CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD **March 16, 2005**

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED FEDERAL OPERATION AND MAINTENANCE DREDGED MATERIAL FROM GRAYS HARBOR, WASHINGTON (***Public Notice CENWS OD-TS-NS-12***) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE SOUTH JETTY OR POINT CHEHALIS DISPERSIVE SITES, OR AT SOUTH BEACH OR HALF MOON BAY BENEFICIAL USE SITES.

1. Introduction. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) on the suitability of material from Grays Harbor, Washington (Figure 1) for unconfined open-water disposal. The requirements for determining the suitability of this material are documented in "*Dredged Material Evaluation Procedures and Disposal Site Management Manual, Grays Harbor and Willapa Bay, Washington*" (GHDMEP, 1995). As outlined in the GHDMEP, full sediment characterization of dredged material from the federal navigation channel is required on a rotating, biennial basis for the reaches of concern in the inner portions of Grays Harbor. Under this scenario, one third of the material dredged from the Crossover, North Channel, Hoquiam, Cow Point and South Aberdeen reaches of the Grays Harbor channel is characterized every two years, resulting in characterization of the entire inner portion every six years. In Grays Harbor, no contaminant testing is required for the outer reaches of the channel (Entrance, Bar, and South channels) per exclusionary criteria specified in Section 40 CFR 230.60 of the Clean Water Act. This exclusion is based on distance from known sources of contamination, generally coarse grain sizes and the high-energy environment of these outer channel areas.

For this project an estimated 1.86 million cubic yards (mcy) of maintenance material is proposed to be dredged annually from the upstream portions of the federal navigation channel. This characterization event completes the first six-year round of testing. Approximately 1/3 of the 1.86 million cy of material (~600,000 cy) underwent GHDMEP sampling and testing in 2000, and another 1/3 was characterized in 2002. The last 1/3 of the material was sampled in 2004 and is summarized in this SDM. Disposal is anticipated to be at the Point Chehalis and South Jetty estuarine sites or at beneficial use sites nearshore or onshore of South Beach or Half Moon Bay.

Table 1. Regulatory Tracking Dates

SAP addendum received	May 26, 2004
SAP approved	June 4, 2004
Sampling dates	June 7 – 10, 2004
Data report submitted	Oct. 14, 2004
Addendum report submitted	Jan. 14, 2005
Recency Determination: Low Concern (6 years)	June 2010
DAIS reference number	GRAYS-1-B-F-199

Table 2. Project Synopsis.

Time of proposed dredging	Annually, February through August, except during fish windows
Proposed disposal sites	Point Chehalis and South Jetty open water dispersive sites; Half Moon Bay and/or South Beach nearshore beneficial use sites, or HMB direct beach nourishment, as needed and approved.
Sediment ranking	Low
Project last dredged	Annually

2. Background. Dredging of the Grays Harbor navigation channel takes place annually to maintain the channel at the authorized depth. Characterization of this channel is not project specific, per the GHDMEP, but performed on a rotating basis. This approach characterizes the dredging volume over time (six years) rather than for a specific dredging event. The low rank of the area, and results from over a decade of sampling in the area continue to support this approach.

The second six-year rotation of sampling and testing based on the GHDMEP began in the year 2000. In order to plan holistically for this entire round of sampling, a programmatic sampling and analysis plan was prepared (Striplin 2000). This PSAP looked at historic dredging volumes in various reaches of the navigation channel and devised a strategy for insuring that the sampling adequately represented those volumes. A SAP addendum is prepared each year to address sampling issues specific to the given sampling and testing event.

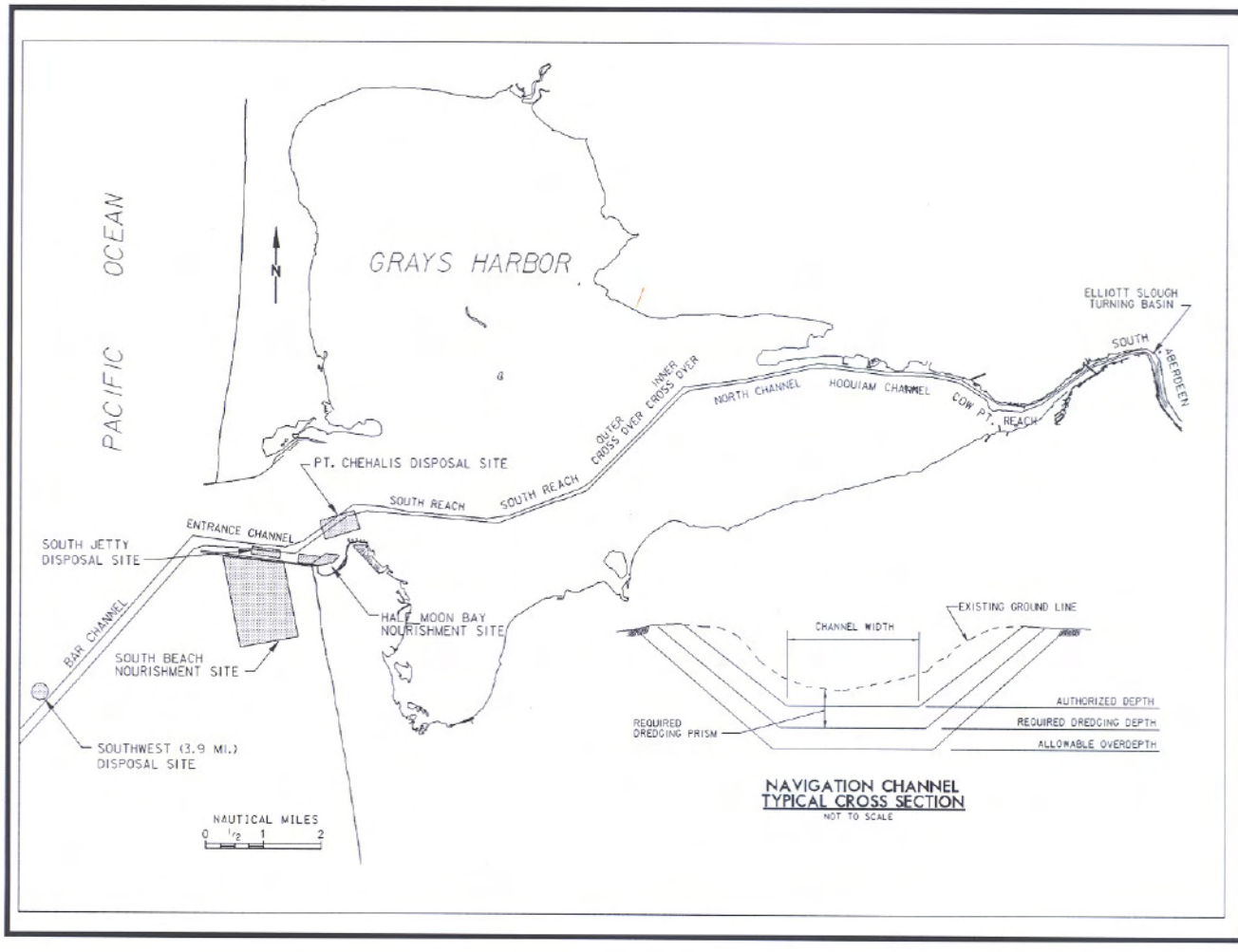

Figure 1. Grays Harbor navigation project. Samples in the DY 2005 characterization were from the Cow Point, Aberdeen and South Aberdeen reaches.

3. Sampling. Sediment sampling took place from June 7 to June 10, 2004. Because the dredging year, as defined by the DMMP, begins on 16 June, this characterization is considered to be a DY 2005 project. As in the past

the area was ranked "low," and the material available for dredging was considered homogenous. The approved programmatic and 2004 addendum sampling and analysis plans were followed, and quality assurance/quality control guidelines specified by the GHDMEP sampling and testing guidelines were generally complied with.

The field sampling effort included collection of 75 sediment grab samples for compositing into 11 dredged material management unit (DMMU) composite samples. Samples came from the upstream portion of the navigation channel (including Cow Point, Aberdeen and South Aberdeen reaches). Sediment collection proved difficult in several DMMU due to accumulations of wood waste on the sediment surface that prevented the grab sampler from closing completely, thus losing the sample. Sample locations were adjusted if possible in order to obtain adequate sample for the composite. However, due to wood waste issues, fewer than 8 samples were taken in DMMUs C1, C7, C8, C9 and C10, as noted in Table 3 below.

The sampling effort also included collection of reference sediment from the North Bay area of Grays Harbor in anticipation of performing confirmatory bioassays. Conventional parameters measured in these 11 DMMU samples are depicted in Table 3.

Table 3. Sediment conventional results.

	COMMENTS			bioassay		bioassay							reference	retest
	DMMU	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	GHS7	GHS7
	# of samples	5	8	8	8	8	8	6	6	7	3	8	---	---
	Reach	Cow Point			Aberdeen Reach					S. Aberdeen Reach			North Bay	
	Volume (cubic yards)	60,000	60,000	60,000	63,000	64,000	62,000	60,000	64,000	62,000	64,000	64,000	n/a	n/a
GRAIN SIZE	% Gravel	0.0	0.1	0.1	0.4	0.1	0.0	3.7	8.8	49.5	0.4	0.2	0.0	0.11
GRAIN SIZE	% Sand	33.3	20.9	22.7	50.3	51.1	76.9	85.6	90.6	53.1	95.5	94.7	37.6	51.3
GRAIN SIZE	% Silt	56.7	70.7	65.1	42.6	43.9	22.3	5.5	2.3	1.1	4.2	5.1	47.2	35.7
GRAIN SIZE	% Clay	12.7	13.0	14.4	10.7	9.7	5.8	3.6	2.0	0.7	2.3	2.7	18.7	13.4
GRAIN SIZE	(clay+silt) % Fines	**69.4**	**83.7**	**79.5**	**53.3**	**53.6**	**28.1**	**9.1**	**4.3**	**1.8**	**6.5**	**7.8**	**65.9**	**49.1**
	Total Solids, %	48	36.7	41.2	49.9	49.2	61.7	71.6	73.8	81.9	70.1	69.6	47.8	54.4
	Volatile Solids, %	6.45	7.89	7.63	6.25	6.37	4.06	3.54	3.44	1.85	2.72	3.03	6.67	6.16
	Total Organic Carbon, %	1.86	2.48	2.26	1.61	1.82	0.80	0.74	0.77	0.20	0.40	0.57	0.64	1.67
	Total Sulfides, mg/kg	17.6	1.7	1.0	0.8	11.4	0.7	1.5	2.2	0.9	1.7	2.0	no data	5.8
	Total Ammonia, mg N/kg	43.1	32.3	24.2	29.5	35.4	17.4	3.9	0.7	nd	1.7	4.3	32.5	21.3

4. <u>Chemical Analysis</u>. The Agencies' approved sampling and analysis plan was followed and quality assurance/quality control guidelines specified by PSEP and DMMP were generally complied with. Chemical analysis results (Table 4) demonstrated that all dredged material management units characterized showed no detected chemical exceedances of DMMP screening levels.

The GHDMEP suggests analysis of special "chemicals of concern" for the Grays Harbor area. These analyses are in addition to the suite of chemical analyses routinely required for DMMP testing. Guaiacols and resin acids were considered special COCs for this characterization. No guaiacols were detected in any sample. Low levels of two out of four resin acids were detected in one sample (C3), but the levels detected were much lower than levels generally associated with environmental or human health effects (Word *et al* 1990). It is important to note that the DMMP does not have interpretive criteria for these chemicals. This detection was a major reason for choosing C3 as one of the DMMU for confirmatory bioassay testing.

It should also be noted that the undetected levels of several chemicals exceeded the DMMP SL. In general, such exceedances require bioassays for those DMMUs with any exceedances of DMMP SLs, whether detected or undetected. In this case, since the only exceedances were of undetected chemicals, confirmatory bioassays on two of the DMMU with undetected exceedances were considered suitable follow-up bioassay testing for this project.

Table 4. Chemical results from GH characterization. Only detects and elevated non-detects are reported.

	DMMP Chemical of Concern		SL	BT	ML	CPA-01	CPA-02	CPA-03	CPA-04	CPA-05	CPA-06	CPA-07	CPA-08	CPA-09	CPA-10	CPA-11
Metals	Antimony	mg/kg	150		200									0.06 U,N	0.06 U,N	0.05 U,N
	Arsenic	mg/kg	57	507.1	700	5.3	5.46	5.38	4.79	4.35	3.79	3.72	3.26	2.29	3.09	2.81
	Cadmium	mg/kg	5.1	11.3	14	0.178	0.216	0.204	0.182	0.209	0.174	0.155	0.132	0.088	0.139	0.131
	Chromium	mg/kg		267		24.8	27.3	28.2	25	26.1	29.8	29.4	29.3	21.2	30.9	28.4
	Copper	mg/kg	390	1027	1300	33.9	40.5	39	36.5	43.8	39.6	34.8	38.5	30.9	38.8	35.1
	Lead	mg/kg	450	975	1200	6.53	8.08	7.32	6.45	7.37	5.37	5.38	3.73	2.24	3.9	3.55
	Mercury	mg/kg	0.41	1.5	2.3	0.04	0.06	0.05	0.04	0.04	0.03	0.02	0.01 B	0.01 B	0.02	0.01 B
	Nickel	mg/kg	140	370	370	19.3	20.5	20.3	20.8	22.9	25.9	27.6	31.5	25.2	29.5	28.2
	Selenium	mg/kg		3		1.3	1.6	1.5	0.9	1	0.7 B	0.5 B	0.5 B	0.4 B	0.5 B	0.4 B
	Silver	mg/kg	6.1	6.1	8.4	0.09	0.117	0.108	0.087	0.092	0.056	0.035	0.031	0.021 B	0.042	0.034
	Zinc	mg/kg	410	2783	3800	51.3	57.1	55.8	51.4	58.3	59	56.4	55.3	41.6	59	53.7
SVOCs	Total LPAH	ug/kg	5200		29000	8.2	9.1	18.2	18.3	18	2.9	8.6	20.8	5.9		
	Naphthalene	ug/kg	2100		2400	3.2 J		3.8 J	4.9 J	3.2 J		2.4 J				
	Acenaphthylene	ug/kg	560		1300											
	Acenaphthene	ug/kg	500		2000			3.4 J	3.4 J	3.8 J			1.4 J			
	Fluorene	ug/kg	540		3600											
	Phenanthrene	ug/kg	1500		21000	5.0 J	9.1 J	11 J	10	11	2.9 J	6.2 J	16	5.9 J		
	Anthracene	ug/kg	960		13000								3.4 J			
	2-Methylnaphthalene	ug/kg	670		1900				3.1 J	2.5 J						
	Total HPAH	ug/kg	12000		69000	19	41.8	43.7	18.6	31.4	7	15.7	74.8	113.5		
	Fluoranthene	ug/kg	1700	4600	30000	6.7 J	13 J	12 J	8.3 J	10 J	4.1 J	7.4 J	20	20		
	Pyrene	ug/kg	2600	11980	16000	5.9 J	12 J	10 J	6.7 J	8.9 J	2.9 J	5.8 J	20	20		
	Benzo(a)anthracene	ug/kg	1300		5100	3.0 J	5.9 J	5.3 J		3.7 J			6.1 J	12		
	Chrysene	ug/kg	1400		21000	3.4 J	6.0 J	6.0 J	3.6 J	4.9 J		2.5 J	6.7 J	15		
	Total benzofluoranthenes (U=0)	ug/kg	3200		9900			6.3					6.7	19.8		
	Benzo(a)pyrene	ug/kg	1600		3600		4.9 J	4.1 J		3.9 J			6.0 J	11		
	Indeno(1,2,3-cd)pyrene	ug/kg	600		4400								4.6 J	8.2 J		
	Dibenzo(a,h)anthracene	ug/kg	230		1900											
	Benzo(g,h,i)perylene	ug/kg	670		3200								4.7 J	7.5 J		

	DMMP Chemical of Concern		SL	BT	ML	CPA-01	CPA-02	CPA-03	CPA-04	CPA-05	CPA-06	CPA-07	CPA-08	CPA-09	CPA-10	CPA-11
Chlorinated Hydrocarbons	1,3-Dichlorobenzene	ug/kg	170													
	1,4-Dichlorobenzene	ug/kg	110		120											
	1,2-Dichlorobenzene	ug/kg	35		110											
	1,2,4-Trichlorobenzene	ug/kg	31		64											
	Hexachlorobenzene	ug/kg	22	168	230											
Phthalates	Dimethylphthalate	ug/kg	1400													
	Diethylphthalate	ug/kg	1200													
	Di-n-butylphthalate	ug/kg	5100							5.4 J		4.0 J		3.5 J		4.1 J
	Butylbenzylphthalate	ug/kg	970													
	bis(2-Ethylhexyl)phthalate	ug/kg	8300			6.2 J	7.9 J	7.7 J	7.6 J	12 J	3.5 J	5.1 J	15 J	12 J	4.0 J	3.1 J
	Di-n-octylphthalate	ug/kg	6200													
Phenols	Phenol	ug/kg	420		1200	35	36 J	41	34	21 J	18 J	25 J	14 J	13 J	12 J	18 J
	2-Methylphenol	ug/kg	63		77											
	4-Methylphenol	ug/kg	670		3600	8.7 J	16	14	10	7.1 J						
	2,4-Dimethylphenol	ug/kg	29		210	52 U†	68 U†	61 U†	50 U†	51 U†	50 U†	50 U†	50 U†	50 U†	50 U†	50 U†
	Pentachlorophenol	ug/kg	400	504	690	33 J				32 J						
Miscellaneous Extractables	Benzyl alcohol	ug/kg	57		870				20							
	Benzoic acid	ug/kg	650		760											
	Dibenzofuran	ug/kg	540		1700											
	Hexachloroethane	ug/kg	1400		14000											
	Hexachlorobutadiene	ug/kg	29		270											
	n-Nitrosodiphenylamine	ug/kg	28		130											
VOCs	Trichloroethene	ug/kg	160		1600											
	Tetrachloroethene	ug/kg	57		210											
	Ethylbenzene	ug/kg	10		50	11 U†	14 U†	12 U†		10 U†						
Pesticides	Total DDT (U=0)	ug/kg	6.9	50	69				0.33			0.37				
	Aldrin	ug/kg	10													
	Total chlordane (PSDDA)	ug/kg	10	37			0.56									
	Dieldrin	ug/kg	10													
	Heptachlor	ug/kg	10				0.56 JP									
	alpha-BHC	mg/kg-OC		10												
	gamma-BHC (Lindane)	ug/kg	10													

	DMMP Chemical of Concern		SL	BT	ML	CPA-01	CPA-02	CPA-03	CPA-04	CPA-05	CPA-06	CPA-07	CPA-08	CPA-09	CPA-10	CPA-11
PCBs	Total PCBs (U=0)	ug/kg	130		3100											
	Total PCBs (U=0)	mg/kg-OC		38												
Resins	3,4,5-Trichloroguaiacol	mg/kg														
	Tetrachloroguaiacol	mg/kg														
	Abietic acid	mg/kg														
	Dehydroabietic acid	mg/kg						3.6								
	Isopimaric acid	mg/kg						0.73								
	Pimaric acid	mg/kg														

Notes:

DMMU shaded in yellow were those selected for confirmatory bioassay testing

† MDL meets or exceeds Screening Level criteria

U - Chemical was undetected at the reported concentration.

J - Estimated concentration when the value is less than the calculated reporting limit.

5. QA/QC. All precision and accuracy goals were met by the analytical laboratory. The following table represents Q\A/QC goals for the DMMP program which have been applied for this project.

Table 5. QA/QC requirements for chemical analysis in the DMMP program.

QA ELEMENT		WARNING LIMITS	ACTION LIMITS
Precision	Metals	None	20% RPD or COV
	Organics	35% COV	50% COV or a factor of 2 for duplicates
Matrix Spikes	Metals	None	75-125% recovery
	Organics:[1] ▪ Volatiles ▪ Semivolatiles and Pesticides	▪ 70-150% ▪ 50-150%	None (zero percent recovery may be cause for data rejection however)[2]
Reference Materials	Metals	None	95% CI if specified for a particular CRM; 80-120% recovery if not.
	Organics	None	95% CI for CRMs. No action limit for uncertified RMs.
Surrogate Spikes	Organics ▪ Volatiles ▪ Pesticides ▪ Semi-volatiles	▪ 85% minimum recovery ▪ 60% minimum recovery ▪ 50% minimum recovery	EPA CLP chemical-specific recovery limits

[1] Warning limits set at the CLP advisory limits for matrix spike duplicates for those chemicals covered under CLP.
[2] Rigorous control limits are not recommended due to possible matrix effects and interferences.

6. Biological Testing. The standard suite of three bioassay tests (amphipod toxicity, larval mortality/abnormality, and *Neanthes* growth) was performed on sediments chosen for safety-net testing. 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 6). 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 (Table 8). 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 7). Because there was no statistically significant difference between test and reference growth, the sample passed DMMP guidelines. The DMMP will be requesting further inquiries into potential sources to this DMMU and off-year sampling.

Table 6. Initial 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 7. 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				

Table 8. Bioassay performance summary.

Bioassay	Negative Control Performance Standard	Positive Control Performance (PSEP Guidelines)	Reference Sediment Performance Standard
Amphipod	0% mortality ≤ 10%; pass		12% ref. mortality – 8% control mortality ≤ 20%; pass
Larval	6% CMA ≤ 30%; pass		3.9% NCMA = ≤ 35%; pass
Neanthes growth 1st test	8% mortality ≤ 10% 0.77 MIG ≥ 0.38 ☺	Reference toxicant control treatments mean survival = 70%, below PSEP criterion of 90% ☹	12% mortality ≤ 20% 122% ref MIG ≥ 80% control MIG ☺
Neanthes growth 2nd test	0% mortality ≤ 10% 1.26 MIG ≥ 0.38 ☺	Reference toxicant control treatments mean survival = 100%, above PSEP criterion of 90% ☺	0% mortality ≤ 20% 75% ref MIG NOT ≥ 80% control MIG; ☹

CMA = Combined mortality and abnormality
NCMA = Normalized combined mortality and abnormality (normalized to seawater control)
MIG – mean individual growth (mg/day/worm)

7. Suitability. This memo documents the suitability of all proposed dredged sediments in the Grays Harbor navigation channel for open water disposal. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the GHDMEP program. Based on the results of the chemical and biological testing and the discussions above, the DMMP agencies concluded that the total dredging volume of 1.86 million cubic yards remains suitable for open water disposal. Open water disposal may be at the South Jetty or Point Chehalis estuarine disposal site, or at an approved beneficial use (nearshore or onshore) site. However, this suitability determination does not constitute final agency approval of the project.

9. References.

Anchor Environmental Associates, Inc. 2004. Data Report: Sediment characterization results for Grays Harbor maintenance dredging, FY 2004. Prepared for the Seattle District, US Army Corps of Engineers, October 2004.

Striplin Environmental Associates, Inc. 2000. Programmatic Sampling and Analysis Plan: Sediment characterization for Grays Harbor Maintenance Dredging, FY 2000 – 2006. Prepared for the Seattle District, US Army Corps of Engineers, 7 July 2000.

Word, J.Q., Ward, J.A. and Squires, A.L. 1990. Results of chemical, toxicological, and bioaccumulation evaluations of dioxins, furans, and guaicol/organic acids in sediments from the Grays harbor/Chehalis River area. Prepared for the US Department of Energy , September 1990.

Concur:

3/16/05
Date

Lauran Cole Warner, Seattle District Corps of Engineers

Date

for John Malek, Environmental Protection Agency

3/17/05
Date

Tom Gries, Washington Department of Ecology

March 17, 2005
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