic yards of potential dredged material within the remaining 10 DMMUs were deemed suitable by the DMMP agencies within this area based on BPJ.

4.2. DREDGING YEAR 2005

4.2.1. Port of Seattle Terminal 46

The project was ranked high for testing purposes. The sampling design called for collecting subsamples from within six DMMUs representing a potential dredging prism of 27,000 cy within the proposed dredging area. An additional DMMU located between Stations 7+00 and 24+00 consisting primarily of riprap with very little sediment representing approximately 4,900 cy of riprap material was excluded from the characterization effort with the concurrence of the DMMP agencies. Sampling within the six DMMUs commenced on March 22, 2004, and six Vibracore samples (two within each DMMU) were collected successfully within three DMMUs (DMMU-1, DMMU-2 and DMMU-3). However, repeated attempts to collect the required core samples at DMMUs 5 and 6 were unsuccessful due to the rocky substrate, which extended over both DMMUs. The decision was made to use divers to collect samples at these locations and at under-pier DMMU-4 on March 25. At DMMU 6 divers reported only a few inches of material overlying the riprap and rocky substrate. They were forced to modify their proposed sampling approach and used a scoop to collect material at 4 locations within the two DMMUs, as deep as possible between the riprap, which amounted to about 2 inches of material on average at DMMUs 5 and 6. Due to presence of extensive riprap at DMMU 4, they were forced to resort to diver core samples of approximately 1 foot in depth at four locations within the DMMU. The composited samples were collected for both chemistry and potential biological testing. A tiered testing approach was initially proposed, and all samples for potential biological testing were archived at $4^{o}C$ pending completion of the chemical analyses.

Chemical analysis of the six DMMUs indicated that three of the DMMUs had no detected or undetected exceedances of chemicals of concern. For the remaining three DMMUs, one had mercury SL exceedances, and two had TBT SL exceedances, one had a 1,4-Dichlorobenzene SL exceedances, one had 2,4-Dimethylphenol, and two had Benzyl Alcohol exceedances. Bioaccumulation Triggers were exceeded for Mercury in one DMMU and in two DMMUs for TBT. The three remaining DMMUs therefore each required both bioassays and bioaccumulation testing to render a determination on suitability for unconfined-open-water disposal. The Port of Seattle determined that due to concerns about testing interfering with the tight construction schedule, they opted to not complete the biological testing. Therefore, DMMUs 3, 4, and 5, are considered unsuitable for unconfined open-water disposal based on BPJ without completing the required biological testing.

The uncharacterized DMMU located between Stations 7+00 and 24+00 consisted predominately of riprap and is bounded on both sides by unsuitable material in DMMU-3, DMMU-4, and DMMU-5. Because of the concern for sediments bound to the riprap within the uncharacterized DMMU, the DMMP agencies are concerned about the potential suitability of this riprap for an upland beneficial use without some kind of washing to clean or remove the sediment bound to the riprap. The heavy concentration of riprap in unsuitable DMMU 5 also limits its utility for upland reuse, and all this material should be disposed of at an Ecology approved upland site.

4.2.2. Lakeside Industries – Post Dredge Surface Sediment Characterization

The agencies are charged with determining the suitability of the post-dredge sediment surface quality after dredging approximately 142 cubic yards of spilled sand and gravel to restore water depths for barges docking at the pier. The sand/gravel spill material was not tested, but was considered by the DMMP to be clean material using BPJ. This material was dredged and subsequently disposed upland at an Ecology approved upland site. The DMMP agencies required a sediment quality assessment of the post-dredge sediment surface based on a "reason-to-believe" after Ecology's SEDQUAL Sediment Quality Database showed a nearby station with 15 chemical CSL exceedances.

The project was ranked high (Salmon Bay) for testing purposes, and the Corps permit special condition required a sediment quality assessment of the top 10 cm of surface sediment following dredging of the sand/gravel spill material. A van Veen grab was used to collect a representative composited sample of the surface material at a single location.

Chemical analysis of the single sample indicated that from a DMMP perspective there were eleven detected screening level exceedances (Acenaphthene, Fluorene, Phenanthrene, 2-methylnapthalene, Total LPAH, Fluoranthene, Pyrene, Benzo(a)anthrancene, Chrysene, Total HPAH, Dibenzofuran), four detection limit exceedances (Hexachlorobenzene and N-Nitrosodiphenylamine, 1,2-Dichlorobenzene, 1,2,4-Trichlorobenzene), and a single bioaccumulation trigger exceedance (Fluoranthene) of DMMP Guidelines. From an SMS perspective there were seven SQS exceedances (Naphthalene, Total HPAH, Benzo(a)anthracene, Benzo(a)pyrene, Total Benzofluoranthenes, Chrysene, and Indeno(1,2,3-cd)pyrene) and seven detected CSL exceedances (Total LPAH, Acenaphthene, Fluorene, Phenanthrene, 2-Methylnaphthalene, Benzo (k) fluoranthene, Dibenzofuran), and four undetected CSL exceedances (Hexachlorobutadiene, Hexachlorobenzene, Butylbenzylphthalate, and 2,4-Dimethylphenol) within the sediment surface. TOC was quantitated at 0.7 %. No biological testing was performed on this sample, and therefore from a DMMP perspective, the new exposed sediment surface represents a degraded sediment quality compared to the predredging surface. From an SMS perspective the sediment quality exceeds the Washington Department of Ecology's anti-degradation standard using BPJ.

The results of the single composited surface sample representing the post-dredge sediment surface layer failed to meet acceptable state sediment quality guidelines as specified by the DMMP program (http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/Antidegradation_Clarif.pdf), which is the Washington State anti-degradation policy. The results of this analysis have been sent to Ecology's Toxics Cleanup Program for enforcement action.

4.2.3. Manke Lumber Company – Supplemental Characterization

The area outlined in this DMMP evaluation was subject to an earlier DMMP characterization and suitability determination dated 10 October 2000, which indicated that 10 of 27 DMMUs evaluated were suitable for unconfined open-water disposal. Dredging of all surface suitable DMMUs from the 2000 SDM have been completed. Approximately 31,500 cy of material from 13 DMMUs remains to be addressed under the requirements of the MTCA Consent Decree, and were the focus of the DMMP characterization summarized below.

Of the 11 remaining DMMUs, three underwent DMMP chemical characterizations, and 10 DMMUs underwent concurrent bioassay testing.

The results of the chemical analyses of the three DMMUs indicated that only one chemical, mercury, exceeded the DMMP SL in 2 of the 3 DMMUs, both quantitated at 0.6 ppm (, and below the bioaccumulation trigger.) The DMMU with no chemical guideline exceedances was not subject to biological testing. The biological testing results are summarized below.

The three Carr Inlet reference samples utilized for toxicity testing (wet sieving estimates for fines: 17%, 48%, and 80%) were run concurrently with the test sediment, and met the performance objective for both amphipod mortality (*Eohaustorius estuaries*) and *Neanthes* growth bioassays.

However, in the bivalve larval bioassay (*Mytilus galloprovincialis*), all three reference sediments failed the PSEP protocol quality control performance standard for reference sediment. Examination of the water quality parameters associated with this test indicated that ammonia and sulfide did not appear to be responsible for the apparent reference sediment performance problems. After consultation, the DMMP agencies agreed to allow a retest using a screen tube inserted into the test beakers to keep the larvae off of the soft sediments. The first retest with the screen tubes used a mesh size of 37 millimicrons and the reference sediments again failed to meet the performance QA standard. In evaluating the reasons for the performance standard Bill Gardiner (MEC) felt the larvae were smaller than the screen mesh of 37 millimicrons and were passing through the screen. He indicated that the problems with the test could be remedied by rerunning the test with a screen tube mesh size of 25 millimicrons. The recommended DMMP holding time for conducting bioassays (56 days) was exceeded by 20 days for the second retest with the smaller mesh size. The holding time exceedance was acknowledged by the DMMO as a serious concern and issue, but David Kendall indicated that because the primary chemical constituent being evaluated was TVS and not likely to be affected by the extended holding time, the retest could proceed[16]. The retest results would be evaluated with BPJ. The results of the second retest with the smaller mesh size indicated that two of the three reference samples met the performance standard and that these results were deemed valid for decision making using BPJ.

1. Amphipod Bioassay (*Eohaustorius estuarius*). Amphipod bioassays were conducted during the initial testing on 10 DMMUs. The results indicate that for the amphipod bioassay, all ten DMMUs exhibited no-hit responses and passed the nondispersive disposal site guidelines.

2. *Neanthes* 20-day Growth Bioassay (*Neanthes arenaceodentata*). For the *Neanthes* growth bioassay nine of the ten DMMUs passed the nondispersive open-water disposal guidelines, whereas one DMMU scored a 2-hit response using BPJ.

3. Bivalve Larval Bioassay (*Mytilus galloprovincialis).* The results of the PSEP protocol failing reference performance guidelines are discussed below. The results of the first test with the screen tubes indicated that they also failed the reference performance guidelines, and were subject to a retest. The results of the second test with the screen tubes using the smaller (25 millimicron) mesh size indicated that six of ten DMMUs passed the nondispersive disposal guidelines, whereas one scored a 2-hit response, whereas, three DMMUs scored 1-hit responses for this bioassay. Therefore, collectively DMMU AML-A9

[16] A subsequent discussion ensued where the biological testing problems with the bivalve larval sediment bioassay were discussed by the DMMP staff with Dr. Jack Word (MEC) and Clay Patmont (Anchor Environmental). The suitability determination stated that the 20 day holding time exceedance was not a serious concern because TVS was likely the only major constituent being expressed in the sediments tested and the holding time exceedance was not likely to reduce the toxicity due to this parameter in the sediments.

This in reality may be just one potential explanation. Tom Gries (Ecology) indicated that there were also two other plausible alternative reasons why we might have had concerns about the holding time exceedance:

a. Allowing a longer holding time of 20 extra days could also result in more volatilization of toxic wood-related toxicants, thereby reducing toxicity being expressed in the 2nd Retest.

b. Unmeasured wood-related toxicants would have had more time to biodegrade to levels below (unknown) toxicity thresholds, thereby reducing toxicity in the 2nd Retest.

Gries indicated that had he been available during the discussion on whether a retest would be authorized with the holding time exceedance, he might not have been willing to go along with the second retest without resampling. He was not around when the decision was made and the retest was allowed to proceed.

We will never know from these analyses if either of the two alternative hypotheses described above might have been true. However, if the increased holding time that was allowed for this project had resulted in an inappropriate reduction in contaminant concentrations and toxicity - explaining the second retest results - then it is also clear that the toxicity observed in the first round was short-lived. This “worst case scenario” of short-lived toxicity was an important point that DMMP agency staff discussed prior to making the suitability determination for this dredged material. It helped the DMMP conclude that the material is not at all likely to cause exceedances of biological conditions allowed at non-dispersive disposal sites.

had two bioassay responses scoring 2-hit responses (e.g., *Neanthes* and bivalve larval bioassay), resulting in a failure to pass the nondispersive disposal guidelines. The three 1-hit responses for DMMUs failed the nondispersive disposal guidelines.

4. DMMP Bioassay Determination. Overall, interpretation of the ten DMMUs characterized, six DMMUs exhibited bioassay responses that were suitable for unconfined open-water disposal (UOWD) and 4 exhibited responses that were unsuitable for UCOWD.

4.2.4. Port of Seattle Fishermen's Terminal

The Fishermen's Terminal is currently undergoing major reconstruction and upgrades, to increase fairway widths, more side-tie moorage and longer slips, and higher voltage/amperage services to better match the projected demand from the commercial fishing fleet. The project was ranked high (Salmon Bay) for testing purposes, and the two proposed dredging subareas (Area 1 and Area 2) were initially sampled for a DMMP and SMS evaluation. Area 2 was subsequently withdrawn from consideration due to budgetary constraints by the Port of Seattle.

The applicant's contractor provided additional information on bioassay testing concerns in freshwater sediments as a response to the DMMP SAP comment/approval letter. The DMMP agencies subsequently agreed to compare porewater TBT results from acclimated sediments to the SL and BT (0.15 ug/L) for determining the need for subsequent bioaccumulation testing requirements.

Chemical analysis results for the tested twelve DMMUs indicated that there were seven detected exceedances of the DMMP SL guideline for mercury, two exceedances each of the SLs for lead and zinc and four detected exceedances of the SL for Total PCBs. In addition, there were seven exceedances of the porewater SL for TBT in the unacclimated samples but only two exceedances of the porewater SL for TBT in acclimated samples.

Comparison to SMS standards indicated that there was one exceedance of the SQS (only) and six exceedances of the CSL for mercury, along with one exceedance each of the SQS and CSL for lead. There were also two exceedances of the SQS for zinc and one exceedance of the SQS for Total PCBs. Finally, there were nine exceedances of the recommended no effects level for porewater TBT (0.05 ug/L) in unacclimated samples, but only six exceedances of this value for acclimated samples.

The agencies agreed to allow the applicants to acclimate the test samples to the saline conditions required by toxicity test protocols until such time as any accumulated ammonia had declined to stable and acceptable levels, prior to biological testing. The acclimation showed that full acclimation occurred by day 31 with a dramatic decrease in ammonia concentrations. Biological testing commenced after acclimating for 31 days. Appendix B provides the bioassay interpretation/performance requirements for the three PSDDA bioassays. Table 4-2 provides an alternative DMMP interpretation of the larval data based on BPJ for the bivalve larval bioassay results, given reference performance problems, which are discussed in detail below. Biological testing was only performed on the Area 1 DMMUs with SL exceedances. Of the two Lake Washington freshwater reference sediments selected, FT-Ref-1 and FT-Ref-2, FT-Ref-1 was rejected because of low pH (less than 4).

Table 4-2. Alternative DMMP interpretation of Sediment Larval Results* Using BPJ.

DMMU	Mean % Combined Normal Larvae	$N_T/N_C < 0.80$? $N_T > 0.80$ = NH $N_T < 0.80$ = reference/criterion comparison	Criterion Comparison $N_T - 80\%$[17] = 2H < 30% 1H >30%	DMMP interpretation
Control (N_C):	85.6	--	--	--
Test Sediment (N_T): 8CS	75.3	0.88 (no)	4.7	NH
7CS[18]	49.1	0.573 (yes)	30.9	1H = 2H (BPJ)
6CS	52.1	0.609 (yes)	27.9	2H
4CS	57.9	0.678 (yes)	22.1	2H
3CS	57.4	0.670 (yes)	22.6	2H
2CS	7.8	0.091 (yes)	65.2	1H
1CS	24.5	0.286 (yes)	55.5	1H

* Conservative interpretation using 80% Absolute Survival (100 - 20 = 80) as criterion for alternative Test Sediment Interpretation

Reference Sediment Performance: $N_R/N_C \geq 0.65$ (N_R = 85.6 x 0.65 = $\geq$55.6 (minimum acceptable reference). 8CS as surrogate reference: 75.3/85.6 = 0.88 (meets reference performance requirements, i.e. > 0.65)

NH = no hit response

<u>Sediment Acclimation.</u> The sediment acclimation procedure followed (for ammonia and TBT) was effective in adjusting the porewater salinity and establishing a marine microbial community that could process ammonia. The porewater salinity reached equilibrium within six days of the introduction of seawater and was effectively adjusted by the addition of brine to the overlying water. The results showed a significant drop in TBT concentrations in acclimated sediments. From the Data Summary Report: "There was an initial increase in ammonia concentrations both in porewater and overlying water following introduction of marine waters to freshwater sediments. After day 6, porewater ammonia concentrations began to decrease gradually, and after day 21, ammonia concentrations in overlying water began to decrease." The bivalve larval tests were initiated on day 41 following acclimation. When acclimated and unacclimated bioassay treatments were compared, there were significant differences in *Neanthes* mean individual growth (MIG) and bivalve larval development. *Neanthes* MIG and larval combined survival were significantly lower in the unacclimated FF-Ref-2 and A1-8CS treatments, relative to the acclimated treatments. With the exception of treatment A1-2CS, MIG in the *Neanthes* test was approximately 0.2 mg/ind/day greater in the acclimated sediment treatments than in the unacclimated treatments. Larval combined mortality was 87 percent to 100 percent in the unacclimated sediments and would have

[17] Test sediment (normal larvae). $N_T/N_C < 0.20$ (e.g., >0.80 normal) = suitable UCOWD without comparison to reference sediment. $N_T/N_C > 0.20$ (e.g., < 0.80 normal), requires comparison with reference.
[18] Freshwater reference sediment is unlikely to have normal survival <85% of negative control: 85% - 57.3% < 30%. Therefore based on the weight of evidence and BPJ, DMMU-7CS is a 2H response for the suitability determination.

been evaluated as 1-hit failures for each of these treatments. However, amphipod survival was not significantly different for the three acclimated and unacclimated test sediment treatments from Fishermen's Terminal.

Water quality monitoring consisted of temperature, dissolved oxygen, salinity, and pH measurements daily in overlying water. Dissolved oxygen remained within acceptable limits throughout the test. The mean mortality in the control sediment for the amphipod toxicity test was 5 percent, meeting the PSEP 1995 test performance standard of less than or equal to 10 percent. The LC50 for the cadmium reference toxicant test was 6.8 mg Cd/L, which is within the control chart limits (2.76 to 7.6 mg/Cd/L), indicating that the test organisms sensitivity were similar to those previously tested at the MEC laboratory.

Reference Sediment performance problems and bivalve larval interpretation. For the bivalve larval test, the mean percent normal survivorship in reference treatment FT-Ref-2 was 25.4 percent, indicating that this reference sediment did not meet the performance requirement as a suitable test sediment comparison. In the test sediment treatments, mean normal survival ranged from 76.2 percent in A1-8CS to 7.8 percent in A1-2CS. Searching for a way to evaluate the test sediment results, otherwise valid for decision making except for lack of a suitable reference sediment (given the poor performance of the FT-Ref-2 sediment), the applicant consulted with the laboratory practitioners and recommended using the A1-8CS test sediment as a surrogate reference sediment to evaluate the test sediment results. This test sediment met the minimum performance requirements for a reference sediment relative to control. The chemical testing results for A1-8CS indicated that this DMMU had lead concentrations slightly over the SL, quantitated at 482 mg/kg, but no other SL exceedances. TBT was present in unacclimated sediments, but dropped below the DMMP SL in the acclimated sediments. A marine reference sediment was not deemed to be the appropriate reference for comparison because the tested sediments were freshwater sediments.

After much consideration, the DMMP agencies chose to reject this recommendation and use an alternative approach (described below and illustrated in Table 4-2). The agencies have never used this proposed interpretive approach - a within-site test sediment is simply not an appropriate point of comparison for test sediment toxicity results.

The DMMP agencies first elected to use 80% absolute as a nominal rate of normal development for a freshwater reference sediment to interpret the bivalve larval results. The summary of this interpretation provided in Table 4-2 indicates that normal survivorship would be significantly lower in test sediments A1-1CS, A1-2CS, A1-3CS, A1-4CS, A1-6CS, and A1-7CS. There would be 1-hit responses for A1-1CS, and A1-2CS, and A1-7CS, with 2-hit responses for A1-3CS, A1-4CS and A1-6CS using a weight of evidence approach and BPJ. Two-hit responses were not corroborated by the other two bioassays, and therefore DMMUs A1-3CS, A1-4CS and A1-6CS would pass the non-dispersive site guidelines, whereas A1-1CS, A1-2CS and A1-7CS would fail the non-dispersive site guidelines using BPJ. However, after further discussion and based on what DMMP staff believed to be typical normal development for past marine reference samples, the agencies decided that it would be relatively unlikely for a freshwater reference sample to exhibit normal development > 85% of that observed in the negative control. With this assumption, if the nominal reference sample for this project was observed to have 85% normal survival relative to the negative control, then A1-7CS (57.4% relative to control) would fail only the two-hit interpretive guideline (< 30% difference). Lacking a second toxicity test 2-hit failure response, this sample would then pass.

4.2.5. Grays Harbor Federal Maintenance Channel - Bioassay Testing

No detected chemicals exceeded DMMP guidelines for the Grays Harbor biennial monitoring conducted in 2004. However, “safety-net” bioassays are routinely performed on two DMMUs chosen by the DMMP during each testing cycle.

The standard suite of three bioassay tests (amphipod toxicity, larval mortality/abnormality, and *Neanthes* growth) was performed on sediments chosen for safety-net testing (C3 and C5). Grays Harbor disposal sites are dispersive sites, which under DMMP guidelines require slightly more conservative bioassay data interpretation than with non-dispersive sites due to the inability to analyze disposed material over time.

Control and reference sediments were within DMMP performance criteria for all bioassays. Preferred species were not available for the larval bioassay, so *Crassostrea gigas* were used, and all performance indicators were within DMMP guidelines.

Test sediment C5 showed an apparent one-hit failure in the *Neanthes* bioassay (Table 4.3). However, there were some quality control issues with this test: worms smaller than those specified in the DMMP guidelines were used, and results of the positive control test were very low, barely within laboratory guidelines. In addition, worm growth in the reference sediment was much higher than in the control sediment, creating a very high standard for test sediments to meet. However, the growth in C3 was clearly lower than control, reference, and C5. Though unwilling to set the data aside due to QA/QC issues, the DMMP authorized a resampling and *Neanthes* retest on C3 test sediments.

The retest showed that growth in C3 was again lower than both reference and control (Table 4.4). Because there was no statistically significant difference between test and reference growth, the sample passed DMMP guidelines.

Table 4.3. Initial Grays Harbor bioassay results summary. Data is interpreted using dispersive site guidelines.

STATION	% fines	% clay	Amphipod *(Eohaustorius)* Mortality (%)		Sediment Larval *(Crassostrea)* NCMA (%)		20-day *Neanthes* Growth					DMMP
							Mortality (%)	MIG (mg/ind/day) 0.49 mg initial wt.		MIG % of control	MIG % of ref.	
			mean	sd	mean	sd		mean	sd			
Control	--	--	3.0	4.5	75.8	2.8	8.0	0.77	0.18	--	--	--
Reference GHS7	65.9	18.7	3.0	4.5	66	5.9	12.0	0.94	0.16	122.1%	--	--
C3	79.5	14.4	2.0	2.7	65.1	7.2	16.0	0.56	0.17	72.7%	59.6%	Fail
C5	53.6	9.7	3.0	4.5	68.5	6.6	16.0	0.76	0.11	98.7%	80.9%	Pass
Reference toxicant							Cadmium chloride, 96 hr LC50, 4.62 mg Cd/L					
Lab Control limits							4.44 - 11.1 mg Cd/L					

Table 4.4. Grays Harbor *Neanthes* retest summary. Data is interpreted using dispersive site guidelines.

STATION	% fines	% clay	20-day *Neanthes* Growth - RETEST				DMMP
			Mortality (%)	Growth (mg/ind/day) 0.62 mg initial wt.		MIG % of control	
				mean	sd		
Control	--	--	0.0	1.26	0.18	--	--
Ref GHS7	49.1	13.4	0.0	0.95	0.11	75.4%	--
C3	88.4	20.5	0.0	0.85	0.14	67.5%	Pass
Reference toxicant			Cadmium chloride, 96 hr LC50, 6.69 mg Cd/L				
Lab Control limits			4.28 - 11.1 mg Cd/L				

CHAPTER 5 – DISPOSAL SITE USE AND MONITORING

5.1 DISPOSAL ACTIVITY AND SITE USE

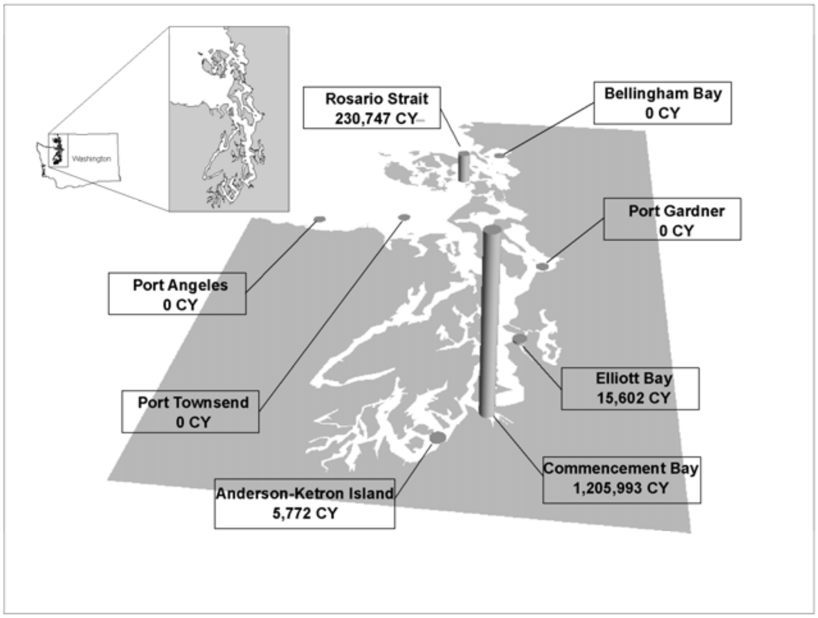
The Washington State Department of Natural Resources (DNR) issues site-use authorizations to project proponents electing to dispose of suitable dredged material at PSDDA and Grays Harbor/Willapa Bay (GH/WB) designated disposal sites. These authorizations are issued for sediments that are 1) suitable for unconfined open-water disposal as determined by the Dredged Material Management Program (DMMP) evaluation process, and 2) associated with dredging projects which have received all required regulatory permits (e.g., CWA 401/404 permits). This section of the report describes the PSDDA and GH/WB disposal activity for Dredging Years 2004 and 2005. This information is discussed by dredging year and individual disposal site.

Dredging Year 2004 (June 16, 2003 through June 15, 2004). In DY04, a total of 1,458,114 cubic yards (cy) of dredged material were deposited at four PSDDA sites, while the Corps of Engineers placed 75,770 cy at the Puget Sound Resources CERCLA capping site near Harbor Island, and 36,522 cy at a Fish Bench habitat enhancement project in Bellingham Bay. Of the four PSDDA sites utilized in DY04, Commencement Bay received the bulk of the material with 1,205,993 cy from six projects, whereas Rosario Strait was second with disposal of 230,747 cy from three projects. The Elliott Bay site received 15,602 cy from two projects, while the Anderson/Ketron Island site received 5,772 cy from a single project during DY04.

In Grays Harbor a total of 2,188,419 cy were disposed at the two estuarine disposal sites and 29,019 cy was disposed at the Southwest ocean disposal site. An additional total of 551,828 cy of Grays Harbor sediments were was placed at two beneficial uses sites: Half Moon Bay received 289,652 cy of federal maintenance dredged material, while 262,176 cy was disposed at the South Beach beneficial use site. No disposal occurred in Willapa Bay during DY04. The Corps maintenance dredging project in Quillayute dredged and disposed 4,989 cy on the Tribal uplands. The volumes disposed at both Puget Sound and Grays Harbor sites in DY04 are graphically presented in Figures 5-1a and 5-1b, and are summarized in Tables 5-1 and 5-2.

Dredging Year 2005 (June 16, 2004 through June 15, 2005). In DY05, a total of 1,059,234 cy of dredged material were deposited at four PSDDA sites. The bulk of the material was disposed of at the Commencement Bay site with 949,399 cy from four projects, principally from the Port of Tacoma's Pierce County Terminal Project. The Elliott Bay site received 77,838 cy from four projects. The dispersive Rosario Strait site received 23,847 cy from one project, while the Anderson/Ketron Island site received 8,150 cy from a single project.

In Grays Harbor 1,412,729 cy were disposed at the two estuarine disposal sites and no disposal took place at the Southwest ocean site. A total of 320,093 cy was placed at two beneficial uses sites, with 102,184 cy going to the Half Moon Bay site and 217,909 cy going to the Southwest Beach beneficial use site. No disposal took place at the Willapa Bay disposal sites. The volumes disposed at both Puget Sound and Grays Harbor sites are graphically presented in Figures 5-2a and 5-2b, and are summarized in Tables 5-3 and 5-4.



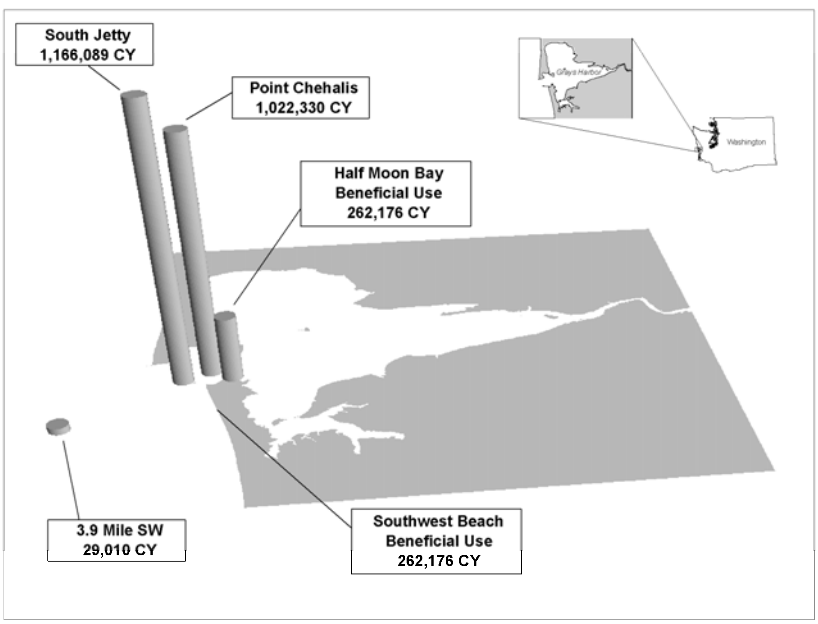


Figure 5-1a. (Upper): DY 2004 Disposal Volumes in Puget Sound, Washington;
Figure 5-1b. (Lower): DY 2004 Disposal Volumes in Grays Harbor, Washington

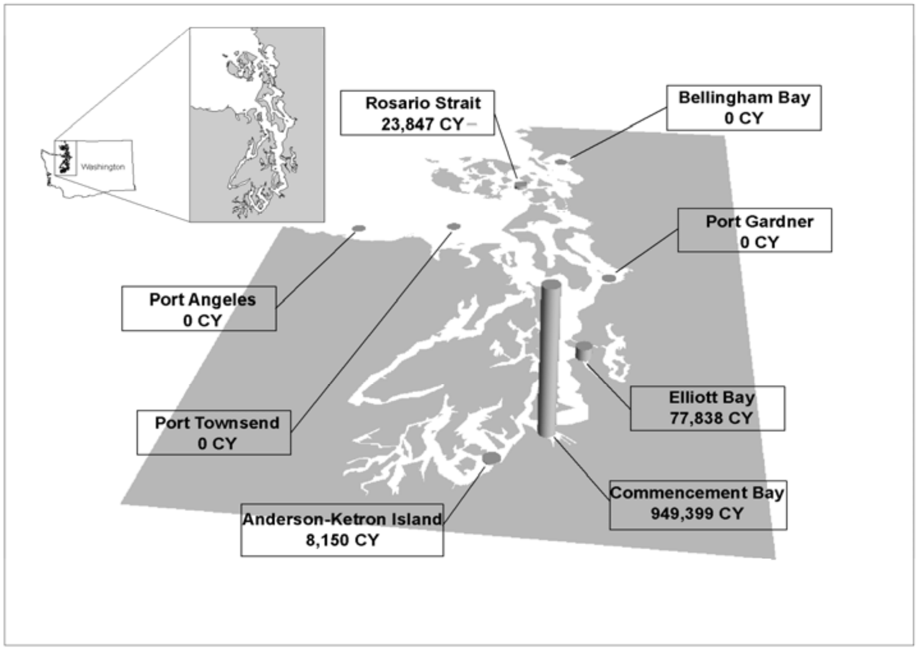
Table 5-1. Disposal Site Activity Summary, DY04

Disposal Site	Jurisdiction	Number of Projects	Total Volume (cy)
Elliott Bay	PSDDA	2	15,602
Puget Sound Resources – BU	PSDDA	1	75,770
Commencement Bay	PSDDA	6	1,205,993
Anderson/Ketron Island	PSDDA	1	5,772
Rosario Strait	PSDDA	2	230,747
Bellingham Bay Fish Bench -BU	PSDDA	1	36,522
Point Chehalis	Grays Harbor	1	1,022,330
South Jetty	Grays Harbor	1	1,166,089
Half Moon Bay – BU	Grays Harbor	1	289,652
Southwest Beach – BU	Grays Harbor	2	262,176
Southwest Ocean	Grays Harbor	1	29,019
Quillayute – Upland	Grays Harbor/Willapa Bay	1	4,989
All Sites within Jurisdiction	PSDDA sites Puget Sounds Resources-BU Bellingham Bay Fish Bench -BU	10 1 1	1,458,114 75,770 36,522
	Grays Harbor Estuarine sites Grays Harbor BU Grays Harbor SW Ocean site Quillayute Upland	2 2 1 1	2,188,419 551,828 29,019 4,989
	Willapa Bay sites	0	0

Table 5-2. Summary of Disposal Activity by Jurisdiction and Site, DY04

Site	Proponent	Dredging Contractor	Disposal Volume (cy)	# Barge Loads	Off Site	Disposal Dates
EB	Delta Marine	General	3,939	3	No	Jan 04
EB	Port of Seattle – T18	ACC	11,663	9	No	Jan-Feb 04
PSR-BU	USACE- Duwamish R O&M	Hurlen	75,776	57	No	Jan-Feb 04
CB	Port of Tacoma – PCT	Manson	819,253	306	No	Nov 03 –Feb 04
CB	Port of Tacoma - Sitcum	Manson	56,153	33	No	Jul – Nov 03
CB	WA Dept of Transportation	TNC	36,325	33	No	Jul 03 – Mar-May 04
CB	City of Tacoma	Manson	128,371	88	No	Oct-Dec 03
CB	Manke Lumber	Manke	19,944	11	No	Jan-Feb 04
A/K	Olympia Yacht Club	General	5,772	4	No	Jan 04
RS	Port of Bellingham/ Bell. Cold Storage	Manson	4,962	2	No	Jan 04
RS	USACE Swinomish Channel O&M	Manson	61,273	30	No	Oct 03
RS	USACE Squalicum Waterway O&M	Manson	164,512	74	No	Jan 04
BEL -BU	USACE Squalicum Waterway O&M	Manson	36,522	21	No	Jan 04
PC	USACE Grays Harbor O&M	Dutra	603,689	324	No	Aug 03 – Jan 04
SJ	USACE Grays Harbor O&M	Dutra	1,012,271	306	No	Nov 03 – Feb 04
PC	USACE Grays Harbor O&M	Great Lakes	353,497	141	No	May 04
SWB-BU	USACE Grays Harbor O&M	Corps, Essayons	262,176	48	No	May 04
SW-O	USACE Grays Harbor O&M	Corps, Essayons	29,019	6	No	May 04
HMB-BU	USACE Grays Harbor O&M	Corps, Yaquina	289,652	291	No	May 04
SJ	USACE Grays Harbor O&M	Corps, Yaquina	153,818	155	No	May 04
TU	USACE Quillayute O&M	Quigg	4,989	20	No	Sep 03

Legend: EB = Elliott Bay Site; PG = Port Gardner Site; A/K = Anderson/Ketron Island; RS = Rosario Strait; PSR-BU = Puget Sound Resources beneficial use; SJ = South Jetty Site; SW-O = Southwest Ocean Site; PC = Point Chehalis Site; HMB-BU = Half Moon Bay-Beneficial Uses; SWB-BU = Southwest Beach-Beneficial Uses; BEL-BU = Bellingham Bay Beneficial uses fish bench: TU = Tribal Upland



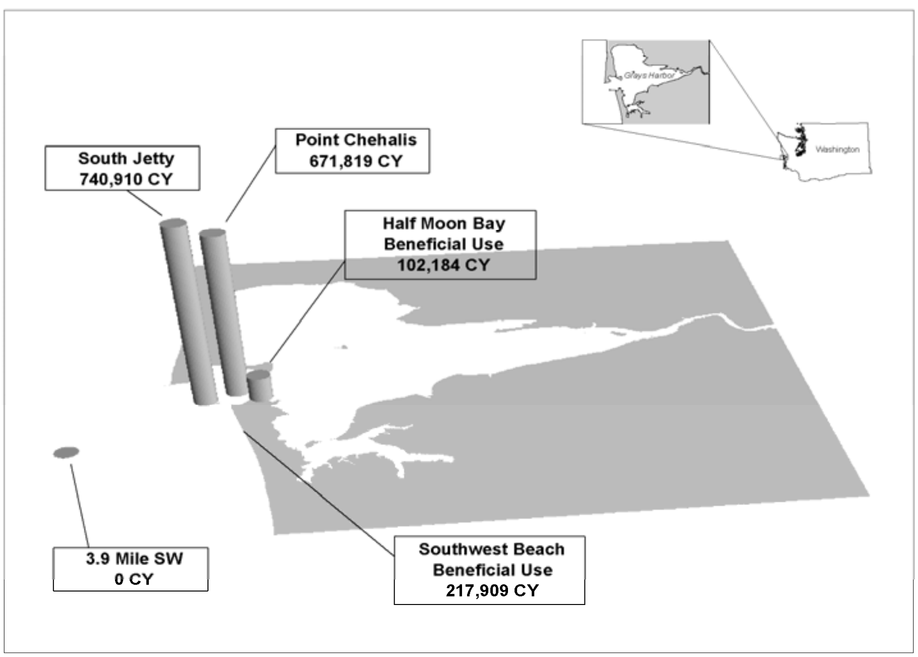


Figure 5-2a. (Upper): DY 2005 Disposal Volumes in Puget Sound, Washington
Figure 5-2b. (Lower): DY 2005 Disposal Volumes in Grays Harbor, Washington

Table 5-3. Disposal Site Activity Summary, DY05

<table>
<tr><th>Disposal Site</th><th>Jurisdiction</th><th>Number of Projects</th><th>Total Volume (cy)</th></tr>
<tr><td>Anderson/Ketron Island</td><td>PSDDA</td><td>1</td><td>8,180</td></tr>
<tr><td>Commencement Bay</td><td>PSDDA</td><td>4</td><td>949,399</td></tr>
<tr><td>Elliott Bay</td><td>PSDDA</td><td>4</td><td>77,838</td></tr>
<tr><td>PSR-CAP</td><td>PSDDA</td><td>1</td><td>297,186</td></tr>
<tr><td>Rosario Strait</td><td>PSDDA</td><td>1</td><td>23,847</td></tr>
<tr><td>Point Chehalis</td><td>Grays Harbor</td><td>3</td><td>671,819</td></tr>
<tr><td>South Jetty</td><td>Grays Harbor</td><td>1</td><td>740,910</td></tr>
<tr><td>Southwest Beach-BU</td><td>Grays Harbor</td><td>1</td><td>217,909</td></tr>
<tr><td>Half Moon Bay-BU</td><td>Grays Harbor</td><td>1</td><td>102,184</td></tr>
<tr><td rowspan="3">All Sites within Jurisdiction</td><td>PSDDA sites
Puget Sound Resources –CERCLA Cap</td><td>11
1</td><td>1,059,264
297,186</td></tr>
<tr><td>Grays Harbor Estuarine sites
Grays Harbor Ocean site
Grays Harbor BU</td><td>3
0
2</td><td>1,412,729
0
320,093</td></tr>
<tr><td>Willapa Bay sites</td><td>0</td><td>0</td></tr>
</table>

Table 5-4. Summary of Disposal Activity by Jurisdiction and Site, DY05

Site	Proponent	Dredging Contractor	Disposal Volume (cy)	# Barge Loads	Off Site	Disposal Dates
PC	Weyerhaeuser Inc.	Dutra	19,400	5	No	7 Feb – 8 Feb 05
PC	Port of Grays Harbor	Dutra	24,400	7	No	2 Feb – 3 Feb 05
PC	USACE – Grays Harbor O&M	Dutra	426,067	115	No	12 Oct 04 – 14 Feb 05
SJ	USACE – Grays Harbor O&M	Dutra	740,910	204	No	12 Oct 04 – 14 Feb 05
PC	USACE – Grays Harbor O&M	Corps Dredges	628,019	362	No	11 Mar – 12 May 05
SWB-BU	USACE – Grays Harbor O&M	Corps Dredges	217,909	46	No	20 Apr – 1 May 05
HMB-BU	USACE – Grays Harbor O&M	Corps Dredges	102,184	107	No	11 Mar – 11 Apr 05
PSR –CAP	USACE – Everett O&M	Dutra	297,186	92	No	5 Jan – 10 Feb 05
R-U	USACE – Everett O&M	Dutra / Ross I.	125,000	Pipeline	No	13 – 31 Jan 05
A/K	WA Dep. Of Transportation	Tacoma Narrows Const.	8,180	6	No	2 Jun – 13 Jun 04
CB	Manke Lumber Co.	Manke Tug/Barge Co.	20,230	14	No	20 Jan – 14 Feb 05
CB	City of Tacoma	Manson Const. Inc.	3,737	10	No	10 Aug – 17 Aug 04
CB	Port of Tacoma	Manson Const. Inc.	918,788	408	No	17 Jul 04 – 15 Jan 05
CB	WA Dep. Of Transportation	Tacoma Narrows Const.	6,644	4	No	16 Jun -23 Jun 04
EB	Glacier NW Seattle Cement	General Const.	4,983	3	No	27 Jan – 3 Feb 05
EB	Port of Seattle	Manson Const. Inc.	5,389	3	No	1 Feb – 2 Feb 05
EB	Port of Seattle	Manson Const. Inc.	59,381	31	No	20 Jan – 1 Feb 05
EB	Port of Seattle	General Const. Co.	4,500	3	No	27 Aug – 1 Sep 04
EB	U.S. Coast Guard	ACC Hurlen	3,585	4	No	29 Jan – 4 Feb 05
RS	Port of Anacortes	General Const. Co.	23,847	16	No	14 Oct – 20 Dec 04

Legend: A/K = Anderson/Ketron Island; CB = Commencement Bay; EB = Elliott Bay; RS = Rosario Strait; PC = Point Chehalis; SJ = South Jetty; HMB-BU = Half Moon Bay; SWB-BU = Southwest Beach renourishment; PSR-CAP = Puget Sound Resources CERCLA capping project; R-U = Riverside Upland Disposal Site

5.2 POST-DISPOSAL SITE MONITORING (2004 – 2005)

Environmental monitoring is the primary tool utilized in the management of DMMP non-dispersive disposal sites. The main objective of post-disposal site monitoring is to determine whether the disposal of dredged material has adversely affected the disposal site environment. Environmental monitoring includes physical, chemical and biological assessment of the sediments and biological resources in, and adjacent to, the disposal site being monitored. The DMMP monitoring program is designed to compare the post-disposal monitoring results to "baseline" values. Baseline values for key environmental parameters such as sediment chemistry, toxicity, and benthic community structure, were determined for each DMMP site and the associated benchmark stations prior to the first use of the sites to serve as an environmental baseline for later comparisons as a reference (PTI, 1988, 1989). The DMMP agencies now evaluate site chemistry changes over time using a time-trend analysis approach. The time-trend analysis technique was first used in 1996 to evaluate post-disposal monitoring data from Commencement Bay.

Post-disposal site monitoring surveys described below collect data to answer three major questions. Full DMMP site monitoring was designed to collect data to answer the three questions and six testable hypotheses (Table 5-5). The DMMP monitoring plan is now designed to work in a tiered framework, with a partial monitoring event addressing questions 1 and 2 and testing the first four hypotheses. Question 3 is only addressed if either of the first two questions, or one or more of the four testable hypotheses is rejected.

The Seattle District Corps is responsible for physical monitoring at all eight disposal sites, while DNR is responsible for chemical and biological monitoring at the five Puget Sound non-dispersive disposal sites. This environmental monitoring is conducted at irregular intervals based on the documented pattern of disposal site-use occurring between monitoring surveys. This pattern encompasses several important factors, such as volume and characteristics (e.g., physical characteristics and sediment quality) of the material disposed at a given site, the nature and recency of previous site monitoring data, and site-specific environmental concerns. For the Central Puget Sound Sites, the DMMP agencies have established a soft trigger of 500,000 cubic yards to initiate monitoring at the site. After reviewing the During the 2004 dredging year (June 16, 2003 to June 15, 2004) a total of 1,205,993 cubic yards from projects was disposed at the Commencement Bay site, which constituted the largest volume of dredged material disposed at any of the Puget Sound disposal activity records at all the non-dispersive sites, the DMMP agencies determined, by consensus, which site(s), if any, will be monitored, and if so what kind of monitoring is called for to evaluate the site relative to site management objectives or concerns.

Based upon this review, the DMMP agencies determined that a tiered-partial monitoring event was required at the Commencement Bay disposal site in 2004, and that a full monitoring event would be required at the Anderson/Ketron Island disposal site in 2005, that would serve as the new baseline because of low site use. Because of the frequency of monitoring at the Commencement Bay site, the DMMP agencies elected to limit monitoring to a Sediment Profile Imagery (SPI) survey, and also conduct a special study to evaluate Phenol concentrations at the site. The Phenol study was precipitated by a Phenol spike observed at the site in 2003. Elevated Phenol concentrations have also been observed at other DMMP Puget Sound sites, and have been noted to occur throughout Puget Sound. The DMMP agencies also determined that a limited special study would be conducted at the Elliott Bay disposal site in 2005, to evaluate sediment quality based on recent dredging and disposal from the CERCLA cleanup site in East Waterway.

Table 5-5. The DMMP Monitoring Framework

Questions	Hypothesis	Monitoring Variable	Interpretive Guideline	Action Item when exceeded*
No.1 Does the deposited dredged material stay onsite?	1. Dredged material remains within the site boundary?	Sediment Profile Imagery (SPI) Onsite & Offsite	Dredged material > 3 cm at the perimeter stations	Further assessment is required to determine full extent of dredged material deposit.
	2. Chemical concentrations do not measurably increase over time due to dredged material disposal at offsite stations.	Sediment Chemistry Offsite	Washington State Sediment Quality Standards and Temporal Analysis	Post-disposal benchmark station chemistry is analyzed and compared with appropriate baseline benchmark station data.
No. 2 Are the biological effects conditions for site management exceeded at the site due to dredged material disposal?	3. Sediment chemical concentrations at the onsite monitoring stations do not exceed the chemical concentrations associated with PSDDA Site Condition II guidelines due to dredged material disposal	Sediment Chemistry Onsite	Onsite chemical concentrations are compared to DMMP maximum levels.	PSDDA agencies may seek adjustments of disposal guidelines and compare post-disposal benchmark chemistry with appropriate baseline benchmark station data.
	4. Sediment toxicity at the onsite stations does not exceed the PSDDA Site Condition II biological response guidelines due to dredged material disposal.	Sediment Bioassays Onsite	DMMP Bioassay Guidelines (Section 401 Water Quality Certification)	Benchmark station bioassays are performed (if archived after monitoring) and compared with baseline benchmark bioassay data.
No. 3 Are unacceptable adverse effects due to dredged material disposal occurring to biological resources offsite?	5. No significant increase due to dredged material disposal has occurred in the chemical body burden of benthic infaunal species collected down current of the disposal site	Tissue Chemistry Transect	Guideline values Metals: 3x baseline conc. Organics: 5x baseline conc.	Compare post-disposal benchmark tissue chemistry with baseline benchmark tissue chemistry data.
	6. No significant decrease due to dredged material disposal has occurred in the abundance of dominant benthic infaunal species collected down current of the disposal site.	Infaunal Community Structure Transect	Guideline values Abundance of major taxa < ½ baseline macrobenthic infaunal abundances	Compare post-disposal benchmark benthic data with baseline benchmark data.

* To determine if observed changes in chemical conditions or infaunal benthos are due to dredged material disposal, data from the benchmark stations are evaluated. The DMMP deliberations use best professional judgment.

Tiered-Partial Monitoring Survey at the Commencement Bay Disposal Site (2004). During the 2004 dredging year (June 16, 2003 to June 15, 2004) a total of 1,205,993 cy was disposed at the Commencement Bay site, which constituted the largest volume of dredged material disposed at any of the PSDDA disposal sites to date. Subsequently, during the 2005 dredging year (June 16, 2004 to June 15, 2005), an additional 949,399 cy was disposed at the Commencement Bay site.

The Commencement Bay disposal site was previously monitored in 2003 (Tiered-Full), 2001 (Full), 1998 (SPI physical mapping only), 1996 (Tiered-Partial) and 1995 (Tiered-Full). **Figure 5-3** depicts the cumulative disposal history at the Commencement Bay site from 1989 – 2005, and illustrates the very active and intense use of this site over the last 10 years. A brief summary of disposal activity since the 2003 Tiered-Partial Monitoring Event follows. During DY 2004, a total of 1,205,993 cy from six projects was disposed at the Commencement Bay site, which triggered the requirement to conduct monitoring during 2004. Due to the intensity of monitoring conducted in 2001 and again in 2003, the DMMP agencies decided to conduct a tiered-partial monitoring event at the site. The results of the 2001 and 2003 full monitoring events are summarized in the DY-00/01 and DY-02/03 Biennial Reports, and the 2002 and 2005 SMARM minutes. A brief summary of these results follows focusing on the monitoring conducted to answer the first two monitoring questions and the first four testable hypotheses highlighted in **Table 5-5**.

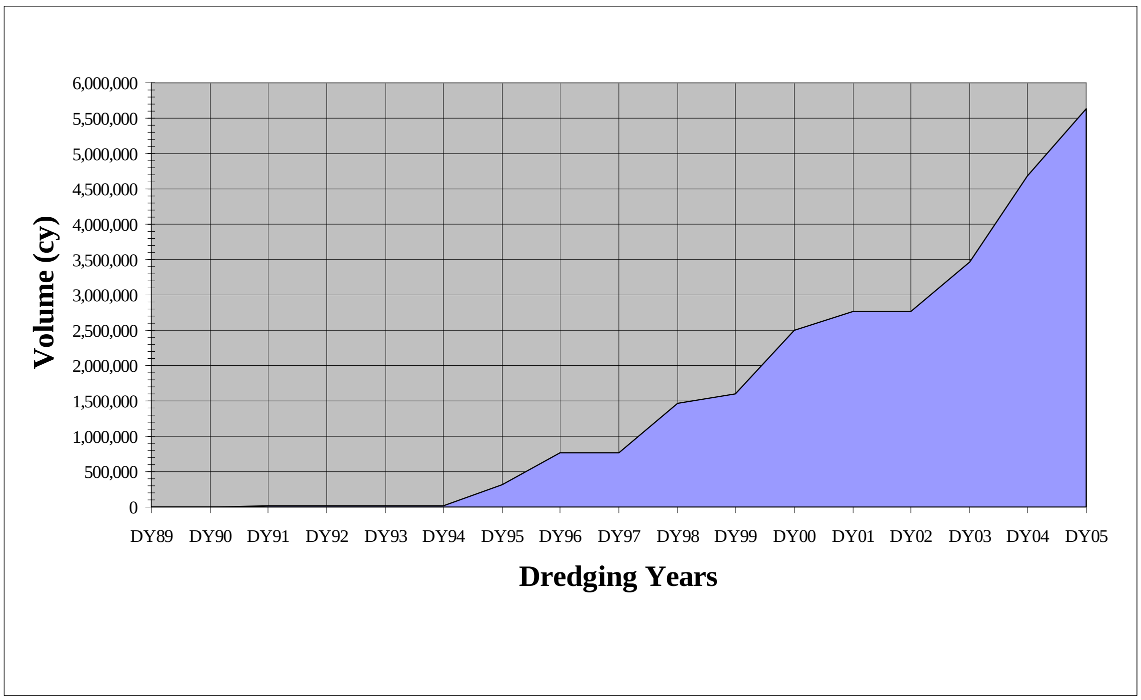


Figure 5-3. Cumulative History of Disposal at the Commencement Bay Site

Commencement Bay Monitoring Results (2004). **Figure 5-4** shows the fixed chemical and biological stations occupied during the 2004 tiered-partial monitoring exercise. Mapping of the disposal site and adjacent areas was conducted with the Sediment Profile Imagery (SPI) camera system, which provides a vertical profile Image of the top 20 cm of the sediment surface, and differentiates the dredged material footprint. The survey indicated that the dredged material footprint extended outside the disposal site boundary and exceeded the 3 cm site management trigger at the perimeter line, which resulted in hypothesis No. 1 being rejected (Figure 5-5). The footprint showed that the dredged material outside the boundary largely extended to the northwest, and the footprint was smaller than observed in 2001 and 2003, and the lobe of dredged material extending to the Southwest was not observed in 2004.

The DMMP agencies evaluated the onsite and perimeter fixed stations relative to site management objectives, which addressed monitoring questions 1 and 2, and hypothesis No. 2-4. The grain size sediment conventional analyses indicated that the material at the center of the site was relatively coarse and predominately gravel/sand (94.8%), whereas the sediment characteristic changed to predominately silt/clays at the perimeter stations (63.3% - 82.4%), which are similar to ambient sediments at the Benchmark Stations. The SPI denoted physical characteristics similar to the quantitative analysis results indicating that the center of the site ranged from medium/fine sand grading to silt-clays outside the disposal zone. Sediments found to the northwest outside the site boundaries consist of compact very fine sands.

Examination of the benthic infaunal successional stage and organism-sediment index confirmed that the benthic community is generally quite healthy, with the impacted benthic community limited to the very center of the disposal zone. Stage III invertebrates, representing high-order successional stage species, were found at all stations except two (center of site, Z1, and one station, CB03, located on the periphery of the disposal impact zone). The Organism-Sediment Index (OSI) provides a measure of general benthic habitat quality, which considers dissolved oxygen concentrations within the upper sediment column, presence or absence of sedimentary methane, the depth of the apparent RPD, and the infaunal successional stage. An aerobic bottom with a deep apparent RPD, evidence of mature macrofaunal assemblage, and no apparent methane gas bubbles at depth will have an OSI value of +11. At the other end of the scale, the lowest value (-10) is given to those bottoms that have low or no dissolved oxygen in the overlying bottom water, no apparent macrofaunal life, and methane gas present in the sediments. OSI values measured at the Commencement Bay site ranged from +5 to +11, with a major mode of +10, indicating a very healthy benthic habitat.

Chemical analyses conducted showed that all the detected concentrations of 2004 Commencement Bay samples were below the DMMP SLs and the State of Washington's SQS values. There were no statistically measurable increases in chemicals measured at the perimeter stations, nor were there any elevated chemicals in the offsite dredged material footprint (all chemicals < SL and SQS). Therefore, hypothesis No. 2 was not rejected. Evaluation of chemistry concentrations at the onsite stations (hypothesis No. 3) and the toxicity of the onsite material relative to the site condition II biological effects response guidelines (hypothesis No. 4), showed no elevated chemistry or apparent toxicity. Therefore, both hypotheses No. 3 and 4 were not rejected. Because this monitoring event only addresses the first two monitoring question, monitoring Question 3 was not evaluated.

An evaluation of onsite and perimeter stations showed that all chemicals were quantitated below the DMMP SL and SMS SQS guidelines. Additionally, an evaluation of chemistry at the perimeter stations using the Chemical Tracking Software showed that there was no statistically significant increase in chemical concentrations over time. All bioassays conducted passed the non-dispersive disposal site interpretation guidelines.

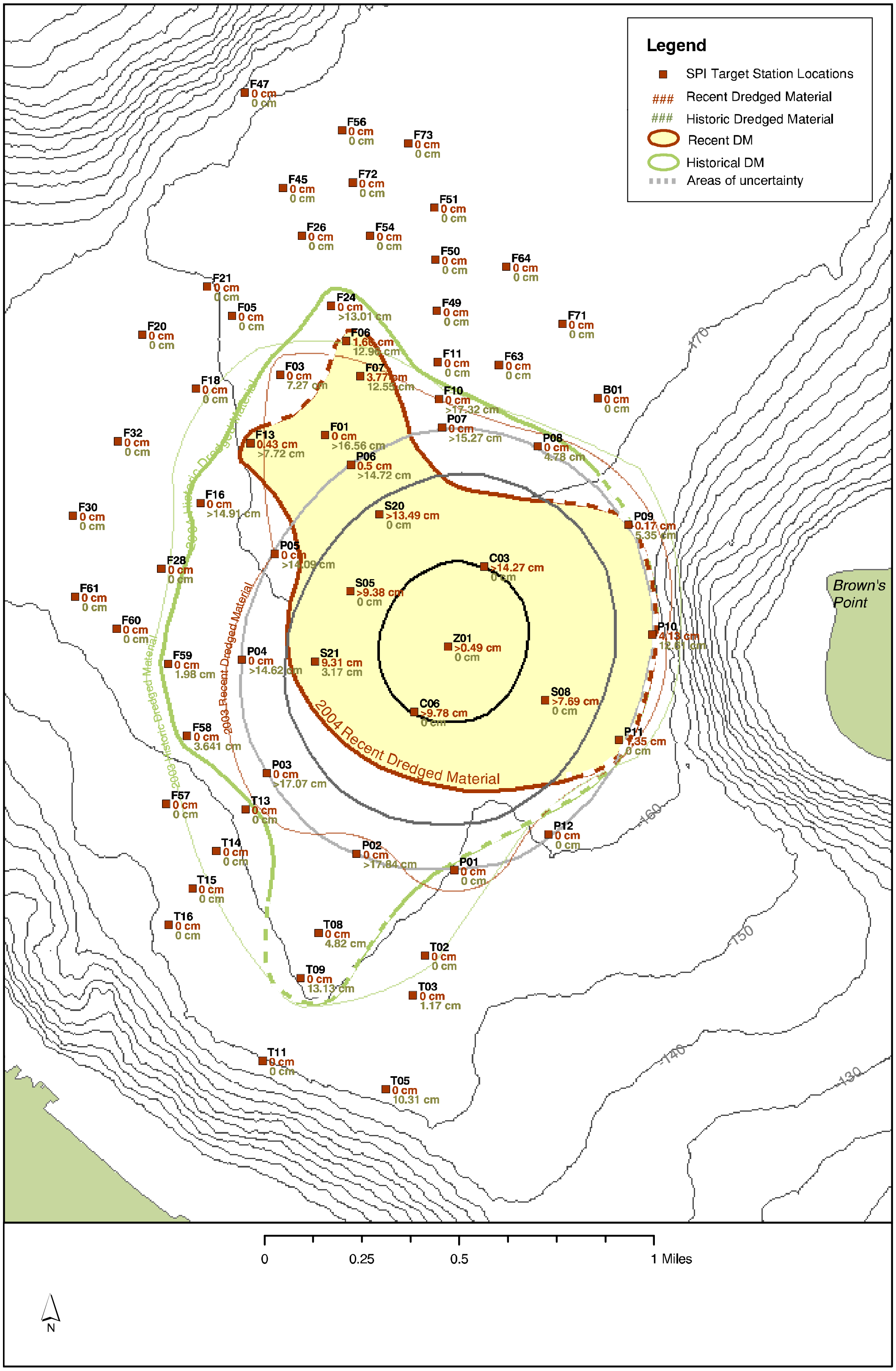


Figure 5-4. Dredged material distribution at Commencement Bay measured during the 2004 SVPS survey (from SAIC, 2004).

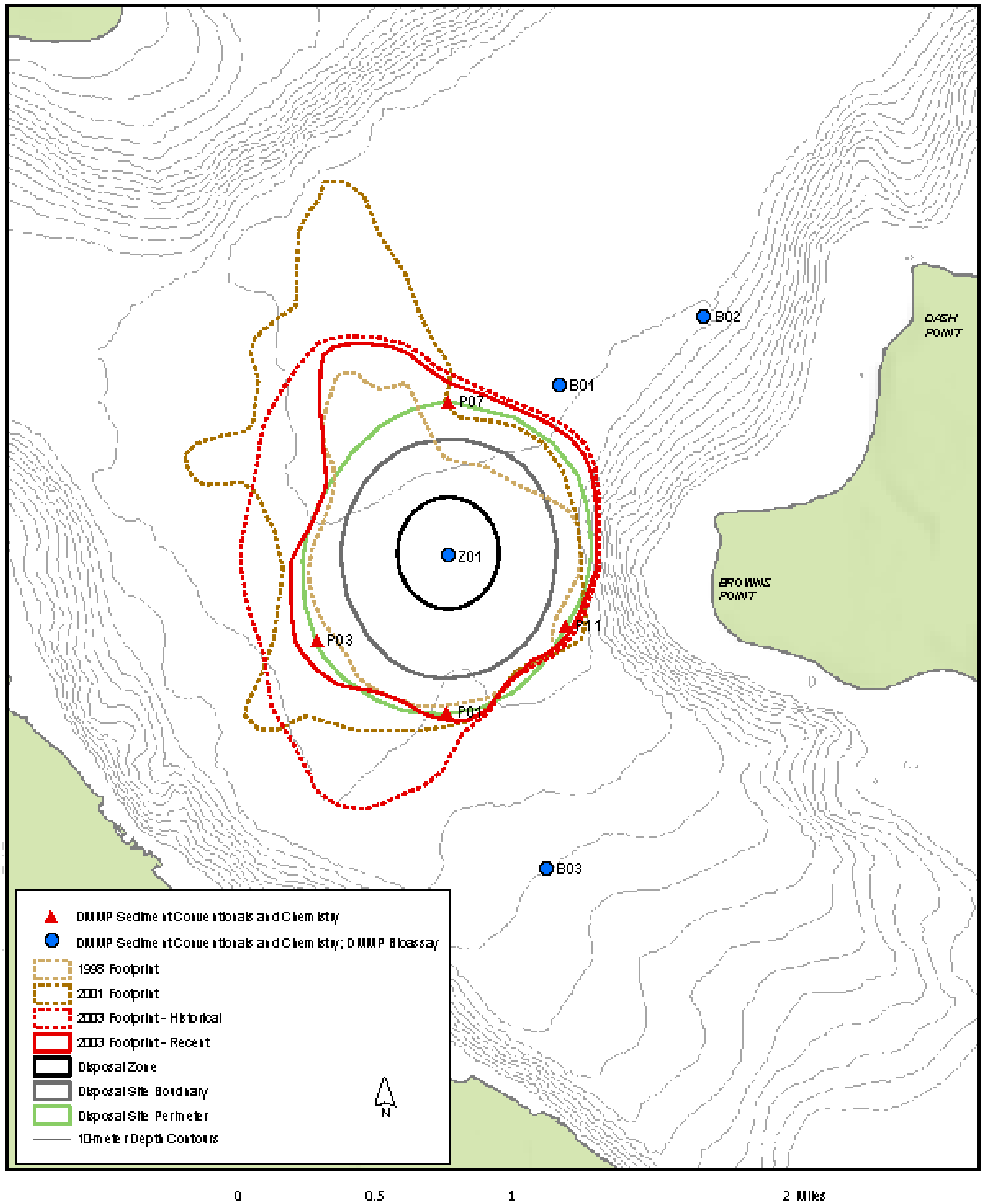


Figure 5-5. Commencement Bay chemistry and bioassay sampling stations in 2004 (from SAIC, 2004).

Commencement Bay Monitoring Results (2005). The SPI survey mapped the dredged material footprint and showed that the footprint for the most part was distributed within the boundary of the disposal site with lobes extending outside the perimeter line to the northwest and southeast (Figure 5-6). The lobe extending to the northwest had a mean thickness of 2.01 cm, and only two of the eleven stations making up the lobe exceeded the 3 cm interpretive guideline for PSDDA monitoring. The distribution based on the DY05 disposal of 949,399 cy was similar to the pattern exhibited during 2004 (see Figure 5-5), except for the absence of the southeast lobe observed in 2004. Therefore, hypothesis No. 1 relating to Question 1 was rejected. The DMMP agencies had previously anticipated that the dredged material footprint would extend outside the perimeter line based on previous monitoring conducted in 2001, 2003, and 2004. All previous monitoring had consistently concluded, that that sediment chemistry results and toxicity testing results within the dredged material footprint verified that the sediment quality was consistent with the site management objectives, and was generally well bellow the SQS. Evaluation of the 2005 SPI results indicated that the benthic community, except largely within the Target Zone, was occupied by Stage I over Stage III, while the center of the site was principally dominated by a Stage I community. An analysis of the Organism-Sediment Index (OSI) indicated that the OSI exceeded 6 throughout the site, except within the Target Zone. Both of these indicators suggest that the benthic community has been able to recover from the large amount of clean dredged material disposed at the site.

The DMMP agencies conducted a short-term temporal study to evaluate Phenol concentrations during two time intervals (June 23-24 and July 13-14, 2005) (Figure 5-7). Previous monitoring in 2003, had noted a pronounced spike in phenol concentrations at the site, and at perimeter stations (Figure 5-8). Predisposal baseline monitoring also indicated that Phenol concentrations were elevated at the disposal site center station, Z1. However, subsequent monitoring in 2004 showed that phenol levels had returned to previously observed concentrations. The DMMP agencies believed that the phenol concentration spikes may be a consequence of seasonal changes and natural sources (e.g., conifer needles, and/or conifer wood particles; or seston deposits from phytoplankton blooms) in the environment, and elevated phenol concentrations have been observed throughout Puget Sound (Long et al., 2003). The study attempted to evaluate short-term temporal variability of phenol concentrations in Commencement Bay. However, the results failed to show a temporal Phenol spike, and concentrations quantitated, were essentially the same, averaging around 15 mg/kg, ranging from 8 – 21.3 mg/kg, among the perimeter and benchmark stations. The phenol results failed to show a short term seasonal change, during this limited investigation. It is likely that there is a seasonal phenol pattern, but elucidating that pattern would probably require a much more robust study to discern. However, the overall conclusion from these data is that it is unlikely that the phenol spike observed in 2003 and during the 1988 predisposal baseline studies was attributable to dredged material disposal. Figure 5-8 summarizes the phenol history at Commencement Bay stations from previous monitoring results at the onsite (Z1, S1, S8), perimeter (P1, P3, P7, P11), and benchmark stations (B1, B2, B3).

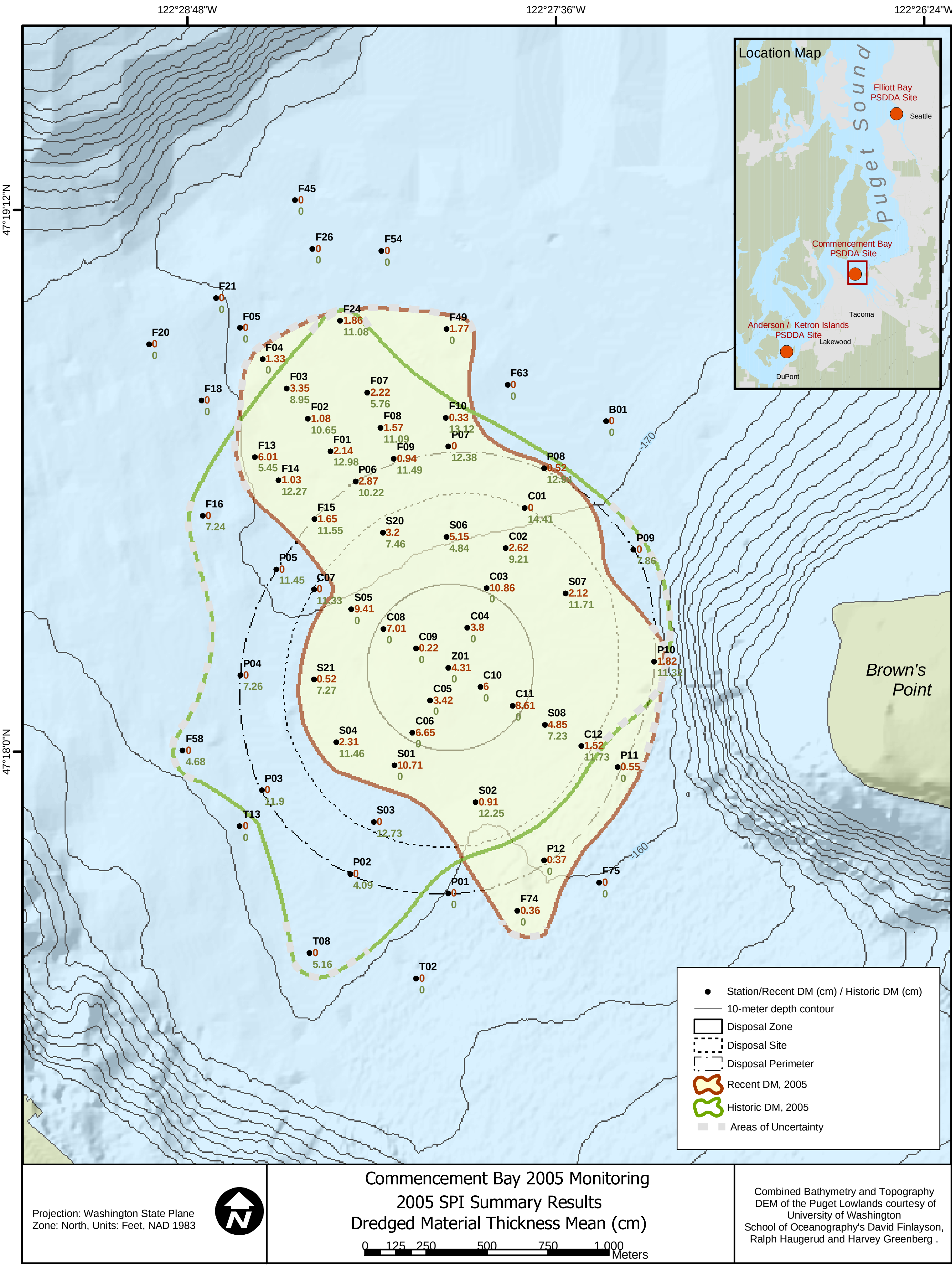


Figure 5-6. Dredged Material Distribution and Thickness (cm) at the Commencment Bay Site in 2005 (SAIC, 2005).

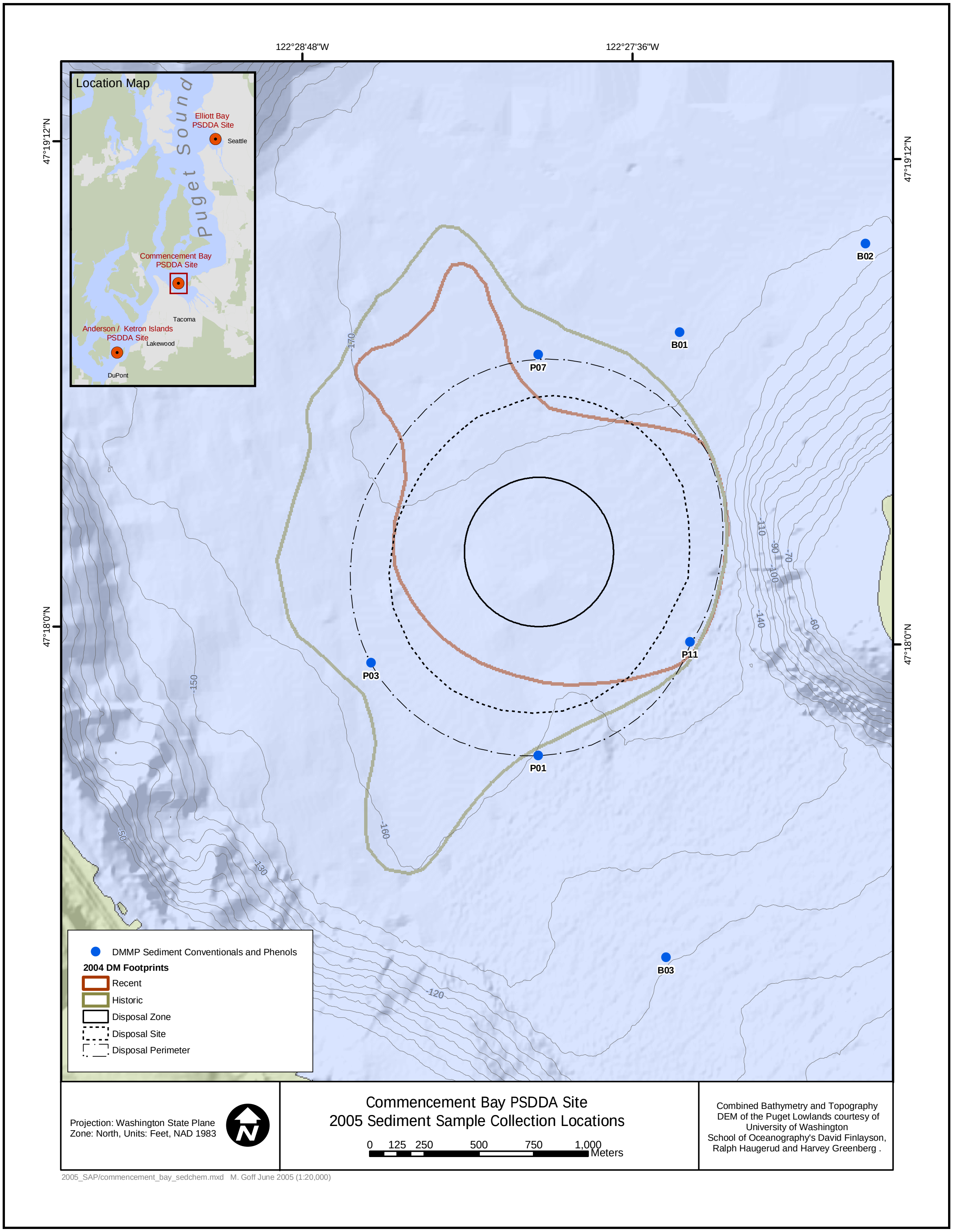


Figure 5-7. Commencement Bay sediment chemistry station locations (SAIC, 2005).

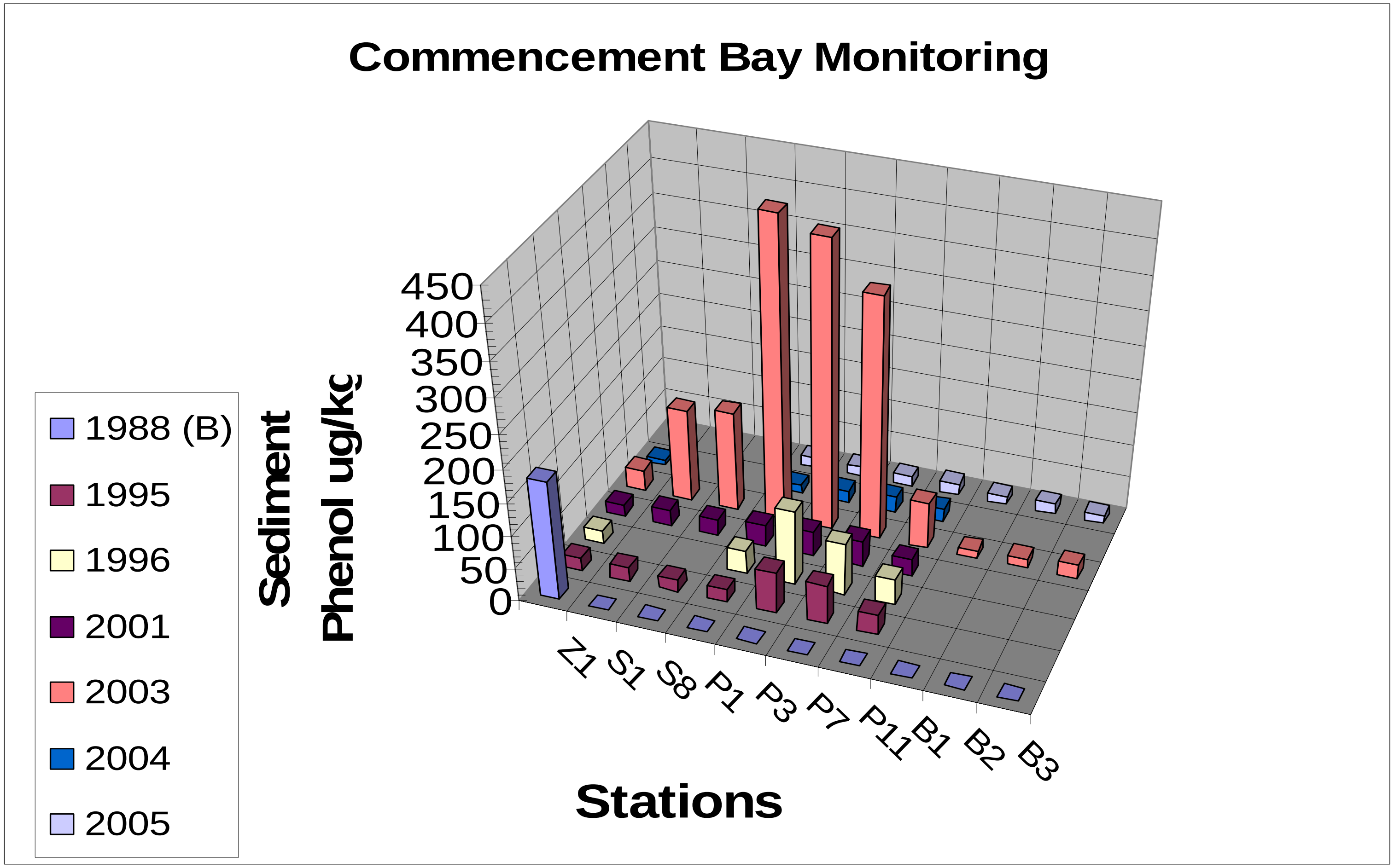


Figure 5-8. Phenol concentrations measured at the Commencement Bay site during previous monitoring events (Sampling Stations: Onsite: Z1, S2, S8; Perimeter: P1, P3, P7, P11; Benchmark: B1, B2, B3)

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Full Monitoring at the Anderson/Ketron Island Disposal Site (2005). The Ketron Island site has only been used sparingly over the past 16 years, with a total of 32,826 cy disposed during this period. Environmental baseline studies were initially conducted in 1989, but no post-disposal monitoring has occurred at this site, due to low site use. A full monitoring exercise was conducted during June 2005, to update and re-evaluate the disposal site, and these results will be used to establish a new environmental baseline to compare future post-disposal monitoring results. Therefore, monitoring at the Anderson/Ketron Island site consisted of examining all three monitoring questions, and six testable hypotheses according to the DMMP site management framework (see Table 5-5).

Anderson/Ketron Island Monitoring Results (2005). An SPI survey was conducted with images collected at 57 Stations in triplicate. The SPI survey map showed that the dredged material footprint was well within the disposal site boundary, and largely confined within the target zone (Figure 5-9). The survey indicated that much of the sediment within the disposal site boundary and target zone, consisted of unimpacted ambient sediments, slightly sandy silts and clays with reduced sediments at depth, with deep RPD depths and numerous feeding voids characteristic of a well established climax benthic community. Ambient sediments along the Perimeter of the Anderson/Ketron Island site were similar to onsite ambient sediments, with the exception of stations along the eastern and western perimeter, which showed a slight enrichment in fine sand. Evidence of dredged material was absent except at 2 onsite stations (Z1, S3) as depicted in Figure 5-9. An examination of the benthic characteristics from the images indicated that Stage III Climax species (Figure 5-10) and relatively high OSI[19] (Organism Sediment Index) values were present at all stations (ranging from 5.7 – 10.3, with a major mode of 9) with no evidence of significant impact from historic dredged material disposal. Therefore, Hypothesis No. 1 relating to Question 1 was not rejected.

Figure 5-11 shows the chemical and biological sampling stations occupied during the 2005 disposal site full monitoring exercise. Thirteen sediment stations were occupied and sampled for chemical testing (3 Onsite Stations, 4 Perimeter Stations, 3 Benchmark Stations, and 3 Transect Stations). The Onsite, Perimeter, and Benchmark Stations were analyzed for all DMMP chemicals of concern, including butyltins, and the List 1 and 2 Bioaccumulative Chemicals of Concern (BCOC). Transect Stations were analyzed for grain size and Total Organic Carbon (TOC). The Carr Inlet Reference Samples were analyzed for conventional sediment parameters. Transect and Benchmark Stations were sampled for either the sea cucumber, *Molpadia intermedia,* or the bivalve, *Compsomyax subdiaphana*. Tissue sampling indicated *Molpadia* was almost entirely absent from Transect and Benchmark Stations, and *Compsomyax* was collected at only one Transect Station (AKT01) and one Benchmark Station (AKB03) in sufficient densities for triplicate analyses at these two Stations. Tissue samples were analyzed for lipids, moisture content, and the BCOCs for List 1 and 2.

The results of the sediment analyses indicated that the site-wide average for percent fines was 43.4%, ranging from a low of 15.6% at Benchmark Station B7 to a high of 70.5% at onsite Station

[19] OSI is a numerical index from -10 to +11, which provides a measure of general benthic habitat quality based on dissolved oxygen conditions, depth of apparent RPD, infaunal successional stage, and presence or absence of sedimentary methane (Rhoads and Germano, 1982).

S10. Benchmark stations consistently had the lowest percent fines of all stations ranging from 15.6% to 30.3%. Analyses of metals of concern indicated that all were detected at low levels below the DMMP SLs and SMS SQS criteria. On average the 2005 metals concentrations were slightly lower than the 1989 baseline levels, although Chromium and Selenium were not analyzed in 1989. Correspondingly, detected and undetected organic chemicals were below the DMMP SLs and detected compounds were below the SMS SQS criteria. However, detection limits for Hexachlorobenzene, which was undetected in all samples, had several TOC-normalized values that exceeded the SMS SQS criteria, which was due in part to the relatively low TOC concentrations measured at these stations (0.52 to 1.53% dry weight). Comparison of these data with the 1989 baseline data indicated that all organic chemicals detected in 2005 were also detected in 1989, with the exception of di-n-butylphthalate and phenol. Organic chemical concentrations were found at similarly low levels during both surveys, with the exception of benzoic acid, which was quantitated in 2005 at 230 ug/kg at Onsite station Z1 and 280 ug/kg at Perimeter station P04, compared with 28 ug/kg at P04 in 1989. However, all concentrations were below the SL of 650 ug/kg. An analysis of the List 1 and 2 BCOC indicated that all List 1 chemicals were detected below the BT concentrations. Hexavalent chromium, a List 2 chemical, was detected at 0.185 mg/kg at benchmark station B7. Therefore, the chemical testing results confirmed that there was no increase in sediment chemistry attributable to dredged material at the perimeter stations, or at onsite stations, and Hypothesis No. 2 relating to Question 1 was not rejected, and Hypothesis No. 3 relating to Question 2 was not rejected.

Bioassay testing was conducted on the three Onsite Station sediments (Z1, S3, S10) using Carr Inlet Reference samples for test interpretation. Benchmark Station (B2, B3, B7) samples were collected and archived, pending the bioassay results of the Onsite Stations. Bioassay testing species were the amphipod *Eohaustorius estuarius*, bivalve larval test with *Mytilus galloprovincialis*, and the 20-day *Neanthes arenaceodentata* growth test. The results for the amphipod test indicated the test met the non-dispersive site interpretation guidelines, below or equal to 10% mortality for all samples. The reference sediment for the *Neanthes* test failed the DMMP performance guidelines, and the test sediments were interpreted using the negative control sediment, which resulted in all samples passing the DMMP non-dispersive guidelines. However, the DMMP agencies elected to do a confirmatory retest of onsite station S10 due to unusually high mortality rates in 3 of 5 replicates (e.g., no surviving worms). The retested sample exhibited no mortality and had acceptable control and reference performance, and passed the non-dispersive site interpretation guidelines. Results for the bivalve larval test indicated all passed except the onsite station Z1, which exhibited a 2-hit response. Since there was no corroborating bioassay responses at Z1 for the other two bioassays, Z1 passed the non-dispersive site condition II guidelines. Therefore, Hypothesis No. 4 relating to Question 2 was not rejected.

Analyses of tissue samples of *Compsomyax subdiaphana* for BCOC List 1 and 2 chemicals at Transect Station T01 and Benchmark Station B03 indicated that the List 1 metals were detected at uniformly low concentrations below established Target Tissue Levels (TTL's), for Arsenic, Mercury, Nickel, and Silver. However, it should be noted that attempts to collect tissue samples during the 1989 baseline survey were unsuccessful, and therefore, there are no tissue guideline values available to compare the 2005 data to. Based on these data Hypothesis No. 5 relating to Question 3 was not rejected.

Analysis of benthic samples at the three Transect stations (five replicates at each station) were processed, enumerated, and identified to the lowest taxonomic level possible. Benthic samples collected at each of the three Benchmark stations were archived. The 2005 results of abundance within each major taxonomic group were compared with the1989 baseline data. Unfortunately, the 1989 samples sorted species into major taxonomic groups, but did not identify benthic species down to the lowest taxonomic level possible. It also should be noted that the sampling protocol in place for processing benthic samples in 1989, utilized the entire core sample, whereas the protocol implemented in 1990 selectively focused on processing only the top 10 cm of the core sample. Therefore, comparing the 1989 data with the 2005 data has some limitations on its comparative utility. The comparisons show that total abundance and arthropod abundance was significantly lower at the 2005 Transect stations than observed in 1989. Correspondingly, the 2005 molluscan, annelida, and miscellaneous taxa abundances showed increased abundances relative to the 1989 baseline data. Overall abundances were depressed compared with the 1989 data, primarily attributable to the large numbers of arthropods. Based on the data at hand Hypothesis No. 6 relating to Question 6 was rejected. The DMMP agencies subsequently evaluated archived benchmark station samples to see if the lowered abundances observed at the Transect Stations were related to an area wide depression in benthic abundances, and to arthropod decreases. These data confirmed that an area wide depression was likely responsible for the depression in arthropod abundances, and that the depressions in abundance were not attributable to dredged material disposal.

During the spring/summer of 2006 the DMMP agencies analyzed archived sediment and tissue samples for Dibenzodioxins/furans. The results of those analyses will be summarized in the next biennial report.

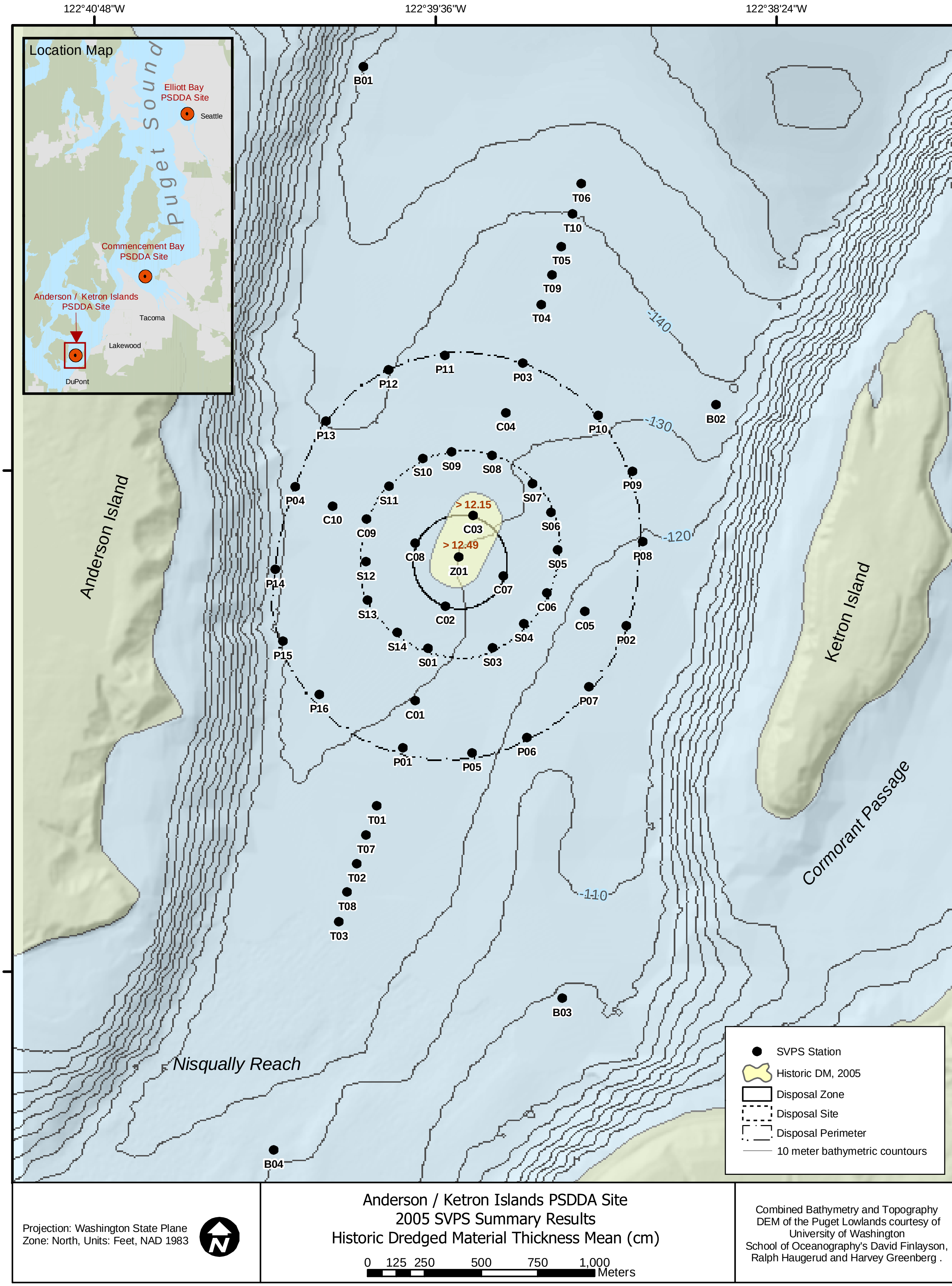

Figure 5-9. Distribution and Thickness (cm) of dredged material at the Ketron Island site in 2005

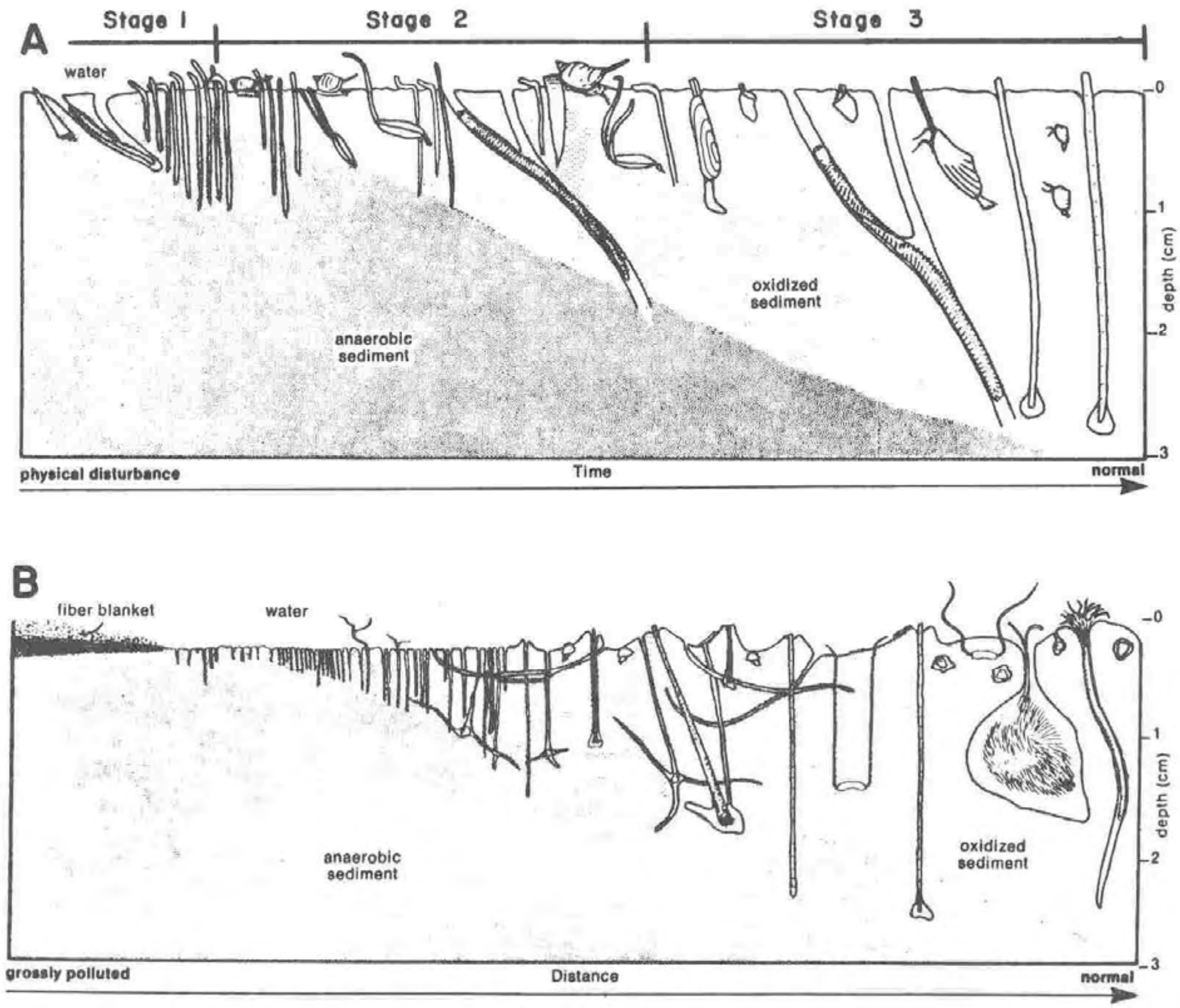

Figure 5-10. Schematic of organism-sediment relationship over time for a physical disturbance (e.g., dredged material) and distance for a pollution gradient (from Rhoads and Germano, 1982).

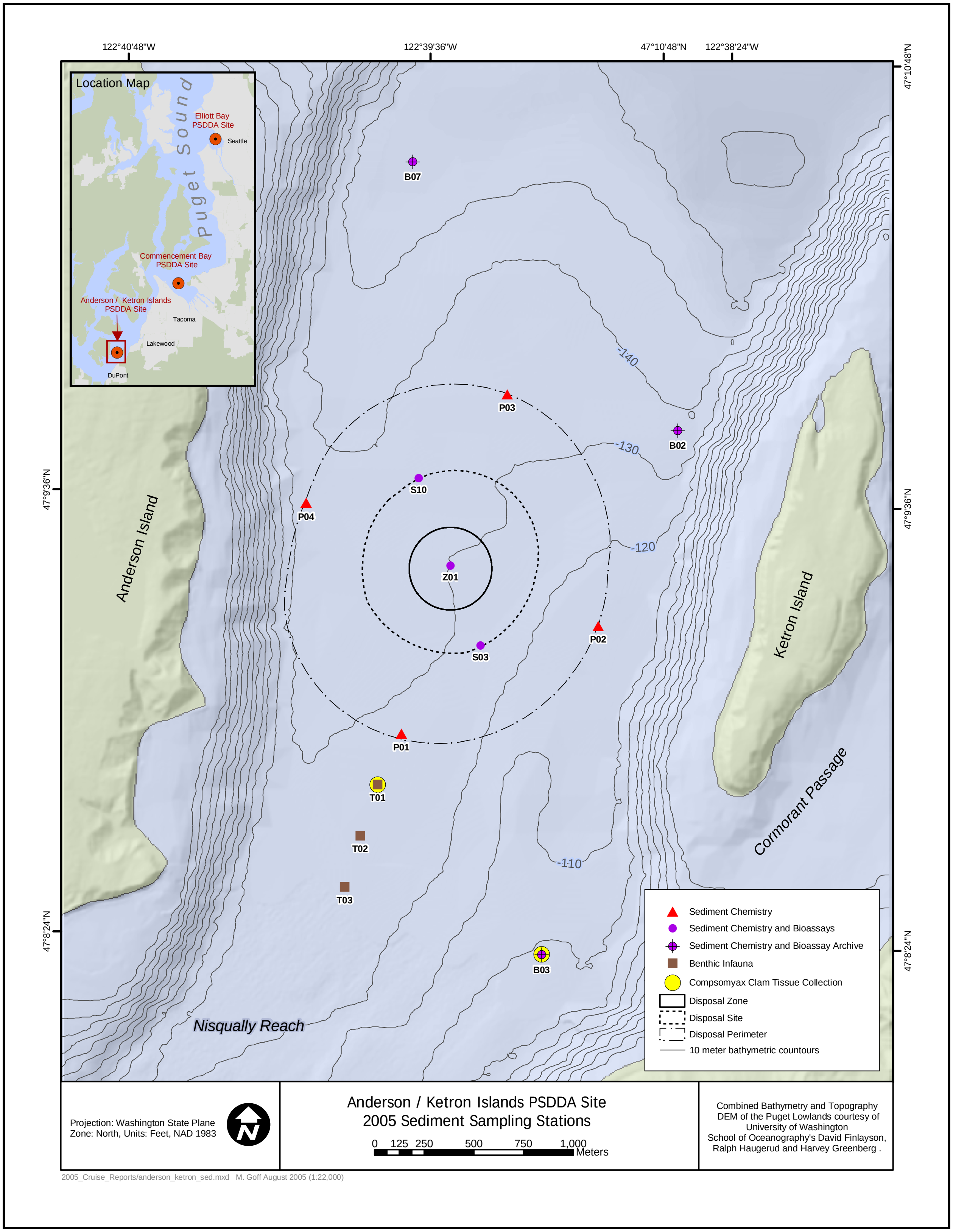

Figure 5-11. Anderson/Ketron chemical and biological station locations (SAIC, 2005).

Special Study at the Elliott Bay Disposal Site (2005). The DMMP agencies elected to conduct a limited chemistry survey of the Onsite Stations (Z1, S2, S4) at the Elliott Bay site to evaluate sediment surface chemistry in recently disposed dredged material (e.g., dioxin/furans, PCBs, mercury, PAHs, Chlorinated Hydrocarbons, Phthalates, Phenols, Miscellaneous Extractables, and Volatile Organics). **Figure 5-11** shows the location of the SPI Imagery stations and the sediment sampling stations. The survey was warranted based on recent post-dredge monitoring conducted in the Port of Seattle's East Waterway, showing a contaminated sediment surface at most stations. Samples were collected at the three onsite stations within the 0-10 cm and 0-2 cm depth horizons. The 0-2 cm samples were archived, pending the results of the 0-10 cm samples.

Elliott Bay Monitoring Results: The three SPI stations were also occupied for chemical analysis. The SPI results confirmed recent dredged material presence at Z1, and S2, but not at S4. The images at S4 failed to show recent dredged material, but showed a relatively undisturbed sediment profile, similar to an undisturbed ambient bottom. S4 also exhibited a well developed RPD layer with Stage III feeding voids, indicative of a Climax Benthic Community.

The initial chemical results of 0-10cm deep samples indicated that at the Z1 center site station, no chemicals exceeded SL or SQS. However at onsite Stations S2 and S4, mercury was slightly elevated, but less than the SL, while PCBs exceeded the SL at 290 mg/kg and 150 mg/kg, respectively, while only S2 was elevated over the SQS criteria at 17.9 mg/kg-OC. The DMMP agencies analyzed PCBs in archived 0-2 cm samples to further evaluate the surface sediment quality. The results of these analyses showed that for PCBs the concentrations were generally lower than the 0-10 cm samples (**Table 5-6**). At Station S2 the PCB concentrations were slightly over the SL at 140 mg/kg, while less than the SL at S4. All 0-2 samples were less than the SQS. In general, these results indicate that the PCB sediment quality at the disposal site remains within the site management objectives.

The results of the onsite dioxin/furan analyses are depicted in **Table 5-7**. In general, the results show generally low or undetected concentrations for the most toxic congeners (2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 2,3-7,8-PeCDF). The total TEQ for dioxin/furans ranged from 0.731 to 6.711 pptr.

Table 5-6. Comparative PCB Concentrations at Onsite Elliott Bay Disposal Site Stations.

Sampling Depth (cm)	Station Z1	Station S2	Station S4
0 - 2 cm	NA	**140 ug/kg-dry wt** 7.6 mg/kg-TOC norm	120 ug/kg-dry wt 6.6 mg/kg-TOC norm
0 - 10 cm	111 ug/kg-dry wt 10 mg/kg-TOC norm	**290 ug/kg-dry wt** **17.9 mg/kg-TOC norm**	**150 ug/kg-dry wt** 7.8 mg/kg-TOC norm

NA = not analyzed; **bolded values** exceed either DMMP or SMS guidelines

Table 5-7. Elliott Bay Onsite Dioxin and Furan Results*

Analyte	TEF WHO (05)	EBZ01 (0-10 cm)			EBS02 (0-10 cm)			EBS04 (0-10 cm)		
		ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ
2,3,7,8-Tetrachloroeibenzo-p-dioxin (TCDD)	1	0.197	U	0.0985	0.291	U	0.1455	0.037	U	0.0185
1,2,3,7,8-Pentachlordibenzo-p-dioxin (PeCDD)	1	0.178	U	0.089	0.255	U	0.1275	**0.296**	J	0.296
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.14	U	0.007	**0.41**	JK	0.041	**0.319**	J	0.0319
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	**0.666**	J	0.0666	**4.52**	J	0.452	**1.426**	J	0.1426
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	**0.506**	J	0.0506	**1.897**	J	0.1897	**0.992**	J	0.0992
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	**15.587**		0.15587	**187.641**		1.87641	**35.024**	B	0.35024
Octachlorodibenzo-p-dioxin (OCDD)	0.0003	**146.718**	B	0.04402	**2431.506**	B	0.72945	**256.255**	B	0.07688
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.247	U	0.01235	**1.52**	CJ	0.152	**1.006**	CJ	0.1006
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.125	U	0.00375	**0.751**	J	0.02253	**0.261**	J	0.01305
2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.117	U	0.0351	**1.902**	J	0.5706	**0.339**	J	0.1695
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	**0.705**	JK	0.0705	**14.933**		1.4933	**1.306**	J	0.1306
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	**0.217**	J	0.0217	**1.982**	J	0.1982	**0.442**	J	0.0442
1.2.3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.103	U	0.00515	0.264	U	0.0132	0.025	U	0.00125
2,3,4,6,7,8-Hexachlorodibenzofuran ((HxCDF)	0.1	**0.322**	J	0.0322	**2.708**	J	0.2708	**0.297**	JK	0.0297
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	**3.362**	J	0.03362	**36.536**		0.36536	**9.891**	BJ	0.09891
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	**0.25**	J	0.0025	**3.643**	J	0.03643	**0.662**	BJ	0.00662
Octachlorodibenzofuran (OCDF)	0.0003	**9.006**	J	0.000901	**92.533**		0.02776	**28.004**		0.002800
TOTAL TEQ:				**0.7117**			**6.7117**			**1.5451**

Legend:
LQ = Laboratory Qualifier; TEF = Toxicity Equivalency Factor; TEQ = Toxicity Equivalency Quotient
U = Undetected; J = Estimated concentration that is less than the MRL but greater than or equal to the MDL
K = Estimated maximum possible concentration for the associated compound; C = Confirmation analysis of the TCDF compound was performed on a second column; B = Associated analyte was found in the method blank as well as in the sample; dw = dry weight; bolded values show detected or confirmed/estimated concentrations.
* For undetected congeners, the detection limits were divided by 2 and multiplied by the TEF and summed in the TEQ

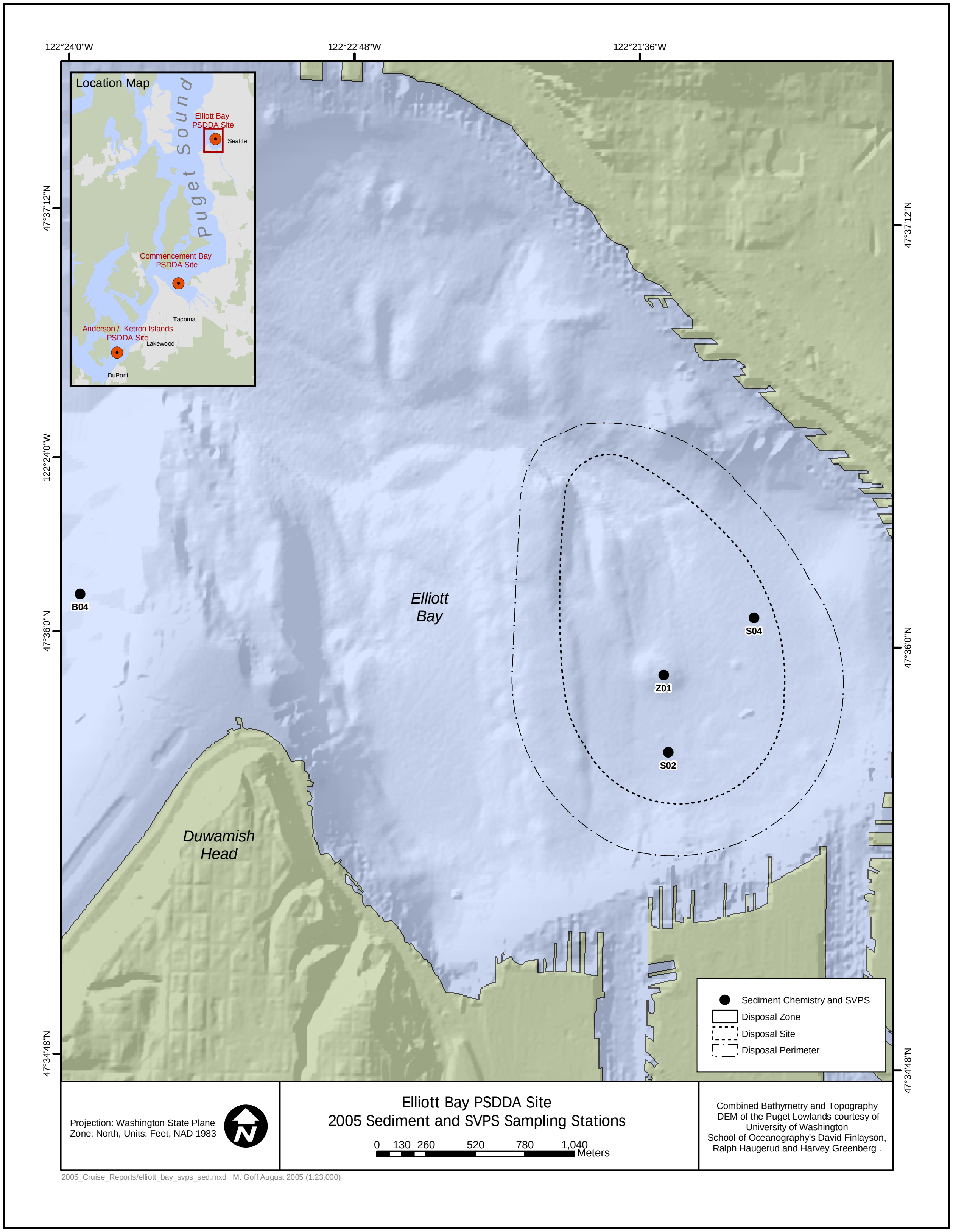

Figure 5-12. Elliott Bay SVPS and sediment sampling station locations (SAIC, 2005).

5.3 SUMMARY: DMMP DISPOSAL SITE USE AND MONITORING FREQUENCY

The cumulative dredged material volumes disposed at each Puget Sound site and Grays Harbor/Willapa Bay site since program implementation are depicted in Figures 5-12 and 5-13 and Table 5-8. All eight DMMP Puget Sound sites have been used, and the two estuarine sites in Grays Harbor and Willapa Bay have also been utilized. Seventeen-year summaries of site use for the Puget Sound sites general show that site capacities appear to be sufficient to last at least 50 years, except the Commencement Bay site which may reach the theoretical site capacity within the next 5-10 years (Table 5-9, Figures 5-3 and 5-12).

The Commencement bay site use has significantly accelerated during the past eight years and has averaged 694,224 cy/year since 1998 (excluding 2002 when the site was shut down by the DMMP agencies). At that rate of site use this site will exceed the estimated 9,000,000 cy site capacity threshold within 4.8 years. Therefore, the DMMP agencies initiated a NEPA/SEPA review of the Commencement bay site to evaluate future site use projections relative to the existing site. It will also consider expanding the site boundaries, selecting a new site, or closing down the existing site. The DMMP agencies expect to convene an interagency workgroup during 2006 to discuss the various alternatives being contemplated and solicit input on alternatives being contemplated to address the future disposal needs in Commencement bay and vicinity.

Table 5-10 summarizes the completed and scheduled DMMP disposal site monitoring surveys at the Puget Sound non-dispersive and dispersive sites. To date, the DMMP agencies have conducted sixteen post-disposal monitoring surveys at non-dispersive sites and three post-disposal bathymetric surveys at dispersive sites and two bathymetric surveys at the Commencement Bay site. The monitoring consisted of 5 full, 2 partial, 3 tiered-full, 3 tiered-partial monitoring, 2 SPI only surveys, and one Side Scan Sonar Survey. Additionally, three special studies were also conducted (see Table 5-8). Three bathymetric surveys have been conducted at the Rosario Strait dispersive site, which is the only Puget Sound dispersive site used on a frequent basis. During 2005 the DMMP agencies conducted a full monitoring exercise at the Anderson/Ketron Island Site, which will become the new monitoring baseline for that site. Additionally, during 2005, an SPI survey was conducted at the Commencement Bay site, a special study was conducted to evaluate phenol chemistry, and a special study was conducted at the Elliott Bay site to evaluate the onsite chemistry from recent dredging/.disposal activities occurring within East Waterway within a Superfund cleanup area.

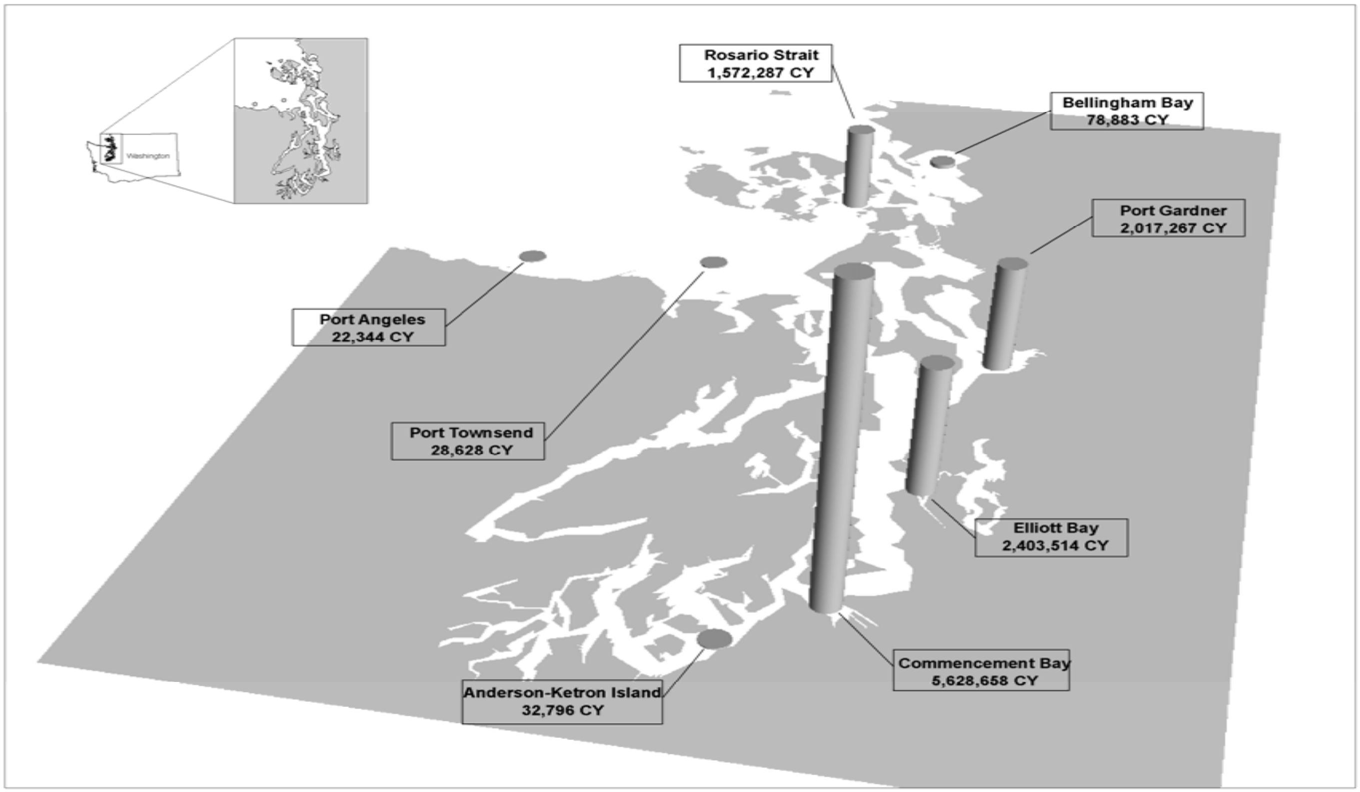

Figure 5-13. DMMP cumulative disposal volumes in Puget Sound DY 1989 – 2005

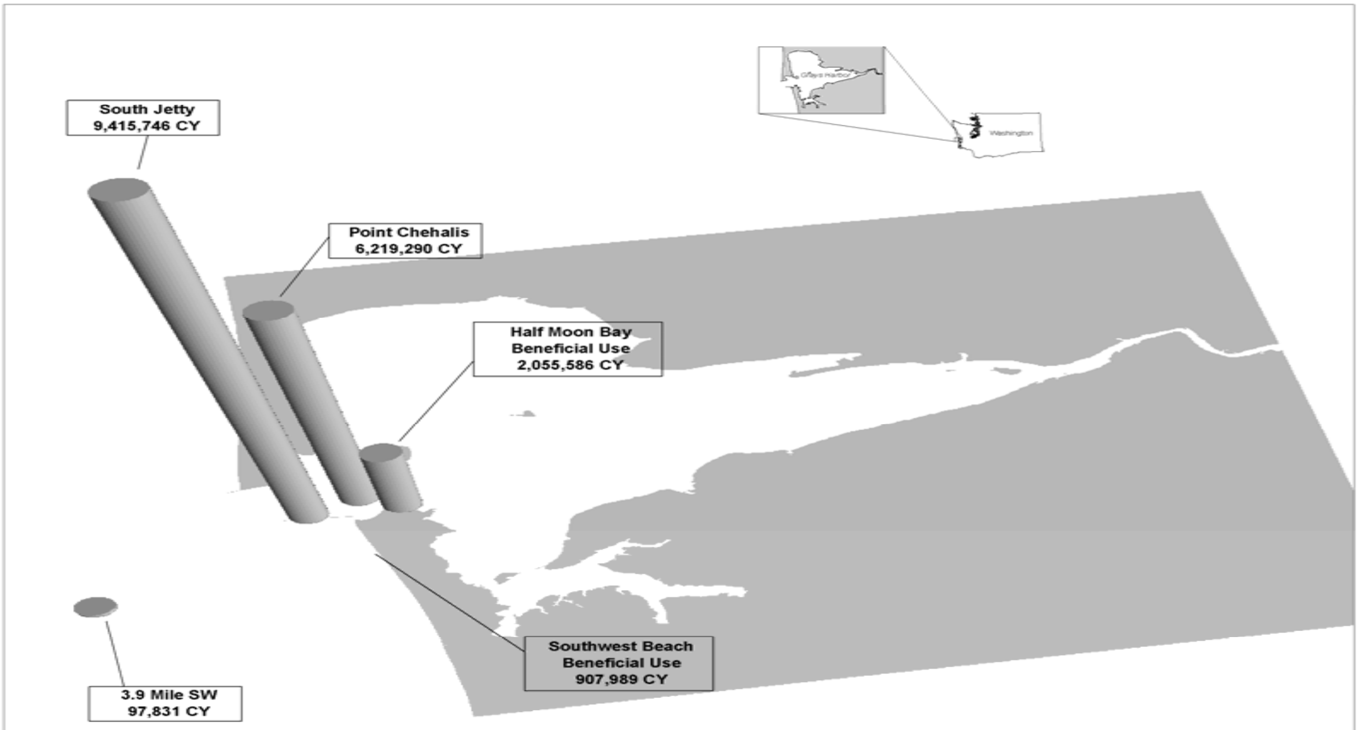

Figure-14. Cumulative disposal volumes for Grays Harbor DY 1996 – 2005.

Table 5-8. Cumulative Site Use Frequency Summary

Disposal Site	Dredging Years Used	Cumulative Volumes Disposed (cy)	Average Annual Disposal Volume (cy)
PSDDA (Central)	(1989 - 2005)		
Port Gardner (ND)	90, 91, 93, 94, 95, 96, 97, 02	2,017,267	118,663
Elliott Bay (ND)	90, 91, 92, 93, 94, 95, 96, 97,98, 99, 00, 01, 02, 04, 05	2,403,514	141,383
Commencement Bay (ND)	89, 91, 95, 96, 98, 99, 00, 01, 03, 04, 05	5,628,658	331,097
PSDDA (North / South)	(1990- 2005)		
Bellingham Bay (ND)	93, 96, 98	78,883	4,930
Anderson/Ketron (ND)	93, 95, 04, 05	32,826	2,052
Rosario Strait (D)	91, 92, 93, 94, 95, 96, 98, 99, 02, 03, 04, 05	1,572,287	98,268
Port Townsend (D)	93, 98, 99	28,628	1,789
Port Angeles (D)	96	22,344	1,397
Total cumulative volume		11,784,395	693,200
GRAYS HARBOR	(1996 - 2005)		
Point Chehalis (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05	6,219,290	621,929
South Jetty (D)	96, 97, 98, 99, 00, 01, 02, 03, 04, 05	9,415,746	941,575
Half Moon Bay (beneficial uses site)	96, 97, 98, 99, 02, 03, 04, 05	2,055,586	205,559
Southwest beach renourishment site	01, 02, 04, 05	907,989	90,799
3.9 Mile Ocean (D)	03, 04	97,831	9,783
Total cumulative volume		22,152,580	2,215,258
WILLAPA BAY	(1996-2005)		
Cape Shoalwater (D)	00, 03	251,095	25,110
Goose Point (D)	99, 03	110,004	11,000
Total cumulative volume		361,099	36,110

Legend: ND = nondispersive; D = dispersive

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Table 5-9. Seventeen-Year (1989-2005) Puget Sound Site Use Summary

Non-dispersive Disposal Site	Cumulative Volumes (CY)	Average Volume per Year (CY/YR)	15-Year Predictions MPR Phase I/II (CY)	Percent of 15-Year Prediction	Estimated Time to Exceed Site Capacity[20] (Years)
Port Gardner (1989-2005)	2,017,267	134,484	8,243,000	24.5	51.9
Elliott Bay (1989-2005)	2,403,514	141,383	10,525,000	22.8	46.6
Bellingham Bay (1990-2005)	78,883	5,635	1,181,500	6.7	1,583
Commencement Bay (1989-2005)	5,628,658	331,098	3,929,000	143	10.2
Anderson/Ketron Island (1990-2005)	32,826	2,052	785,000	4.2	4,374
SUBTOTALS:	10,161,118	597,713	24,763,500	41.0	N/A
Dispersive Disposal Site	**Cumulative Volumes (CY)**	**Average Volume per Year (CY/YR)**	**15-Year Predictions MPR Phase I/II (CY)**	**Percent of 15-Year Prediction**	**Estimated Time to Exceed Site Capacity[21] (Years)**
Rosario Strait (1990-2005)	1,572,287	98,268	1,801,000	87.3	N/A
Port Townsend (1990-2005)	28,628	2,045	687,000	4.2	N/A
Port Angeles (1990-2005)	22,344	1,596	285,000	7.8	N/A
SUBTOTALS:	1,623,259	101,454	2,773,000	58.5	N/A
GRAND TOTALS:	11,784,365	693,198	27,536,500	42.8	N/A

[20] Site capacity estimated in Phase II Disposal Site Selection Technical Appendix for non-dispersive sites is approximately 9,000,000 cubic yards, therefore (Site Capacity – Cumulative Volume)/average annual disposal volume = Estimated Time to Exceed Site Capacity.

[21] Actual site capacity for dispersive sites is not limited, assuming complete dispersal of dredged material off site.

Table 5-10. Puget Sound Disposal Site Monitoring Surveys

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	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
2001	Commencement Bay	Full + Bathymetric Survey
2002	Elliott Bay	Tiered-Partial
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

Legend. SPI = Sediment Profile Imagery Survey; PG = Port Gardner; BB = Bellingham Bay

Based on Puget Sound site monitoring conducted to data (including physical mapping, on and offsite sediment chemistry, sediment toxicity, offsite infaunal bioaccumulation, and offsite 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 goal of the DMMP site monitoring program is to ensure that the DMMP prescribed disposal site conditions are maintained and 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 any management plan adjustments if needed.

The PSDDA Management Plan Reports (MPR, 1998, 1989) recognize that intensive post-disposal monitoring surveys would be required early in the program implementation to gather data on the adequacy of the evaluation procedures to meet the site management objectives. All the monitoring events to data have not detected unexpected adverse impacts at any of the non-dispersive sites that have been monitored. In accordance with the management plan, following the 1997 SMARM, 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 initiating site monitoring from 300,000 cy to 500,000 cy at the Commencement Bay, Elliott Bay, and Port Gardner disposal sites following the 2002 SMARM, but left the volume trigger at 300,000 cy for the two less frequently used non-dispersive sites (Bellingham Bay and Ketron/Anderson Island). It should be emphasized that the monitoring triggers are soft triggers, and may be relaxed at the discretion of the DMMP agencies based on best-professional-judgment.

The Corps, in consultation with the DMMP agencies re-initiated consultation process with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) during March 2005 relative to the Puget Sound disposal sites after updating the existing programmatic biological evaluation. The findings of NMFS and USFWS in their respective concurrence letters (June 15, 2005 and May 17, 2005) found that disposal of dredged material at the five non-dispersive disposal sites and three dispersive sites "may affect, but are not likely to adversely affect" the listed species.

In 1996, the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) was reauthorized and amended to establish procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan (i.e. only for commercially harvested species). MSFCMA requires all federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect EFH (MSFCMA 305(b)(2)). Therefore, the Corps, in consultation with the DMMP agencies, updated the existing Essential Fish Habitat Assessment for the eight PSDDA disposal sites in Puget Sound as part of the Programmatic Biological Evaluation for the Section 7 ESA Consultation. The objective of this EFH assessment was to describe potential adverse effects to designated EFH for federally managed fisheries species within the proposed action areas. It also describes conservation measures proposed by the U.S. Army Corps of Engineers (Corps) to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action. Monitoring results verify that during the first 16 years of operation of the sites, the program management plan has effectively protected the environment from unacceptable impacts. Continued use of the DMMP management and monitoring program, including adaptive management, is expected to allow continued safe and publicly acceptable disposal of dredged materials. Therefore, potential cumulative impacts to designated EFH are not considered to be significant. The NMFS issued an opinion (June15, 2005 letter) under consultation on the EFH programmatic assessment, which will be in effect until June 2010, which states that the built-in conservation measures described in the EFH Assessment, while not completely avoiding the adverse effects attributable to open-water disposal of dredged material, they do minimize, to the maximum extent practicable, those effects.

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APPENDIX A - DY04/DY05 GUIDELINE VALUES (CHEMISTRY)

CHEMICAL NAME	Units	SL	BT	ML	(SL+ ML)/2
METALS & ORGANOMETALS					
Antimony	mg/kg	150	150	200	175
Arsenic	mg/kg	57	507.1	700	378.5
Cadmium	mg/kg	5.1	11.3	14	9.55
Chromium	mg/kg		267		
Copper	mg/kg	390	1,027	1,300	845
Lead	mg/kg	450	975	1,200	825
Mercury	mg/kg	0.41	1.5	2.3	1.355
Nickel	mg/kg	140	370	370	255
Selenium	mg/kg		3		
Silver	mg/kg	6.1	6.1	8.4	7.25
Zinc	mg/kg	410	2,783	3,800	2,105
TBT ion (porewater)	ug/L	0.15	0.15		
LPAH					
Naphthalene	ug/kg	2,100		2,400	2,250
Acenaphthene	ug/kg	500		2,000	1,250
Acenaphthylene	ug/kg	560		1,300	930
Fluorene	ug/kg	540		3,600	2,070
Phenanthrene	ug/kg	1,500		21,000	11,250
Anthracene	ug/kg	960		13,000	6,980
2-Methylnaphthalene	ug/kg	670		1,900	1,285
Total LPAHs	ug/kg	5,200		29,000	17,100
HPAH					
Fluoranthene	ug/kg	1,700	4,600	30,000	15,850
Pyrene	ug/kg	2,600	11,980	16,000	9,300
Benzo(a)anthracene	ug/kg	1,300		5,100	3,200
Benzofluoranthenes (b+k)	ug/kg	3,200		9,900	6,550
Chrysene	ug/kg	1,400		21,000	11,200
Benzo(a)pyrene	ug/kg	1,600		3,600	2,600
Indeno(1,2,3-c,d)pyrene	ug/kg	600		4,400	2,500
Dibenzo(a,h)anthracene	ug/kg	230		1,900	1,065
Benzo(g,h,I)perylene	ug/kg	670		3,200	1,935
Total HPAHs	ug/kg	12,000		69,000	40,500
CHLORINATED HYDROCARBONS					
1,2,4-Trichlorobenzene	ug/kg	31		64	47.5
1,2-Dichlorobenzene	ug/kg	35		110	72.5
1,3-Dichlorobenzene	ug/kg	170		--	
1,4-Dichlorobenzene	ug/kg	110		120	115
Hexachlorobenzene (HCB)	ug/kg	22	168	230	126

CAL NAME	Units	SL	BT	ML	(SL+ ML)/2
PHTHALATES[2]					
Bis(2-ethylheyesyl)phthalate	ug/kg	1,300		8,300	4,800
Butylbenzylphthalate	ug/kg	63		970	516.5
Di-n-butyl phthalate	ug/kg	1,400		5,100	3,250
Di-n-octyl phthalate	ug/kg	6,200		6,200	6,200
Diethylphthalate	ug/kg	200		1,200	700
Dimethylphthalate	ug/kg	71		1,400	735.5
PHENOLS					
2-Methylphenol	ug/kg	63		77	70
4-Methylphenol	ug/kg	670		3,600	2,135
2,4-Dimethylphenol	ug/kg	29		210	120
Pentachlorophenol	ug/kg	400	504	690	545
Phenol	ug/kg	420		1,200	810
MISCELANEOUS EXTRACTABLES					
Benzyl Alcohol	ug/kg	57		870	463.5
Benzoic acid	ug/kg	650		760	705
Dibenzofuran	ug/kg	540		1,700	1,120
Hexachlorobutadiene	ug/kg	29		270	149.5
Hexachloroethane	ug/kg	1,400		14,000	7,700
N-Nitrosodiphenylamine	ug/kg	28		130	79
VOLATILE ORGANICS					
Ethylbenzene	ug/kg	10		50	30
Tetrachloroethene	ug/kg	57		210	133.5
Total Xylene (sum of o,m,p)	ug/kg	40		160	100
Trichloroethene	ug/kg	160		1,600	880
PESTICIDES AND PCBs					
Total DDT	ug/kg	6.9	50	69	37.95
Aldrin	ug/kg	10		--	
alpha-Chlordane	ug/kg	10	37	--	
Dieldrin	ug/kg	10		--	
Heptachlor	ug/kg	10		--	
Alpha-BHC	ug/kg	--	10	--	
gamma-BHC (Lindane)	ug/kg	10		--	
Total PCBs	ug/kg	130	38 [1]	3,100	1,615

[1] mg/kg - carbon normalized

[2] 2004 SL/ML's based on 1998 LAET/HAET's (2004 Phthalate Clarification Paper)

APPENDIX B - DY04/DY05 BIOLOGICAL TESTING INTERPRETATION 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	$M_C < 10\%$	$M_R - M_C < 20\%$	$M_T - M_C > 20\%$ and M_T vs. M_R SD (p=.05) and		$M_T - M_C > 20\%$ and M_T vs. M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I > 0.70$	$N_R > N_C > 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SD (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	$M_C < 10\%$ and $MIG_C > 0.38$	$M_R < 20\%$ and $MIG_R \div MIG_C > 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

M = mortality, N = normal survivors, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

APPENDIX C - LEGEND

S	=	reported concentration exceeds screening level
SB	=	reported concentration exceeds screening level and bioaccumulation trigger
M	=	reported concentration exceeds maximum level
BM	=	reported concentration bioaccumulation trigger and maximum level
(U)	=	detection limit exceeds either screening level, bioaccumulation trigger, or maximum level
(B)	=	analyte detected in corresponding blank
(E)	=	estimate
(J)	=	detected between the SDL and the CRDL
(UJ)	=	analyte not detected above the sample quantitation limit; however the reported quantitation limit is approximate
(D)	=	compound required a dilution as a result of the matrix or the sample concentration
(M)	=	estimated value of anlyte found and confirmed by analyst, but with low spectral match
(N)	=	estimate based on presumptive evidence
(G)	=	estimate is greater than value shown
(Y)	=	raised non-detect due to matrix interferences
NA	=	not analyzed
NT	=	not tested
2H	=	a hit under the two-hit interpretation guideline
1H	=	a hit under the one-hit interpretation guideline
PASS	=	test sediment passes DMMP guidelines for open-water unconfined disposal
FAIL	=	test sediment fails DMMP guidelines for open-water unconfined disposal
FAIL (C)	=	DMMU found unsuitable for open-water disposal in the absence of bioaccumulation and/or Tier IV testing data
(BPJ)	=	best professional judgement applied to suitability determination
(BTI)	=	bioassay testing incomplete
L	=	the highest reported concentration was below SL
LM	=	the highest reported concentration was between SL and (SL + ML)/2
M	=	the highest reported concentration was between (SL + ML)/2 and ML
H	=	the highest reported concentration exceeded ML
H*	=	the sediment rank is based on biological testing results

Appendix C. DY 04/05 Evaluation Guideline Exceedances.

PROJECT	Lehigh NW			East Waterway Stage II			Dakota Creek Shipyard/Pier 1			
DMMU ID:	S1	S2	SS3	COMP9	COMP10	COMP11	D1-A	D2-A	P1	P2
Testing Rank:	H	H	H	H	H	H	M	M	M	M
METALS & ORGANOMETALS (mg/kg)										
Antimony										
Arsenic										
Cadmium										
Chromium										
Copper										
Lead										
Mercury				0.55		0.55				
Nickel										
Silver										
Zinc										
TBT ion (porewater) (ug/L)										
LPAH (ug/kg)										
Naphthalene										
Acenaphthene										
Acenaphthylene										
Fluorene										
Phenanthrene										
Anthracene										
2-Methylnaphthalene										
Total LPAHs										
HPAH (ug/kg)										
Fluoranthene								5,200		
Pyrene								6,400		
Benzo(a)anthracene								3,000		
Benzofluoranthenes (b+k)								3,300		
Chrysene										
Benzo(a)pyrene								2,400		
Indeno(1,2,3-c,d)pyrene								1,200		
Dibenzo(a,h)anthracene										
Benzo(g,h,I)perylene								3,100		
Total HPAHs								25,270		
CHLORINATED HYDROCARBONS (ug/kg)										
1,2,4-Trichlorobenzene										
1,2-Dichlorobenzene										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
Hexaclorobenzene (HCB)										
PHTHALATES (ug/kg)										
Bis(2-ethylheyesyl)phthalate										
Butylbenzylphthalate										
Di-n-butylphthalate										
Di-n-octylphthalate										
Diethylphthalate										
Dimethylphthalate										
PHENOLS										
2-Methylphenol										
4-Methylphenol										
2,4-Dimethylphenol										
Pentachlorophenol										
Phenol										
MISCELANEOUS EXTRACTABLES (ug/kg)										
Benzyl alcohol										
Benzoic acid										
Dibenzofuran										
Hexachlorobutadiene										
Hexachloroethane										
N-Nitrosodiphenylamine										
VOLATILE ORGANICS (ug/kg)										
Ethylbenzene										
Tetrachloroethene										
Total Zylene (sum of o,m,p)										
Trichloroethane										
PESTICIDES AND PCBs (ug/kg)										
Total DDT		13 (U)		10 (U)		20 (U)				
Aldrin										
alpha-Chlordane										
Dieldrin				20 (U)	19 (U)	20 (U)				
Heptachlor										
gamma-BHC (Lindane)										
Total PCBs		159		568	240	1,260				
Total PCBs (TOC normalized) (mg/kg)						63				
GRAIN SIZE: % Fines	24.5	23.0	36.2	74.7	66.3	70.5	39.60	18.90	58.40	66.90
BIOASSAYS (NH, 2H, 1H)										
Amphipod		1-H		1-H	1-H	1-H				
Sediment Larval (Bivalve/Echinoderm)		NH		NH	NH	1-H				
Neanthes Growth		NH		NH	NH	NH				
Bioassay: (Pass/Fail)	PASS	FAIL	PASS	FAIL	FAIL	FAIL		Not Tested		
BTs exceeded:	no	no	no	no	no	yes	no		no	no
Bioaccumulation test conducted:	no	no	no	no	no	no	no		no	no
Bioaccumulation (Pass/Fail):	Not Tested	Not Tested	Not Teste	Not Tested	Not Tested	Not Tested	no		no	no
ML Rule exceeded:	no	no	no	no	no	no	no		no	no
OVERALL PASS/FAIL:	PASS	FAIL	PASS	FAIL	FAIL	FAIL	PASS	FAIL	PASS	PASS
VOLUME: (CY)	3,000	3,000	3,000	4,030	4,000	4,000	230,000	16,000	16,000	16,000
HIGHEST RANKING:	L	LM	L	LM	LM	LM	L	LM	L	L

Appendix C. DY 04/05 Evaluation Guideline Exceedances.

PROJECT	Grays Harbor O&M										
DMMU ID:	CPA-01	CPA-02	CPA-03	CPA-04	CPA-05	CPA-06	CPA-07	CPA-08	CPA-09	CPA-10	CPA-11
Testing Rank:	L	L	L	L	L	L	L	L	L	L	L
METALS & ORGANOMETALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury											
Nickel											
Silver											
Zinc											
TBT ion (porewater) (ug/L)											
LPAH (ug/kg)											
Naphthalene											
Acenaphthene											
Acenaphthylene											
Fluorene											
Phenanthrene											
Anthracene											
2-Methylnaphthalene											
Total LPAHs											
HPAH (ug/kg)											
Fluoranthene											
Pyrene											
Benzo(a)anthracene											
Benzofluoranthenes (b+k)											
Chrysene											
Benzo(a)pyrene											
Indeno(1,2,3-c,d)pyrene											
Dibenzo(a,h)anthracene											
Benzo(g,h,I)perylene											
Total HPAHs											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexaclorobenzene (HCB)											
PHTHALATES (ug/kg)											
Bis(2-ethylheyesyl)phthalate											
Butylbenzylphthalate											
Di-n-butylphthalate											
Di-n-octylphthalate											
Diethylphthalate											
Dimethylphthalate											
PHENOLS											
2-Methylphenol											
4-Methylphenol											
2,4-Dimethylphenol											
Pentachlorophenol											
Phenol											
MISCELANEOUS EXTRACTABLES (ug/kg)											
Benzyl alcohol											
Benzoic acid											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Zylene (sum of o,m,p)											
Trichloroethane											
PESTICIDES AND PCBs (ug/kg)											
Total DDT											
Aldrin											
alpha-Chlordane											
Dieldrin											
Heptachlor											
gamma-BHC (Lindane)											
Total PCBs											
Total PCBs (TOC normalized) (mg/kg)											
GRAIN SIZE % Fines	69.4	83.7	79.5	53.3	53.6	28.1	9.1	4.3	1.8	6.5	7.8
BIOASSAYS (NH, 2H, 1H)											
Amphipod			NH		NH						
Sediment Larval (Bivalve/Echinoderm)			NH		NH						
Neanthes Growth			NH*		NH*						
Bioassay: (Pass/Fail)			*PASS		PASS						
BTs exceeded:			no		no						
Bioaccumulation test conducted:			no		no						
Bioaccumulation (Pass/Fail):			Not Tested		Not Tested						
ML Rule exceeded:			no		no						
OVERALL PASS/FAIL:	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VOLUME: (CY)	60,000	60,000	60,000	63,000	64,000	62,000	60,000	64,000	62,000	64,000	64,000
HIGHEST RANKING:	L	L	L	L	L	L	L	L	L	L	L

*QA/QC failures, retest passed

Appendix C. DY 04/05 Evaluation Guideline Exceedances.

PROJECT	Port of Seattle, Fishermen's Terminal											
DMMU ID:	A1-1CS	A1-2CS	A1-3CS	A1-4CS	A1-5CS	A1-6CS	A1-7CS	A1-8CS	A2A-1CS	A2B-1CS	A2B-2CS	A2B-3CS
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS (mg/kg)								482				
Antimony												
Arsenic												
Cadmium												
Chromium												
Copper												
Lead												1860
Mercury		0.86		0.76		0.67	0.45		11		0.66	2.12
Nickel												
Silver												
Zinc									427			609
TBT ion (porewater) (ug/L)	0.16	0.18				0.31	0.31	1.1	12		4.5	
LPAH (ug/kg)												
Naphthalene												
Acenaphthene												
Acenaphthylene												
Fluorene												
Phenanthrene												
Anthracene												
2-Methylnaphthalene												
Total LPAHs												
HPAH (ug/kg)												
Fluoranthene												
Pyrene												
Benzo(a)anthracene												
Benzofluoranthenes (b+k)												
Chrysene												
Benzo(a)pyrene												
Indeno(1,2,3-c,d)pyrene												
Dibenzo(a,h)anthracene												
Benzo(g,h,I)perylene												
Total HPAHs												
CHLORINATED HYDROCARBONS (ug/kg)												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
Hexaclorobenzene (HCB)												
PHTHALATES (ug/kg)												
Bis(2-ethylheyesyl)phthalate												
Butylbenzylphthalate												
Di-n-butylphthalate												
Di-n-octylphthalate												
Diethylphthalate												
Dimethylphthalate												
PHENOLS												
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol												
Pentachlorophenol												
Phenol												
MISCELANEOUS EXTRACTABLES (ug/kg)												
Benzyl alcohol												
Benzoic acid												
Dibenzofuran												
Hexachlorobutadiene												
Hexachloroethane												
N-Nitrosodiphenylamine												
VOLATILE ORGANICS (ug/kg)												
Ethylbenzene												
Tetrachloroethene												
Total Zylene (sum of o,m,p)												
Trichloroethane												
PESTICIDES AND PCBs (ug/kg)												
Total DDT												
Aldrin												
alpha-Chlordane												
Dieldrin												
Heptachlor												
gamma-BHC (Lindane)												
Total PCBs	140	659	470	215								
Total PCBs (TOC normalized) (mg/kg)												
GRAIN SIZE: % Fines	39.8	40.3	65.1	51.3	67.5	73.2	62.1	82.4	79.4	60.4	91.9	84.5
BIOASSAYS (NH, 2H, 1H)												
Amphipod	NH	NH	NH	NH	NH	NH	NH	NH				
Sediment Larval (Bivalve/Echinoderm)	1H	1H	1H	2H	2H	2H	2H (bpj)	NH				
Neanthes Growth	NH	NH	NH	NH	NH	NH	NH	NH				
Bioassay: (Pass/Fail)	FAIL	FAIL	PASS	PASS	NT	PASS	PASS	PASS	NT	NT	NT	NT
BTs exceeded:	no	no	no	no	no	no	no	no	yes	no	yes	yes
Bioaccumulation test conducted:												
Bioaccumulation (Pass/Fail):												
ML Rule exceeded:	no	no	no	no	no	no	no	no	yes	no	no	yes
OVERALL PASS/FAIL:	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	F (BTI)	PASS	F (BTI)	F (BTI)
VOLUME: (CY)	4,247											
HIGHEST RANKING:	H*	H*	LM	LM	L	LM	H	H	H	L	H	H

Appendix C. DY 04/05 Evaluation Guideline Exceedances.

PROJECT	Port of Seattle, Terminal 46						Harris Avenue Shipyard MTCA					
DMMU ID:	T46-1	T46-2	T46-3	T46-4	T46-5	T46-6	1A	1B	2.00	2Z	3.00	4.00
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS (mg/kg)												
Antimony												
Arsenic									67			
Cadmium												
Chromium												
Copper												
Lead												
Mercury			2.22	0.79								
Nickel												
Silver												
Zinc									622			
TBT ion (porewater) (ug/L)				1.9	2.2							
LPAH (ug/kg)												
Naphthalene												
Acenaphthene									1400			
Acenaphthylene												
Fluorene									1200			
Phenanthrene									4600			
Anthracene												
2-Methylnaphthalene												
Total LPAHs									8058			
HPAH (ug/kg)												
Fluoranthene									6300			
Pyrene									5200			
Benzo(a)anthracene									1300			
Benzofluoranthenes (b+k)												
Chrysene												
Benzo(a)pyrene												
Indeno(1,2,3-c,d)pyrene												
Dibenzo(a,h)anthracene												
Benzo(g,h,I)perylene												
Total HPAHs									16,990			
CHLORINATED HYDROCARBONS (ug/kg)												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene				180								
Hexaclorobenzene (HCB)												
PHTHALATES (ug/kg)												
Bis(2-ethylheyesyl)phthalate												
Butylbenzylphthalate												
Di-n-butylphthalate												
Di-n-octylphthalate												
Diethylphthalate												
Dimethylphthalate												
PHENOLS												
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol			48									
Pentachlorophenol												
Phenol												
MISCELANEOUS EXTRACTABLES (ug/kg)												
Benzyl alcohol				720	110							
Benzoic acid												
Dibenzofuran												
Hexachlorobutadiene												
Hexachloroethane												
N-Nitrosodiphenylamine												
VOLATILE ORGANICS (ug/kg)												
Ethylbenzene												
Tetrachloroethene												
Total Zylene (sum of o,m,p)												
Trichloroethane												
PESTICIDES AND PCBs (ug/kg)												
Total DDT												
Aldrin												
alpha-Chlordane												
Dieldrin												
Heptachlor												
gamma-BHC (Lindane)												
Total PCBs												
Total PCBs (TOC normalized) (mg/kg)												
GRAIN SIZE: % Fines	42.4	21.6	30.1	14.2	17.2	27.8	16.50	21.50	12.40		6.20	21.50
BIOASSAYS (NH, 2H, 1H)			Not Tested	Not Tested	Not Tested							
Amphipod												
Sediment Larval (Bivalve/Echinoderm)												
Neanthes Growth												
Bioassay: (Pass/Fail)									Not Tested			
BTs exceeded:	no	no	yes	yes	yes	no	no	no	yes		no	no
Bioaccumulation test conducted:	no	no	no	no	no	no	no	no	no		no	no
Bioaccumulation (Pass/Fail):			Not Tested	Not Tested	Not Tested		no	no	Not Tested		no	no
ML Rule exceeded:	no	no	no	no	no	no	no	no	no		no	no
OVERALL PASS/FAIL:	PASS	PASS	FAIL (BTI)	FAIL (BTI)	FAIL (BTI)	PASS	PASS	PASS	FAIL (BTI)	PASS (BPJ)	PASS	PASS
VOLUME: (CY)	4,000	4,200	3,800	4,900	3,400	3,100	2,284	1,514	3,697		3,956	3,981
HIGHEST RANKING:	L	L	M	H	H	L	L	L	M	L	L	L

Appendix C. DY 04/05 Evaluation Guideline Exceedances.

PROJECT	Manke Lumber Company										
DMMU ID:	A-4	A-5	A-6	A-7	A-8	AML-A9	AML-A10	A-14	A-16	A-21	A-22
Testing Rank:	H	H	H	H	H	H	H	H	H	H	H
METALS & ORGANOMETALS (mg/kg)											
Antimony											
Arsenic											
Cadmium											
Chromium											
Copper											
Lead											
Mercury						0.60	0.60				
Nickel											
Silver											
Zinc											
TBT ion (porewater) (ug/L)											
LPAH (ug/kg)											
Naphthalene											
Acenaphthene											
Acenaphthylene											
Fluorene											
Phenanthrene											
Anthracene											
2-Methylnaphthalene											
Total LPAHs											
HPAH (ug/kg)											
Fluoranthene											
Pyrene											
Benzo(a)anthracene											
Benzofluoranthenes (b+k)											
Chrysene											
Benzo(a)pyrene											
Indeno(1,2,3-c,d)pyrene											
Dibenzo(a,h)anthracene											
Benzo(g,h,I)perylene											
Total HPAHs											
CHLORINATED HYDROCARBONS (ug/kg)											
1,2,4-Trichlorobenzene											
1,2-Dichlorobenzene											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Hexaclorobenzene (HCB)											
PHTHALATES (ug/kg)											
Bis(2-ethylheyesyl)phthalate											
Butylbenzylphthalate											
Di-n-butylphthalate											
Di-n-octylphthalate											
Diethylphthalate											
Dimethylphthalate											
PHENOLS											
2-Methylphenol											
4-Methylphenol											
2,4-Dimethylphenol											
Pentachlorophenol											
Phenol											
MISCELANEOUS EXTRACTABLES (ug/kg)											
Benzyl alcohol											
Benzoic acid											
Dibenzofuran											
Hexachlorobutadiene											
Hexachloroethane											
N-Nitrosodiphenylamine											
VOLATILE ORGANICS (ug/kg)											
Ethylbenzene											
Tetrachloroethene											
Total Zylene (sum of o,m,p)											
Trichloroethane											
PESTICIDES AND PCBs (ug/kg)											
Total DDT											
Aldrin											
alpha-Chlordane											
Dieldrin											
Heptachlor											
gamma-BHC (Lindane)											
Total PCBs											
Total PCBs (TOC normalized) (mg/kg)											
GRAIN SIZE: % Fines						36.80	44.20				
BIOASSAYS (NH, 2H, 1H)											
Amphipod	NH	NH	NH		NH	NH	NH	NH	NH	NH	NH
Sediment Larval (Bivalve/Echinoderm)	1H	NH	NH		NH	2H	NH	NH	NH	1H	1H
Neanthes Growth	NH	NH	NH		NH	NH	NH	NH	NH	NH	NH
Bioassay: (Pass/Fail)	FAIL	PASS	PASS	Not Tested	PASS	FAIL	PASS	PASS	PASS	FAIL	FAIL
BTs exceeded:	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation test conducted:	no	no	no	no	no	no	no	no	no	no	no
Bioaccumulation (Pass/Fail):	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
ML Rule exceeded:	no	no	no	no	no	no	no	no	no	no	no
OVERALL PASS/FAIL:	FAIL	PASS	PASS		PASS	FAIL	PASS	PASS	PASS	FAIL	FAIL
VOLUME: (CY)	2,500	3,100	2,100	2,400	1,400	1,400	1,700	4,400	4,100	900	1,400
HIGHEST RANKING:	H*	L	L	L	L	H*	LM	L	L	H*	H*