DOUGLAS HARBOR

Dredged Disposal Test Summary

5 March 2010

Juneau, Alaska

Outline

- Background
- Project Collaboration
- Testing Guidance
- Objectives
- Test Design and SAP
- Test Results
- Comparison to Guidance & Regulatory Values

Background

- This is **Not** Site Designation; site previously approved for use by USEPA/USACE
- Disposal analysis options for Inland (404) or MPRSA (Ocean) unconfined disposal of dredged materials
  - Federal guidance is based on effects-based testing not simply *sediment* or *water* chemistry
  - Data interpretation is consistent nationally and described in two joint publications by USACE/USEPA; states can increase level of scrutiny
  - Statistical and biological Comparisons relative to Reference sites
    - Reference sites are similar to disposal sites but without any signs of historical disposal.
- Testing provides scientific FACTUAL information and conclusions can be used to make informed decisions

Background (Continued)

- Factual Information includes:
  - Physical and chemical spatial data collected from representative quantities of dredged material
  - Modeling
    - STFATE modeling to assess potential adverse biological effects extending outside of boundaries
    - STFATE modeling to assess chemical-specific water quality exceedance within or outside of the boundary of the disposal site
  - Biological response data
    - Bedded sediment biological response data with representative /sensitive species of benthic organisms
    - Suspended sediment acute and sublethal toxicity with sensitive species, including abnormal development of bivalve or echinoderm larvae
    - Bioaccumulation data to assess:
      - Body burden and potential adverse biological effects (ecological assessment)
      - Body burden and food web modeling to determine potential effects within food web, including human health

Objectives

- Collect test sediment to project depth using a vibratory or push core.
- Collect reference sediment from the proposed reference area (five spatial replicates and one reference composite made from five spatial replicates) using a Van Veen grab.
- Conduct toxicity testing of test, reference, and control sediments using ITM methods for water-column toxicity, benthic toxicity, and bioaccumulation potential.
- Measure mercury concentrations in sediment, pore water, and tissue.
- Prepare a detailed interpretative report of methods, results, and a comparison of test and reference materials using ITM guidance for test acceptability and evaluation criteria.

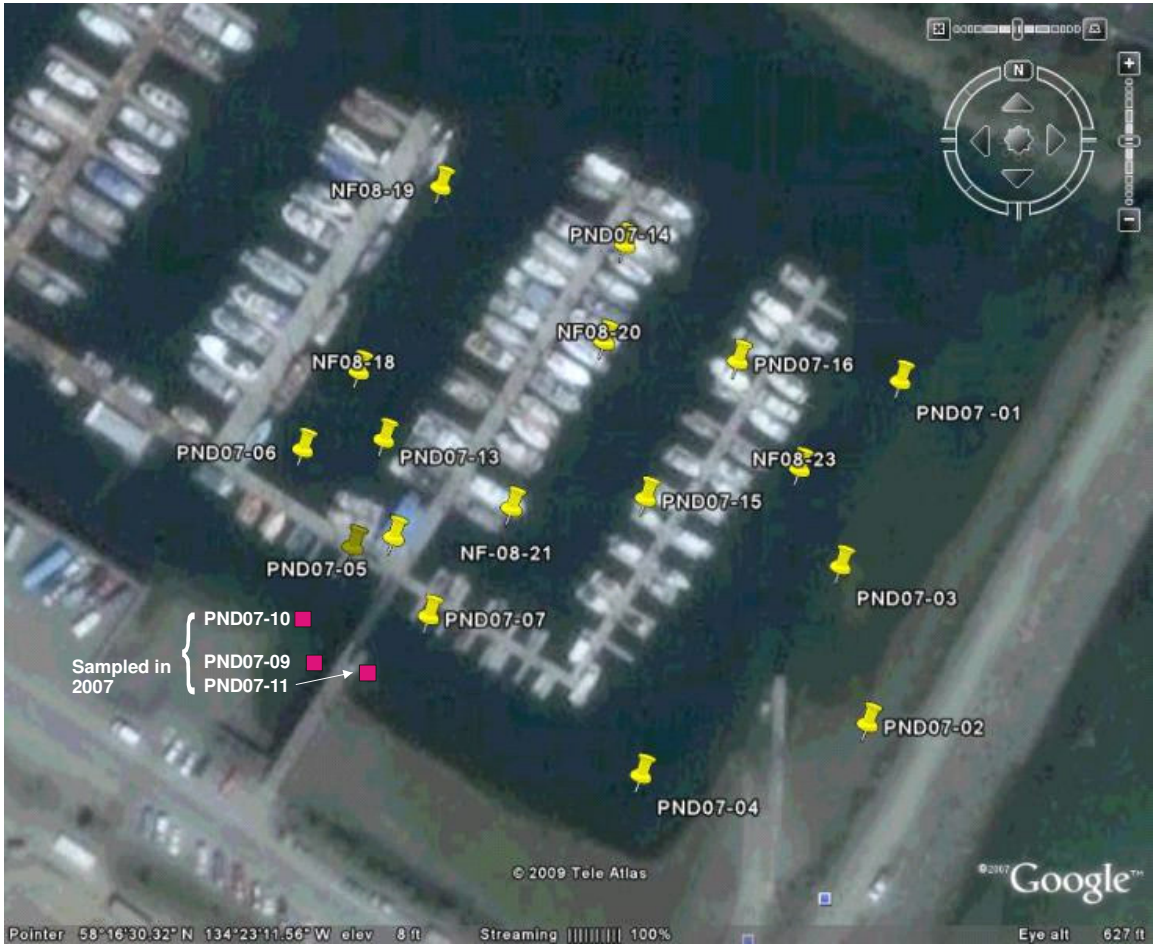
Testing Design

- Project SAP was reviewed, modified and approved by agencies prior to testing; sampling site and testing site visits
- Protocols followed ITM with Tier II/III/IV analysis
  - Collected sediment to project depth (-14 ft MLLW) using a vibratory or a push core.
  - Collected reference sediment from proposed reference area using approach approved by agencies.
  - Conducted toxicity testing for water-column, benthic toxicity, and bioaccumulation potential disposal site modeling.
  - Measured a selected suite of potential contaminants of concern in sediment, pore water, and tissue.

Field Sampling Information

Date	Station	Comp.	Latitude	Longitude	MLLW Water Depth	Number of Cores	Core Length (ft)	Upper Composite (ft)	Lower Composite (ft)
11/17/08	PND07-01	1	58° 16.513	134° 23.131	-6	1	10.5	1.3	8
11/21/08	PND07-02	1	58° 16.478	134° 23.138	+8	3	1.5/1.5/1.5	1 each	0
11/21/08	PND07-03	1	58° 16.494	134° 23.143	+8	3	1.5/1.5/1.5	1 each	0
11/18/08	PND07-04	1	58° 16.473	134° 23.182	-10	1	3.0	2	1
11/18/08	PND07-05	2	58° 16.497	134° 23.230	-9	2	4.5/3.1	1.8/1.8	2.7/1.4
11/18/08	PND07-06	2	58° 16.506	134° 23.248	-9	2	4.2/3.0	1.7/1.7	2.5/1.3
11/19/08	PND07-07	2	58° 16.489	134° 23.223	-8.5	2	2.6/1.5	1/1	1.6/0.5
11/18/08	NF08-17	2	58° 16.496	134° 23.238	-9	2	3.9/5.0	1.7/2.7	2.2/2.3
11/21/08	PND07-14	4A	58° 16.527	134° 23.185	-10	1	1.0	1	0
11/18/08	PND07-16	4A	58° 16.515	134° 23.163	-11	1	2.5	1.3	1.2
11/19/08	NF08-19	4A	58° 16.533	134° 23.221	-10.5	1	4.6	3	2.6
11/18/08	NF08-20	4A	58° 16.517	134° 23.189	-10.5	1	7.5	2	2.5
11/19/08	NF08-23	4A	58° 16.504	134° 23.151	-9	1	6.0	3	3
11/19/08	PND07-13	4B	58° 16.507	134° 23.232	-11.5	1	4.0	1.3	1.7
11/18/08	PND07-15	4B	58° 16.501	134° 23.181	-11	1	4.2	1.6	2.6
11/19/08	NF08-18	4B	58° 16.514	134° 23.237	-7.5	1	5.2	4.8	0.4
11/19/08	NF-08-21	4B	58° 16.500	134° 23.207	-9	1	5.2	2.5	2.7
11/19/08	NF08-22	4B	*58° 16.485	134° 23.175	-9.5	1	4.2	2.3	1.9

Locations within Douglas Harbor

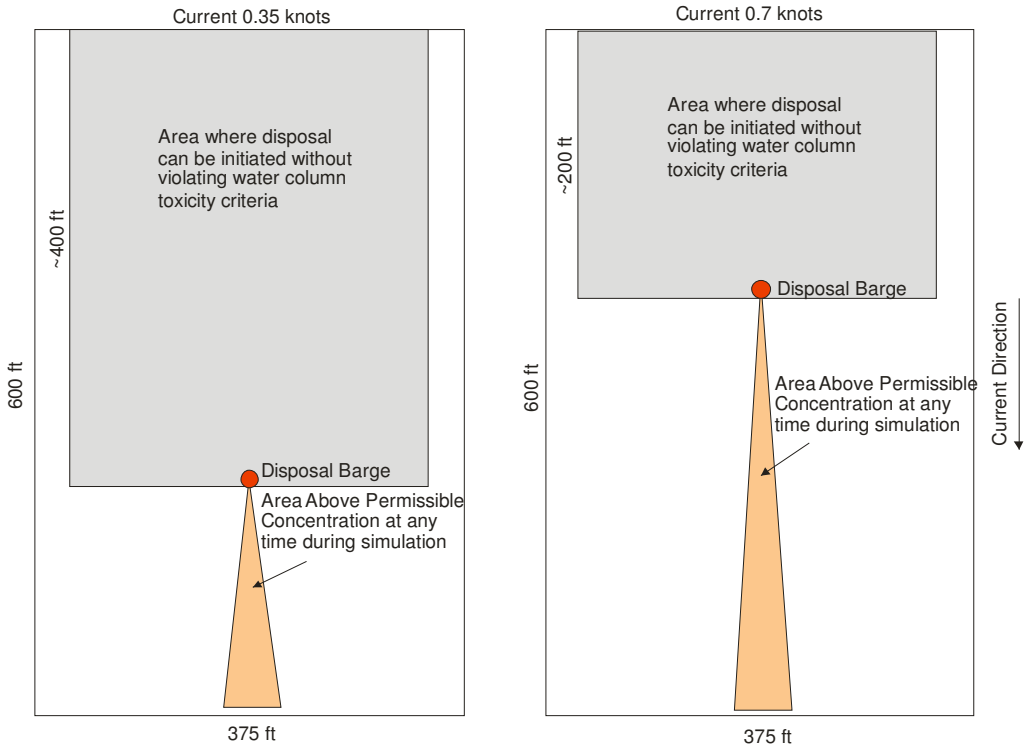


Toxicity Test Results

Summary Results	Area 1	Area 2	Area 4A	Area 4B	Area 4B Acclimated	Lower Comp	Lower Comp Acclimated
Benthic (% survival)	composites pass ITM/ PSDDA Evaluation Criteria						
A. abdita	92	92	90	87	94	76	94
N. arenaceodentata	96	88	92	100	NA	84	NA
Water-column (LC_{50} or EC_{50})	Composites pass Water Column Criteria (ST Fate Model)						
A. bahia	>100%	>100%	>100%	>100%	NA	>100%	NA
M. beryllina	>100%	>100%	>100%	>100%	NA	>100%	NA
Mytilus. Sp.	>100%	87.3	74.6	42.2*	NA	> 100%	NA
Mean Total Mercury Conc. (mg/kg wet)	Environmental Effects Protection of 95% all acute, chronic, and sublethal responses ERED NOED ≤0.09 ERED LOED ≤ 0.23 (n=242 and 92 respectively) – presumed to be on methyl Hg which are the principal Hg compound in biological tissues						
M. nasuta	0.027	0.052	0.039	0.041	NA	NA	0.213
N. caecoides	0.008	0.012	0.010	0.009	NA	NA	0.027
* Effect in water column assessment is related to ammonia concentration in sample							

ST Fate Model Output

- Modeling Runs
  - Tier III option to determine compliance with toxicity assessments
  - Tier II for Hg water quality criteria during disposal
- Tier III - Toxicity effects contained within the disposal site at both average and maximum tidal currents
- Tier II
  - Maximum Hg porewater concentrations observed in the Douglas Harbor sediments (0.029 µg/L) did not exceed the lowest Alaska water quality standard in Table 1 (0.051 µg/L) at any time during the one-hour simulation
  - A porewater concentration 250 times higher than the maximum observed concentration would be needed to violate the criteria at 1.5 minutes after initiation of the disposal operation, at 3 minutes the violation ends. Violation is only at the site of disposal barge.



Specialized Mercury Analysis

- Battelle Marine Sciences Laboratory conducted the mercury analysis. High reputation among analytical laboratories for conducting mercury analysis.
- Helped EPA develop the standardized procedure for methyl Hg assessment in sediment. Validation study participant.
- Total and methyl mercury were analyzed in sediment; total, dissolved, and methyl Hg were analyzed in pore water and total mercury was analyzed in tissues of test organisms.

Porewater Mercury Concentrations

Station Composite	Volume cy	Pore Water	
		Total Hg	Measured Methyl Hg
		ng/L	ng/L
Station 1	2000	13.1	0.35
Station 2	900	25.3	0.23
Station 4A	5300	14.8	0.38
Station 4B	5900	17.4	0.23
Lower Composite	15400	29.2	0.979
Weighted Mean Upper		16.3	0.303
Weighted Mean Lower		29.2	0.98
Weighted Mean Combined		23.0	0.66

Comparisons to Alaska Administrative Code

	Water	
	Total Hg ng/L	Methyl Hg ng/L
Comparison to 18 ACC 75, Table C		
Groundwater Cleanup Level	2000	3700
Comparison to Water Quality Criteria (ADEC 2008)		
Aquatic Life, Fresh Water CMC	1400	
Aquatic Life, Fresh Water CCC	770	
Aquatic Life, Marine Water CMC	1800	
Aquatic Life, Marine Water CCC	940	
Human Health Water+Aquatic Org	50	
Human Health Aquatic Org Only	51	
Douglas Harbor Porewater Concentrations		
Weighted Mean Upper	16.3	0.303
Weighted Mean Lower	29.2	0.98
Weighted Mean Combined	23.0	0.66

Mercury Concentrations in Sediment

Station Composite	Volume cy	Sediment (dry weight) Total Hg µg/g	Sediment (dry weight) Measured Methyl Hg µg/g
Station 1	2000	1.11	0.0025
Station 2	900	2.5	0.0008
Station 4A	5300	3.22	0.0013
Station 4B	5900	2.33	0.0011
Lower Composite	15400	2.24	0.0026
Reference Composite	NA	0.226	0.00028
Weighted Mean Upper		2.50	0.0014
Weighted Mean Lower		2.24	0.0026
Weighted Mean Combined		2.37	0.0020

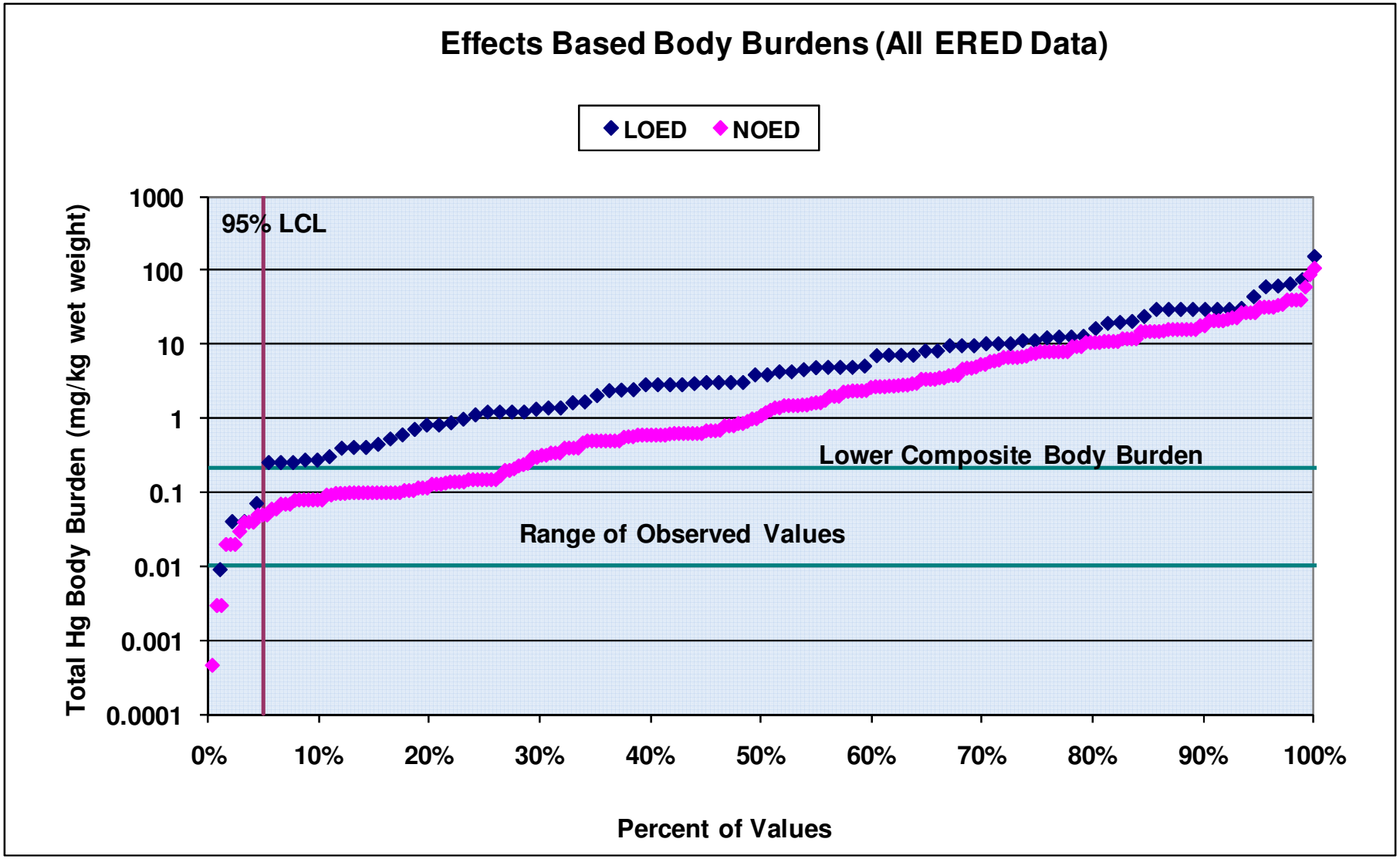
Comparison to 18 AAC 75, Table B1	Total Hg µg/g	Methyl Hg µg/g
Soil Cleanup Level, Direct Contact	25	0.0063
Migration to Groundwater	1.4	0.000012

Tissue Concentrations (ppm)

Summary Results	Area 1	Area 2	Area 4A	Area 4B	Lower Comp Acclimated*
Mean Total Mercury Concentration (mg/kg wet weight)					
M. nasuta	0.027	0.052	0.039	0.041	0.213
N. caecoides	0.008	0.012	0.010	0.009	0.027
Mean Estimated Methyl Hg (mg/kg wet weight)					
M. nasuta	0.012	0.023	0.017	0.018	0.094
N. caecoides	0.004	0.005	0.004	0.004	0.012

* Lower comp acclimated to reduce sulfide concentrations and create an aerobic biogenically active microbial layer near the sediment water interface

ERED Graph – Ecological Effects



Bioaccumulation Potential

Station Composite	Pore Water (ng/L)		Estimated Volume cy	Macoma (wet weight)			Nepthys (wet weight)		
	Total Hg ηg/L	Methyl Hg ηg/L		Total Hg	Estimated Methyl Hg	Project BAF	Total Hg	Estimated Methyl Hg	Project BAF
				mg/kg	mg/kg	X 10^5	mg/kg	mg/kg	X 10^5
Station 1	13.1	0.347	2000	0.03	0.012	0.34	0.008	0.003	0.08
Station 2	25.3	0.225	900	0.05	0.023	1.0	0.012	0.005	0.22
Station 4A	14.8	0.382	5300	0.04	0.017	0.45	0.010	0.004	0.11
Station 4B	17.4	0.225	5900	0.04	0.018	0.8	0.009	0.004	0.17
Lower Composite	29.2	0.979	15400	0.21	0.092	0.94	0.027	0.012	0.12
Reference Comp	8.83	0.433	NA	0.016	0.007	0.16	0.008	0.004	.09
Maximum/Mean Estimated Trophic 4 methyl Hg Projection[b] - Lower Composite				0.157/0.105[c]					
Estimated Trophic Level 4 Projection[b] - Reference Composite				0.069					

a Project BAF is Tissue methylHg concentration/Pore Water methylHg Concentration

b BAF values from OHHEA 2006 used to calculate estimated trophic level IV tissue levels = 1.6 X 10^5

c Tissue level for unrestricted consumption of fish and shellfish is ≤0.15 mg/kg wet (Verbrugge 2007).

Tissue Level Comparisons

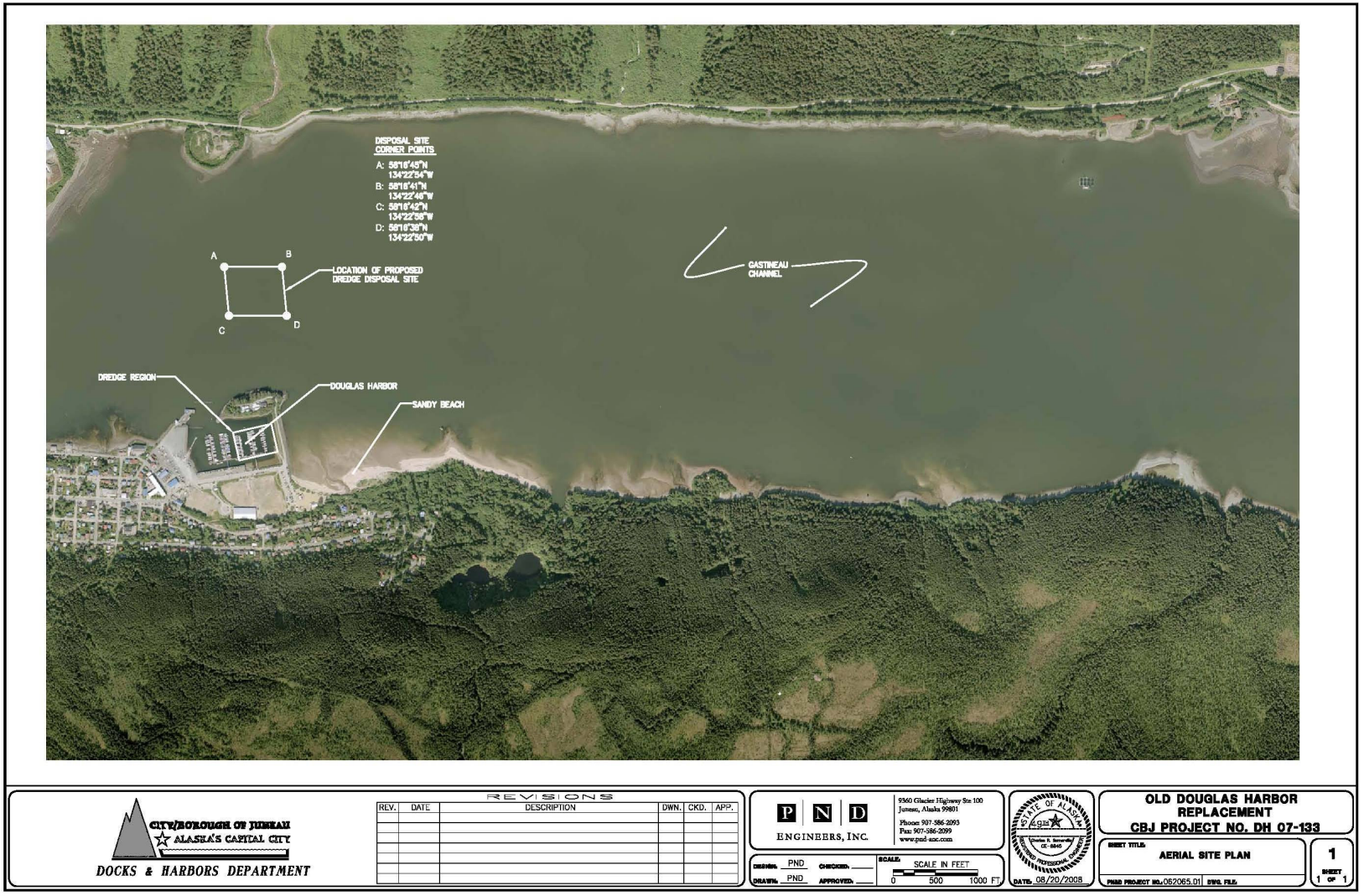
Guidance Value (mg/kg Wet)	Protection Level	Source
0.003 to 0.09	Methyl Hg concentration range for bioaccumulation exposures	NewFields, 2009
0.04	Human health protection level suggested by USEPA	McLerran letter 2 March 2010
0.09	NOED 95% protection level all acute, chronic and sublethal responses (n=243)	ERED, 2010
0.094 to >0.533	USEPA for estimated trophic level 4	McLerran letter 2 March 2010
0.105	Weighted mean of tropic level 4 concentration from BAF calculation using pore water and translator values	NewFields, 2009 and OHHEA, 2006
0.11	Aquatic Dependant Wildlife Target Threshold Values	RSET 2009*
0.12	Deep water Aquatic Dependant Wildlife	RSET 2009*
0.15	Unrestricted Consumption of fish and shellfish	Verbrugge, 2007
0.157	Maximum predicted Trophic level 4 concentration from BAF calculation using pore water and translator values.	NewFields, 2009 and OHHEA, 2006
0.2	Protective Body Burden	Beckvar et al., 2005
0.2	95% of all LOED Acute, chronic and sublethal responses (n=93)	ERED, 2010
0.3	Ambient Criteria for methyl Hg in fish	OHHEA 2006
0.32	Protective level for women and children under 12 for 16 meals/month and 170 g portions. All others unrestricted	Verbrugge, 2007

* RSET bioaccumulation assessment values are under review and have not been adopted by the region.

Summary

- Elevated sediment Hg values
- No bedded sediment toxicity
- No suspended sediment toxicity outside of disposal site boundaries
- Tissue concentrations <NOED to <LOED
- Tissue burdens do not predict direct acute, chronic or sublethal toxicity to test organisms
- Modeled uptake to Trophic Level 4 from pore water (BAF determination) methyl Hg concentrations < 0.15 mg/kg wet weight for weighted mean of all stations and less for all but one station.
  - Lower composite maximum is 0.157 mg/kg
    - unrestricted consumption level for Alaska is 0.15 mg/kg
    - 0.32 mg/kg is unrestricted for all groups except pregnant women and children; consumption guidance is restricted to 16, 6-oz meals per month.

Gastineau Channel Disposal Site



Practicable Alternative Analysis

- Confined disposal behind Douglas Harbor retaining wall extension
  - Insufficient storage capacity
- Confined disposal beneath expanded Douglas Harbor parking lot
  - Insufficient storage capacity
  - Property ownership issues
  - Construction not feasible due to steepness of slope
- Confined disposal at Treadwell Mine cave-in
  - Insufficient storage capacity
  - Opposition from historical societies
  - Groundwater infiltration possible
- Confined disposal on tidelands near Thane Ore House
  - DNR will not transfer land to CBJ because not seen as beneficial use of tidelands
- Confined disposal at AML storage yard
  - Cost prohibitive
  - Timing, temporary material storage issues

Practicable Alternative Analysis

- Upland disposal at Fish Creek Quarry
  - Denied use by CBJ Land & Resources
- Upland disposal at depressions within Treadwell Mine complex
  - Insufficient storage capacity
  - Opposition from historical societies, CBJ Parks & Recreation
  - Access road construction across existing tidelands required
- Upland disposal at Juneau Waste Management Landfill
  - No final decision of acceptance due to lack of non-permeable liner system and limited remaining landfill capacity
  - Cost prohibitive
- Upland disposal in an approved landfill in Washington or Oregon
  - Exceedingly cost prohibitive
- COE evaluate disposal options for material dredged from COE navigation basin
  - Different conclusions unlikely
- Do nothing
  - Southern portion of harbor will need to be shut down resulting in the loss of (120) slips and $200,000 in annual revenue for CBJ