Segment No. 05-10-01

WA-10-0020

88-e30

ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

TO: Scott Morrison

FROM: Dale Norton D.N.

SUBJECT: Review of Metals and Organics Data of Sediment Samples Collected by Ecology June 9-10, 1987, from Tacoma Tideflats Storm Drains

DATE: April 15, 1988

Per your request, the following is a brief interpretation of metals and organics data on sediments collected by Ecology Southwest Regional Office (SWRO) Inspectors June 9-10, 1987, from several storm drains in the Tacoma Tideflats area. Locations of these samples are shown in Figure 1. Descriptions of each collection site are also provided in Table 1.

Quality Assurance

Metals analyses were performed by Weyerhaeuser Technology Center, Tacoma, Washington, using Puget Sound Estuary Program (PSEP) protocols. Quality assurance (QA) review of this data was performed by Steve Twiss of the Ecology/EPA Manchester Laboratory. Metals results were considered acceptable under PSEP guidelines with the exception of silver and selenium, which are consequently not reported here (see attachment #1).

Organics analyses for semi-volatile compounds were done by Analytical Resources, Inc. (ARI), Seattle, Washington, using EPA Method 1625 Isotope Dilution Gas Chromatography/Mass Spectroscopy modified for sediments or alternately by EPA Method 625 where appropriate. ARI also did Pesticide/PCB determinations by EPA Method 608 Gas Chromatography/Electron Capture. QA review of organics data was performed by Cliff Kirchmer of the Manchester Laboratory. It was not possible to conduct a thorough review of this data set since the raw data were not submitted along with the results. However, based on the results of duplicate analyses and percent recoveries of surrogate and spike compounds, in the opinion of the reviewer these data are considered acceptable (see attachment #2). It should be emphasized that the most appropriate use of the organics results are for screening purposes, primarily due to the lack of detailed QA documentation to fully assess the data sets quality, which would be required to use the data for activities such as enforcement. This is especially important in light of the difficulties encountered in the analysis of several samples and the absence of standardized procedures for applying Method 1625 to the analysis of sediment samples.

Results

The results of metals and organics analyses of sediment samples from several storm drains in the Tacoma Tideflats area are summarized in Tables 2 and 3,

respectively. The primary purpose for collecting these data was to determine if the drains sampled are ongoing sources of priority chemicals to the Waterways. Priority 1, 2, and 3 (1=highest priority, 3=lowest) chemicals were identified for each Waterway during the Commencement Bay Nearshore/Tideflats Remedial Investigation (CBNTRI) by Tetra Tech, Inc. In the present report, information on priority chemicals was used in conjunction with apparent effects threshold (AET) criteria also developed during the CBNTRI to determine which drains should receive further source control work. Table 4 summarizes the results of this analysis.

Drains CI-235, CI-243, and CI-245 in Segment 1 of City Waterway and HY-052 in Segment 1 of Hylebos Waterway, were the only discharges where concentrations of Priority 1 chemicals (primarily metals) exceeded AET values in drain sediments. These drains should receive the highest priority for further source control work. In addition, a number of Priority 2 and 3 chemicals (see Table 4) were detected in discharges to Middle, City, Sitcum, and Hylebos Waterways at concentrations which warrant further investigation before any sediment remedial actions proceed in these Waterways. Finally other chemicals not listed as priorities but present in sufficient levels to cause some concern are as follows: City Waterway, CI-235-(PCB), CI-245-(DDD, PCB); Sitcum Waterway, SI-169-(aluminum, pentachlorophenol) and Hylebos Waterway, HY-063-(4-methylphenol).

Recommendations

In general a number of discharges were identified which require further work before any sediment remedial actions can proceed in the affected Waterways. This work should consist of controlling the release of contaminants from areas where a documented source has been identified. A review of existing data should aid this effort. In drains where no likely source has been identified, additional sediment samples should be collected upstream in the drainage in such a manner that the source(s) of contamination can be isolated. Tetra Tech, Inc. is currently preparing a document titled "Elliott Bay Revised Action Program: Storm Drain Monitoring Approach" which should provide some excellent guidance for designing and conducting future storm drain investigations.

DN:cp
Attachments

cc: Bill Backous
Dave Bradley
Dick Cunningham
Bill Yake

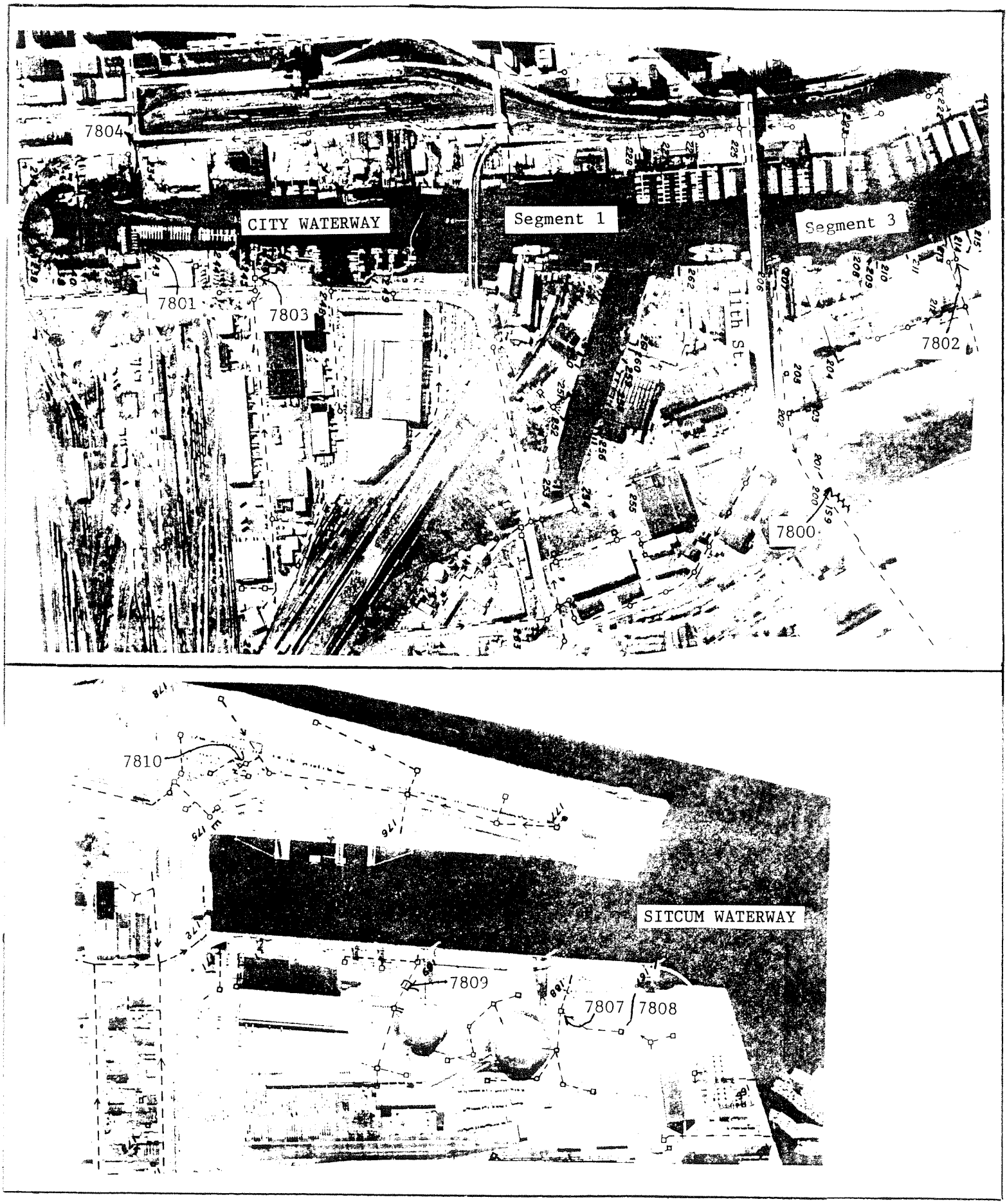

Figure 1. Station locations, Tacoma storm drain samples.

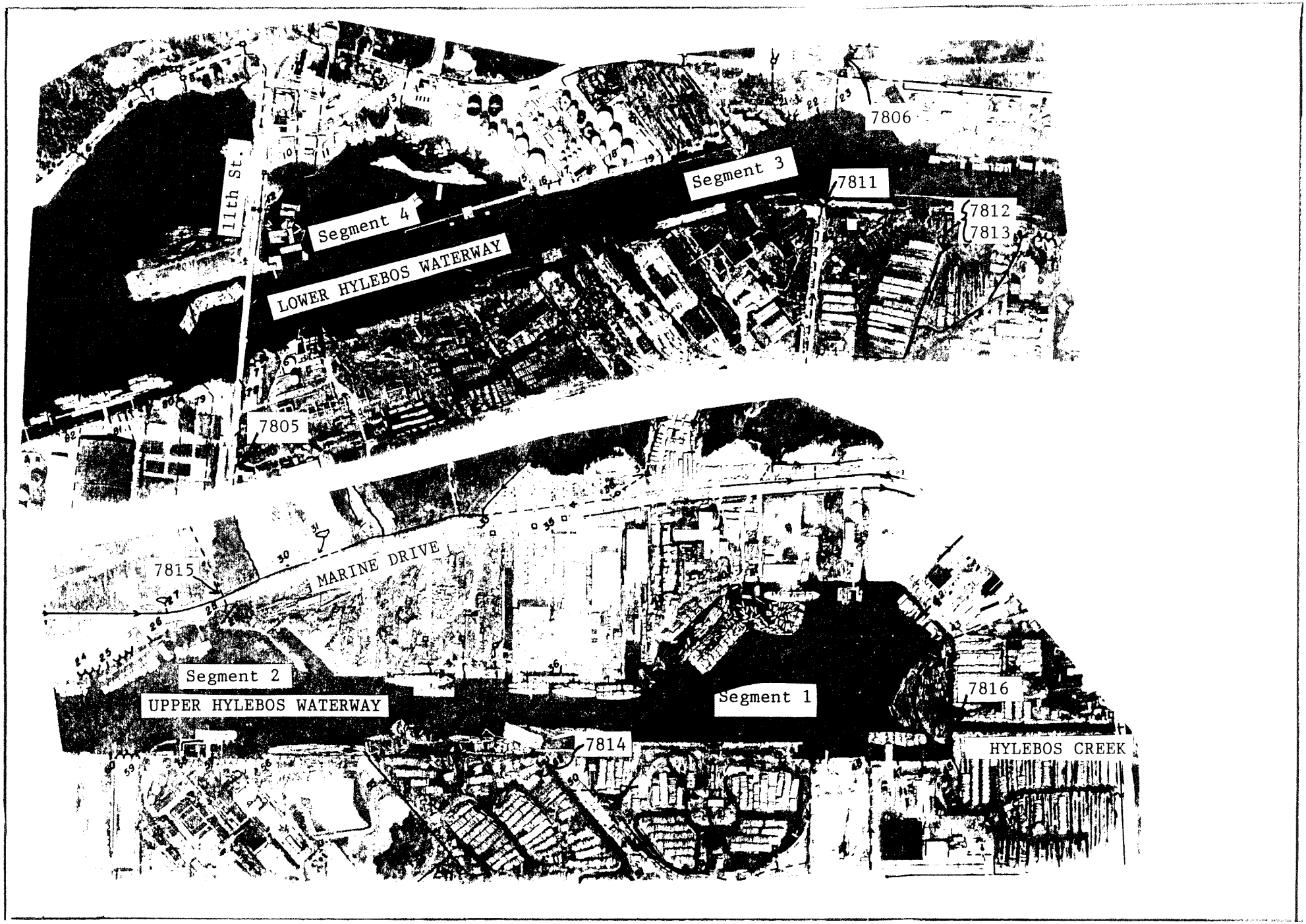

Figure 1 - continued.

Table 1. Station locations and descriptions for Tacoma storm drain sediment samples collected by Ecology June 9-10, 1987.

Sample Number	TPCHD Drain Number	Description
Middle Waterway		
24-7800	MI-200	Intertidal head of waterway @ mouth of drain
City Waterway		
24-7801	CI-243	Intertidal @ pipe mouth
24-7802	CI-214	Catch basin @ corner of 7th and D Streets
24-7803	CI-245	Manhole in parking lot of Johnnys restaurant
24-7804	CI-235	Intertidal @ mouth in concrete apron
Sitcum Waterway		
24-7807	SI-168	Sitcum ore dock 1st catch basin upstream of mouth
24-7808	--	Duplicate of 24-7807
24-7809	SI-169	Sitcum ore dock catch basin
24-7810	--	Sealand terminal catch basin trib. to SI-176
Hylebos Waterway		
24-7805	HY-078	Catch basin near fire station adjacent to 11th St.
24-7806	HY-023	Catch basin in center of Marine Dr. opposite Lincoln Ave.
24-7811	HY-066	Intertidal @ mouth of drain
24-7812	HY-063	Murry Pacific Yard #1, inside main ditch before discharge
24-7813	--	Duplicate of 24-7812
24-7814	HY-052	Kaiser ditch inside pond @ mouth
24-7815	HM-028	Morningside drain, NE side of Marine Dr. in embayment
24-7816	HC-000	Intertidal @ mouth of Hylebos Creek Wasser/Winters side

Table 2. Results of analysis of sediment samples collected by Ecology June 9-10, 1987, from Tacoma Tideflats storm drains (ug/kg, dry weight).

Location	Middle Waterway	City Waterway				Sitcum Waterway				Hylebos Waterway								
Segment No.	-	1	2	1	1	-	-	-	-	4	3	3	3	3	1	2	1	-
TPCHD Drain No.	MI-200	CI-243	CI-214	CI-245	CI-235	SI-168	(DUP)	SI-169	SI-733	HY-078	HY-023	HY-066	HY-063	(DUP)	HK-052	HM-028	HC-000	AET
Sample No. 24-	7800*	7801*	7802+	7803+	7804+	7807+	7808+	7809*	7810+	7805+	7806*	7811*	7812*	7813*	7814+	7815*	7816*	Range**
Conventionals																		
Moisture (%)	54.6	58.0	25.1	64.7	68.0	31.4	35.2	43.5	56.7	19.9	31.7	43.1	68.4	63.5	71.9	50.2	44.1	
Total Organic Carbon (%)	6.3	5.1	1.9	9.6	6.7	6.4	6.3	7.0	11.0	0.9	1.2	3.4	8.8	3.6	19.0	1.9	1.5	
Grain Size Fines (%)	52.5	22.99	7.01	21.68	33.23	20.81	20.91	62.17	60.31	2.04	5.53	18.03	23.03	20.42	33.93	91.8	34.34	
Base/Neutral/Acids																		
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	320	-	-	-	-	560-1200
4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	63	7700	7700	-	-	-	670-1200
2-Methylnaphthalene	51	-	-	-	-	-	-	47	-	-	-	-	39	-	-	-	-	670
Dibenzofuran	-	-	520M	-	-	-	-	550	-	-	-	-	120	-	-	-	-	540
Pentachlorophenol	-	-	-	-	-	-	-	11000	-	-	-	-	-	-	-	-	-	>140
Di-n-butylphthalate	-	750	-	-	-	-	-	-	-	-	610	-	-	-	-	180	-	
Butylbenzylphthalate	-	6800	-	-	-	-	-	92	-	1500	340	-	120	-	-	660	-	
Bis (2-Ethylhexyl) phthalate	29000	9600	-	8700	9200	9900	18000	7100	15000	1300	3600	1500	620	-	-	7200	-	
Di-n-Octylphthalate		-	-	-	-	-	-	520	-	-	280	-	-	-	-	300	-	
Carbazole	-	-	-	-	-	-	-	780	-	-	-	-	-	-	-	-	-	
Naphthalene	390	150	400J	-	-	-	-	300	-	-	-	-	51	-	-	-	-	2100
Acenaphthylene	-	130	-	-	-	-	-	890	-	-	-	-	-	-	-	-	-	560-640
Acenaphthene	-	83	1300	-	-	-	-	5300	-	-	-	-	-	-	-	-	-	500-640
Fluorene	540	340	1300	-	-	-	-	1700	-	-	-	-	-	-	-	38	-	540-640
Phenanthrene	4200	4000	13000	-	3700	3600	5400	4400	4600	-	1400	220	610	-	1400	750	-	2100-3200
Anthracene	1000	1000	2800	-	330M	1300	680	2900	900M	-	-	-	-	-	410M	220	-	960-1300
Sum of LPAH	6100	6900	19000J	-	4000M	4900	6000	15000	5500M	-	1400	220	660	-	1800M	1000	-	5200-6100
Fluoranthene	4600	5500	14000	-	7100	12000	12000	31000	8300	350M	1400	640	790	620	12000	1300	-	3900-6300
Pyrene	3400	5100	12000	-	6800	11000	12000	20000	8200	290M	1100	600	580	420	8300	1300	-	4300-7300
Benzo (a) anthracene	1400	1800	6500	-	2900	2400	2200	7400	4500	160M	250	210	190	290	4500	590	-	1600-4500
Chrysene	2300	3200	4800	-	3800	6400	13000	13000	12000	360M	870	600	490	340	11000	1400	-	2800-6700
Benzo Fluoranthenes	2600	3800	8100	-	5300	7900	7300	14000	12000	400M	900	800	810	420	12000	1300	-	3700-8000
Benzo (a) Pyrene	1400	2000	3400	-	2700	2200	2700	7400	4200	160M	320	260	230	-	5500	350	-	2400-6800
Indeno (1,2,3-cd) Pyrene	1300	1500	3300	-	3400	2500	4700	5900	5500	-	-	210	-	-	2900	240	-	690-5200
Dibenzo (a,h) anthracene	550	780	1500	-	710J	680J	3100	1500	1900	-	-	42	-	-	1300	56	-	260-1200
Benzo (g,h,i) perylene	970	1600	2900	-	2500	2600	4100	4500	5700	-	240	170	-	-	2700	350	-	740-5400
Sum of HPAH	18000	25000	57000	-	35000J	48000J	61000	100000	62000	1700M	5100	3500	3100	2100	60000	7100	-	18000-51000
Pesticide/PCB++																		
Beta-BHC	-	-	-	42	-	-	-	-	-	-	-	-	-	-	-	-	-	
Heptachlor	-	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	
Aldrin	-	-	9C	-	25	46	1F	-	146	4C	-	-	-	-	-	-	-	
4,4'-DDD	-	-	-	208	-	-	-	-	-	-	-	-	-	-	-	-	-	2-43
Total PCBs	-	240F	140	2700	1200	-	-	-	-	-	-	-	-	-	890	560	-	1100-2500

-=Not detected
+=Method No. 625 (GC/MS)
*=Method No. 1625 (Isotope dilution)
++=Method No. 608
**=Amphipod and Benthic infauna effects, dry weight basis

F=Hit below detection limit considered real by analyst
C=Tentatively identified
M=Estimated concentration with low spectral match
J=Estimated concentration below detection limit

Table 3. Results of metals analysis (Puget Sound Protocols) of sediment samples collected by Ecology June 9-10, 1987, from Tacoma storm drains (mg/kg, dry weight).

Location	Middle Waterway	City Waterway				Sitcum Waterway				Hylebos Waterway								
Segment No.	-	1	2	1	1	-	-	-	-	4	3	3	3	3	1	2	1	-
TPCHD Drain No.	MI-200	CI-243	CI-214	CI-245	CI-235	SI-168	(DUP)	SI-169	SI-733	HY-078	HY-023	HY-066	HY-063	(DUP)	HK-052	HM-028	HC-000	AET
Sample No. 24-	7800*	7801	7802	7803	7804	7807	7808+	7809	7810	7805	7806	7811	7812*	7813	7814	7815	7816	Range**
Aluminum	65400	60700	35300	55900	51900	83700	86767	213000	56600	55400	53500	69200	41700	41500	58900	65400	83300	-
Arsenic	25	21	124	34	33	129	140	2940	61	279	57	81	1650	1850	101	23	10	85-93
Antimony	9	5	77	16	7	74	81	270	33	202	30	27	965	1060	50	11	<3	3.2-5.3
Beryllium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-
Cadmium	3	4	5	12	4	13	14	21	9	5	4	3	4	4	3	4	4	5.8-6.7
Chromium	68	69	189	83	93	96	115	89	237	105	71	56	180	188	48	72	50	59-130
Copper	149	244	263	3190	139	469	511	9550	276	613	302	60	821	815	121	203	62	310-800
Mercury	0.26	1.2	1.3	2.2	1.7	0.35	0.21	2.8	0.58	<0.02	0.04	0.07	0.04	<0.04	0.11	0.36	0.06	.88-2.1
Nickel	35	32	76	47	38	35	42	44	83	145	33	22	29	37	48	41	28	49-120
Lead	163	177	493	785	416	1540	1633	5690	1160	434	335	40	772	867	121	192	55	300-700
Thallium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-
Zinc	410	213	688	948	310	2470	2610	3390	1440	1200	1030	296	3225	3530	291	569	80	260-870

*=Mean of duplicates
+=Mean of Triplicates
**=Amphipod and Benthic infauna effects, dry weight bases

Table 4. Summary of priority chemicals exceeding apparent effects threshold values in storm drain sediments.

Waterway	Segment Number	TPCHD Drain Number	Chemical Priority 1	2	3
Middle	--	MI-200	--	--	Zn, LPAH, HPAH
City	1	CI-235	Hg, Pb, Zn	HPAH, Phthalates	--
		CI-243	Hg	LPAH, HPAH, Phthalates	
		CI-245	Hg, Pb, Zn	Cd, Cu, Phthalates	--
	3	CI-214	--	LPAH, HPAH	Hg, Zn
Sitcum	--	SI-168	--	As, Cu, Pb, Zn	Dibenzofuran, LPAH
		SI-169	--	As, Cu, Pb, Zn	LPAH, HPAH
		SI-733	--	As, Pb, Zn	LPAH, HPAH
Hylebos	1	HY-052	As, Zn, HPAH	Sb	--
	2	HY-028	--	Sb	--
	3	HY-023	--	As, Zn	--
		HY-063	--	As, Zn	--
		HY-066	--	As, Zn	--
	4	--	--	--	--

BRADY BONKER
Director

Attachment #1

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Post Office Box 346 • Manchester Washington 98353-0346 • (206) 895-4740

MEMORANDUM

October 15, 1987

TO: Merley McCall

FROM: Steve Twiss

SUBJECT: Commencement Bay Data

The data received from Weyerhauser for samples #247800 through #247817 has been reviewed. The results for the most part look acceptable for both the Puget Sound Protocols and the CLP procedures.

The silver results obtained from the Puget Sound Protocols are of little value due to solubility problems with the fluoroboric acid matrices as indicated in the footnote on the data summary sheet. There also appears to be significant matrix interference in the determination of Selenium (Se).

The % RSD of duplicates and replicates is less than 25% with the following exception:

66.7% RSD for Mercury (Hg) in sample #247808

This could possibly be the result of subsampling problems during sample preparation.

Spike recoveries for Arsenic and Mercury were low while the recovery for Zinc was very high. There was no recovery of spike values for Selenium and Silver. All other spike recoveries were in the range 90-110 percent.

Based on replicate and spike sample results the results are acceptable with the exception of Silver and Selenium due to solubility and matrix interference problems.

Attached are the % solids results obtained in a telephone conversation with Karie Doxee. Also attached is a comparison of the two different procedures. As suspected, the CLP procedure results are generally lower than the Puget Sound Protocol results. The user of Puget Sound Protocols results must be aware that the results are based on total dissolution of the sample and therefore will be higher than results obtained from the nitric acid/perioxide digestion procedure. Users that need to relate the results to hitorical database must be especially careful.

Attachment #2

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Post Office Box 346 • Manchester, Washington 98353-0346 • (206) 895-4740

MEMORANDUM

September 9, 1987

TO: Merley McCall

FROM: Cliff J. Kirchmer

SUBJECT: Data Review

This review corresponds to the following data package:

Lab	- Analytical Resources Inc. (ARI)
DOE Account Number	- 922
Title	- Tacoma Storm Drain
Sample Numbers	- 24-7800 through 24-7817
Matrix	- Sediment
Methods	- EPA 1625 (modified for sediments)
	- EPA SW 846-8270 (625)

The following comments correspond to the review of the above referenced data:

1. Data was reported using EPA Method 1625. However, EPA Method 1625 is specific for water samples while the samples analyzed were sediments. The laboratory should have reported exactly how EPA Method 1625 was modified to permit analysis of sediments.

2. The laboratory reported using EPA Method SW 846-8270 in which the internal standards are added to the final extract for analyses of some samples not amenable to isotope dilution. This was apparently done in order to have more internal standards for quantitation since Method 8270 specifies that six internal standards be added to the final extract, while Method 1625 specifies that only one internal standard, 2,2'-difluorobiphenyl, be added to the final extract.

3. The laboratory did not provide sufficient information to judge whether the less than ("U" coded) values are reasonable. Neither was it possible to check whether the adjustments in these 'detection limits' for percent moisture had been properly done.

4. The values for percent recoveries of the isotopically labeled internal standards are reported together with sample results. The method specifies that these recoveries be determined by analyses using isotopically labled internal standards added to the final extracts. It is recommended that these percent recoveries not be reported to the data users since their significance can easily be misinterpreted by persons unfamiliar with the isotope dilution procedure. The isotope dilution procedure is used precisely because it has low bias, based on the reasonable assumption that losses of isotopically labeled internal standards are directly proportional to the unlabeled analog pollutant compounds of interest. Therefore, there is no correlation between percent recovery of the isotopically labeled internal standards and accuracy of analysis.

5. It is recommended that those values reported by ARI as NC be reported by DOE as I (Invalid) along with a comment that the isotopically labeled internal standard was not recovered.

6. On samples #249800 and 247805, percent recoveries well above 200 were reported for a number of isotopically labeled internal standards. These are unexpected since the loss of standards during processing should lead to lower, not higher, recoveries. There may be an error either in the calibration or spiking solutions for some of these compounds.

7. On samples #27800, 27809, 27810 and 27815, the percent recoveries of dibutylchlorendate surrogate were higher than expected. No qualification of the data is recommended however.

8. On sample #247805 matrix spike, the percent recoveries of the isotopically labeled internal standards are reported as surrogate percent recoveries. This is incorrect since they are used as internal standard for calibration and analysis purposes, not to simulate HSL compounds, as is the case for surrogates.

9. Percent recoveries of spiked compounds on samples #247805 matrix spike and 247805 matrix spike duplicate were generally very good, with the exception of those compounds for which the isotopically labeled analogs gave 0 percent recovery and for some aromatic compounds.

10. On sample #247813, the percent recoveries of the isotopically labeled internal standards were low, many being 0.0 percent. Consideration should be given to reanalyzing this sample.

11. In summary, it has not been possible to review this data in detail since the raw data was not submitted along with the results. For future contracts consideration should be given to requesting that the laboratory submit raw data, including chromatograms, mass spectra, and example calculations of results. This is particularly necessary when new, non-routine methods such as EPA 1625 are being used.

ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Post Office Box 346 • Manchester Washington 98353-0346 • (206) 895-4740

MEMORANDUM

February 25, 1988

TO: Dale Norton

FROM: Cliff J. Kirchmer

SUBJECT: Review of Tacoma Storm Drain Samples 24-7800 through 24-7817

The following comments are supplemental to those in my memo to Merley McCall on September 9, 1987, on the same subject.

The data reported was based on two different quantitation methods, isotope dilution or 1625 and 625, as indicated on the attached list.

Only two surrogates have been reported for the 625 results. This is reasonable if we know that the lab intended initially to analyze the samples using method 1625. In that case, the compounds d5-nitrobenzene and d5-phenol would have been added as isotopically labeled internal standards for the purpose of determining the concentrations of phenol and nitrobenzene by the isotope dilution technique. When it was later decided to analyze by method 625, the purposes of d5-nitrobenzene and d5-phenol were altered to use them as surrogates since they are used for that purpose in the 625 method. No other surrogate compounds would have been added as a consequence of using the 1625 method. The NR values reported do not mean not recovered since they were not added in the first place. This was verified in a phone conversation with David Mitchell at the ARI Lab.

Surrogate recoveries were generally acceptable with the exception of d5-nitrobenzene in -803, -803MSD, -804, and 805MSD and d5-phenol in -803MSD and -804.

The spike recoveries for the 1625 method (-805MSD) are scattered somewhat, but generally look good. On this basis, and the a priori advantages of the 1625 isotope dilution technique, it would appear that the available 1625 data should be used preferentially if accuracy is the prime concern.

For the dibutylchlorendate surrogate, recoveries were high on samples -801, -803, -803MS, -803MSD, and -804 in addition to those mentioned in the previous memo. No action is recommended, however.

Attachment
CK/mb