Operations Division
Dredged Material Management Office

27 November 1995

MEMORANDUM FOR RECORD

SUBJECT: DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED UNDER PSDDA GUIDELINES FOR UPPER DUWAMISH RIVER MAINTENANCE DREDGING (CENPS-OP-NP-92; 7 July 1995) FOR PLACEMENT AT THE ELLIOTT BAY NONDISPERSIVE OPEN WATER SITE

1. The following summary represents the suitability determination for the upper Duwamish River characterization (Station 257+35 to 241+00) conducted during August, 1995. It reflects information on analyses gathered for and reviewed by the PSDDA agencies' (Corps, Departments of Ecology and Natural Resources, and the Environmental Protection Agency). The technical decision is based on a careful review of the sediment characterization results documented in November 20, 1995 report from Science Application International Corporation (SAIC) entitled: "Sediment Characterization at Duwamish Waterway, Seattle, Washington". A determination of suitability has been made for the 28,000 cubic yards of dredged material proposed for maintenance dredging from the upper Duwamish River navigation channel. An additional 70-95,000 cubic yards from the upper turning basin is also proposed for dredging, but is exempt from testing under the PSDDA recency/frequency guidelines. The factual basis for the exemption under PSDDA frequency/recency guidelines are documented by past characterization, where two sequential testing rounds of upper turning basin material were conducted. This final determination is made relative to suitability for unconfined open-water disposal (UCOWD) at the PSDDA Elliott Bay nondispersive site. Relevant dates for regulatory tracking purposes are included in Table 1.

Table 1. Regulatory Tracking Dates

SAP Approval date	August 11, 1995
Sampling date(s): Station 257+35 to 241+00	August 15-17, 1995
Data report submittal date	November 20, 1995
Past Sampling and Analysis History: Station 236+00 to 180+00 Station 206+00 to head of Navigation Channel	August 1990 Summer 1991
Recency Determination Dates: High Concern DMMU (2 years)	Recency date = August 1997

2. The proposed dredging area was previously characterized in 1991 from Station 206+00 to the head of navigation (upstream turning basin), and all dredged material management units characterized were determined to be suitable for unconfined open-water disposal (see attached

1992 suitability determination, enclosure 1). The material characterized for the most part, reflects recently settled material carried downstream from the upper Duwamish River. Sediment characterization sampling occured on August 15 and 17, 1995. Characterization from this high ranked area included the collection of seven uncomposited vibracore samples. Conventional parameters representative of the.uncomposited dredged material management units (DMMU) analyzed are depicted in Table 2. As noted in Table 2, the bulk sulfides were uniformly high in all seven DMMU, ranging from 1,000 to a high of 3,000 mg/kg. Bulk ammonia was also somewhat elevated and relatively uniform among the seven DMMU, ranging from 89 to 110 mg/kg.

3. The Agencies' approved sampling and testing plan (verbally approved by PSDDA agencies on August 11, 1995) was followed, and quality assurance/quality control guidelines specified by PSEP and the PSDDA program were generally complied with. Chemical analysis results depicted in Table 3 demonstrated that all seven dredged material management units characterized contained small but measurable levels of chemicals of concern with all seven exhibiting chemical exceedances of screening levels. Minor chemical exceedances occurred for mercury, TBT and organic chemicals such as indeno(1,2,3,c,d)pyrene, pyrene, total HPAH, total DDT, and total PCBs (Table 3). No bioaccumulation trigger levels or maximum levels were exceeded for chemicals of concern. Therefore, biological testing was initiated on all seven DMMUs.

4. PSDDA biological testing performance guidelines for control and reference sediments are depicted in Table 4a for each of the PSDDA bioassays. Interpretative guidelines for nondispersive sites are summarized in Table 4b. The testing outcome summary for the seven DMMU undergoing biological testing are depicted in Table 5. In general, the control and reference performance standards were met for all bioassays. Positive control LC50 ($CdCl_2$ expressed as Cd) responses indicated that both amphipod (*Ampelisca abdita*) and juvenile polychaete growth (*Neanthes arenaceodenta*) bioassays exhibited LC50's within observed DAIS limits. The *Neanthes* LC50's were within both the laboratory performance limits and the observed DAIS limits. Positive control responses observed for the sediment larval bioassay utilizing the bivalve *Mytilus galloprovincialus*, were within the observed laboratory performance limits (see Table 5). The PSDDA program does not have much experience to date with this bivalve species in the sediment larval bioassay. Positive control EC50 (Phenol) data for the saline Microtox bioassay were generally within the observed DAIS values and the laboratory observed limits.

5. The analysis results for amphipod and *Neanthes* growth bioassays met PSDDA disposal guidelines, whereas the bioassay results for the sediment larval bioassay utilizing the bivalve *Mytilus galloprovincialus* exhibited a toxic response relative to reference sediments in all seven DMMU. The results for this bioassay depicted five double hits and two single hit failures (S5, S7). The microtox bioassay results, although not currently being used for regulatory decisionmaking[1],

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The PSDDA agencies agreed to set aside the saline microtox bioassay for regulatory decisionmaking at the May 1994 Annual Review Meeting, due to inconclusive results, questions about the protocol, and the apparent lack of test sensitivity compared to the remaining PSDDA bioassays.

also confirmed the amphipod and *Neanthes* bioassay results, where no toxicity was observed.

6. The Agencies concluded based on the above discussion and summary of sediment chemical and biological testing results for the Duwamish River maintenance dredging project, that 20,000 cubic yards is suitable for disposal at a PSDDA nondispersive site, whereas 8,000 cubic yards (represented by DMMU S5 and S7) are not suitable for unconfined disposal.

7. This memorandum documents the suitability of proposed dredged sediments for disposal at a PSDDA open-water disposal site. This determination of suitability does not preclude the consideration of this material for an appropriate beneficial use. It does not constitute final agency approval of the project. During the public comment period which follows a public notice, the resource agencies will provide input on the overall project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

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Table 2. Summary of DMMU Sediment Conventional Parameters and suitability for UCOWD[1].

Conventional Parameters	S1	S2	S3	S4	S5	S6	S7	Mean	Ref (CI)
DMMU Volume (cubic yards)	4,000	4,000	4,000	4,000	4,000	4,000	4,000	28,000 (total)	--
Grain Size (%):									
Gravel	2	0	0	0	0	0	0		0
Sand	29	31	36	22	32	39	31		36
Silt	59	61	54	69	58	50	60		57
Clay	10	8	10	9	10	11	9		7
Fines	69	69	64	78	68	61	69	68.3	64
Total Solids (%)	53.5	51.2	51.0	47.5	49.3	53.2	49.5	50.7	64.4
Total Volatile Solids (%)	8.0	8.4	8.5	9.0	8.8	7.8	9.0	8.5	2.2
Total Organic Carbon (%)	2.6	2.8	2.6	2.8	2.5	2.1	2.5	2.5	0.45
Bulk Ammonia (mg/Kg)	100	89	110	110	92	96	110	101	12
Total Sulfides (mg/Kg)	1,500	2,400	1,000	1,300	2,400	2,000	3,000	1,943	1.2U

Table 3. DMMU with screening level guideline exceedances[1].

Parameters	Chemical Guidelines			S1	S2	S3	S4	S5	S6	S7
	SL	BT	ML							
DMMU Volume (cubic yards)				4,000	4,000	4,000	4,000	4,000	4,000	4,000
Metals (ppm) Mercury	0.21	1.5	2.1			0.24				
Butyltins (ppb)	30	219	--		38		34			
Organics (ppb) Indeno(123cd)pyrene	69		5,200		130	80	130	120	81	110
Pyrene	430		7,300		440					
Total HPAHs	1,800		51,000		2,177		2,160	2,000		1,806
Total DDT	6.9	50	69						27	
Total PCBs	130	(38[1])	2,500	249 (9.6[1])						

1/ (ppm expressed on a carbon normalized basis)

Table 4a. Solid Phase Bioassay Performance Standards.

PARAMETER	AMPHIPOD BIOASSAY	SEDIMENT LARVAL BIOASSAY	*NEANTHES* 20-DAY GROWTH TEST	SALINE MICROTOX TES
Negative control performance	Mortality ≤ 10 %	CMA[1] ≤ 30 %	Mortality ≤ 10 % (≥ 0.72 mg-ind-day)[3]	None
Reference sediment performance	Reference mortality minus control mortality ≤ 20 %	NCMA[2] ≤ 35 % Seawater Control	Mean individual growth[4] ≥ 80 % of control	Blank-corrected light decr ≤ 20%

[1] Combined mortality and abnormality.
[2] Normalized combined mortality and abnormality relative to Seawater control$_{(final)}$
[3] Proposed control growth guideline (1995 SMARM)
[4] Expressed as mg-individual-day (dry weight)

Table 4b. Solid Phase Bioassay Interpretive Guidelines for Nondispersive sites.

BIOASSAY	NONDISPERSIVE INTERPRETATION GUIDELINES[1]	
	2-HIT	1-HIT
Amphipod (% Mortality)	Test mortality > 20% over Control mortality; Test mortality < 30% over Reference mortality, and statistically significant[2]	Test mortality > 20% over Control mortality; Test mortality > 30% over Reference mortality, and statistically significant[2]
Sediment Larval (%Combined Mort+Abnor)	Test CMA > 20% over Control CMA; Test CMA < 30% over Reference CMA, and statistically significant[2]	Test CMA > 20% over Control CMA; Test CMA > 30% over Reference CMA, and statistically significant[2]
Neanthes-20-day Growth (mg-individual-day)	Test growth < 80% or > 120% of Control growth; Test growth < 70 of Reference growth, and statistically significant[2]	Test growth < 80% or >120% of Control growth; Test growth < 50% of Reference growth, and statistically significant[2]
Saline Microtox (% light Δ)	Test light Δ > 20% over Control light Δ; Test light Δ <20% (absolute) over Reference light Δ, and statistically significant[2]	NA

1/ Test response ≤ 20% of Control response (test ≥ 80% or < 120% of control growth endpoint for *Neanthes* Bioassay) = No Hit.

2/ Statistically significant (t-test, $p<0.05$).

Table 5. Solid Phase Bioassay Results Summary for seven DMMU undergoing testing.

Dredged Material Management Units (DMMU)	Amphipod Mortality, % (*Ampelisca abdita*)	Sediment Larval Test[1] (Mussel: *Mytilus galloprovincialus*)		20-day *Neanthes* growth, mg-ind-day (% reference), mortality %	Saline Microtox % light change (reference)	DMMU Suitability
		Mort+Abnor %	Abnormality %			ND
Control	4	17.2	6.7	init. wgt = 0.7± 0.2 mg-individual 1.06 mortality = 0%	--	NA
Carr 04 (64% fines)	6	0.6	3.0	0.97 mortality = 0%	-0.13	NA
S1 (69% fines)	4	29.9[DH]	5.6	0.98 (100%) mortality = 0%	-15.33 (-21.77 ref)	yes
S2 (69% fines)	5	22.7[DH]	10.2	0.92 (93.9%) mortality = 8%	-12.12 (-21.77 ref)	yes
S3 (64% fines)	9	26.5[DH]	12.5	0.83 (84.7%) mortality = 0%	-1.4 (-21.77 ref)	yes
S4 (78% fines)	13	28.0[DH]	11.9	0.75 (76.5%) mortality = 0%	-10.55 (-21.88 ref)	yes
S5 (68% fines)	10	30.7*[SH]	10.2	0.75 (76.5%) mortality = 0%	-6.1 (-21.88 ref)	No
S6 (61% fines)	6	29.3[DH]	10.8	0.75 (76.5%) mortality = 4%	1.67 (-21.88 ref)	yes
S7 (69% fines)	13	36.5*[SH]	11.7	0.87 (88.8%) mortality = 0%	-2.54 (-21.5 ref)	No
Positive Control (LC50/EC50) TEST Lab Performance and/or DAIS (Mean ± SD)	$CdCl_2$ 0.76 mg/L Cd (DAIS: Cd 0.49 ± 0.42 mg/L)	$CuSO_4$ 12.6 μg/L EC50 29.0 μg/L LC50 11.7 ± 4.75 μg/L EC50 (Mean Lab Performance)		$CdCl_2$ 8.83 mg/L Cd EC50 6.18 ± 1.95 mg/L Cd (Mean Lab Performance) (12.5 ± 5.4 mg/L Cd DAIS)	Phenol 14.9, 19.8, 24.1 mg/L EC50 12.5 -30 mg/L EC50 (Mean Lab Performance) (20.1 ± 4.7 mg/L DAIS)	

Legend: ND = Nondispersive site suitability; SD = Standard Deviation: * = Statistically significant (t-Test; p<0.05), DH = Double Hit failure (requires two bioassay hits for DMMU to be unsuitable for nondispersove site disposal); SH = Single Hit failure under PSDDA disposal guidelines for nondispersive sites.

Coordinates shown are referenced to NAD 27 and are in feet on the SPCS 27 WA 4601. Differences between NAD 27 and NAD 83 and between SPCS 27 and SPCS 83 at the center of the sheet are shown on the diagram below. Datum conversion was performed using the computer program "CORPSCON". Metric conversions were on US Survey Foot - 1200/3937 Meter

LEGEND:

SAMPLE LOCATION ①

SURFACE DMMU

200 0 200 400
SCALE IN FEET

NOTES:

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THE TIME.

SOUNDINGS TAKEN ABOVE THE DATUM PLANE ARE PREFIXED WITH (+) SIGN

HORIZONTAL CONTROL BASED ON LAMBERT GRID PROJECTION FOR WASHINGTON NORTH ZONE.

SOUNDINGS AND ELEVATIONS ARE IN FEET AND ARE REFERRED TO PLANE OF MEAN LOWER LOW WATER.

PHOTO-MAP PREPARED BY SURVEY BRANCH, ENGINEERING DIVISION, C OF E.

PHOTOGRAPHY FLOWN: 1 JULY 1990

SURVEYS FROM 10, 11, 15, 18 MAY 1995

Sample Number	Station	Range	Est. Depth To Surface (in feet)	Est. Length Of Sample (in feet)	NAD 27 State Plane	NAD 27 Geographic	NAD 83 State Plane	NAD 83 Geographic
1	242+50	75 RIGHT	10	4	193,376.9 N 1,636,082.8 E	47 31 14.1 N 122 18 22.2 W	193,318.1 N 1,276,204.3 E	47 31 13.5 N 122 18 26.7 W
2	245+25	50 RIGHT	14	4	193,115.9 N 1,636,172.0 E	47 31 11.6 N 122 18 20.9 W	193,057.1 N 1,276,294.5 E	47 31 10.9 N 122 18 25.3 W
3	248+20	50 RIGHT	14	4	192,829.5 N 1,636,243.7 E	47 31 08.7 N 122 18 19.7 W	192,770.7 N 1,276,365.2 E	47 31 08.1 N 122 18 24.2 W
4	250+75	75 LEFT	13	4	192,611.9 N 1,636,426.2 E	47 31 06.6 N 122 18 17.0 W	192,553.1 N 1,276,547.6 E	47 31 06.0 N 122 18 21.5 W
5	252+50	CENTERLINE	13	4	192,424.0 N 1,636,395.3 E	47 31 04.8 N 122 18 17.4 W	192,365.2 N 1,276,516.8 E	47 31 04.1 N 122 18 21.9 W
6	254+10	CENTERLINE	13	4	192,268.7 N 1,636,433.6 E	47 31 03.2 N 122 18 16.8 W	192,209.9 N 1,276,555.1 E	47 31 02.6 N 122 18 21.3 W
7	256+20	75 LEFT	10	4	192,082.8 N 1,636,556.8 E	47 31 01.4 N 122 18 15.0 W	192,024.0 N 1,276,678.3 E	47 31 00.8 N 122 18 19.4 W

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U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

DUWAMISH WATERWAY

SEDIMENT CHARACTERIZATION PLAN

AUGUST 1995

SEATTLE HARBOR WASHINGTON

DWG NO. E-12-2.1-115

SHEET F

Sheet 1 of 1