Water Body No. WA-01-0050
Segment No. 01-01-03

DEPARTMENT OF ECOLOGY 93-e05

June 17, 1993

TO: Lucy Pebles, NWRO

FROM: Jim Cubbage, EILS JC DY KRC

SUBJECT: Metals Results From Sediment Samples Collected From Bellingham Bay

BACKGROUND

This memorandum reviews results of sediment samples collected from five sites in March 1993 in eastern Bellingham Bay. The purpose of these samples was to refine the borders of areas of known metals contamination in Bellingham Bay. Sites were chosen to reduce the size of the largest polygon plots represented by previous sampling in the bay. These polygons and associated data will help guide clean up efforts in Bellingham Bay.

METHODS

You and I took samples on March 29, 1993, following Puget Sound Protocols for sampling in marine sediments. We sampled from Ecology's 20 foot skiff equipped using a 0.1 m^2 stainless steel Van Veen grab sampler. Sites were located with a Magellan GPS (Global Positioning System) receiver. All sites yielded adequate samples on the first grab. A grab was considered adequate if it was filled with sediment and both the grab as well as access doors on top of the grab were closed tightly. For each grab, the top 2 cm of sediment not touching the walls of the grab was scooped out of the top doors of the sampler and placed in a stainless steel beaker. The beaker contents were stirred and the subsample for metals analysis was dispensed into 8 ounce priority pollutant-clean jars capped with teflon lid liners. Grain size samples were placed in Whirl-Paks®. All stainless steel tools (beakers and spoons) were decontaminated prior to use with the following procedure: (washing in hot water and Liquinox® detergent, rinse in tap water, rinse in 10% nitric acid, rinse with deionized water, rinse with pesticide analysis grade acetone, air dry, and wrapped in aluminum foil. Between grabs, the sampler was thoroughly brushed and rinsed with on-site water.

Samples were analyzed for metals, grain size, and percent moisture. All analyses were conducted within Puget Sound Protocols and EPA Contract Laboratory Program (CLP) procedures. Table 1 shows the analytical methods and laboratories. The laboratory case narrative for the metals analysis is attached and reviews aspects of quality control. Recoveries of metals spiked onto samples run in the same analysis batch as these samples are shown in Table 2. All data can be used with the qualifications listed in the case narrative.

RESULTS

Table 3 lists the results of metals analysis as well as Department of Ecology's Marine Sediment Criteria. Figure 1 maps the sample locations and mercury concentrations found in this study. The two eastern-most sites (Bell52 and Bell53) exceeded criteria for mercury. The three other sites were at least 50% of the criteria for mercury. All other metals were found at low concentrations. Grain size distributions were similar among the five sites.

These data can be used to help delineate the areas that need further analysis and potential remediation.

REFERENCES CITED

APHA, 1985. Standard Methods for the Examination of Water and Wastewater, 16th edition. American Public Health Association, Washington D.C.

EPA, 1986a. Test methods for evaluating solid waste. EPA Environmental monitoring and support laboratory, Cincinnati, OH, U.S. Environmental Protection Agency.

EPA, 1986b. Puget Sound Estuary Program: Recommended protocols for measuring selected environmental variables in Puget Sound, Final Report. U.S. Environmental Protection Agency Region 10, Office of Puget Sound.

Washington State Department of Ecology, 1991. Sediment management standards. Washington Administrative Code (WAC) Chapter 173-204.

JC:krc
Attachment

cc: Bill Yake
Bill Kammin

Table 1. Analytical Methods.

Analysis	Method	Reference	Laboratory
Grain size	Seives and pipettes	EPA 1986a (PSEP protocols)	Soil Technology
% Moisture	Dry @ 105 degrees C	APHA 1985	EPA/Ecology Manchester
Arsenic	Atomic Absorption	EPA 1986b	EPA/Ecology Manchester
Cadmium	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Chromium	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Copper	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Mercury	Cold Vapor Atomic Absorption	EPA 1986b	EPA/Ecology Manchester
Lead	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Nickel	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Silver	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester
Zinc	Inductively Coupled Argon Plasma	EPA 1986b	EPA/Ecology Manchester

Table 2. Spike recovery results for metals.

	Lab No. 148165			Lab No. 148156		
	Spike Recovery			Spike Recovery		
	Result 1	Result 2	RPD*	Result 1	Result 2	RPD*
Arsenic	86%	86%	0%	88%	89%	1%
Cadmium	100%	97%	3%	103%	104%	1%
Chromium	82%	81%	1%	94%	92%	2%
Copper	98%	122%	22%	95%	93%	2%
Lead	81%	87%	7%	95%	93%	2%
Nickel	93%	94%	1%	96%	93%	3%
Silver	83%	88%	6%	18%	91%	134%
Zinc	94%	84%	11%	97%	96%	1%
	Lab No. 148166					
Mercury	103%	120%	15%			

*RPD = Relative percent difference (a-b)/((a+b)/2)

Table 3. Metals concentrations in Bellingham Bay Sediments.

Site	Bell50	Bell51	Bell52	Bell53	Bell54	
Lab No.	148173	148174	148175	148176	148177	Marine
Latitude	48° 45.012'	48° 44.627'	48° 44.631'	48° 44.370'	48° 44.725'	Sediment
Longitude	122° 30.380'	122° 30.825'	122° 30.121'	122° 30.230'	122° 30.467'	Criteria*
METALS mg/kg dry weight						
Arsenic	11	13	10	12	9.1	57
Cadmium	0.63 P	0.95 P	0.64 P	1.24 P	0.92 P	5.1
Chromium	80	79	81	78	81	260
Copper	57	52	53	53	46	390
Lead	20	20	21	25	17	450
Mercury	0.31	0.23	0.58	0.74	0.25	0.41
Nickel	130	128	122	117	133	NC
Silver	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	6.1
Zinc	99 E	108 E	103 E	108 E	95 E	410
% Solids	43%	41%	37%	38%	42%	
%Sand**	2%	3%	4%	6%	6%	
%Silt**	64%	55%	58%	59%	60%	
%Clay**	34%	42%	38%	33%	34%	

*Washington Dept of Ecology 1991
Outline = exceeds marine sediment criteria.
P=Metal detected above detection limit but below quantification limit.
U=Not diluted at detection limit shown.
E=Concentration is estimate because of interference.
**Sand=(>62.5μm); Silt=(62μm-3.9μm); Clay=(<3.9μm)
NC=No criteria available

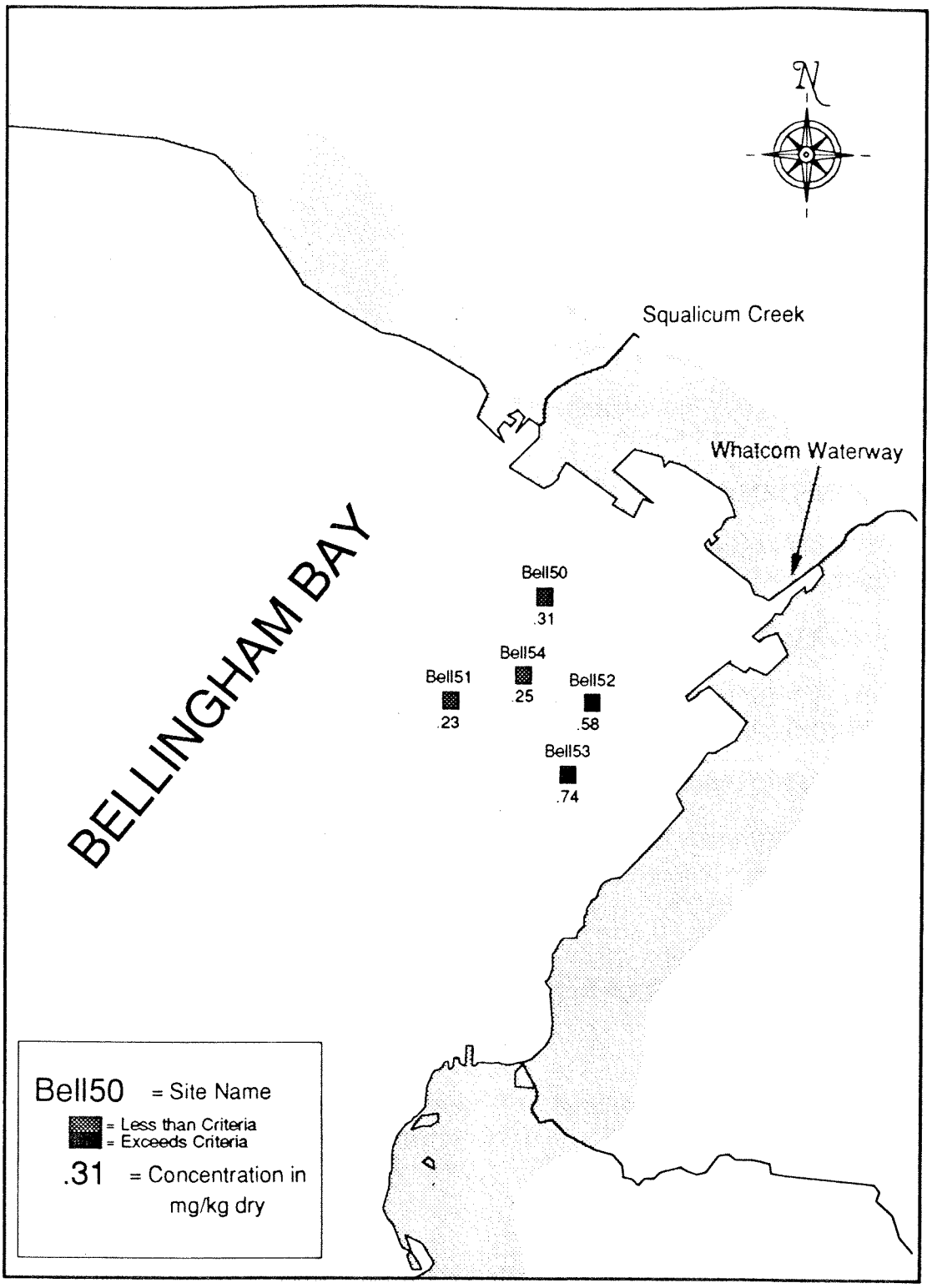

Figure 1. Location of sample sites and mercury concentration in sediments.

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May 10, 1993

TO: Jim Cubbage

FROM: Bill Kammin, Environmental_Lab_Director BK

SUBJECT: Metals Quality Assurance memo for the Bremerton/Bellingham Storm Drains Project

SAMPLE INFORMATION

These samples from the Bremerton/Bellingham Storm Drains Project were received by the Manchester Laboratory on 3/31/93 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples showed no analytically significant levels of analytes, with the following exception: copper. Sample results less than 10 times the level of copper in the procedural blank are qualified with B.

SPIKED SAMPLE ANALYSES

Spike and duplicate spike sample analyses were performed on this data set. All spike recoveries were within the CLP acceptance limits of +/- 25%, with the following exception: silver. Silver results are qualified with J, denoting estimated values.

PRECISION DATA

The results of the spike and duplicate spike samples were used to evaluate precision on this sample set. The Relative Percent Difference (RPD) for all analytes was within the 20% CLP acceptance window for duplicate analysis, with the following exception: silver.

LABORATORY CONTROL SAMPLE (LCS) ANALYSES

LCS analyses were within the windows established for each parameter, with the following exception: silver.

SERIAL DILUTION ANALYSES

Serial dilution is used in ICP analyses to examine sample results for potential interferences. The serial dilution results for this sample set met CLP specifications, with the following exception: zinc. Zinc results are qualified with E, denoting possible sample based interferences.

SUMMARY

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

WRK:wrk